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The effect of sovereign credit ratings on the domestic loan supply

The effect of financial development

Master thesis Department Finance

Ruud Meeuwissen

327100

MSc. Finance

Supervisor: Prof. Dr. H.A. Benink

Second reader: dr. Olivier de Jonghe

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Abstract

This thesis investigates the impact of sovereign downgrades on bank ratings and the loan supply to the private sector. I use the differential effect of banks rated at the sovereign bound and banks rated below their sovereign to find the impact of sovereign ceiling policies implemented by CRA's. I find evidence that CRA's may be moving away from these policies and are using alternative factors to determine bank ratings. Financial development factors seem to play a more important role than implicit government support (on which the ceiling policies are based) in determining bank credit ratings. After sovereign downgrades the loan supply to the private sector is decreased significantly. Again, instead of the sovereign ceiling policies, financial development seems to play a bigger role in the decision to decrease loans after a downgrade. Sovereign creditworthiness may play a less significant role as thought of in previous research.

I. Introduction

Since the financial crisis of 2008 the role of financial institutions has once again been highlighted. The important role these institutions play in conveying monetary policy implementations has sparked a renewed interest amongst scholars. Bernanke and Blinder (1988) are among the first to investigate the bank lending channel. They find shifts in bank credit supply due to restricted access to wholesale funding brought about by a tightening monetary policy. According to this and related views the variation in the supply of loans is a reaction to individual bank factors. Smaller, more risky banks with lower liquidity and lower levels of collateral are less able to fight of the consequences of tight monetary policies as they are less able to attract uninsured funding. Larger banks, often situated in highly concentrated markets are often less affected by monetary policy due to better access to funding (Cantero-Saiz et al., 2014).

Tighter policies may be introduced when governments are experiencing financial distress. This sovereign risk has been the source of many concerns since the last crisis. Many worry about the impact sovereign risk has on financial institutions, their statements, and their capability to provide loans. Countries have experienced an increase in their perceived bond risk or have even lost their risk free status during these times of financial distress. These troubles have led to an upsurge of cost and to a decrease in the accessibility of some bank's funding which in turn lead to a reduction in the amount of loans a bank can supply.

Over the past years even the most financially developed countries have suffered sovereign rating downgrades. The U.S. and France, for instance, have been downgraded by Standard & Poor's from AAA to AA+ in 2011 and 2012, respectively (Adelino, Ferreira, 2014). This raises the question of whether the three biggest rating agencies, Standard & Poor's, Moody's, and Fitch ratings, create an effect when issuing a rating that reaches further than just a potential downgrade. These ratings carry more information than what is reflected in just bond and stock prices (Hand, Holthausen, and Leftwich, 1992).

Several views have been put forward about the impact of sovereign risk on the bank lending channel and the subsequent effect on the loan supply and about whether this effect should be stronger in emerging or developed economies. On the one hand, various studies have argued that because of a lack of transparency, asymmetric information, high political risk, capital restrictions, and higher risk premiums the influence of sovereign risk is amplified in emerging countries (Kaminsky and Schmukler, 2002, Borensztein et al., 2013, and Cantero-Saiz et al., 2014). On the other hand, scholars argue that especially in developed countries sovereign risk should be transferred to affect the lending supply. They attribute this to larger government holdings by banks, heavy private sector reliance on bank loans, and stronger creditor rights protection (Gennaioli et al., 2013 and Mallucci, 2013). These studies focus on one particular group of countries, emerging or developed, or on one particular factor in financial development, often strength of creditor protection. They do not explicitly explain the differences between markets in various stages of financial development or what underlying factors of development are most important in explaining the sovereign effect on the loan supply.

The importance of this research lies in the consequences of cutting loans. Banks that are downgraded solely because of the sovereign ceiling experience a reduction in funding and have to cut credit to the private sector which in turn limits sources of investment. When this effect is even larger in emerging markets, a lack of much needed investment will cause a period of financial and real sector setbacks. A larger effect in developed markets would lead to an accelerated impact on the real sector because of the amount of domestic and foreign banks. If all banks, including foreign subsidiaries, suffer regardless of their financial health (Borensztein, Cowan, and Valenzuela, 2013) CRAs might have to refrain from using sovereign ceiling policies when rating financial institutions, especially in emerging markets where sovereign ratings may well be below the financially sound banks'.

Along these lines, this thesis will contribute to the relevant literature by quantifying the differences between the effect of sovereign risk on the lending supply in emerging and developed countries. This paper relates to previous research on sovereign ceiling policies, sovereign ratings, and bank ratings and

the relationship amongst these three. This research will be focused on the implementation of sovereign ceiling policies in a large sample of countries. The main difference with the previous research will be the extensive data set and the focus on financial development as a possible indicator of the CRA's rating decisions. The main question I will investigate is whether higher or lower levels of financial development will have a bigger impact on the supply of loans as a response to a sovereign downgrade. In this effect the theoretical relationship runs from a sovereign downgrade through a lowered implicit government support to lower bank ratings and to a shift in the lending supply. To do so, I use a difference in differences estimator with an interaction term between relevant variables to examine whether banks with equal or bigger ratings than the sovereign reduce lending to the private sector more than their counterparts with lower ratings than the sovereign in emerging versus developed markets. Financial development will be measured by four variables as introduced by Cihak and Demirgüç-Kunt (2013). These indicators are access, stability, efficiency, and depth.

Earlier work by Adelino and Ferreira (2014) has identified that the sovereign effect on bank lending can be attributed to the bank lending channel and not to the firm borrowing channel. Hence, demand side effects will play no central role in the investigation but will be used as control variables. Also, balance sheet effects will be omitted because the issue of a bank's financial health is addressed by separating the sample in a control group and a treatment group. Information on loans will be restricted to a few types of loans as testing for all types would be outside the scope of this research.

For the experiment a more comprehensive sample (as opposed to previous literature) of 85 countries consisting of 29 developed and 56 emerging countries, as categorized by IMF (2014), is used. Results suggest that sovereign creditworthiness and subsequently implicit government support for banks are not as important indicators for CRA's as once thought. Indicators of financial development seem to provide a better explanation for CRA's decisions to downgrade banks and for banks to change their lending supply.

This thesis will continue as follows. Part II provides the theoretical framework. Part III describes the methods and data that were used. Part IV presents and discusses the results from the empirical research and part V concludes. In section VI limitations are discussed and recommendations for further research are made.

II. Background and literature review

Credit rating agencies

Since the early twentieth century credit rating agencies (CRAs) have played an important role in providing credit risk information and in financial market regulation. The biggest three CRAs, Standard & Poor's Rating Services, Moody's investors service, and Fitch ratings provide two main services. They distribute information about an issuer's ability to meet debt obligations and provide monitoring services with which they influence issuers through the threat of a downgrade (De Haan and Amtenbrink, 2011). The ratings they assign differ in type depending on the denomination of currency and maturity of the issue Almeida et al. (2014). Because assigning the right credit rating is time consuming and requires special know-how it is advantageous for individual investors to rely on CRAs. An agency uses two important features to assign a rating. The first one is the probability of repayment of debt owed by the issuer and the second, "in the case of foreign currency ratings, is the issuer profile after taking into account the risk of exchange controls being imposed by the government that would hinder the ability of issuers to meet their financial obligations in foreign currency" (Almeida et al., 2014). Assigned ratings can come as either a solicited rating, which is paid for by an issuer, or an unsolicited rating, which is originated by the CRA. Kormos (2008) argues that the latter is more questionable due to the fact that unsolicited ratings are based on publicly available information and are issued without consulting management. In studies by Poon et al. (2009) and Bannier et al. (2010) evidence is presented that solicited bank ratings are indeed significantly higher than unsolicited ratings. CRAs have been criticized for other issues as well, including a time lag in adjusting ratings after an important event, potential conflicts of interest arising from the fact that they are paid by the client issuing the rating, and their failing to predict sovereign distress and crises resulting in downgrades of multiple notches, exacerbating the problems (De Haan and Amtenbrink, 2011). Yet, CRAs have become a critical source of information about credit risk.

Sovereign risk and sovereign credit ratings

The first relationship that will be explained is link between sovereign risk and a sovereign's credit rating. The term sovereign risk refers to the chance that a borrower, in this case the government, will default

on its obligations. This likelihood is assessed by a sovereign rating which governments issue to increase their access to international capital markets. They can increase their access because investors tend to prefer rated securities over unrated ones of equal perceived risk. Kim and Wu (2008) test this with a sample covering 51 emerging markets and find that after a sovereign upgrade FDI, international banking, and portfolio flow improve. Over the years international investors have increased the demand for bonds denoted in their domestic currency and governments have moved to issuing domestic currency bond ratings instead of just foreign currency bond ratings (Cantor and Packer, 1996). Cantor and Packer (1996) have identified eight key determinants commonly used by the CRAs to assess sovereign risk and to assign a credit rating accordingly. These determinants are a broad tax base as measured by per capita income, a growing economy which suggests that existing debt will become easier to repay in the future, inflation which can indicate structural financial problems for the government, fiscal and external balances, the height of the external debt burden, economic development, and the default history of the sovereign. Although the CRAs base their ratings on comparable information they tend to disagree often about a sovereign rating. However, this deviation is usually limited to one or two notches (Hill et al., 2010). A downgrade may result in the sovereign being classified as non-investment grade increasing the default risk. A government is in default when it fails to pay interest or fails to make a principal repayment in time (IMF, 2010). According to Eaton and Gersovitz (1981) the threat of a deteriorating credit reputation and less access to credit markets should be enough for sovereigns to avoid default. However, Bulow and Rogoff (1989) argue that this is not enough and that foreign creditors should have the ability to impose sanctions if the obligations are not met.

