The Impact of Basel II Reforms: A Contraction in SME Lending

By

Apolline Charpentier
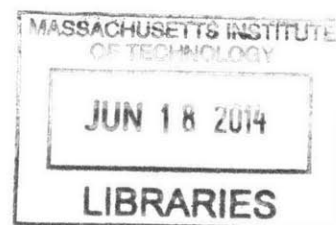
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Apolline Charpentier

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ABSTRACT

The implementation of Basel II reforms has been designed to protect the international financial system from major bank collapses through the enforcement of minimum capital adequacy ratios. This new set of rules has raised concerns of triggering changes in institutions' business models leading to credit contraction, which in turn could potentially contribute to slower global economic development. Small and Middle Enterprises, which have traditionally been engines of growth, innovation, and R&D in Europe, are highly reliant on bank loans as opposed to equity funding. This thesis focuses on the specific impact of Basel II reforms on SME access to financing. The paper is structured around four sections. Part I provides a technical summary of the regulation, focusing on the specific capital requirements for SMEs. Part II reviews today's literature on the topic. Finally, parts III and IV respectively provide a theoretical and empirical examination of the consequences of the reforms on SME financing. Based on these analyses, this thesis supports the conclusion that Basel II reforms have not been the cause of a contraction in SME lending.

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I. Introduction

1) Basel reforms

a) Overview of Basel I, II, and III timeline and implementation

In 1988, the Basel Committee on Banking Supervision (BCBS) published a set of minimum capital requirements for banks which were enforced by national law in the G-10 (Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States).

A new set of rules known as the Basel II accords were then published in June 2004 to protect the international financial system from major bank collapses. These reforms superseding Basel I are aimed to be implemented globally, although timelines and methodologies vary between countries. In particular, Basel II accords are required since 2009 by the United States, Australia, India, and since 2008 in the European Union via the EU Capital Requirements Directive. European banks were at the forefront of Basel II from an implementation standpoint. All financial institutions (accounting for 171,477 units in the Euro area and 217,716 in the EU[1]), regardless of size and geographic activity, were required to implement the Basel II Simplified Standardized Approach (SSA) by January 2007, and the Foundation Internal Ratings Based (FIRB) or the Advanced Internal Ratings Based (AIRB) by 2008.

By 2007, banks in major economies, particularly Japan and the EU, started reporting capital adequacy ratios according to the new Basel II rules. Others such as Brazil, Turkey and

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[1]   Structural Indicators for the EU Banking Sector online, data last updated on 06-01-2014

Chile revised their implementation deadlines, primarily due to the state of their banks' which were not yet ready to implement these reforms. In 2008, the vast majority of the global banking system had to be Basel II compliant, with the exception of the US. By the end of 2008, most banks were expected to smooth out the operational aspects of Basel II calculation and reporting and start managing regulatory capital on a more proactive basis.[2]

In the aftermath of the financial crisis, Basel II was criticized for flaws in its framework, which was blamed for not protecting banks from bankruptcy and in some cases actually amplifying the effects of the crisis.[3]

In response to these deficiencies, the BCBS outlined strategic responses in 2009 to strengthen the Basel II framework.[4] A new regulatory framework known as Basel III was then agreed upon by the BCBS in 2011, the objective being to strengthen bank capital requirements while working alongside Basel I and II. First scheduled to be fully implemented between 2013 and 2015, Basel III was postponed to 2019, bankers arguing that they would throw the global economy into deepened recession.[5] In the European Union, Basel III was implemented on January 1st 2014 through the CRD4 package (Capital Requirements Directive), with new provisions to be phased in between 2014 and 2019.[6]

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[2]   Ahmet Yetis, managing director of Bear Stearns in Tokyo, Basel II special report, January 2008

[3]   Slovik, P. (2012), "Systemically Important Banks and Capital Regulation Challenges", OECD Economics Department Working Papers

[4]   Beyond the crisis: the Basel Committee's strategic response, Nout Wellink

[5]   Easing of Rules for Banks Acknowledges Reality, Andrew Ross Sorkin, January 7th 2013

[6]   European Banking Authority, Implementing Basel III in Europe, CRD IV package

b) Overview of Basel II requirements

Basel II reforms are structured in three pillars

I.   Pillar 1:

The first pillar focuses on the minimum amount of regulatory capital that a bank has to hold in the face of three key risks, namely credit risk, market risk and operational risk. Credit risk can be calculated using the Simplified Standardized Approach (SSA), and Foundation Internal Ratings Based (FIRB), or the Advanced Internal Ratings Based (AIRB). The latter two methodologies are based on probability of default (PD), Loss Given Default (LGD), and on banks' internal analysis. We will go into further detail below. Operational risk is measured using the BIA (Basic Indicator Approach), STA (Standardized Approach), or AMA (Advanced Measurement Approach). Finally, market risk is calculated using the VaR (Value at Risk).

Figure 1, Basel III risk categories
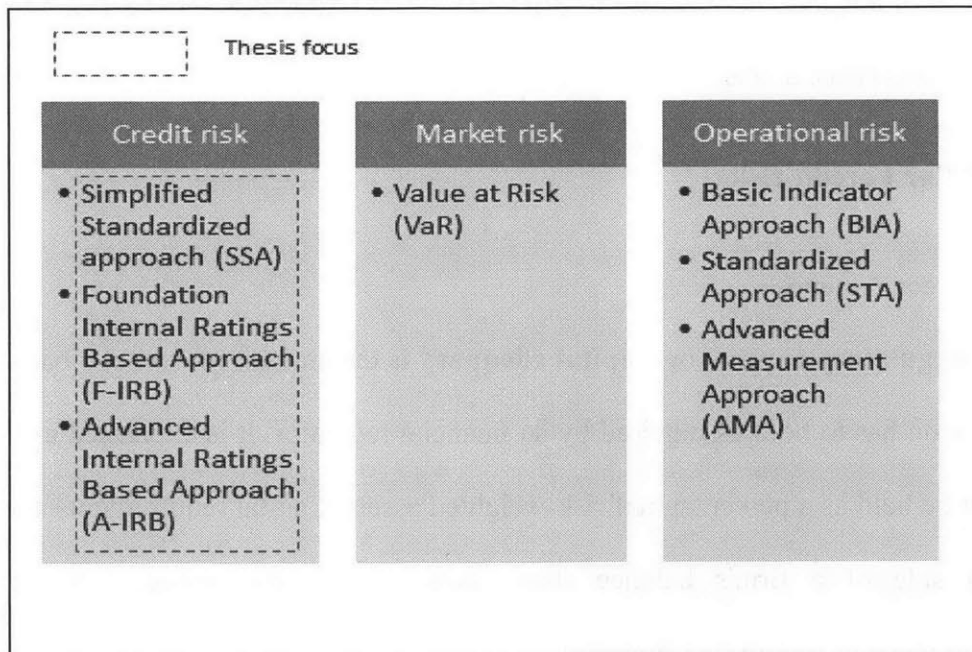
Credit risk refers to the risk that a borrower will default on any type of debt by failing to make required payments. The impact of credit risk requirements within Pillar I will be the focus of the thesis.

II.   Pillar 2:

The second pillar dives into the regulatory process for the implementation of minimum capital requirements. In particular, it sets out the supervisory monitoring process to evaluate a bank's capital adequacy and its strategy to maintain these minimum requirements, as well as interventions in case capital falls below the threshold.

It also provides a framework to deal with other residual risk types such as systemic risk, pension risk, concentration risk, strategic risk, reputational risk, liquidity risk, and legal risk.

III.   Pillar 3:

The third pillar sets out a series of disclosure requirements, thus enabling market participants to judge the capital adequacy of a bank. Disclosures on total capital, risk exposures, risk assessment processes are to be publicized twice a year.

c) Pillar I credit risk

i.   Basel II capital requirements

Capital requirement, Regulatory capital, or **Capital adequacy** is the amount of capital a bank or other financial institution has to hold as required by its financial regulator. It is expressed as a ratio of equity that must be held as a percentage of risk-weighted assets. Capital requirements are recorded on the right side of a firm's balance sheet, under the equity category. These requirements are put into place to ensure that financial institutions do not take on excess risk and become insolvent, if there is a run on the bank or if creditors are unable to pay back their debt.

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Bank regulations must make sure that firms operating in the industry are prudently managed in order to protect the financial institutions themselves, their customers and the economy as a whole. Conversely, **Economic Capital** is the amount of capital than an institution would have held in without capital regulations.

Tier 1 capital ratio = Tier 1 capital/ Risk-weighted assets

Tier 1 + Tier 2 capital ratio = (Tier 1 capital + Tier 2 capital)/ Risk-weighted assets

Leverage ratio = Tier 1 capital/ Total Assets

Liquidity Coverage Ratio = high-quality liquid assets (<30 days)/ net cash outflows (<30 days)

Net Stable Funding Ratio = stable funding (>1 year)/ required amount of stable funding (>1 year)

Table 1, Basel II requirements

	Adequately capitalized	Well capitalized
Core Tier 1 (common equity)	2%	
Tier 1 capital ratio	4%	8%
Tier 1 + Tier 2 capital ratio	6%	10%

Table 2, Basel II requirements

	Well capitalized
Core Tier 1 (common equity)	3.5%
Tier 1 capital ratio	4.5%
Capital Conservation Buffer	2.5%
Counter cyclical buffer according to national circumstances (Tier 1)	0-2.5%
Surcharge for Systemically Important Financial Institutions (Tier 1)	2.5%
Tier 1 + Tier 2 capital ratio	6%
Leverage ratio	3%
Net Stable Funding Ratio	100%
Liquidity Coverage Ratio	100%

ii.   Tier 1 and Tier 2

In Basel II accords, regulatory capital is divided into two tiers.

Tier 1, the most conservative, consists of shareholders' equity, disclosed reserves, and mandatorily convertible preferred shares.

Equity is the amount paid up to originally purchase shares of the Bank (not the amount those shares are currently trading for on the stock exchange). Equity also includes retained profits subtracting accumulated losses. Retained profits are the cumulative profits made by the company which are not reinvested, distributed as dividends, or used to repurchase shares. Disclosed reserves are share premium accounts. These are defined as cash set aside to pay shareholders who may have bought a share at a higher price than its effective cost, or to pay-out bonuses and write-off underwriting costs. Shareholders equity and retained earnings are referred to as "Core" Tier 1 capital, whereas Tier 1 is core Tier 1 together with undisclosed reserves and mandatorily convertible shares.

Tier 2, or supplementary capital, includes revaluation reserves, undisclosed reserves, hybrid instruments and subordinated term debt.

Revaluation reserves are on an account created for assets which have gained value since their acquisition. Undisclosed reserves are banks' profits which are not yet disclosed as normal retained earnings. Hybrid instruments are like non-mandatorily convertible shares, which are initially debt but are able to take losses without triggering the banks' liquidation. Finally, subordinated term debt is the lowest ranking debt.