Defaults

Secondly, the effect of a sovereign default is explained. In their paper, Borensztein and Panizza (2009) find that the costs of sovereign default come in four forms: international exclusion of trade, reputational costs, political costs to the authorities, and costs to the domestic economy, with the last one being the most interesting one for this paper. They argue that because of large holdings of government bonds by domestic residents a default may have significant effect on the domestic private sector. This problem is amplified by stress on the financial sector if the domestic banks hold large amounts of government debt. A sovereign default may cause banking crisis or domestic credit crunch in a number of ways including reduced confidence in the banking sector leading to a bank run, and a negatively affected bank balance sheet and weaker creditor rights causing a more conservative lending strategy. Mallucci (2013) also

identifies a cyclical pattern in bank's balance sheets. When government bonds increase in price, banks tend to expand their balance sheet. The opposite happens when government bond prices drop. Through this channel a sovereign default or crisis amplifies these problems. A bank's funding ability drops and the collateral channel sends these difficulties to the credit market and then to the real sector. He finds that this effect should be stronger in more financially developed economies where firms are more able to rely on bank loans.

Rating changes and the effects on the market

The third relation I cover is the effect of a sovereign rating and outlook change on the domestic market. Although sovereign defaults may be uncommon, especially since 2002, changes in ratings are more frequent and have a notable effect as well (Reinhart and Rogoff, 2008). Because of the CRAs tendency to follow the market, upgrading a sovereign in upswings and downgrading it in bad times, the volatility in stock markets is exacerbated. Kaminsky and Schmukler (2002) argue that emerging countries are affected more by rating changes because of problems of transparency and asymmetric information. They also state that if CRAs do not follow the market exactly a downgrade or upgrade may still send shock waves through the economy. Many institutional investors are only allowed to hold investment grade securities and are affected if a sovereign is downgraded to below investment grade or upgraded to above investment grade. Brooks et al. (2004) find that instead of just having an effect on individual stocks a downgrade in sovereign rating also has an effect on the entire stock market. They find that only downgrades are associated with significant effects and that upgrades do not convey the same implicit information. These results remain the same in case of downgrade over multiple notches and in emerging and developed countries. Interestingly, their analysis only returns significant market reactions caused by the ratings of S&P and Fitch. Similar results are found in studies by Gande and Parsley (2005) and Ferreira and Gama (2007) who find that sovereign downgrades convey important information for bond spread and stock market returns. They find significant effects in emerging markets while upgrades do not have the same results. Almeida et al. (2014) find that the effect of rating changes is also felt in the real market. Downgrades tend to decrease leverage and investments of firms rated at similar levels as the sovereign before the downgrade. Borensztein, Cowan, and Valenzuela (2013) argue that if the sovereign credit rating is not at the high end of the spectrum, credit ratings of domestic firms are likely to suffer regardless of their financial health in case of a downgrade. They present results which suggest that the effect of sovereign ratings should be felt in particular in countries with high political risk and

capital account restrictions. According to them there are three ways in which private sector creditworthiness can be affected by that of the sovereign. The first is the negative effect of a country's default on the overall domestic market economy which will in turn weaken the financial integrity of the private sector. The second is the consequence of a higher tax imposed by the government or inflationary measures to cope with insolvency which hurts private debtors. The last one represents the restriction of capital flows in and out of the country. Through this administrative measure the sovereign is impeding companies to service their foreign obligations.

Besides actual upgrades or downgrades in sovereign rating the mere anticipation or announcement of a downgrade can have negative effects. The three CRAs adopt a set of notification to convey their views about a potential change in rating. They can, for example, use a negative outlook notification to show that there may follow a downgrade within the next two years. To show a potential downgrade within the next 90 days they use a negative watch notification. Larraín et al. (1997) perform an event study for 26 emerging economies and find a strongly significant announcement effect when their sovereign bonds were given a negative outlook. Arezki, Candelon, and Sy (2011) find similar results and observe statistically and economically significant effects on other financial markets and countries suggesting that CRAs can cause financial instability.

Sovereign ceiling policies

Until 1997, the three CRAs employed the standard of not rating any private company above the credit rating assigned to the sovereign. Since then the agencies have gradually moved away from this policy and made it possible for a company to be rated higher than the country it operated in. However, a company rising above this 'ceiling' is still rare. In 2012 S&P reported that only 54 non-financial firms had received a credit rating which was higher than that of the sovereign (Almeida et al., 2014). This is proven by Borensztein, Cowan, and Valenzuela (2013), who show that the sovereign rating ceiling is still used as an upper bound for rating companies. They argue that the imposing of capital constraints provides evidence for a sovereign ceiling as the private sector will frequently fail to honor its external obligations if the sovereign is in default. The economic rationale behind the sovereign ceiling policies is that of governments being emergency liquidity providers. When a country is downgraded the government is perceived to be less able to bail out a domestic bank in distress. This in turn has a negative effect on a bank's ratings as part of the country risk is transferred to the domestic bank (Adelino and Ferreira, 2014).

The few firms that are rated above the sovereign ceiling are generally strong companies that are still perceived to be able to meet their foreign currency obligations, even in the case of a sovereign default. Their risk profile tends to be lower because they earn sizeable revenues from export, have assets abroad, or have a foreign parent company. An issuer will receive a credit rating above the ceiling if it shows itself to have low default correlation with the country and if it is believed to withstand the financial economic turbulence that is inherent to a sovereign default. Still, the agencies tend to employ the policy of not rating a firm more than two notches above the country (Almeida et al., 2014).

Sovereigns and domestic banks

Fourthly, I investigate the relationship between a domestic bank and its sovereign. Gathering information about the creditworthiness of financial institutions is hard and costly for individual investors and is often outsourced to the CRAs to overcome these costs and the collective action problems (Hau et al., 2013). Rating a bank provides a challenge for CRAs compared to other companies because of problems with transparency and the numerous risks that banks face. Morgan (2002) argues that because of this asymmetric information and possible regulatory interventions bank ratings can be thought of as a lower bound for the quality of external credit ratings as opposed to other firm ratings.

Banks play a critical role in providing access to international capital markets to companies and other agents who may not be able to access these markets themselves. Because of the tight relationship between spreads and ratings a change in a bank's rating can have a big impact on the financial environment in which these agents operate. It can be argued that bank ratings have a higher correlation with sovereign ratings than other sectors do as banks have, in general, much higher levels of leverage. This makes them more prone to suffer downgrades when macro-economic variables worsen due to a sovereign downgrade. Banks may even be affected directly by sovereign distress when they hold a substantial portion of government debt (Borensztein, Cowan and Valenzuela, 2006).

When rating the banking sector the CRAs do not only look at the bank as a separate entity but also at the likelihood that government support will be offered in case of imminent bankruptcy. Since 2007 the implicit support from governments to banks has boosted bank credit ratings even though a 'no bailout' policy might still apply. According to the market, these policies have not weakened the probability of government support for 'too big to fail' banks (BIS, 2013). This also provides part of the rationale behind the use of the sovereign ceiling as an upper bound for ratings. It is argued that when a country is

downgraded because of a weakened financial position it will also be less able to bail out domestic banks which in turn makes the banks' position riskier and, hence their rating will have to be adjusted accordingly.

Bank ratings also reflect the bank's financial stability and home country factors such as a lower level of development which is likely to cause lower bank ratings (Caporale et al., 2012). For a sample of 425 banks in 54 emerging economies Williams, Alsakka and Gwilym (2012) find that changes in sovereign ratings have a strong impact on individual bank ratings. In the sample the probability of a bank being upgraded after a sovereign upgrade is higher than the probability in case of a downgrade. The strength of the effect of a sovereign upgrade depends on a country's policies with respect to financial, business, investment, and economic freedoms. Another interesting finding is that banks with a credit rating below that of the sovereign are less affected by a change in sovereign rating than those rated at or above the sovereign level. This effect is most evident in emerging markets. In a related study, Borensztein, Cowan and Valenzuela (2006) use a sample 123 banks in 32 countries and show that only 2 percent of the banks were rated above the sovereign level, 88 percent was rated lower, and 10 percent was rated equally. They find a significant effect of sovereign ratings and the sovereign ceiling on private bank ratings. Especially in emerging countries this effect is large when there is a the lack of a strong parent company to give support to the bank, a sovereign downgrade, a high exposure to sovereign risk, and the banks are rated at the sovereign bound. They argue that because the relation between sovereign ratings and bank ratings is asymmetric and non-linear there is significant evidence in favor of a sovereign ceiling.

Panetta et al. (2011) investigate all channels through which sovereign risk can affect a bank's access to funding (asset holdings, collateral, sovereign ratings, government guarantees, international spillovers, risk aversion, impact on a bank's non-interest income, crowding out effects on the banking sector, and the hedging strategy of the sovereign) and find that a weakening balance sheet, sovereign downgrades, a decrease in the value of collateral, and a reduction in implicit bank support are making funding more difficult and costly to obtain, pushing down ratings. Huang and Shen (2014) argue that the sovereign ceiling is no longer being used but find similar results in support of the sovereign effect. They also provide hypotheses for the effects of asset deterioration and foreign funds. Banks with smaller holdings of government assets and larger access to foreign funds, because they are a foreign subsidiary, are less affected by a decreasing sovereign rating. This effect is enhanced in non-high income countries.

Bank lending channel

The relation between a bank's financials and its ability to provide credit to the market will be described next. The influence of monetary policy is felt through a number of channels. Mishkin (1995) identifies the most important ones among which are the exchange rate channel, interest rate channel, other asset price effects, and the credit channel. This last channel exerts its influence through the balance sheet channel and the bank lending channel. The first one causes the value of bank collateral to decrease in difficult times causing the lenders to require higher compensation. When this requirement cannot be met, lending will be reduced. Through the second one, deposits are reduced, restricting the bank's access to funding and its ability to provide loans (Bernanke and Blinder, 1988).

Jiménez and Ongena (2012) find that in difficult economic circumstances with tight monetary policies and deteriorating balance sheets banks tend to reduce lending significantly. These results are even more evident when banks have lower liquidity or capital ratios. When faced with this credit restriction companies cannot offset the consequences of the lower granting of loans by lending from other banks. Schnabl (2012) finds similar results when he investigates whether financial institutions transfer liquidity risk across markets and into the real sector. He suggests that, if the efficient market hypothesis does not hold, financial frictions can limit a bank's access to resources to cover any shortfall, sending a liquidity shock through markets which can in turn affect the lending. He finds that after the Russian default of 1998 international banks reduced lending to Peruvian banks which in turn reduced lending to Peruvian companies. When the economic climate worsens and leads to tighter rules regarding higher capital requirements banks have the option to either recapitalize through the sale of new equity or to cut the risky loans (Hyun and Rhee, 2011). They find that the latter is the preferred choice when left up to incumbent shareholders. The reason for this is that in times of monetary restrictions and financial uncertainty banks tend to hold large amount of precautionary liquidity which leads to a reduction in the loan supply.

Sovereign rating and the lending supply

The last relationship to describe is the impact of a sovereign rating on the supply of domestic credit. When investigating a sample of Italian banks during the last sovereign debt crisis, Bofondi et al. (2012) find that in times of increased sovereign distress banks reduce the amount of loans and increase their

price. Evidence for this supply side effect, as opposed to alternative explanations, is obtained by comparing domestic bank lending to foreign bank lending. They find that the domestic loans increased less and were more expensive than those of their foreign counterparts, providing evidence for a sovereign effect. Mallucci (2013) finds a positive relation between sovereign bond prices and the supply of loans indicating the danger of a credit crunch in times of sovereign distress or default. Gennaioli et al. (2013) come to similar conclusions and state that a sovereign default leads to a reduction in private sector lending. This effect should be larger in more financially developed economies where creditor rights are better protected because banks tend to own a larger amount of government bonds, creating more severe consequences when facing sovereign default. We can argue that this effect may also be closely tied to a better financial position of governments in developed economies (and therefore more government holdings) but this was outside the scope of the paper. Cantero-Saiz et al. (2014) come to slightly different conclusions in their investigation of European banks. They also find that sovereign risk acts as an important determinant of the loan supply, though argue that banks operating in countries with a higher risk premium should be especially vulnerable to the increased risk and tight monetary policies. The opposite effect, in times of monetary expansion, is not clear because banks in countries with higher sovereign risk may still have trouble accessing external funds and are therefore not able to transfer the positive effects of expansion into the loan supply (Cantero-Saiz et al., 2014).

Besides deteriorating balance sheets, the decrease in value of the collateral, increased risk aversion in high risk countries, and a decline of implicit government guarantees, a bank's rating may also suffer when the sovereign is downgraded due to sovereign ceiling policies. A sovereign downgrade will increase the costs of borrowing and decrease a bank's ability to access the market resulting in a downgrade (CGFS, 2011). Ferri et al. (2001) find that banks are more likely to receive a lower rating after a sovereign downgrade than they are to receive a higher rating after an upgrade.

Adelino and Ferreira (2014) ask if banks downgraded because of sovereign ceiling policies reduce lending to the private sector and investigate a sample of banks rated at the sovereign bound and banks rated below the bound. Despite other macroeconomic influences correlated with a sovereign downgrade they find that banks rated at the sovereign bound are downgraded significantly more than their counterparts below the bound. They go on to explain that banks rated at the sovereign bound reduce lending more and increase the interest rate spread in case of a sovereign downgrade. In line with previous research they attribute this to a declined access to wholesale funding and to an increase in the funding costs. Insurance companies and other institutional investors are only allowed to invest in

securities that fulfill certain capital requirements. A rating change may significantly impact a bank's funding through this channel forcing it to reduce the lending supply. The main differences between the Adelino and Ferreira (2014) paper and this thesis will be the more comprehensive data set and the inclusion of financial development as a possible explanation for some of the CRA's decisions. Previous research has largely ignored the possible role that financial development plays in policies affecting credit ratings. Often, financial development was only reflected by one variable possibly causing misleading results because the large scope of the level of development cannot be observed in just one variable. This is where this current research comes in, exploring the sovereign ceiling policies in the light of various measures of financial development.

Financial development

In this theoretical framework the indicators emerging and developed have been used to broadly indicate the level of financial development of certain countries. However, further investigation requires more specific definitions of the underpinnings of this development. Throughout this thesis I use regressions with variables that reflect characteristics of the financial system to illustrate what factor of being financially (under)developed contributes most to the sovereign effects on the lending supply. Cihak and Demirgüç-Kunt (2013) identify four variables which they consider to be at the basis of financial development. In doing this they deviate from the traditionally used size of the banking sector as a sole indicator. The first characteristic they identify is financial depth. Their report primarily uses the value of transactions in the stock market as a percentage of GDP. They argue that this is a suitable indicator because it not only incorporates the value of shares but also the activity. The second characteristic is financial access or inclusion. This indicator measures the ability of the private sector, firms and individuals, to use financial services. The main proxy used in the paper is the number of bank accounts (per 1000 adults). The third characteristic is financial efficiency. Efficiency reflects the degree to which the financial sector performs transactions in the least costly fashion. When transactions are not performed efficiently costs may be transferred to the private sector. The primary measure for efficiency in markets is the turnover ratio. A higher ratio reflects more liquidity because of a higher trading volume which allows price information to flow more easily and hence create more efficient markets. This ratio is calculated by dividing the total value of shares traded during the period by the average market capitalization. The average market capitalization is the average of previous and current end of period values. The last financial development characteristic is financial stability. Stability of the financial system is crucial even if the financial sector seems, at the surface, to be efficient and deepening. These

characteristics may be attained through cutting costs and shortening or eliminating, for example, the screening process of loans. However, if loans are granted without a sufficient background check of the borrower, eventually even the smallest shock may disrupt the entire system. Bank nonperforming loans to total gross loans are used as a proxy for financial stability. This percentage is calculated as the value of nonperforming loans divided by the value of the entire loan portfolio. A debtor has a nonperforming loan if he has not made any payments for at least 90 days.

The questions that remain largely unanswered in related literature are the ones about what specific factors of financial development contribute the most to the impact of sovereign downgrades on the loan supply and whether this should be felt more in emerging or developed countries. Two schools of thought can be identified that differ in their opinion about whether and why, more or less financial development should have a bigger impact. On the one hand, authors argue that strong creditor rights protection, larger holdings of government bonds, and heavy reliance on bank loans convey sovereign risk to the private sector, especially in better financially developed countries. On the other hand, political risk, lack of transparency and asymmetry of information, and higher risk premiums are blamed for transferring risk between the sovereign and private sector, especially in emerging markets. When investigating this difference, four factors are used to identify the level of financial development. These are access, efficiency, stability, and depth of the financial system, each of which will determine a small part of the total difference between developed and developing countries. In the empirical part of this research these factors will be included in the regressions to observe which one causes a more severe decline in the supply of loans after a sovereign downgrade. From the results I will then be able to conclude whether an emerging or developed country's loan supply suffers more or less after a sovereign downgrade and to which factors this effect is most attributable.

III. Methodology and data

Design

In this section I present the description of the data and methods I use to determine the effects of sovereign ceiling policies on financial development indicators in developing and developed countries. CRAs rate companies on the basis of the maturity and currency denomination of their issue. This divides the credit ratings into four groups ranging from long-term to short-term ratings and from local to foreign

currency. Still, credit ratings of domestic firms depend heavily on the credit rating of their sovereign. This policy is referred to as the sovereign ceiling. In this thesis I use the foreign currency, long-term issuer ratings since agencies still use these sovereign ratings as a strong upper bound for any firm located in this country (Adelino and Ferreira, 2014). Moody's itself points this out by stating that: "foreign currency deposit ratings are subject to Moody's country ceilings for foreign currency deposits which may result in the assignment of a different (and typically lower) rating for the foreign currency deposits relative to the bank's rating for domestic currency deposits." In their rating process they include measures of intrinsic financial strength, sovereign transfer risk, and both implicit and explicit external support elements (Moody's, 2009).

Some countries in the sample have chosen to move away from using debt denominated in foreign currency as they are no longer willing to accept the currency risk. Moody's solves this problem by setting the foreign currency rating, as provided on their website, equal to the domestic currency rating after such a decision has been made, making them comparable. For the sovereign and bank ratings I choose Moody's ratings because they tend to be the most stable and its rating decisions most often lead the other agencies (Alsakka and Gwilym, 2010). Also, a rating action by Moody's tends to have a larger effect on the stock market (Brooks et al., 2004). This suggests that Moody's is the most suitable one to identify effects of sovereign rating changes as the market is more prone to react to these changes. Because these sovereign and bank ratings are not assigned randomly and the sovereign effects are exogenous of the model the experiment follows a quasi-natural design.

Data

The countries in the sample are selected from a full alphabetic list which is narrowed down on the basis of two main characteristics. Firstly, only countries with a sufficient amount of rated banks are selected. Secondly, only countries are selected that issue debt denominated in foreign currency or have a strong domestic currency that is also traded internationally. Belize, for instance, was omitted because it did not issue any foreign currency ratings and its own rating was not traded. Countries that do possess the necessary characteristics are, for example, Germany (which issues debt in foreign currency) and the U.S. (with a strong domestic currency).

In the bank level analysis the output variable will be the change in bank credit rating after a sovereign downgrade and in the loan level analysis the dependent variables are the logs of various types of loans.

In these analyses I will use various control variables for banks as well. Poon and Firth (2005) find bank size, quality of assets, profitability, sovereign risk, and liquidity to be important factors in determining individual bank ratings. The size of the bank is defined as the log of total assets. Capital is proxied by the ratio of equity over total assets. Liquidity is denoted as liquid assets over total assets. Profitability is the operating income divided by total assets (ROA). Lastly, deposits will be included and defined as deposits divided by total assets. To control for the nationality of banks and time varying country effects I control for GDP growth, inflation, and government holdings by banks. These will be obtained on an annual basis from the World Bank (Adelino and Ferreira, 2014).