Tier 1 = equity + disclosed reserves + mandatorily convertible preferred shares

Tier 2 = revaluation reserves + undisclosed reserves + hybrid instruments + subordinated debt

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d) Risk Weighted Assets (RWA) [7]

i. The Simplified Standardized Approach (SSA)

The first methodology for calculating RWA is the Simplified Standardized Approach (SSA). Under this approach, banks are required to use ratings from External Credit Rating Agencies to quantify required capital for credit risk. Let us note that the Standardized Approach (SA) also exists. It also relies on external rating, but has more buckets than the SSA.

Below is a summary of the risk-weighting attributed to each category of assets held by a financial institution:

Table 3, Risk weighting of assets by claim type under Basel II

Rating	AAA to AA-	A+ to A-	BBB+ to BB-	Below BB-	unrated
Corporates	20%	50%	100%	150%	100%

Rating	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	unrated
Banks and securities companies	20%	50%	100%	100%	150%	100%
Sovereigns	0%	20%	50%	100%	150%	100%

Rating	No rating
BIS, IMF, ECB, …	0%
Retail products	75%
Residential property	35%
Secured by commercial real estate	100%
Other assets	100%
Cash	0%

Retail products includes exposures to individual persons or small businesses, revolving credit lines, lines of credit, loans and leases (e.g. instalment loans, auto loans and leases, student and educational loans, personal finance) and small business facilities and commitments. The

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[7] Basel II: International Convergence of Capital Measurement and Capital Standards: a Revised Framework (BCBS) (November 2005 Revision),

supervisor must be satisfied that the regulatory retail portfolio is sufficiently diversified to a degree that reduces the risks in the portfolio to obtain the 75% risk weight (no aggregate exposure to one counterparty can exceed 0.2% of the overall regulatory retail portfolio). The maximum aggregated retail exposure to one counterpart cannot exceed an absolute threshold of €1 million.

Table 4, Risk Weighting of Assets by claim type under Basel I

Cash, obligations on OECD governments and US treasuries	0%
Claims on OECD banks Securities issued by US government agencies Claims on municipalities	20%
Secured by residential mortgages	50%
Corporate loans, non OECD/ US government, bank, and corporate debt, secured by real-estate, plant, equipment, personal consumer loans	100%

ii.   The Foundation Internal Ratings Based Approach (FIRB)

The second methodology is the Foundation Internal Ratings Based Approach (FIRB). This approach is based on risk components: probability of default (PD), loss given default (LGD), exposure at default (EAD), and maturity (M). Banks can use own PD estimates, but rely on supervisory estimates for the other components. Furthermore, stress testing is required.

PD is the degree of likelihood that the borrower of a loan or debt will not be able to make the necessary scheduled repayments over one year.

LGD is the amount of funds that is lost by a bank or other financial institution when a borrower defaults on a loan, which may be less than the loan itself if the borrower can sell assets as held collateral or if the lender makes use of courts.

EAD is the extent to which a bank may be exposed to a counterparty in the event default. For fixed exposures like term loans, EAD is equal to the outstanding amount of the loan

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(100%). For lines of credit or revolving credit commitments, the loan is divided between drawn and undrawn commitments. If the borrower has not drawn on the entire commitment, EAD will be lower than the outstanding amount (100%).

For public companies, PD is estimated using either the structural model of credit risk proposed by Robert Merton (1974). For retail and unlisted company exposures such as SMEs, default probabilities are estimated using credit scoring or logistic regression. A credit score is based on past credit history such as paying bills and not holding too much debt. It is a number between 300 and 850 - the higher the number, the more creditworthy the person is deemed to be.

Once PD, LGD, EAD, and M are defined, RWAs for corporate exposure are calculated as follows, with N(x) denoting the normal cumulative distribution function, G(z) denoting the inverse cumulative distribution function, and LN the normal logarithmic function.

Corporates and SME not qualifying as retail products (loan > €1M) IRB formulas

Correlation R for corporates

$$R = 0.12 * \frac{1 - e^{-50*PD}}{1 - e^{-50}} + 0.24 * \left(1 - \frac{1 - e^{-50*PD}}{1 - e^{-50}} \right)$$

Maturity adjustment

$$b = (0.11852 - 0.05478 * \ln(PD))^2$$

Capital requirement K for corporates

$$K = \left[LGD * N \left(\sqrt{\frac{1}{1 - R}} * G(PD) + \sqrt{\frac{R}{1 - R}} * G(0.999) \right) - (LGD * PD) \right] * \frac{1 + (M - 2.5)b}{1 - 1.5b}$$

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Capital requirement adjusted for SMEs (annual sales turnover S <€50M)

$$R = 0.12*\frac{1 - e^{-50*PD}}{1 - e^{-50}} + 0.24*\left(1 - \frac{1 - e^{-50*PD}}{1 - e^{-50}}\right) - 0.04*(1 - \frac{\max(S - 5, 0)}{45})$$

Risk weighted assets for corporates and SMEs

$$RWA = K * 12.5 * EAD$$

Retail product IRB formulas (SME loan < €1M)

Correlation R for retail products

Correlation (R) =   0.03 × (1 − EXP(-35 × PD)) / (1 − EXP(-35)) +
0.16 × [1 − (1 − EXP(-35 × PD))/(1 − EXP(-35))]

Capital requirement K retail products

Capital requirement (K) =   LGD × N[(1 − R)^-0.5 × G(PD) + (R / (1 − R))^0.5 × G(0.999)]
− PD x LGD

Risk weighted assets for retail products

$$RWA = K * 12.5 * EAD$$

iii.   The Advanced Internal Ratings Based Approach (AIRB)

Under the AIRB, capital requirements are determined as in FIRB. However, banks can use their own estimates for PD, LGD, EAD and M, subject to supervisory validation of systems. Stress testing is also required.

iv.   Specifics for SME lending

Banks on the IRB approach will be permitted to adjust downward the capital requirements on exposures to SMEs with less than €50 million in annual sales.

Under the SAA, retail products include SME loans smaller than €1M, provided that the aggregate retail portfolio is sufficiently diversified (based on the supervisor's decision),

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providing a risk-weighting of 75%. Retail products also include revolving credits and lines of credit (including credit cards and overdrafts), personal term loans and leases and small business facilities and commitments.[8]

Basel II regulations also allow banks to make use of collateral such as government guarantees to reduce or "mitigate" the risk weights. The credit rating of the collateral or of the guarantor will be substituted for the rating of the borrower for the collateralized portion of the exposure. The collateral must be marked-to-market and re-valued every six months. For instance, if a bank makes a loan to an SME which is guaranteed by the government, its RWA will be 0%.

Finally, the Basel Committee's definition of off-balance sheet items includes open lines of credit and trade credit, which account for a large part of SME financing. Under Basel II, off-balance sheet items are currently translated onto the balance sheet at 20%. Basel III raises this conversion factor to 100%, which is likely to restrict the access to trade finance.

2) Small and Middle Enterprises

a) SME definition

Based on the European Commission's definition, SMEs are defined by both number of employees and by turnover or balance sheet.

Table 5, European Commission SME criteria

Company category	Max Employees	Yearly turnover (€M) OR	Total balance sheet (€M)
Medium-sized	250	50	43
Small	50	10	10

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[8]   The New Basel Capital Accord, April 2003

| Micro	10	2	2

b) SMEs in Europe

I chose to focus my thesis on SMEs as these firms have traditionally been engines of economic growth, produce many technological innovations, and create new jobs at a faster pace than larger companies do. SMEs are also highly significant in Europe in terms of employment contribution and of GDP growth.

They account for 99.8% of the number of firms in the euro area, 60% of turnover and 70% of employment. Moreover, SMEs are essential in the European economy, playing an important role in economic growth, innovation, and R&D.[9]

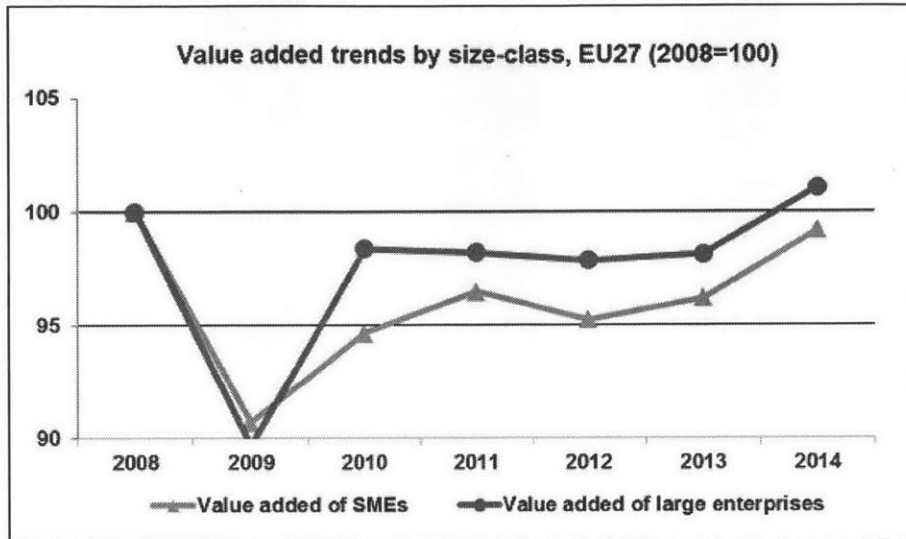The SME performance review reports the following trends for European SMEs:

Figure 2, employment trends by company size

Employment trends by size-class, EU27 (2008=100)

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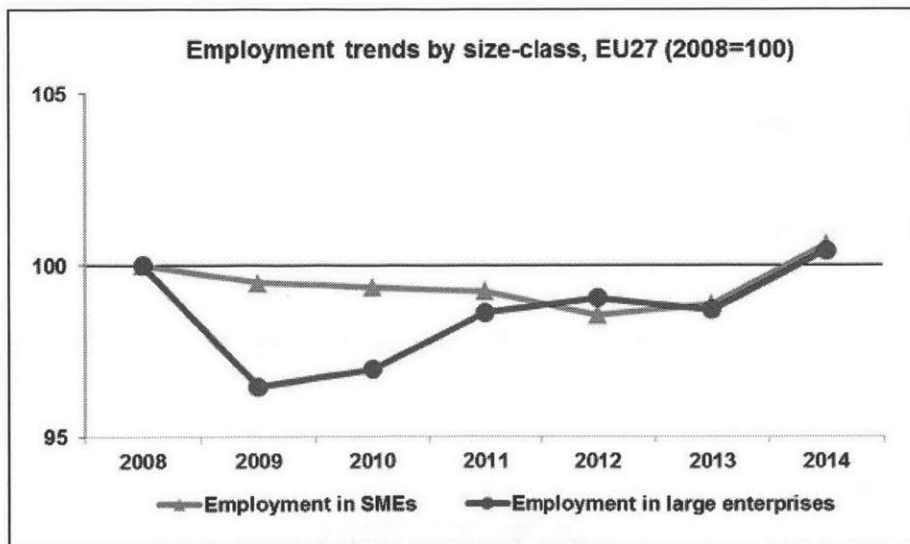
9   SME performance review, European Commission, November 26th 2013