To further investigate the effects of financial development I include the independent variables depth access, efficiency, and stability of financial markets as defined by Cihak and Demirgüç-Kunt (2013). These will be measured by respectively the value of transactions in the stock market as a percentage of GDP, the number of bank accounts per 1000 adults, the turnover ratio (i.e. the activity of the stock market), and bank nonperforming loans to total gross loans to show which indicator of financial development contributes significantly to a change in the credit supply. These variables will be included in the regressions as their logarithms and will give a more in depth view of what factor of financial development is most important, rather than just the conventional measure of financial development: size of the banking sector. These proxies for financial development are obtained from IMF's Financial Access Survey, FSI (Financial Soundness Indicators), and the World Bank. Again these country level indicators are used at an annual level. Including some variables as their logarithms is done to be able to better understand the marginal changes with respect to the other variables.

Firm fixed effects for banks will be included in the analysis to reduce concerns about the selection of the sample. The regression techniques will only hold reliable results if the same bank extends loans both before and after the sovereign downgrade. This way the sovereign ceiling effect will only be identified for the relevant companies. Time fixed effects are included as well to control for any unobserved changes over time that might affect the sample.

Analysis

In order to use the novel technique proposed by Adelino and Ferreira (2014) bank ratings will be converted to a numerical scale with 21 representing the best (Aaa) rating and 1 representing the worst (C) rating. Also, banks will be divided into a treatment group with credit ratings at least equal to the

sovereign and a control group with credit ratings below that of the sovereign. For example, in a given country with a rating of Aaa, banks which also have this Aaa credit rating will fall into the treatment group whereas banks that have any rating below the Aaa bound will fall into the control group. A greater effect on the treatment group due to a sovereign downgrade can be expected because sovereign ceiling policies do not apply to the control group. CRA's employ these policies when rating banks and use them to set the upper rating bound of banks equal to that of its country of domicile. Because of these policies it remains very difficult for a bank to obtain a greater rating than its sovereign and will most likely change with it as the ceiling policy is being maintained after a sovereign downgrade. This helps me to disentangle the bank lending channel from any firm demand channels since the treatment group has better initial credit quality and is less affected by other confounding macro-economic effects that may cause reverse causality issues (e.g. a decrease in demand for loans from domestic firms, the increased risk of domestic banks that cause a sovereign downgrade). Another way of putting this would be to say that a worsening economic climate, causing overall lower demand for loans, will not be the reason for a reduction in the loan amount as the higher rated treatment group will be better able to withstand these economic pressures. The overall worse conditions in a country after a sovereign downgrade will cause lower demand for loans over the whole of the banking sector. There is, however, no economic reason to believe that higher rated, and financially healthier banks would experience an even bigger drop in the demand for their loans (as opposed to the lower rated banks). This tells us that if banks at the sovereign bound are downgraded more than the ones below the bound the effect can be attributed to the bank lending channel (i.e. through the ceiling policies) and not to the firm demand channel (i.e. lesser demand for loans).

As in Williams, Alsakka and Gwilym (2012), I have chosen for a maximum lag of three months between a sovereign rating action and a subsequent effect on bank ratings. They argue that three months is an appropriate window after which the effects on bank ratings are very likely to have other causes. Another reason they refer to, is a CRA's time to take action after a bank has been put on watch, which is usually 90 days. Even if there is more than one rating action in a period of three months, causing the possibility of a bank reaching the same rating as it started with three months before, the first rating action will be used. The first downgrade will be the most likely to happen because of sovereign ceiling policies as CRA's often exaggerate their actions which makes it necessary to correct ratings again later on.

In the regression of bank ratings and sovereign ratings I need two data measurements at two points in time for the control group and the treatment group. The difference is calculated between the control

group and treatment group at time $t=1$. The same is done at time $t=2$. The outcomes at $t=1$ are then subtracted from the ones at $t=2$ to arrive at the difference between differences (DID). Instead of using four ordinary least squares (OLS) regressions a 'difference in differences estimator' will hold the same results. The general form is described by the formula: $y = \beta_0 + \beta_1 T + \beta_2 S + \beta_3 (T \cdot S) + \varepsilon$. When the difference in rating between the control group and the treatment group becomes smaller after the 'treatment' (i.e. the sovereign downgrade) evidence is provided on the implementation of sovereign ceiling policies because the banks rated at the bound are downgraded more. This general formula is adjusted to incorporate the relevant variables for testing.

$$\begin{aligned} \text{Bank rating}_{it} = & \beta_1 (\text{Bank rating}_{i,t-1} \geq \text{Sovereign rating}_{i,t-1}) + \beta_2 (\text{Sovereign downgrade})_{i,t} \\ & + \beta_3 (\text{Bank rating}_{i,t-1} \geq \text{Sovereign rating}_{i,t-1}) * (\text{Sovereign downgrade})_{i,t} \\ & + \beta_4 X_{i,t-1} + \beta_5 Y_{i,t-1} + C_i + T_t + \varepsilon_{it} \end{aligned}$$

In this regression equation the variables of interest are the interaction term between the dummy for banks having an equal or higher rating than the sovereign and the dummy for a sovereign downgrade ($\text{Bank rating} \geq \text{Sovereign rating}$) and the development indicators. A negative coefficient for β_3 means that a bank belonging to the treatment group is downgraded more than a bank in the control group after the country receives a lower rating. This means that this interaction variable reflects an indicator of the use of sovereign ceiling policies. It isolates the effect of a sovereign downgrade on just those banks that are rated at least as high as the sovereign. $X_{i,t-1}$ is a vector of individual bank controls (size, profitability, capital, liquidity, and deposits) and time varying controls for a bank's nationality. $Y_{i,t-1}$ is a vector of financial development indicators (access, depth, efficiency, and stability). C and T denote bank and time fixed effects respectively.

Next, the effect of a sovereign downgrade on the lending supply is investigated with another DID estimator.

$$\begin{aligned} \text{Loan supply}_{it} = & \beta_1 (\text{Bank rating}_{i,t-1} \geq \text{Sovereign rating}_{i,t-1}) + \beta_2 (\text{Sovereign downgrade})_{i,t} \\ & + \beta_3 (\text{Bank rating}_{i,t-1} \geq \text{Sovereign rating}_{i,t-1}) * (\text{Sovereign downgrade})_{i,t} \\ & + \beta_4 X_{i,t-1} + \beta_5 Y_{i,t-1} + C_i + T_t + \varepsilon_{it} \end{aligned}$$

Here loan supply will be the log of the total amount of loans, both to consumers and SME's, and mortgages. The control variable and development indicators represent the same variables as in the first

regression equation. The coefficient β_3 reflects how much the treated group reduces lending more than the control group after a sovereign downgrade.

Validity

The quasi natural experimental design of this thesis makes the study more feasible by not requiring randomization of the subjects. However, by using this design the results may be affected by confounding variables. This can bring about concerns of endogeneity and reverse causality. Differentiating between the bank lending channel and the firm borrowing channel may be difficult because of the impact of other macroeconomic shocks that coincide with a sovereign downgrade. These concerns are largely mitigated by the fact that banks at the sovereign bound are financially sounder than banks below the bound. A decrease in the demand for loans should therefore affect banks at the bound less than their lower rated counterparts. This will be supplemented with bank and country specific controls to further moderate these problems. Finally, bank and time fixed effect will absorb any remaining endogeneity issues not tackled by the control variables. In an earlier study Adelino and Ferreira (2014) reduce reverse causality matters by showing that the causal relationship runs from sovereign to bank and not from bank to sovereign by running regression with exclusively loans to foreign borrowers. These loans to other countries will most likely not be affected by any macroeconomic troubles that the bank's sovereign is experiencing because of a downgrade. This way the demand from the foreign borrowers will remain high when supply from the downgraded country's bank will drop. They have already shown this relationship to hold. Finally, all standard errors will be clustered at banks home country level. This is done to correct for any changes that are shared among more countries (e.g. variables that do not only vary within the same country).

IV. Results

Summary statistics and overview

For the experiment a more comprehensive sample (as opposed to previous literature) of 85 countries consisting of 29 developed and 56 emerging countries as categorized by IMF (2014) is used. Ratings are also collected from banks in each country leading up to a total of 229 banks and 415.472 observations over 24 years (from 1989 to 2013). Figure 1 shows how big the rating differences are between

sovereigns and banks. A positive difference means that the bank is rated below the sovereign. A negative difference indicates that the bank has a higher rating than the sovereign and a difference of 0 shows that the banks is rated at the sovereign bound. For example, a difference of +2 between a given country and bank means the bank is rated two notches below the sovereign (e.g. the bank would be rated at Aa2 and the sovereign would be rated at Aaa). A significant share (over 30%) of the banks is rated at the bound. Very few banks are rated higher than the sovereign (observations to the left of zero) and the majority of banks is rated one notch below the sovereign (a difference of +1) or at the sovereign bound (difference of 0).

Figure 2 plots sovereign ratings against individual bank ratings. Observations on the 45 degree line are banks rated at the sovereign bound. In countries rated at 14 (Baa1), for instance, a number of banks is given a very low rating. As the circles approach the line, the frequency of banks increases, indicating that most banks are rated in the vicinity of their country of domicile. The figure shows that most banks are rated below the sovereign and at the high end of the rating spectrum. The bigger circles on the right, as opposed to the smaller ones on the left, indicate that more country-bank pairs receive a higher rating. Only few countries have a rating below Caa1. Figure 3 shows the distribution of the sovereign ratings. Spikes around 12 and 20 illustrate that most countries are given ratings in the neighborhood of Baa3 and Aa1. Most countries are rated above Baa3 which specifies most countries to be investment grade.