Figure 3, value added trends by company size

Value added trends by size-class, EU27 (2008=100)
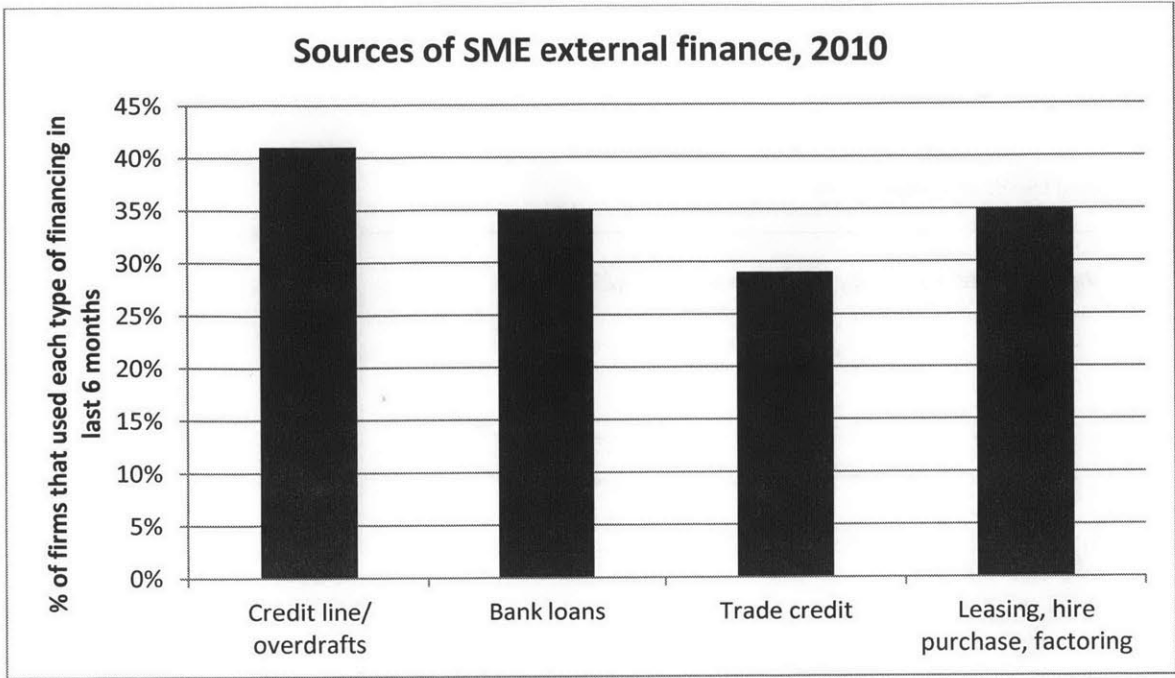
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c) SME financing

SMEs are highly reliant on external sources of financing, so the banks' ability to make loans or allow for credit lines and overdrafts will have a significant impact on their business model, as opposed to larger firms.[10]

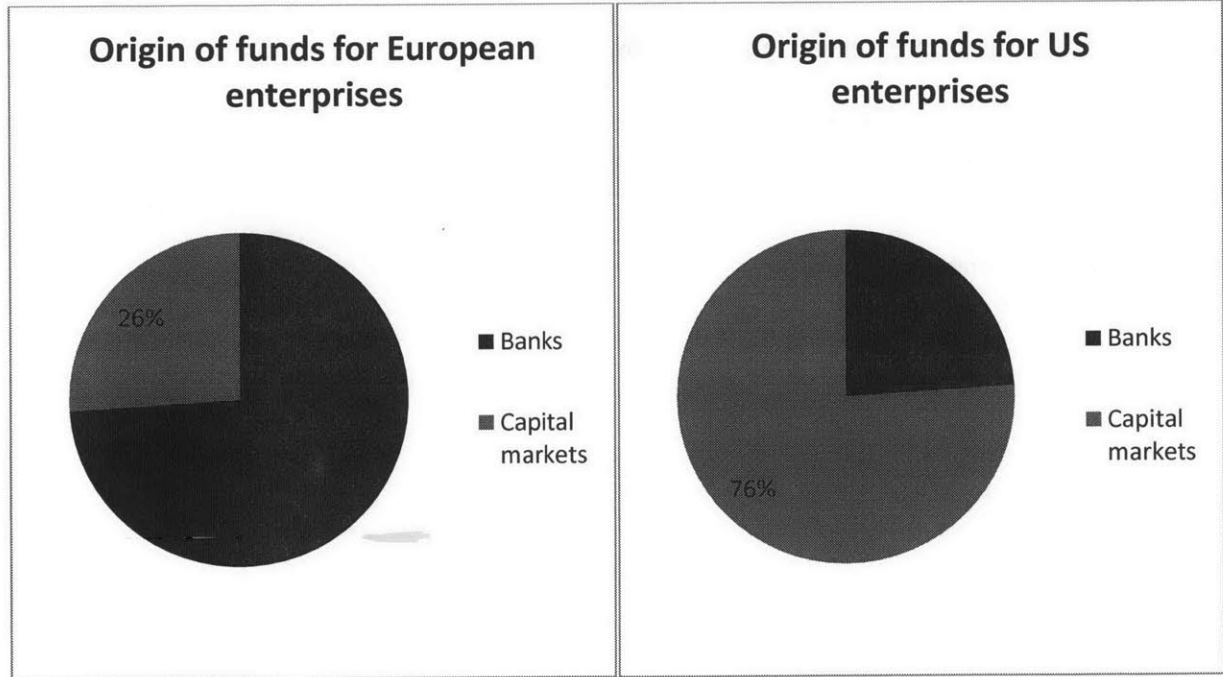**Figure 4, sources of SME external financing**

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[10]   ECB/EC Survey on SME access to finance, 2H2010. Base of 6941 firms

Sources of SME external finance, 2010

A bar chart titled "Sources of SME external finance, 2010". The y-axis is labeled "% of firms that used each type of financing in last 6 months" ranging from 0% to 45%.

- Credit line/overdrafts: ~41%
- Bank loans: ~35%
- Trade credit: ~29%
- Leasing, hire purchase, factoring: ~35%

This high reliance on the banking system (41% for credit lines and overdrafts and 35% for loans) leads me to focus my thesis on the specific effect of Basel reforms on SME lending.

European enterprises are also highly reliant on bank financing compared to equity funding.

Figure 5, sources funds for European and US companies

Origin of funds for European enterprises

Pie chart: Capital markets 26%, Banks (remainder).

Origin of funds for US enterprises

Pie chart: Capital markets 76%, Banks (remainder).

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As a result, Basel reforms are likely to have a significant impact in Europe in terms of company funding needs compared to other regions, which leads me to focus my thesis subject on this area.

II.   Literature review

1) The Institute of International Bankers

The Institute of International Bankers supports the idea that Basel II is already largely based on the economic practices of banks, so should not trigger any sudden change in the institutions' business models. The new regulation simply brings regulatory capital closer to banks' internal models, putting companies whose economic capital is already higher than the regulatory capital at a market advantage. By providing a consistent framework across countries and institutions, Basel helps supervisors identify portfolios where capital is not sufficient and enforces transparency. Before implementing the reforms, they examined their costs and benefits and benefits on the economy. In their view, the main issue with Basel is trans-national regulatory surveillance, with diverging standards and laws across countries. However, the impact on lending to corporates, and particularly SMEs, was not raised as an issue.[11]

2) The Council of Mortgage Lenders

According to the Basel Committee, Basel II was not intended to reduce the total capital held in the banking system as a whole. Moreover, it introduced floors to ensure that financial institutions

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[11]   Implementation of Basel II, challenges and opportunities, Institute of International Bankers, March 2007

did not increase their lending standards too quickly from Basel I levels in the early years. Furthermore, capital is not only held for regulatory reasons. There can be strategic reasons for holding additional capital, to finance acquisitions for example. Also, the higher a lender's capital ratios, the safer it will appear to investors, allowing it to raise funds more cheaply. Finally, financial institutions also need to manage their risk regardless of regulatory reasons, leading them to hold a certain amount of economic capital.

According to the Council of Mortgage Lenders, the main consequence of the transition to Basel II was for large banks that spent between £50-100m on implementation. The greatest effects of the reforms will be raised risk management standards across the industry, and an increase in the understanding of senior management in issues related to risk. However, it should not directly affect consumers, or enterprises needing loans, since much of the risk was already managed internally.[12]

3) The Organization for Economic Cooperation and Development

A study on the Macroeconomic impact of Basel III shows the impact of required capital on banks' Returns on Equity, and as a result on banks' lending spreads to compensate for the increase on their funding costs.

In the Euro Area, a 1% increase in RWAs is estimated to create a 14.3 basis points increase in lending spreads (based on 2003-2006 data).

Table 6, Increase in bank lending spreads as a result of a 1% increase in RWAs

	Increase in bank lending spread

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[12]   Council of Mortgage Lenders, January 2013

	(basis points)
United States	20.5
Europe	14.3
Japan	8.4
Average	16.1

The report then proceeds to analyze the macroeconomic impact of a 100 basis point increase in bank lending rates on GDP growth. Experts have approximated this increase to long-term interest rates, and have shown that in the Euro Area, a 100 basis point increase in lending rates reduces GDP growth by 0.42% on average. To conclude, a 1% increase in RWAs would lead to a 0.06% decrease in GDP growth in Europe.[13]

OECD focus on SMEs

According to a 2012 OECD study on focused on financing SMEs and entrepreneurs, the Basel risk weighting system encourages portfolio concentrations in low-weighted assets such as government bonds (0% RWA), mortgages (35%) and interbank lending. Financial institutions would have a strong incentive to save on capital by expanding their business into lower-weighted areas. In theory, this could generate a crowding out effect on private loans, as banks are encouraged to lend to governments rather than to enterprises.

Based on July 2011 data from the Bank Lending Survey undertaken by the ECB, banks are already adjusting their capital position, building up their capital position via retained earnings while divest themselves of the riskier assets. Deposit-taking institutions that need to raise more capital may choose to increase retained earnings by distributing less dividends or be re-investing fewer cash, rather than by decreasing RWAs.

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[13]   Macroeconomic Impact of Basel III, Patrick Slovik, Boris Cournède, February 14th 2011

However, no specific analysis so far seems to prove that SME access to bank finance has reduced, and views remain mitigated. Some experts view that Basel reforms will have little or even a positive impact on SME lending, while others see more negative effects, particularly on SMEs that are heavily indebted or dependent on bank credit.

One country expert believed that commercial banks would continue to lend to SMEs because margins were higher than on loans to large enterprises.