In table 1 the conversion from Moody's rating notation to a numerical rating is visualized. Every rating is given a numerical equivalent from Aaa (21) to C (1). This is done to be able to incorporate the ratings into regression equations. Table 2 provides the summary statistics. The average bank credit rating in the sample is 12,3 with the highest being Aaa. The bank with the lowest rating is in default (1). Of these banks 32% is rated at the sovereign bound. A sovereign downgrade occurs in 0,03% percent of the observations. This percentage appears to be quite low because the observations are done at a daily frequency. The average size of a bank in the sample is over \$10.4 billion. The smallest and the largest banks have assets of \$3,5 billion and \$19 billion, respectively. \$481 million worth of loans are granted by banks on average. The average profitability (return on assets) is about 1,1%. The equity over assets ratio (capital ratio) is 8,5% and liquidity (cash and marketable securities) is about 26% of the assets. Deposits account for 62% of total assets. Table 2b shows summary statistics only for the treatment groups with banks rated at the same level as the sovereign. As expected the average credit rating is higher than that of the full sample with 13.3. About double the amount of downgrades can be found in the treatment group. Although banks in the treatment group are of better financial health they still experience more

downgrades. This may point to the implication of sovereign ceiling policies. The banks in the treatment group appear slightly smaller and less active in the loan market with an average size of \$10.2 billion and loans of \$219 million. They are, however, more profitable with ROA of 1.5%. Claims on the government are about half of those in the full sample with 23% reducing concerns about downgrades happening because of a deteriorating financial position of the government.

Table 2c compares summary statistics of developed countries and developing countries. We see that the average bank rating is, not surprisingly, higher in developed countries (16.17) and that banks in these countries are not as often rated at the sovereign bound (19%). This is understandable as developed countries often have high credit ratings which are of a level that is more difficult to obtain for any firm. The fact that more banks are rated at the bound in developing countries might already reveal signs of a sovereign ceiling. Banks that are of sound financial health (sometimes better than their sovereign) but still rated below the bound provide evidence for this. The frequency of downgrades remains the same throughout countries. Rather surprising, a greater amount of average loans per bank is found in developing countries. This may mean that only larger companies (as opposed to the often poorer households) take out loans (which are of a bigger size) and not the average households. Households do take out more loans in developed economies bringing down the average. Slightly bigger banks (10.74 billion on average) can be found in developed countries. With an average return on assets of 1.4% in developing countries as opposed to 0.4% in developed countries it is clear that banks are able to utilize more lucrative investment opportunities in the emerging markets (albeit with increased risk). Also capitalization is slightly higher in emerging countries. This may act as a buffer against the higher risk often experienced in such countries. Liquidity ratios remain similar across all samples (26%) because of regulatory requirements. The fraction of deposits is also similar for the samples although it is slightly higher for the developing countries. Lastly government holdings are much lower in the emerging countries since banks do not wish to run any more risk by holding assets of a potential risky sovereign.

Sovereign downgrades and bank ratings

In the first regression the effect of a sovereign downgrade on treated (at the sovereign bound) versus control banks (below the sovereign bound) is investigated. The effect on both groups is measured within the quarter of the sovereign downgrade. Difference in differences estimators are obtained with OLS regressions. To see how much banks that are rated at an equal level as the sovereign are downgraded more after a sovereign downgrade (and hence, the implementation of sovereign ceiling policies) the

interaction variable, $(\text{Bank rating} \geq \text{Sovereign rating}) * (\text{Sovereign downgrade})$, is created. When sovereign ceiling policies are indeed employed by CRA's I expect to see a positive sign for the Treatment group and a negative sign for both Sovereign downgrade and $\text{Treatment} * \text{Sov. Downgrade}$.

Table 3 presents the results obtained from the first regression equation. In the first regression of the three variables of interest only bank and time fixed effects are included. In the second regression the control variables are included. The same controls are included in the third regression together with financial development indicators. In the last regression the indicators of financial development are included as well as bank and time fixed effect and the country macro controls.

In column (1) I find that if a bank belongs to the treatment group (dummy = 1) its rating is 0.77 notches higher than a bank belonging to the control group (dummy = 0). This was to be expected as my definition of the two groups will always result in higher ratings for the treatment group. In case of a sovereign downgrade, all banks are downgraded as well with an average of 1.24 notches. The sign of this coefficient remains constant for the complete sample of banks. The interaction term looks only at the treatment group after a sovereign downgrade. It shows that a bank with a rating at the sovereign bound is downgraded 0.81 notches more than a bank rated below the bound. The three coefficients are statistically significant at the 5%, 1%, and 10% level respectively. These results are in line with the expectations of CRA's using sovereign ceiling policies. When banks are rated at or above their country of domicile they suffer downgrades regardless of the fact that they may have better financial health than the control group (with lower initial ratings).

Column (2) includes the control variables which amplify the effect of the treatment dummy and the interaction term. The sovereign downgrade dummy increases slightly (-0.96) and now, the treatment group receives even higher ratings than the control group (0.86 notches) but is also downgraded more severely after a sovereign downgrade (1.23 notches). Of the control variables only capital, liquidity, and deposits are significant (all at 5%) with coefficients of 5.13, -1.85, and 2.03, respectively. Banks with a better capital ratio receive higher credit ratings. This coefficient is large by construction (a one point increase in the ratio, or 100%, leads to a 5.13 notch increase in rating) as it is difficult for banks to gain a full point on capital ratio. Banks with higher income from deposits also appear to receive higher ratings. At first sight it might seem strange that liquidity has a negative coefficient. However, if I argue that most banks operate close to their liquidity requirements, a full point increase in liquidity (liquid to total assets ratio) might plausibly decrease a bank's rating by 1.85 notches. The rationale here is that banks prefer to have as many outstanding loans as possible. However, due to liquidity requirements they are obligated

to have a buffer. The bigger this buffer gets the less loans banks will be able to sell which leads to lower income and might jeopardize their financial health, resulting in a lower rating.

After including financial development indicators (depth, access, stability, and efficiency) in column (3) the interaction term and treatment dummy are no longer significant at the 10% level. We can argue that there is another effect that explains the height of bank ratings that absorbs the significance of the treatment dummy. Financial development seems to be affecting the credit ratings as well, making the treatment group lose significance as well as the interaction term. This provides some evidence of CRA's moving away from their use of sovereign ceiling policies as the sole measure of ratings. A sovereign downgrade still leads to a significant downgrade of the sample of banks but the treatment group is no longer downgraded significantly more than the control group. A better capital ratio and more income from deposits still ensure banks of a higher rating. When looking at the financial development indicators we can see that a one percent increase in the value of stock market transactions (depth) will lead to a 0.012 notch increase in bank rating. Although access is not significant the positive sign tells us that an increase in the amount of bank accounts would also lead to an increase in bank rating. Since stability reflects the amount of non-performing bank loans, the negative sign indicates that an increase of one percent decreases bank ratings by about 0.009 notches. This stands to reason as people who cannot repay their loan hurt a bank's financial health which in turns leads to a lower rating. The coefficient for efficiency (-0.74) is slightly more peculiar because of the minus sign. A higher turnover ratio (i.e. more liquidity in the market) would lead to lower bank ratings. Although higher market liquidity is mostly a positive indicator, possible explanations for the negative sign would be a lesser willingness of investors to hold on to bank stocks or portfolios due to low confidence. A higher turnover ratio in banks' portfolios may also result in higher brokerage fees making them less desirable to hold. Lastly, higher market volatility due to a high ratio may create an incentive (or a necessity) for investors to pursue short-term capital gains. These gains are taxable at the ordinary income rate for investors which also decreases its attractiveness. However, as this coefficient lacks significance I cannot be sure about its outcome.

In the last column controls for macro-economic indicators are included. Overall, coefficients are of the same sign and magnitude indicating that downgrades are not explained by a general shift in a country's macro-economic conditions. The sovereign downgrade dummy regains some of its significance again due to a better fit of the model and less noise (as judged from the R-squared). Still, the treatment

dummy and interaction term remain insignificant. The significance of stability is reduced quite drastically because the macro economic conditions explain part of the unrepaid loans.

So far, we can see that all banks are downgraded significantly when their home country is. The financial development indicators tell us that a more financially developed country (i.e. more depth and higher stability) will lead to higher bank ratings. Also, when including these indicators the treatment dummy and interaction term are no longer significant. This indicates that CRA's do not only use a general sovereign ceiling policy (e.g. implicit government support) to downgrade banks but rather look at certain aspects of a country's level of financial development. When determining a bank rating, the level of financial development acts as a mitigating factor for the use of the ceiling policies.

Sovereign downgrades and the loan supply

Next, we will look at how a sovereign downgrade effects the amount of loans provided by the domestic banks. The second regression will investigate how the loan supply reacts to a sovereign downgrade. This is measured within four groups of loans: the total loan amount, loans to small and medium sized enterprises, loans to consumers or households, and mortgages. The dependent variables are measured two quarters after the sovereign downgrade.

Straight away we can see a different development of the level of significance in this table as opposed to table 3. In column (1) the treatment group variable tells us, although not significantly, that a bank at the sovereign bound makes on average 1.9% less total loans than their lower rated counterparts. We can argue that although these banks provide less loans, they still receive a higher rating because the loans are of higher quality. The second dummy illustrates that banks in general reduce loans after a sovereign downgrade by 17%. Rather surprisingly it does not seem that treated banks reduce their loans more than control banks. The reason for this is the fact that they initially had a lower amount of loans, but of better quality. When the country is downgraded these banks will not have a need to cut loans as drastically as the lower rated banks (who have provided worse loans initially). As we have seen in table 3, treated banks are downgraded more than the control banks after the country experiences a downgrade. However, it does not follow that these banks reduce their lending supply. We can argue that this is because of the better initial loans provided by the treatment group. A more serious result may be the potential flaw in the sovereign ceiling policies. From the CRA's point of view, banks at the sovereign bound need to be downgraded because of the lower possibility of receiving government support. Better rated banks seem to disagree as they do not feel the need to reduce their lending any

more than their lower rated counterparts. This supports the idea of ceiling policies not being based on fundamental financial health of banks but reflect only a basic rule of thumb.

Column (2) includes bank control variables. The sovereign downgrade dummy loses some of its significance and size as the control variables explain part of the reasons why banks reduce lending. Bigger banks provide more loans (0.84) as do more capitalized banks (0.63). We can already see that liquidity always plays an important role due to the regulatory requirements. The negative sign for ROA indicates that part of the group of total loans is not a good source of revenue. As we will see later on, this group seems to be the small and medium sized enterprises.