More specifically looking at the effects of Basel III states, it is viewed that mostly large banks (SIFIs) would be affected since they are required to hold an additional 2.5% of Tier 1 capital. However, since SMEs are less likely to use large banks, basing loans on their local banks and on close relationships with they may not be highly penalized by Basel III changes.

To summarize, the OECD specifies that banks seem to have refocused their portfolios on less risky assets such as government loans, and are increasing retained earnings. However, nothing so far proves that the risky assets that are being divested because of Basel II include SME loans. In particular, if these credits provide higher margins for banks.[14]

4) The International Monetary Fund

According to an IFC analysis, the application of different capital charges based on the credit risk of a type of loan may lead banks to change the composition of their asset portfolios. Banks could increase their holding of low risk assets and reduce their holdings of riskier assets which generate a higher capital charge, putting upward pressure on lending rates. However, the paper is

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[14]   Financing SMEs and Entrepreneurs 2012, An OECD Scoreboard

not conclusive in the likeliness of occurrence of such portfolio shifts, or on the specific effect on SME lending.[15]

5) The Bank of International Settlements

Following a European Commission workshop on Basel II accords in 2003, the Governor of the Bank of Spain and Chairman of the Basel Committee shared the expected effects of Basel II on SME lending.

Investigations found that although probabilities of default are on average higher for individual SMEs, empirical evidence identified that most banks' holdings of loans to SMEs benefit are more diversified than loans to larger enterprises, reducing overall exposure to credit risk posed. Furthermore, experts found that when banks made loans to SMEs, they usually required guarantees or collateral.

Also, Quantitative Impact Studies run by the BIS have shown that the reduction of capital charges for SME loans on businesses with less than €50M in yearly sales benefit from an adjustment that could make requirements lower than for large corporates. Basel II accords also allow banks to treat SME loans as pooled retail exposures, as long as the loan is <€1M in a diversified portfolio. This provides an advantageous risk-weighting of 75%, as opposed to over 100% for large unrated or low-rated corporates.

The results of quantitative studies show that banks' capital charges on loans to SMEs will remain largely stable for banks using the standardized approach to credit risk, and will even decline by

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[15]   Implementation of Basel II—Implications for the World Bank and the IMF, July 22nd 2005

an average of between 3% and 11% for banks on the IRB approach. Capital savings would be even greater for SME loans treated as retail.[16]

6) Conclusion

Several studies and groups such as the Institute of International Lenders and the Council of Mortgage Bankers support the idea that Basel reforms do not have a specific impact on lending, whether to SMEs or to corporates in general. Conversely, the OECD defends the idea that Basel reforms will mechanically lead to an increase in credit spreads, which in itself will create a contraction in GDP growth. They also analyzed a shift in banks' portfolios towards less risky assets. However, there is no evidence that this shift concerns a reduction in SME loans. Finally, studies developed before Basel II was implemented, such as QIS by the Bank of International Settlements show that the way the agreement was structured does not put SMEs at a disadvantage to larger firms.

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[16]   Jaime Caruana: Consequences of Basel II for SMEs, July 10th 2003

III. Theoretical Analysis

1) Basel reforms and RWAs

a) Required RWAs as a % of total assets for large corporates vs. SMEs under Basel II

Using the RWA Basel II calculation methodology, I analyzed the conversion factor of total assets into RWAs for SMEs using the SSA and the IRB approaches, compared with large corporates.

I also looked at two scenarios for SMEs: loans > €1M, included in the corporate SME category, and loans > €1M, included in the retail product category.

I assumed a LGD of 70%, an EAD of 80%, a loan maturity of 1 year. For the SME curves, I chose values of €25M for total yearly sales (staying below the €50M threshold for the SME reduction in RWAs).

Table 7, RWA for large corporates and SMEs under all Basel II methodologies

Large corporates and SMEs under Basel II for all methodologies							
Probability of default	Equivalent rating (S&P mapping)	Large Corporate Basel II SAA	Large Corporate Basel II IRB	SME Basel II corporate SAA (unrated)	SME Basel II corporate IRB (S = 25M)	SME Basel II retail SAA (loan <1M)	SME Basel II retail IRB (loan <1M)
0.00%	AAA	0.20	0.04	1.00	0.03	0.75	0.01
0.15%	A+	0.50	0.31	1.00	0.27	0.75	0.10
0.30%	BBB+	0.50	0.48	1.00	0.43	0.75	0.16
0.45%	BBB-	0.50	0.61	1.00	0.54	0.75	0.20
0.60%	BB+	1.00	0.72	1.00	0.63	0.75	0.24
0.75%	BB+	1.00	0.80	1.00	0.70	0.75	0.27
0.90%	BB	1.00	0.87	1.00	0.77	0.75	0.29
1.05%	BB	1.00	0.93	1.00	0.82	0.75	0.31
1.20%	BB	1.00	0.98	1.00	0.86	0.75	0.33
1.35%	BB	1.00	1.03	1.00	0.90	0.75	0.34
1.50%	BB-	1.50	1.07	1.00	0.94	0.75	0.36
1.65%	BB-	1.50	1.11	1.00	0.97	0.75	0.37
1.80%	BB-	1.50	1.15	1.00	1.00	0.75	0.38
1.95%	BB-	1.50	1.18	1.00	1.03	0.75	0.38
2.10%	B+	1.50	1.21	1.00	1.06	0.75	0.39
2.25%	B+	1.50	1.24	1.00	1.08	0.75	0.40
2.40%	B+	1.50	1.27	1.00	1.10	0.75	0.40
2.55%	B+	1.50	1.29	1.00	1.12	0.75	0.41
2.70%	B+	1.50	1.32	1.00	1.14	0.75	0.41
2.85%	B+	1.50	1.34	1.00	1.16	0.75	0.42
3.00%	B+	1.50	1.37	1.00	1.18	0.75	0.42

Hypotheses

Loss Given Default (for IRB)	70%
Exposure At Default (for IRB)	80%
Maturity (for non retail)	1
Yearly turnover (for non retail)	25

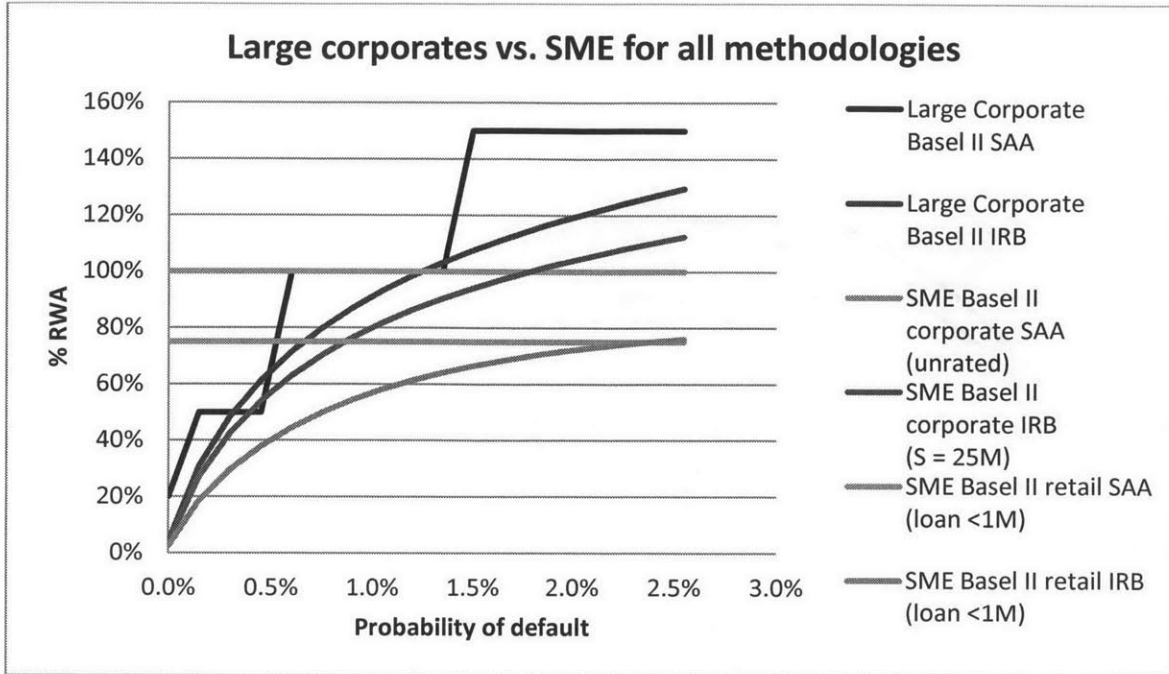Figure 6, RWA for large corporates and SMEs under all Basel II methodologies

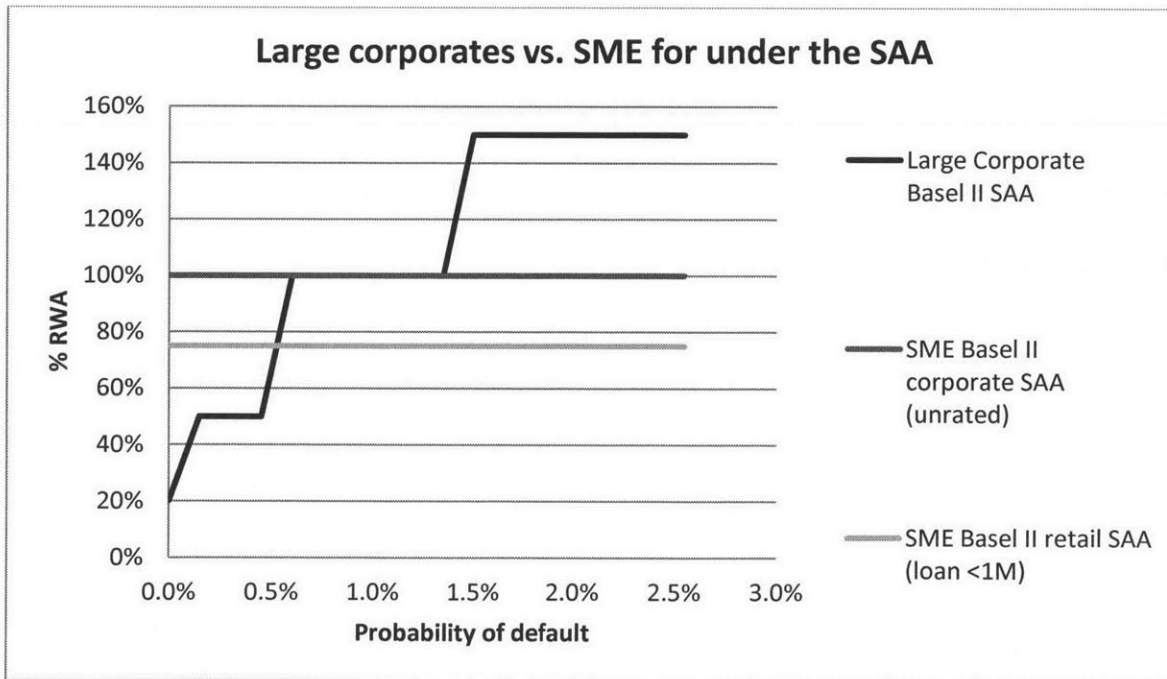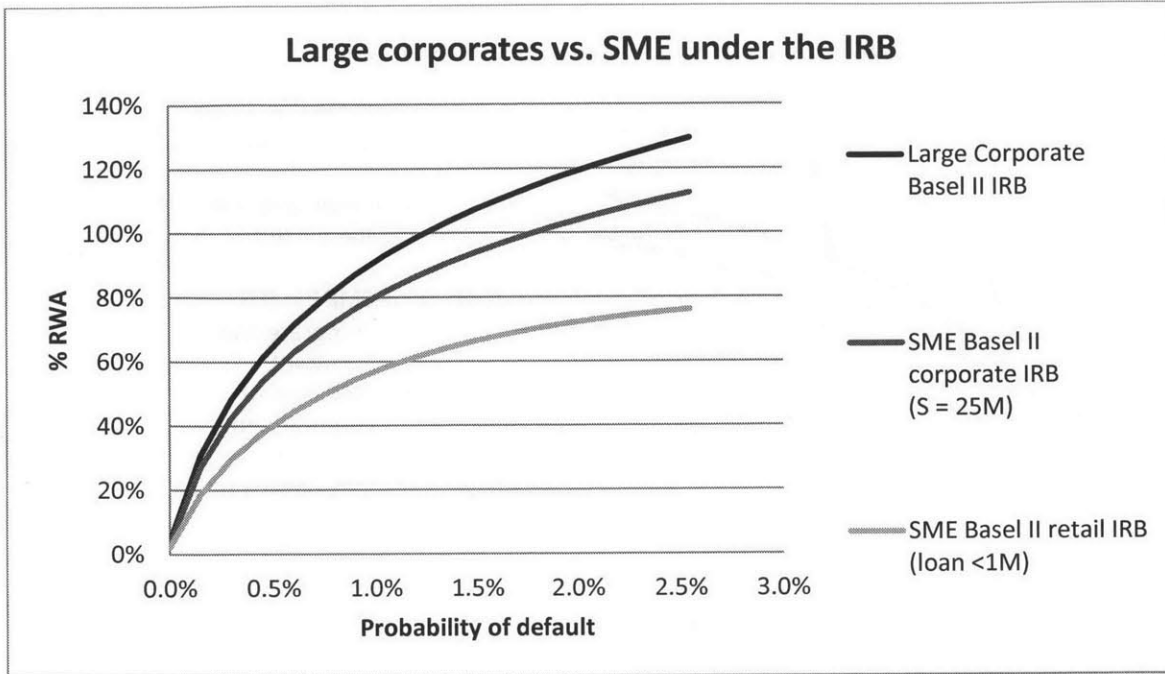**Figure 7, RWA for large corporates and SMEs under Basel II SAA**

Figure 8, RWA for large corporates and SMEs under Basel II IRB

Large corporates vs. SME under the IRB

Investment grade is between AAA and BBB-, which corresponds to PD > 0.52%. When I compared Basel II capital requirements for large corporates and for SMEs, I found that under the SAA, banks were required to hold less capital for large corporates as long as these were in the investment grade category. However, under the IRB approach, banks were always required to hold less capital for SMEs.

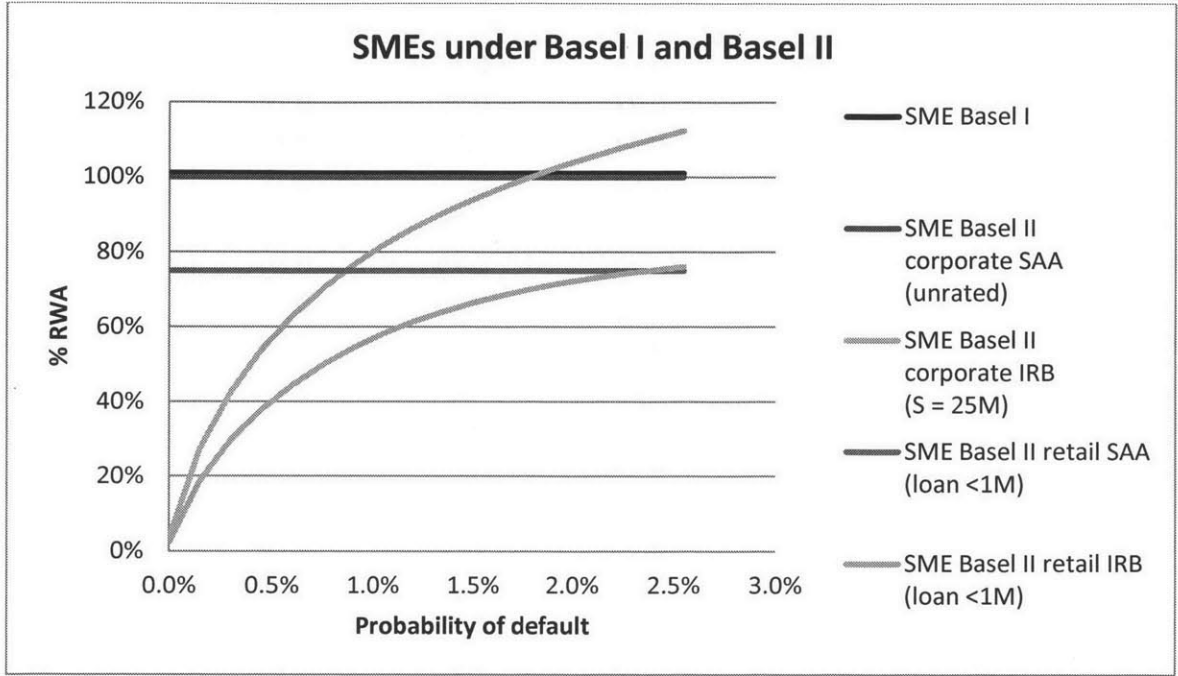b) **Required RWAs as a % of total assets under Basel I vs. Basel II for different loan types**

Table 8, RWA for SMEs under Basel I and Basel II

SMEs under Basel I and Basel II for all methodologies					
Probability of default	SME Basel I	SME Basel II corporate SAA	SME Basel II corporate IRB (S = 25M)	SME Basel II retail SAA (loan <1M)	SME Basel II retail IRB (loan <1M)
0.00%	1.00	1.00	0.03	0.75	0.02
0.15%	1.00	1.00	0.27	0.75	0.19
0.30%	1.00	1.00	0.43	0.75	0.30
0.45%	1.00	1.00	0.54	0.75	0.38
0.60%	1.00	1.00	0.63	0.75	0.45
0.75%	1.00	1.00	0.70	0.75	0.50
0.90%	1.00	1.00	0.77	0.75	0.54
1.05%	1.00	1.00	0.82	0.75	0.58
1.20%	1.00	1.00	0.86	0.75	0.61
1.35%	1.00	1.00	0.90	0.75	0.64
1.50%	1.00	1.00	0.94	0.75	0.66
1.65%	1.00	1.00	0.97	0.75	0.68
1.80%	1.00	1.00	1.00	0.75	0.70
1.95%	1.00	1.00	1.03	0.75	0.72
2.10%	1.00	1.00	1.06	0.75	0.73
2.25%	1.00	1.00	1.08	0.75	0.74
2.40%	1.00	1.00	1.10	0.75	0.75
2.55%	1.00	1.00	1.12	0.75	0.76

Hypotheses

Loss Given Default (for IRB)	70%
Exposure At Default (for IRB)	80%
Maturity (for non retail)	1
Yearly turnover (for non retail)	25

SMEs under Basel I and Basel II

Legend:
- SME Basel I
- SME Basel II corporate SAA (unrated)
- SME Basel II corporate IRB (S = 25M)
- SME Basel II retail SAA (loan <1M)
- SME Basel II retail IRB (loan <1M)

Y-axis: % RWA
X-axis: Probability of default

The retail category requires less capital than the corporate one for any given approach.

For SMEs with a probability of default above 1.8% in the corporate category and above 2.5% in the retail category, with a LGD of 70% and an EAD of 80%, the IRB methodology becomes more expensive. Finally, compared to Basel I, for SMEs in the retail category and for corporates with a PD < 1.8%, Basel II has lowered capital requirements.

Note: It is difficult to reach a precise value for SME default rates. However, researchers have provided approximate assumptions for certain countries. In Germany for instance, the average

SME default rate is assumed to be about 2%. [17] In Spain, papers have assumed the average PD to be equal to 5% between 2005 and 2009. [18] In France, this value is close to 4%. [19]

Table 9, RWA for large corporates under Basel I and Basel II

Large corporates under Basel I and Basel II for all methodologies				
Probability of default	Equivalent rating (S&P	Corporate Basel I	Corporate Basel II corporate	Corporate Basel II corporate IRB
0.00%	AAA	1.00	0.20	0.04
0.15%	A+	1.00	0.50	0.31
0.30%	BBB+	1.00	0.50	0.48
0.45%	BBB-	1.00	0.50	0.61
0.60%	BB+	1.00	1.00	0.72
0.75%	BB+	1.00	1.00	0.80
0.90%	BB	1.00	1.00	0.87
1.05%	BB	1.00	1.00	0.93
1.20%	BB	1.00	1.00	0.98
1.35%	BB	1.00	1.00	1.03
1.50%	BB-	1.00	1.50	1.07
1.65%	BB-	1.00	1.50	1.11
1.80%	BB-	1.00	1.50	1.15
1.95%	BB-	1.00	1.50	1.18
2.10%	B+	1.00	1.50	1.21
2.25%	B+	1.00	1.50	1.24
2.40%	B+	1.00	1.50	1.27
2.55%	B+	1.00	1.50	1.29

Hypotheses

Loss Given Default (for IRB)	70%
Exposure At Default (for IRB)	80%
Maturity	1

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[17] Evaluation of minimum capital requirements for bank loans to SMEs, Klaus Düllmann, Philipp Koziol

[18] "What do Basel Capital Accords mean for SMEs? 1", Clara Cardone-Riportella , Antonio Trujillo-Ponce, Anahí Briozzo