After including the development indicators in column (3) the first variable remains similar. Banks now reduce their loans slightly more (but highly significantly) after a sovereign downgrade. Also, treated banks now significantly reduce their loans less (7%) than the control group. In other words, after a sovereign downgrade the lower rated banks have to cut loans more than the banks rated at the sovereign bound. Of the control variables size plays an important role with a one percent increase leading to a 0.56 % increase in the loan amount. Bigger banks seem to provide more loans. Again, we see a significant negative coefficient of -0.68 for liquidity. The same rationale applies here as before: if banks (have to) increase their buffer of liquid assets (liquidity ratio) by one, this will lead to an average reduction in the loan supply of 68%. Stability is the only significant control of the development indicators. An increase of one percent in the ratio of non-performing loans to total loans causes a bank to reduce its loan supply by 0.05%. It is clear that if payments on loans are not met these will be canceled as soon as possible or at least not provided again to the same party. Stability (the ratio of nonperforming loans) absorbs the significance of profitability because the source of lower profits seems to be the amount of nonperforming loans.

Even after including macro-economic circumstances in column (4), banks still significantly reduce loans after a sovereign downgrade by 7%. This indicates that we can rule out a general shift in the macro-economy being the cause of a drop in loans. Banks may only be willing to grant loans to borrowers who are more certain to uphold their agreement, thereby mitigating the risk of having to be bailed out because of the issuance of bad loans. Except for stability, the other variables remain similar in size and significance. The number of non-performing loans does no longer significantly influence the loan supply suggesting that a worsened economic climate may be the cause of these bad loans in the first place.

In column (5) we move to loans to small and medium sized enterprises (SME's). The positive sign for the treatment group tells us that higher rated bank provide 23% more loans to SME's. Companies may often seek a more financially sound and bigger bank to secure a less expensive and safer loan. Still, loans to SME's are also cut after a sovereign downgrade by 14%. Although the coefficient of -0.16 is not significant, the treatment group does seem to cut loans more than the control after a sovereign downgrade. However, these results remain insignificant throughout the regressions.

In column (6) bank controls are included of which only size and liquidity are significant. Again, bigger banks seem to be better able to provide loans to the SMEs. These loans are also quite heavily influenced by regulatory requirements regarding liquid reserves. The treatment dummy and interaction term remain similar.

In column (7) the control variables and the financial development indicators are included again. Size and liquidity are again of importance but the treatment group no longer provides significantly more loans to the SME's. We can argue that big banks (with the most assets), not necessarily higher rated banks, are the ones that provide loans to SME's as they may often be better capable of providing loans of bigger size. An increase of 0.85% in loans after a 1% increase in size illustrates this point. Banks, in general, also do not seem to cut loans with significance anymore after the country receives a downgrade. The level of financial development seems to better explain the reasons for banks to cut loans as does a sovereign downgrade. Again, liquidity proves to be an important indicator for the same reasons listed above. If we look at the financial development indicators, access has a rather surprising sign. It tells us that for an increase of 1% in bank accounts per 1000 adults the loan supply to SME's drops by 0.53%. This may be just a mechanical effect. On the one hand, as the number of bank account holders (e.g. households) increases, everything else equal, this number will be an increasing fraction of the total loans granted by banks. On the other hand, a decreasing fraction of loans is granted to SME's. This effect will be confirmed by the effect on consumer loans in column (11) and (12). Column (8) shows no further surprises. All previously significant variables are amplified slightly and the rest remains of approximately the same size. The only variables that changes significantly is ROA. It shows us that an increase of one (100% by construction) in the profitability ratio leads to a 233% decrease in loans to SME's. It seems that the more profitable banks provide less loans to SME's indicating that these type of loans are not a good source of profit as opposed to loans to consumers (as we have noticed already in the previous regression group). The next group will illustrate this difference as well. However, before I attributed this

lower source of profit to a higher amount of nonperforming loans. Stability is now not significant suggesting that the source of these bad loans lies somewhere in the overall economic conditions.

Column (9) starts of the group of loans to consumers. None of the dummy variables are significant, indicating that consumer loans are not affected much by a sovereign downgrade or by the height of bank ratings. This trend continues through all regressions in this group. The reason banks are reluctant to cut loans to consumers may be that this group is a better source of revenue than the SMEs. We can also see this in the previous column when we look at the negative signs for the downgrade variable. Banks are able to charge higher interest rates in the consumer sector making this a preferable sector.

Column (10) includes bank controls but the same trend continues. None of the variables seem to influence the loan supply significantly suggesting that the residual effects are all still absorbed by the fixed effects.

Only after including financial development indicators in column (11) we see that better capitalized banks provide more loans to consumers. An increase in capital ratio leads to a large effect (3.86) on the loans supplied to consumers. This stands to reason as a better capital ratio enables a bank to provide more loans of any kind. Although not always significant, this positive effect is shown throughout all regressions. Again, the negative coefficient for liquidity underlines the effect of an increasing liquidity ratio mentioned above. For the first time deposits have a significant positive impact on the loan amount. This is no surprise as the more money flowing to the bank through deposits the more the bank will be able to lend. This is only significant for loans to consumers as the relatively small amount of revenue generated by deposits is more easily able to fulfill the smaller amount of loans (relative to loans to SME's) requested by these consumers. These bank controls are only now significant as the background noise was lowered by including the development indicators and improving the fit of the model. The coefficient for access (1.06) tells us the opposite of what we saw in columns (7) and (8). An increase in the number of bank account holders per 1000 adults will most likely lead to an increase in the number of loans provided to households. Although loans to SME's did not seem to be affected by an increase in non-performing loans the next coefficient (-0.32) tells us that consumer loans are affected, suggesting that the bigger part of bad loans are located in the group of loans to consumers. The nonperforming loans in the consumer sector seem to be the cause of the negative stability coefficient in column (3). Usually this is the case as companies often have a better balance sheet and are better able to uphold their loan agreement because of a more stable financial health. As we have seen in column (8) the source of bad loans in the SME sector has to, indeed, be attributed to other reasons than non-

repayment. If we compare this argument to the latest financial crisis, consumers were indeed the first to fail on their debt. Moving on to column (12) we see that all variables remain similar but capital is no longer of significant importance. Apparently the macro controls absorb the significance suggesting that a better equity to assets ratio is also improved along with the overall economy.

The last group of loans consists of mortgages. From the start we can see a rather fluctuating trend throughout the columns. The treatment group seems to provide significantly more mortgages than the control group. Unlike in the SME loan group this effect remains significant after including size. This means bigger and healthier banks usually provide mortgages to consumers. This is probably because a mortgage is such a significant investment for many years. People want to feel secure with their bank's future and thus choose for a financially sound bank as reflected by ratings. Strangely, the sovereign downgrade dummy has a positive coefficient (0.31) suggesting that banks provide more mortgages after a sovereign downgrade. As in the latest financial crisis, mortgages and related products are at the core of bank and eventually sovereign distress. We may argue that this positive sign reflects a lag in the cut of loans. Banks were still eager to provide these profitable mortgages even though signs indicated a deteriorating economy. This effect, however, is no longer significant after including more controls and eventually changes sign.

Column (14) includes the normal bank controls but no financial development indicators or country macro controls. The size coefficient tells us that for every one percent increase in size the amount of mortgages increases by 1.14%. Understandably, bigger banks are able to provide more mortgages. The ROA coefficient shows us that more profitable banks issue more mortgages. This can mean that either mortgages are a good way to generate profit or profitable banks take more risks with customized loans. In light of the recent crisis the latter reason seems the more plausible one.

In column (15) we see that mortgages are now significantly reduced (0.5%) after a sovereign downgrade and that better capitalized banks provide more mortgages. Unfortunately, the interaction term is omitted after including the financial development indicators. This is caused by collinearity between the included variables. Apparently, indicators of financial development tell the same story as the interaction term. As the interaction term is an indicator of CRA's using sovereign ceiling policies, the fact that indicators for financial development tell the same story may indicate that there is more to downgrading a bank than just using the sovereign ceiling. Besides looking at the rating of the country and financial health of the government (to judge the ability of a government to bail out banks) banks may also be looking at the level of development of the country in question to justify any changes in the amount of

mortgages supplied. In the last column (16) macro-economic controls are included which have some implications for the other variables. Higher rated banks still provide more mortgages than the control group. Also ROA is omitted as the included macro-economic conditions apparently are the cause of the profitability factor. A bank's profitability is clearly closely correlated with the overall state of the economy.

Access is now significant at the 1% level showing a one percent increase in the number of bank accounts leading to a 1.09% increase in mortgages. This effect follows the same line of reasoning as does the loans to consumer group. For the first time efficiency is significant (1%). A one percent increase in the turnover ratio increases the amount of mortgages by 0.09%. A more liquid and efficient market transfers information faster allowing mortgages and potentially other asset backed securities to be traded quickly. When these products can be bought and sold quickly with as little transaction costs as possible, this creates an incentive to increase the amount of mortgages and related products with the goal of raising revenue.

V. Conclusion

In this study the effect of sovereign downgrades on bank ratings and the bank loan supply, through the bank lending channel, is investigated. I started off to show whether the sovereign ceiling effect is more dominant in developing or emerging countries. As it turns out, the level of development seems to be a more important factor in determining bank ratings than the sovereign ceiling. To illustrate these effects the research uses the fact that CRA's use of sovereign ceiling policies in determining bank credit ratings. The sample of banks is split up in a treatment group, with better initial credit quality, and a control group. The treated group is rated at the sovereign bound creating a differential effect when this group is downgraded more than the control group after a sovereign downgrade which rules out any confounding effects that should affect all banks equally.