[19] Impact de Bâle II sur l'offre de crédit aux PME, Tresor Eco, Avril 2007

Large corporates under Basel I and Basel II
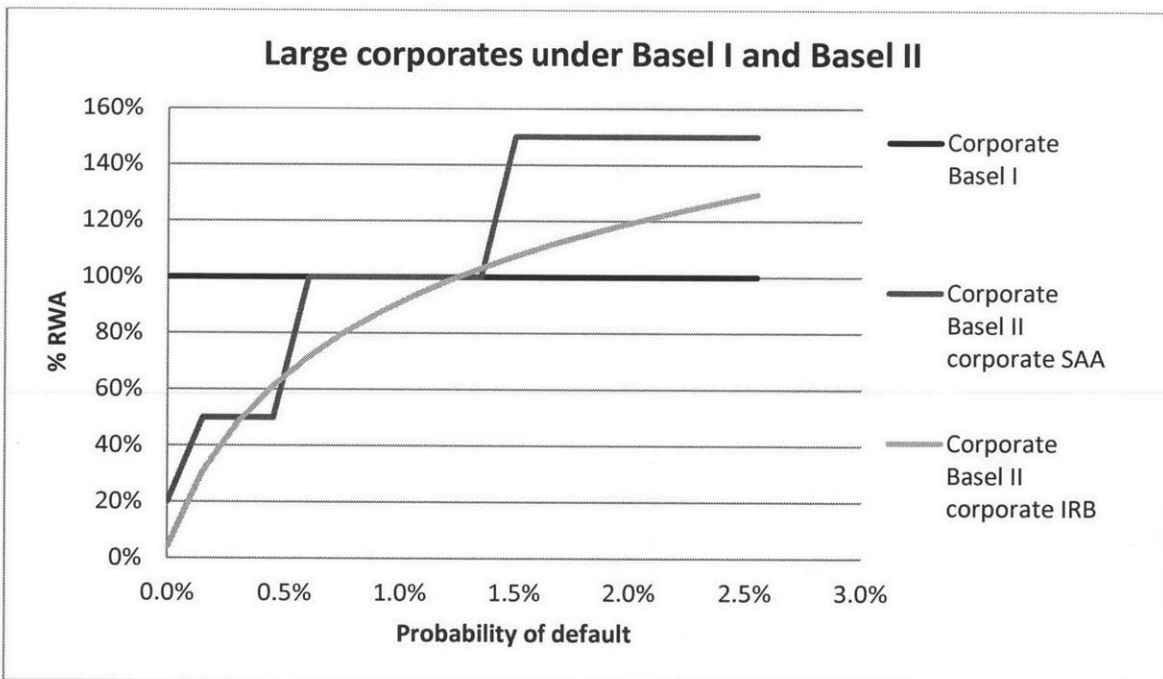
For all large corporates with PD > 1.5% (BB-), Basel I capital requirements are lower than under Basel II. Investment grade is between AAA and BBB-, which corresponds to PD > 0.52%. Therefore, Basel II becomes more expensive for large corporates which are non-investment graded.

Table 10, Residential and commercial mortgages under Basel I and II

Residential and commercial mortgages under Basel I and Basel II for all methodologies				
Probability of default	Residential secured loans Basel I	Commercial secured loans Basel I	Residential secured loans Basel II SAA	Residential secured loans Basel II IRB	Commercial secured loans Basel II SAA and IRB
0.0%	0.50	1.00	0.35	0.00	1.00
0.2%	0.50	1.00	0.35	0.05	1.00
0.3%	0.50	1.00	0.35	0.08	1.00
0.5%	0.50	1.00	0.35	0.11	1.00
0.6%	0.50	1.00	0.35	0.14	1.00
0.8%	0.50	1.00	0.35	0.17	1.00
0.9%	0.50	1.00	0.35	0.20	1.00
1.1%	0.50	1.00	0.35	0.22	1.00
1.2%	0.50	1.00	0.35	0.25	1.00
1.4%	0.50	1.00	0.35	0.27	1.00
1.5%	0.50	1.00	0.35	0.29	1.00
1.7%	0.50	1.00	0.35	0.31	1.00
1.8%	0.50	1.00	0.35	0.33	1.00
2.0%	0.50	1.00	0.35	0.35	1.00
2.1%	0.50	1.00	0.35	0.37	1.00
2.3%	0.50	1.00	0.35	0.39	1.00
2.4%	0.50	1.00	0.35	0.41	1.00
2.6%	0.50	1.00	0.35	0.43	1.00

Hypotheses

Loss Given Default (for IRB)	70%
Exposure At Default (for IRB)	80%
Maturity	1

Figure 11, Residential and commercial mortgages under Basel I and II

Residential and commercial loans under Basel I and Basel II
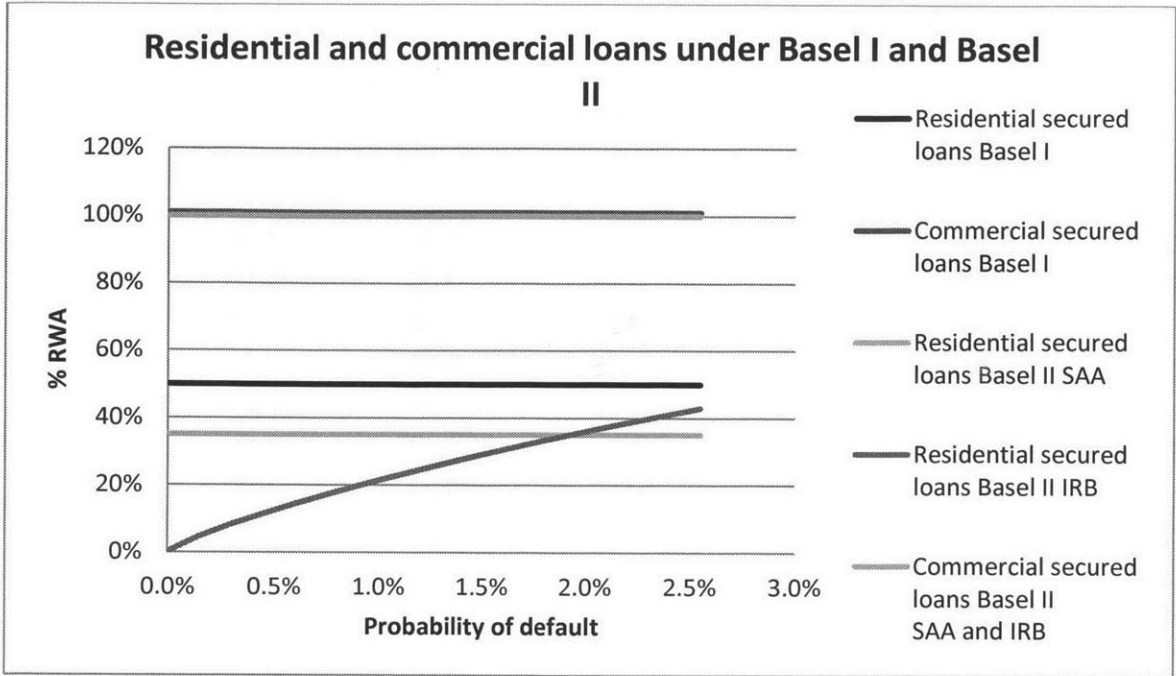
Under Basel II, capital requirements for residential secured loans dropped from 50% to 35% under the SAA, with a capital advantageous IRB methodology. Conversely, commercial secured loans kept a 100% risk weighting and were not attributed a specific IRB calculation methodology.[20] This change is claimed to have caused a strong shift of banks' portfolios towards residential real estate.

2) Impact on required returns of lending

Figure 12, Methodology for quantifying the impact of a 1% increase in RWAs on the required return on lending

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[20]   BCBS, International Convergence of Capital Measurement and Capital Standards

$$r_t^{AL} \times AL + r_t^{AO} \times AO = r_t^L \times L + r_t^E \times E$$

$$r_{t+1}^{AL} \times AL + r_t^{AO} \times AO = r_t^L \times \left(L - \frac{RWA}{100}\right) + r_t^E \times \left(E + \frac{RWA}{100}\right)$$

$$\left(r_{t+1}^{AL} - r_t^{AL}\right) = \frac{(r_t^E - r_t^L)}{AL} \times \frac{RWA}{100}$$

Legend:

AL - Lending Assets to Total Assets (%) r_t^{AL} - Return on Lending Assets (%)
AO - Other Assets to Total Assets (%) r_t^{AO} - Return on Other Assets (%)
L - Liabilities to Total Assets (%) r_t^L - Cost of Borrowing (%)
E - Common Equity to Total Assets (%) r_t^E - Cost of Equity (%)
RWA - Risk-weighted Assets to Total Assets (%)

The financing structure is assumed constant. A 1% increase in RWAs forces the bank to increase its common equity by 1% as well. In order for the cost of financing to be equal to its returns on lending assets, the bank needs to increase its lending spread by (Cost of equity – cost of borrowing)*RWA/ (% of lending assets*100). Since the cost of equity is higher than the cost of borrowing, this spread is positive.

3) Example

SSA methodology – for a loan of €1M to a SME under the SSA, assumed to belong to the retail products category, RWAs will be equal to 75% of total assets, or 1*0.75=€750.000.

In order to fulfill Basel II and be well-capitalized, the bank will have to increase its Tier 1 equity by 8%*750.000 = €60.000 and its total equity by 10%*750.000 = €75.000

Assuming that this loan is the only asset owned by the bank, that its cost of equity is 10% and cost of debt is 5%, the return on lending assets will increase by (10%-5%)*0.75 = 0.0375, or 3.75 basis points.

IRB methodology – for a one year loan of €1M to an SME with an annual turnover of €40M and a default probability of 6% (industry average for SMEs), the table above shows that RWAs will be equal to 89% of total assets, or 1*0.89 = €890.000

In order to fulfill Basel II and be well-capitalized, the bank will have to increase its Tier 1 equity by 8%*890.000 = €71.200 and its total equity by 10%*890.000 = €89.000

Assuming that this loan is the only asset owned by the bank, that its cost of equity is 10% and cost of debt is 5%, the return on lending assets will increase by (10%-5%)*0.89 = 0.0445, or 4.45 basis points.

4) Conclusion of theoretical analysis

Comparing capital requirements for large corporates and for SMEs, I found that under the SAA, Basel II requires higher capital requirements for large sub-investment grade large corporates than for SMEs. However, investment grade large corporates require less capital than SMEs under the SAA. Under the IRB, SMEs always require lower capital requirements.

The shift from Basel I to Basel II seems to have reduced capital requirements for investment grade large corporates, and increased them for non-investment grade. It has also reduced capital requirements for SMEs in two ways: first, for SME loans classified as corporates, when these firms have a probability of default of 1.8% and below (for an EAD of 80% and an LGD of 70%). Second, all loans classified as retail products (< €1M) benefit from reduced capital requirements. Finally, Basel II strongly diminished capital requirements for residential secured real estate loans. The well-known shift of banks' portfolios towards this type of loans is proof of the potential impact of Basel II reforms.

To conclude, it appears that the shift from Basel I to Basel II has not made it more difficult for banks to make loans to SMEs, with the possibility to put these loans into the retail category. Furthermore, for a given PD, large corporates are only advantaged to the extent that they are investment grade, under the SAA, and are always at a disadvantage under the IRB. If we assume that banks would allocate economic capital for loans based on companies' PD, regardless of regulatory requirements, this theoretical would imply that Basel II in itself should not have created a credit contraction for SMEs.

IV. Empirical analysis

1) Supply side empirical analysis: from the banks' perspective

a) Data

The Eurosystem has developed a survey of bank lending in the euro area. The main objective of the survey is to enhance the Eurosystem's knowledge of financing conditions in the euro area and hence to help the Governing Council of the ECB to assess monetary and economic developments as an input into monetary policy decisions. It is designed to complement existing statistics on retail bank interest rates and credit with information on supply and demand conditions in the euro area credit markets and the lending policies of euro area banks. The survey addresses issues such as credit standards for approving loans as well as credit terms and conditions applied to enterprises and households. It also asks for an assessment of the conditions affecting credit demand.

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The survey is addressed to senior loan officers of a representative sample of euro area banks and will be conducted four times a year, from April 2003 until October 2012. The sample group participating in the survey comprises around 90 banks from all euro area countries and takes into account the characteristics of their respective national banking structures. Data can be found for 5 different countries (France, Germany, Italy, Spain, and Ireland), and over 38 quarters, yielding a total of 180 data points. Answers by senior loan officers to the question *"Over the past three months, how have your bank's credit standards as applied to the approval of loans or credit lines to enterprises changed?"* are given on a 5 point scale: tightened considerably, tightened somewhat, remained basically unchanged, eased somewhat, eased considerably. Results are split into three categories: overall approval of loans, loans to SMEs, and loans to large enterprises.

I used a weighted average scale (1 for tightened considerably to 5 for eased considerably) to find the average availability of financing.

Figure 13, ECB bank loan survey sample

I. Loans or credit lines to enterprises

1.   Over the past three months, how have your bank's credit standards as applied to the approval of loans or credit lines to enterprises changed?

	Overall	Loans to small and medium-sized enterprises	Loans to large enterprises	Short-term loans	Long-term loans
Tightened considerably					
Tightened somewhat					
Remained basically unchanged					
Eased somewhat					
Eased considerably					

b) Choice of threshold

Furthermore, under the European Capital Requirements Directive which encompasses Basel II, banks were expected to implement the SAA Basel II approaches by January 2007, and could choose to continue with Basel I until 2008, when Basel II also became compulsory for the Foundation and Advanced Internal Ratings Based (FIRB and AIRB).

Figure 14, Levels of Bank Capital in the Euro Area (as a % of RWA)
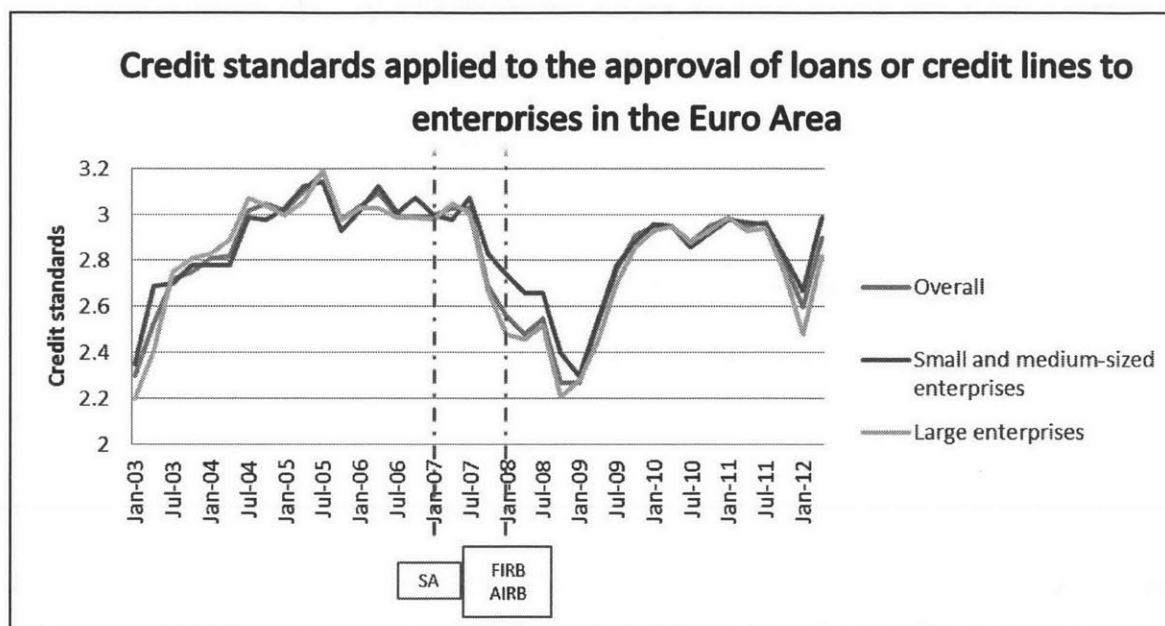
Note: Credit standards as applied to the approval of loans (1- tightened considerably, 2- tightened somewhat, 3- remained basically unchanged, 4- eased somewhat, 5- eased considerably)

Table 11, Average capital as % of total assets for European banks

	2006	2007	2008	2009
Tier 1	8.0	7.7	8.6	9.4
Common equity	6.8	6.6	7.3	8.0

From January 2008 onwards, banks in Europe had to implement Basel II, using whichever method was preferred. Most European banks had already started implementing Basel II by 2007.

The table above shows the increase in banks' RWAs throughout Europe.[21] The survey data looks at how credit standards evolved over the past 3 months. This leads me to look at the years before and after 2008, and see if credit standards tightened over this period.

c) Choice of control variables

Banks' willingness to make loans was strongly affected by the global financial crisis and by the European crisis. I therefore analyzed the correlation between banks' credit standards and several macroeconomic variables which could be strong determinants of credit availability: these included.

- YoY GDP working day and seasonally adjusted, calculated per quarter

- One-year and two-year lags on GDP growth

- Yearly unemployment rates

- Long-term interest rates defined as secondary market yields of government bonds with a remaining maturity close to ten years (where no harmonized long-term government bond yields are available, proxies are derived from private sector bond yields or interest rate indicators)

- Financial institutions' average credit spreads on loans to non-financial corporations, defined as the weighted spread between the MFI interest rate for new business loans to NFC and the swap rate with a maturity corresponding to the loan category initial period of rate fixation

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[21] OECD paper, Macroeconomic Impact of Basel III, Patrick Slovik, Boris Cournède

Some of these variables are represented in the graphs below, which picture the correlation between some macroeconomic and credit availability.

Figure 15, credit standards and GDP growth in the Euro area

Credit standards for loans or credit lines and output in the Euro area
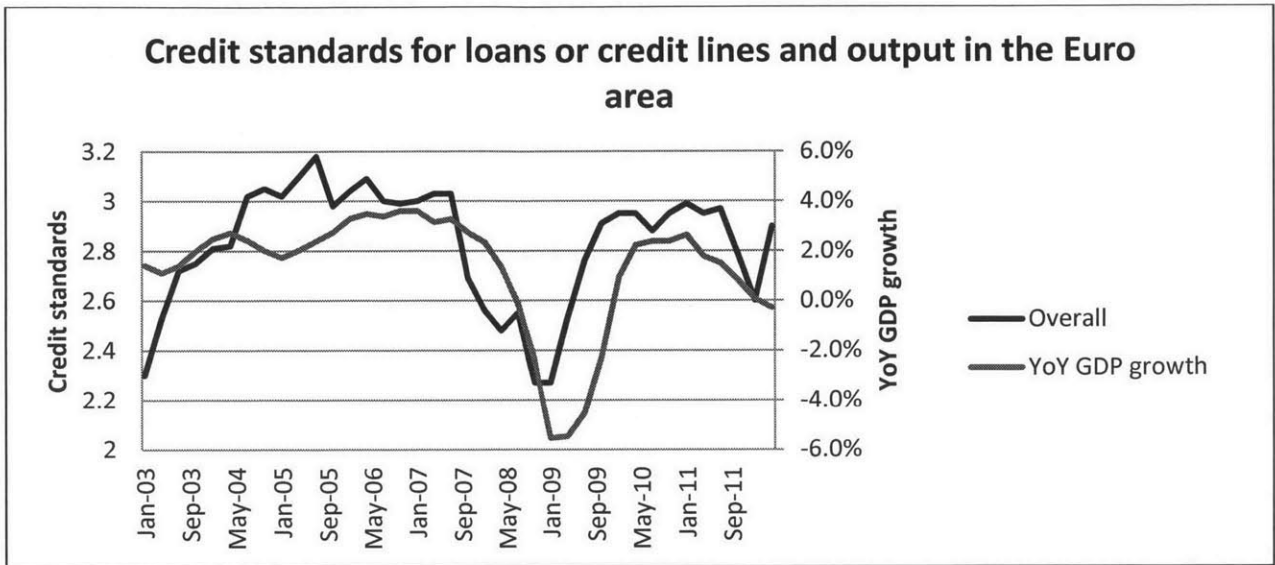
Figure 16, credit standards and long-term interest rates in the Euro area

Credit standards and long term interest rates in the Euro area
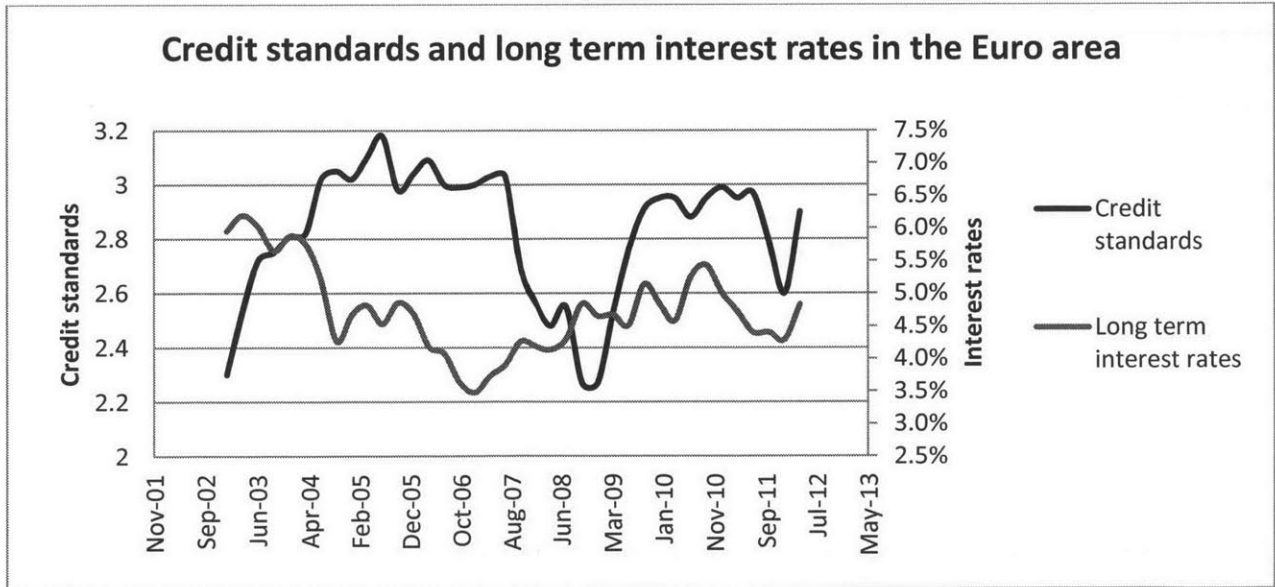
Analyzing several regressions and the statistical significance of their coefficients led me to choose YoY GDP growth, long-term interest rates and credit spreads for my regression design. It was particularly essential to capture and control for the effect of the financial crisis in Europe,