My results show that all banks are downgraded significantly after a sovereign downgrade and that treated banks often suffer a bigger downgrade regardless of their initial financial health. CRA's employ these sovereign ceiling policies for all countries which causes banks that are not located in a country with a rating at the high end of the spectrum and with deteriorating credit quality to be downgraded even if the bank is financially healthy. However, after including the level of financial development, the

interaction term, the indicator of the implementation of sovereign ceiling policies, does no longer play a significant role. These policies are robust to controlling for macro-economic conditions and indicators of bank strength but not for indicators of financial development. Higher rated banks are no longer downgraded more than their lower rated counterparts. It seems that implicit government support is not as strong a factor when compared to the level of financial development. Evidence points to higher levels of financial development, especially a bigger market and better overall loan quality, to have a positive effect on bank ratings. In countries with lower levels of financial development and with, often corresponding lower ratings, the bailout ability of governments seems not as important to CRA's as does financial development in determining rating actions. CRA's have been moving further away from their sovereign ceiling policies than previous literature may have thought because sovereign downgrades and financial development often go hand in hand.

At first sight an opposite trend seems to appear in the results. Banks are, in general, downgraded after a sovereign downgrade but do not lower their loan supply subsequently. Banks do not seem to share the CRA's opinion of increased risk and keep providing loans. This may indicate that although the ceiling policies employed by the CRAs are a measure which is widely accepted, the banks know better. They see that only their rating, and not their implicit financial health, is affected by a sovereign downgrade. In light of this argument it is hard to justify the bank downgrades even if bank fundamentals suggest otherwise.

Bigger more capitalized banks will receive higher ratings as well as banks that operate close to or at their liquidity requirements. This trend shows up in the sample of loans as well. Overall, no convincing evidence is found that higher rated banks provide more loans. Generally, banks do reduce their amount of loans supplied in all groups after a sovereign downgrade. Also, treated banks do not seem to cut loans after a sovereign downgrade by more than the control group. After a sovereign downgrade, loans to SME's are reduced more when compared to households.

An increasing amount of adults with access to bank accounts will also result in a greater amount being borrowed. Also, in countries where people are better able to repay their debt, banks feel more comfortable to issue more loans. Overall, a higher level of financial development positively influences bank credit ratings and the loan supply. CRA's and banks both look at the level of financial development to determine rating actions and the supply of loans and not only at implicit government support, through the use of the sovereign ceiling. Still, the potential negative effects of a sovereign downgrade should be factored into a government's borrowing plans.

The results of this paper are rather surprising. I set out to show the degree to which the implementation of the sovereign ceiling policies is dependent on the level of financial development. Instead, I found that these factors seem to be mutually exclusive. When looking at both the sovereign ceiling and the level of development, the latter plays a more important role in both the CRA's rating decisions and the bank's decision regarding the loan supply. This is quite a different result when compared to previous research. However, I believe this difference comes from the fact that the data set used is more comprehensive and uncovers and incorporates the workings in the smaller (developing) countries as well. Previous literature has focused on larger countries with bigger banks where the more developed market may well force the banks to act in accordance with the decisions of the CRAs. These forces may not hold in all economies revealing a fundamentally different mechanism and possibly the shortcomings of the sovereign ceiling policies.

VI. Recommendations and limitations

A main limitation of this research is the availability of data. A large part of the dataset had to be constructed manually resulting in many different initial sets. After incorporating all available data and subsequently merging it into one dataset much of the data was lost. The financial development indicators created a funnel at the end of each regression group because this was the group of variables with the least amount of available data. This in turn, combined with the limited amount of loan data, led to a decreasing number of observations throughout the regressions and possibly skewed results. The solution here would be to use more frequent (than annual) data from the Worldbank. The website states that this feature will be available in the future. As this database is developed, the possibility to create an even more comprehensive dataset is increased. The availability of more data on different types of loans for more banks would benefit related research greatly.

Future research may want to look into including even more indicators of development as these factors seem to be of increasing importance in judging a bank's creditworthiness. When CRA's are moving further away from the use of sovereign ceiling policies something has to fill the void. This research has looked into more reliable factors of determining credit ratings. Further research has to expand these variables and datasets to uncover exactly what it is that governs bank ratings and the bank lending supply across countries.

VII. References

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VIII. Appendix

Table 1. Conversion from Moody's credit ratings to a numerical scale

This table converts the rating notation as provided by Moody's into a numerical scale.

Rating notation	Numerical rating
Aaa	21
Aa1	20
Aa2	19
Aa3	18
A1	17
A2	16
A3	15
Baa1	14
Baa2	13
Baa3	12
Ba1	11
Ba2	10
Ba3	9
B1	8
B2	7
B3	6
Caa1	5
Caa2	4
Caa3	3
Ca	2
C	1

Figure 1. Differences in rating between banks and their sovereign.

This chart plots the differences between ratings of the bank and sovereign against their relative frequencies. Ratings are substituted by their numerical equivalent, such that Aaa corresponds to 21, Aa1 to 20, and so on. A positive number indicates the sovereign having a higher rating than the bank whereas a negative number indicates the opposite. A difference of zero means that the bank is rated at the sovereign bound.

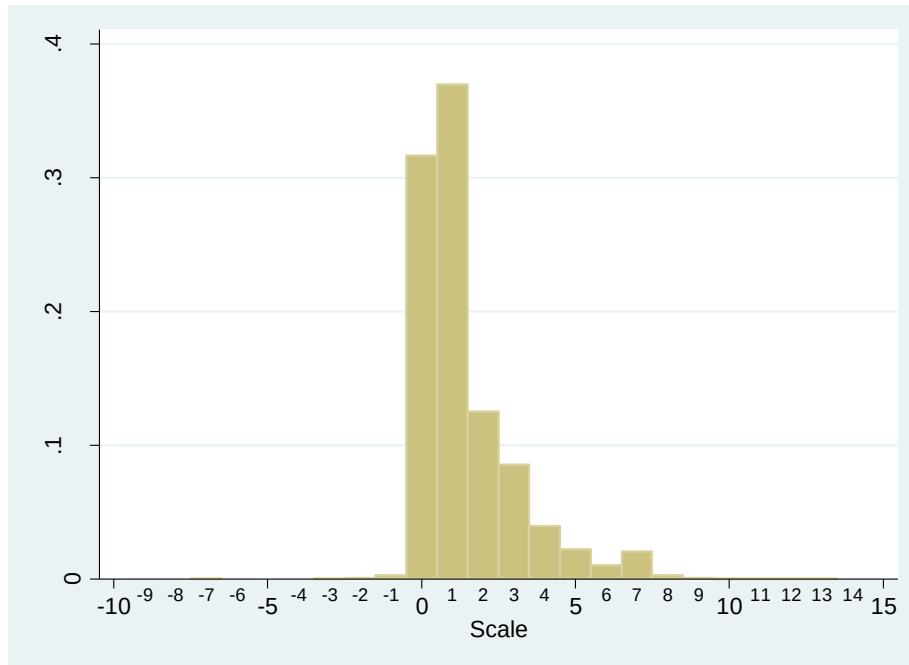


Figure 2. Sovereign Ceiling

Bank ratings and corresponding sovereign ratings are plotted for each individual bank. Ratings are substituted by their numerical equivalent, such that Aaa corresponds to 21, Aa1 to 20, and so on. Observations on the 45 degree line are banks rated at the same level as the sovereign. Relative frequency is depicted by the size of the observation.

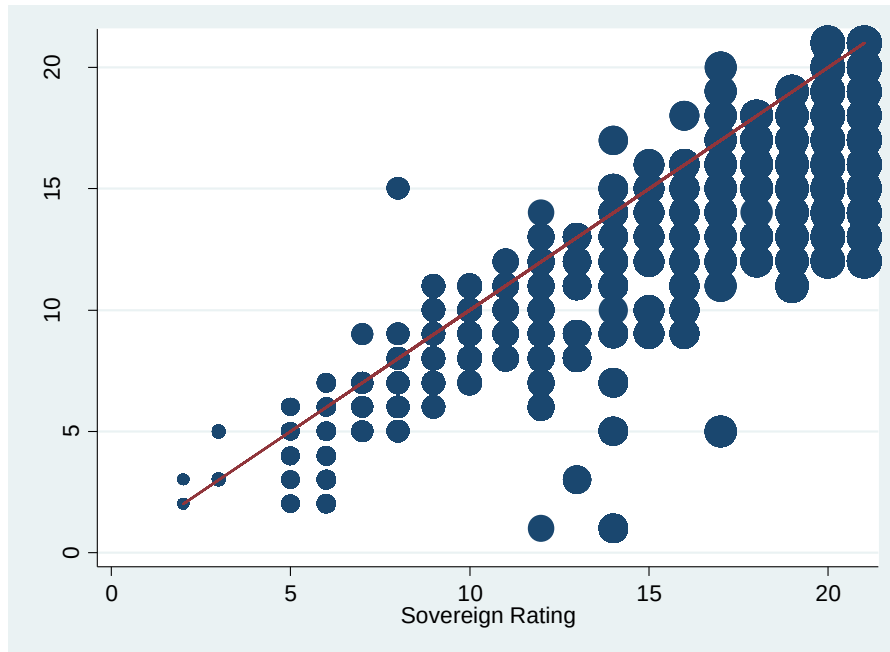


Figure 3. Sovereign ratings

Sovereign ratings are plotted against their relative frequency. Ratings are substituted by their numerical equivalent, such that Aaa corresponds to 21, Aa1 to 20, and so on.

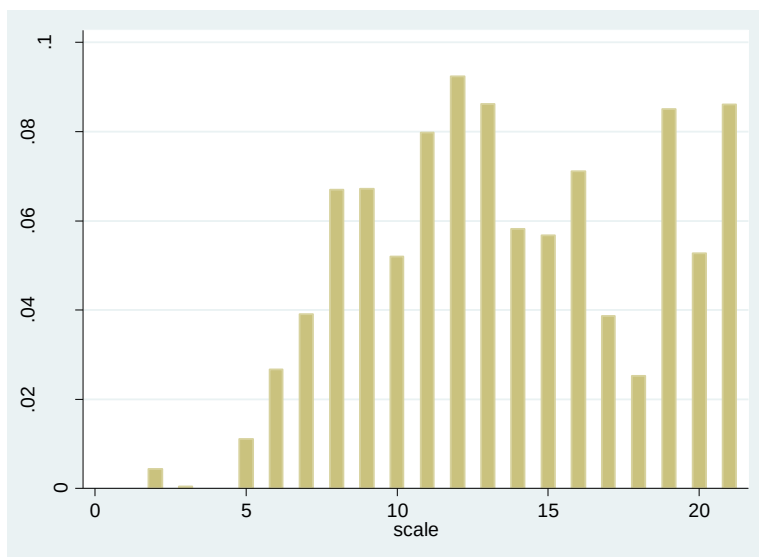


Table 2a. Summary Statistics: Full sample

This table shows the mean, standard deviation, minimum, maximum, and number of observations of the variables.

	Mean	Median	Standard Deviation	Minimum	Maximum	Number of Observations
Bank Rating	12.27	13	4.14	1	21	415472
Treatment group (dummy)	0.32	0	0.47	0	1	415472
Sovereign downgrade (dummy)	0.0003	0	0.02	0	1	415472
Loans (\$ million)	481.6	16.2	3923	13	93200	415472
Size (\$billion)	10.41	10.43	2.34	3.53	18.91	415472
ROA	0.011	0.013	0.041	-0.81	0.094	415472
Capital	0.085	0.08	0.099	-2.32	0.41	415472
Liquidity	0.26	0.23	0.16	0.001	0.89	415472
Deposits	0.62	0.67	0.21	0	1.16	415472
Government Holdings	0.48	0.28	0.42	0.04	1.37	39300

Table 2b. Summary Statistics: Treatment group

	Mean	Median	Standard Deviation	Minimum	Maximum	Number of Observations
Bank Rating	13.25	14	3.31	2	21	133420
Sovereign downgrade (dummy)	0.0006	0	0.03	0	1	133420
Loans (\$ million)	219.7	16.14	1221	37	15200	133420
Size (\$ billion)	10.21	10.46	2.35	4.60	17.03	133420
ROA	0.015	0.015	0.020	-0.81	0.093	133420
Capital	0.11	0.096	0.062	-0.71	0.41	133420
Liquidity	0.27	0.25	0.16	0.002	0.73	133420
Deposits	0.66	0.71	0.20	0	1.16	133420
Government Holdings	0.23	0.29	0.11	0.042	0.40	12570

Table 2c. Summary Statistics: Developed vs. Developing countries

	Developed countries			Developing countries		
	Mean	Standard Deviation	Number of Observations	Mean	Standard Deviation	Number of Observations
Bank Rating	16.17	2.42	140570	10.27	3.33	274902
Treatment group (dummy)	0.19	0.39	140570	0.39	0.49	274902
Sovereign downgrade (dummy)	0.0003	0.018	140570	0.0003	0.017	274902
Loans (\$ million)	76.86	130.00	140570	688.49	4809	274902
Size (\$ billion)	10.74	1.70	140570	10.24	2.59	274902
ROA	0.004	0.037	140570	0.014	0.043	274902
Capital	0.057	0.14	140570	0.10	0.068	274902
Liquidity	0.26	0.18	140570	0.26	0.15	274902
Deposits	0.53	0.22	140570	0.67	0.18	274902
Government Holdings	1.08	0.21	12081	0.22	0.091	27219

Table 3. Sovereign downgrade and bank downgrade

This table shows the results of the OLS regression of a sovereign downgrade on banks that have ratings at the sovereign bound. The dependent variable is the bank's rating converted to a numerical scale (see Table 1 for more information). Sovereign downgrade is a dummy variable that takes the value of one in case of a negative rating event. Country macro controls include the amount of GDP growth, the level of inflation, and the amount of government holdings by banks. Standard errors are in brackets and clustered at the bank's sovereign level.

*, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Treatment group	0.77** (0.32)	0.86*** (0.30)	-0.84 (0.56)	-0.89 (0.57)
Sovereign downgrade	-1.24*** (0.45)	-0.96*** (0.33)	-0.92* (0.47)	-1.27** (0.53)
Treatment*Sov. Downgrade	-0.81* (0.35)	-1.23* (0.68)	-0.17 (0.33)	0.27 (0.23)
Size		0.22 (0.30)	0.18 (0.95)	0.25 (0.98)
ROA		2.42 (1.60)	-2.23 (14.54)	-0.33 (12.5)
Capital		5.13*** (1.18)	23.03** (11.58)	23.25** (11.73)
Liquidity		-1.85** (0.72)	2.57 (4.25)	2.72 (4.22)
Deposits		2.03** (0.94)	5.28*** (1.62)	5.96** (2.79)
Depth			1.21*** (0.33)	1.15*** (0.26)
Access			5.07 (5.34)	5.41 (5.28)
Stability			-0.89*** (0.21)	-0.77* (0.43)
Efficiency			-0.74 (0.65)	-0.64 (0.56)
Country macro controls	N	N	N	Y
Time FE	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Number of Observations	12638	12638	814	797
R-Squared	0.30	0.42	0.69	0.70

Table 4. Sovereign downgrade and the loan supply

This table shows the results of the OLS regression of a sovereign downgrade on the log of the amount of total loans, loans made to small and medium sized enterprises (SME), loans to consumers, and mortgages as provided by banks at the sovereign bound prior to the downgrade. Sovereign downgrade is a dummy variable that takes the value of one in case of a negative rating event. Country macro controls include the amount of GDP growth, the level of inflation, and the amount of government holdings by banks. Columns (1) to (3) include results from all loans, and columns (4)-(12) include the results from the respective groups. Standard errors are in brackets and clustered at the bank's sovereign level. *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Total Loans					Loans to SME		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment group	-0.019 (0.07)	0.03 (0.03)	-0.03 (0.03)	-0.03 (0.03)	0.23*** (0.09)	0.20** (0.08)	0.01 (0.02)	0.0004 (0.017)
Sovereign downgrade	-0.17** (0.08)	-0.05* (0.03)	-0.06*** (0.02)	-0.07*** (0.02)	-0.14* (0.07)	-0.11** (0.05)	-0.05 (0.03)	-0.035 (0.04)
Treatment*Sov. Downgrade	0.52 (0.35)	0.13 (0.10)	0.07*** (0.02)	0.07*** (0.023)	-0.16 (0.15)	-0.11 (0.15)	0.02 (0.03)	0.02 (0.05)
Size		0.84*** (0.04)	0.56*** (0.19)	0.58*** (0.20)		0.65*** (0.15)	0.85*** (0.31)	1.03*** (0.26)
ROA		-1.25** (0.24)	-0.85 (1.55)	-0.65 (1.47)		-0.54 (0.80)	1.84 (1.54)	-2.33* (1.28)
Capital		0.63*** (0.09)	1.36 (1.18)	1.42 (1.16)		0.19 (0.25)	0.77 (1.20)	1.55 (1.20)
Liquidity		-1.11*** (0.22)	-0.68*** (0.25)	-0.66** (0.29)		-1.54*** (0.40)	-1.65*** (0.40)	-1.92*** (0.37)
Deposits		0.24 (0.16)	0.23 (0.17)	0.34 (0.28)		0.63* (0.35)	-0.39 (0.75)	-0.47 (0.73)
Depth			0.04 (0.03)	0.03 (0.03)			0.02 (0.03)	0.07 (0.054)
Access			0.09 (0.48)	0.11 (0.51)			-0.53* (0.30)	-0.65** (0.32)
Stability			-0.05*** (0.01)	-0.04 (0.03)			0.11 (0.08)	0.05 (0.04)
Efficiency			-0.08 (0.05)	-0.06 (0.06)			-0.03 (0.06)	-0.14 (0.09)
Country macro controls	N	N	N	Y	N	N	N	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y
Number of Observations	12406	12406	798	784	4985	4985	331	315
R-squared	0.42	0.82	0.91	0.92	0.29	0.56	0.69	0.70

Table 4 (cont'd). Sovereign downgrade and the loan supply

	Loans to Consumers				Mortgages			
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Treatment group	-0.02 (0.25)	-0.04 (0.20)	-0.05 (0.03)	-0.03 (0.04)	0.47*** (0.17)	0.36** (0.16)	0.008 (0.006)	0.01* (0.005)
Sovereign downgrade	-0.03 (0.13)	0.002 (0.11)	0.04 (0.03)	0.02 (0.03)	0.31* (0.18)	0.17 (0.18)	-0.005*** (0.002)	-0.003 (0.008)
Treatment*Sov. Downgrade	-0.11 (0.19)	-0.09 (0.20)	0.03 (0.02)	0.007 (0.03)	-0.08 (0.21)	-0.15 (0.30)	- (-)	- (-)
Size		0.64 (0.43)	0.10 (0.58)	-0.24 (0.49)		1.14*** (0.24)	-0.30 (0.91)	-0.40* (0.24)
ROA		3.54 (3.08)	-4.73 (3.71)	3.20 (2.85)		1.67* (0.89)	-1.06 (11.08)	- (-)
Capital		-3.72 (3.01)	3.86** (1.60)	2.19 (1.37)		2.96 (3.40)	1.49** (0.60)	1.54* (0.79)
Liquidity		1.39 (1.18)	-1.14* (0.67)	-0.46 (0.52)		-0.15 (0.86)	0.58 (0.87)	0.70 (0.90)
Deposits		-1.02 (0.92)	2.80** (1.22)	2.62*** (0.96)		0.25 (0.61)	0.04 (0.56)	0.07 (0.34)
Depth			0.02 (0.03)	-0.06 (0.07)			0.04 (0.63)	-0.016 (0.04)
Access			1.06** (0.44)	1.29*** (0.43)			0.92 (1.88)	1.09*** (0.11)
Stability			-0.32** (0.12)	-0.20*** (0.08)			-0.06 (0.04)	-0.05 (0.08)
Efficiency			-0.08 (0.08)	0.11 (0.13)			0.03 (0.65)	0.09*** (0.02)
Country macro controls	N	N	N	Y	N	N	N	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y
Number of Observations	4080	4080	319	303	2407	2407	190	187
R-squared	0.41	0.49	0.69	0.68	0.63	0.72	0.77	0.77