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which took place during the same period as the implementation of Basel II reforms. This can be clearly seen in the first graph, which depicts an important drop in YoY GDP growth rates in January 2009.

d) Regression design

Using a differences-in-differences regression design, I studied the effect of the implementation of Basel II reforms (from 2008 onwards) for SMEs as opposed to large enterprises using the following equation:

$Y = a + b*Control1 + b'*Control2 + b''*Control3 + c*dummy\_08 + d*dummy\_SME + e*dummy\_08*dummy\_SME$

Y: European banks' credit standards in terms of approval of loans and credit lines to entreprises on a scale of 1 to 5 (1- tightening, 5- easing)

Control 1: year-on-year GDP % change, working day and seasonally adjusted, calculated per quarter

Control 2: Weighted average of credit spreads on loans from Financial Institutions to Non-Financial Corporations

Control 3: 10-year government bond interest rates

Dummy_SME: dummy variable equal to 1 if for SME and 0 otherwise

Dummy_08: dummy variable equal to 1 if for every quarter after December 2007 and 0 otherwise

Dummy_SME*dummy_08: interaction term equal to 1 for SMEs after December 2007 and 0 otherwise

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The regressions use individual macroeconomic data, and credit standards from France, Germany, Spain, Ireland, and Italy, in order to account for differences in each country.

e) Results

Figure 17, regression of credit standards pre and post Basel II in Europe

reg Creditstandard YoYGDP Creditspread LTinterestrate Dummy08 dummy_SME dummy_08_SME

Source	SS	df	MS				
				Number of obs =	380		
Model	35.6558825	6	5.94264709	F(6, 373) =	18.15		
Residual	122.136205	373	.327442908	Prob > F =	0.0000		
				R-squared =	0.2260		
				Adj R-squared =	0.2135		
Total	157.792087	379	.416337961	Root MSE =	.57223		

Creditstandard	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
YoYGDP	8.168319	1.208637	6.76	0.000	5.791723	10.54492
Creditspread	36.77267	6.478482	5.68	0.000	24.03374	49.51159
LTinterestrate	-2.743682	2.352498	-1.17	0.244	-7.369502	1.882139
Dummy08	-.193134	.0946509	-2.04	0.042	-.3792503	-.0070178
dummy_SME	.01635	.080925	0.20	0.840	-.1427764	.1754764
dummy_08_SME	.1293374	.1175813	1.10	0.272	-.1018679	.3605428
_cons	2.020142	.1301985	15.52	0.000	1.764127	2.276157

These regressions show that there is effectively a credit contraction -0.193 after following the implementation of Basel II from 2008 onwards, controlling for GDP growth, long-term interest rates and short-term interest rates. Furthermore, the interaction factor is equal 0.129. This positive value denotes that SMEs are not more affected than large enterprises since Basel reforms. The p-value is equal to 0.272% (greater than the 5% threshold), which implies that we cannot prove that SMEs have been less affected than large enterprises. However, this evidence - taken with several controls which seemingly affect bank lending - seems to suggest that they have not been more affected by reforms.

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2) Analysis of banks' overall credit standards for SMEs broken down by country

In order to further control for the dominant effects of the financial crisis which took place in 2009 in Europe, I chose to break the analysis down by country, using data from the five key ones in Europe: Germany, France, Italy, Ireland, and Spain. The effects of the financial crisis have different in these countries, so choosing to analyze the consequences of Basel II in each one individually can yield clearer results.

a) Data

The ECB's bank lending survey aggregate data is also accessible for several individual EU states on the countries national bank's statistics. I found data for Germany, France, Italy, Spain, and Ireland to the question *"Over the past three months, how have your bank's credit standards as applied to the approval of loans or credit lines to enterprises changed?"* The information is also available from Q1 2003 until Q2 2012 for these countries, which provides 190 data points. Time series are given as a net response from a scale of -1 to 1, where 1 represents a strong tightening of credit standards and -1 a considerable easing. I adapted the data to be on a scale from 0 to 5 $((X+1)*2.5)$.

Figure 18, credit standards in Germany
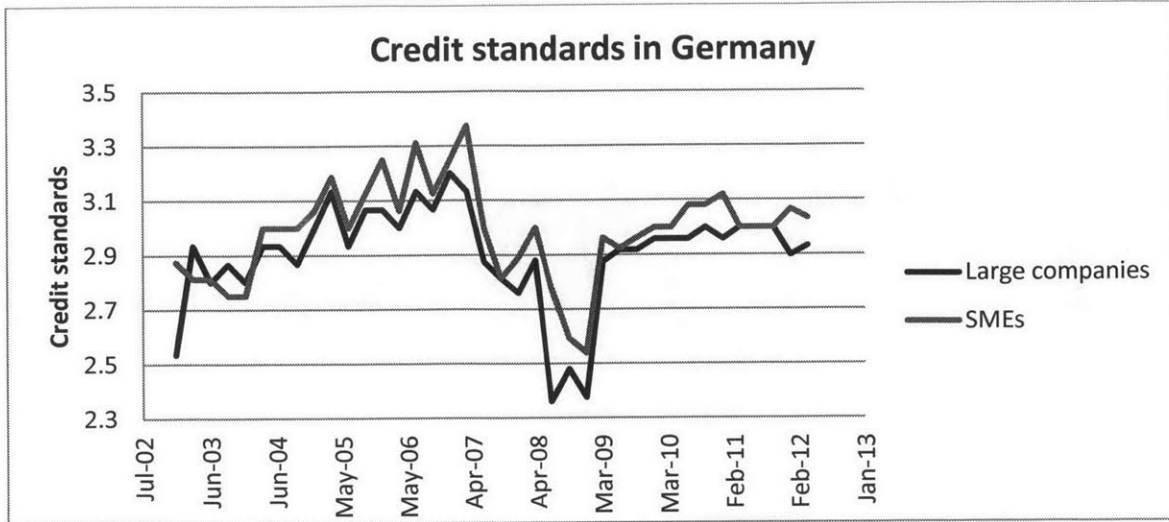
Figure 19, credit standards in France
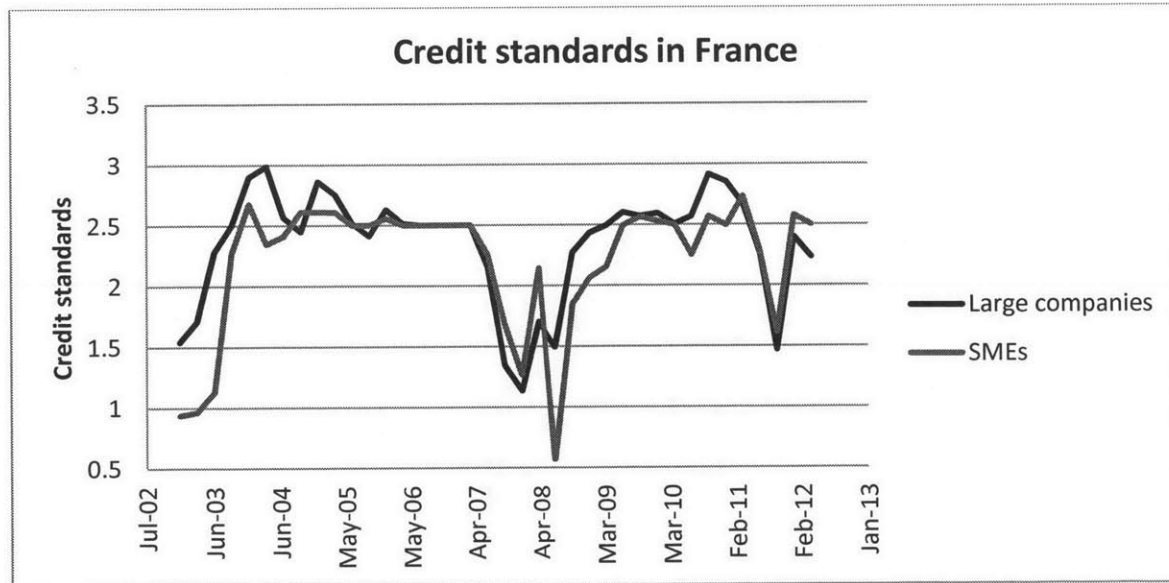
Figure 20, credit standards in Spain

Credit standards in Spain
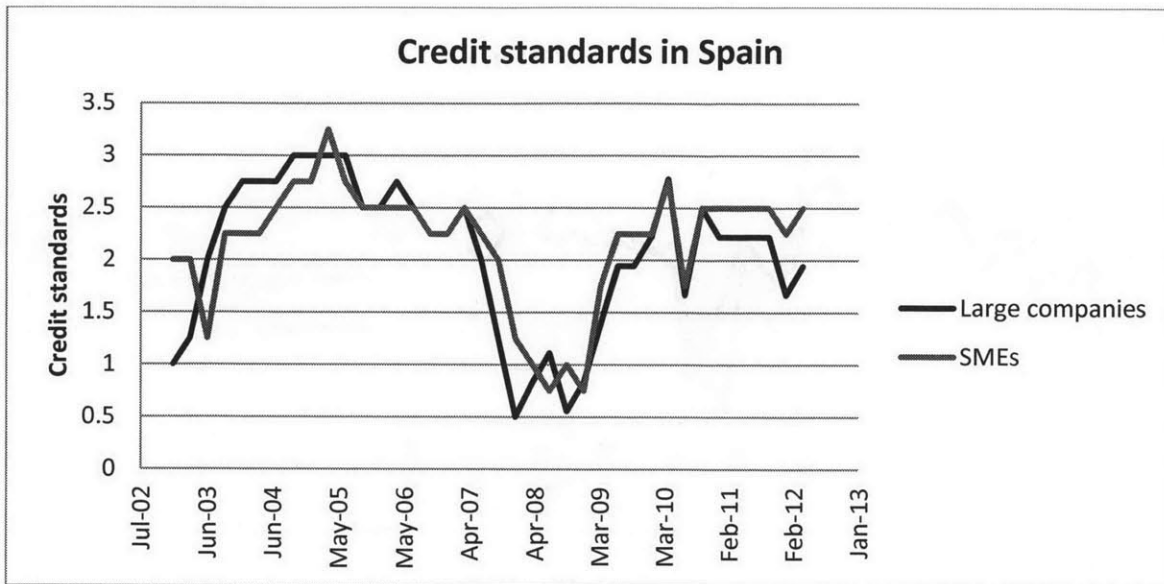
Figure 21, credit standards in Italy

Credit standards in Italy
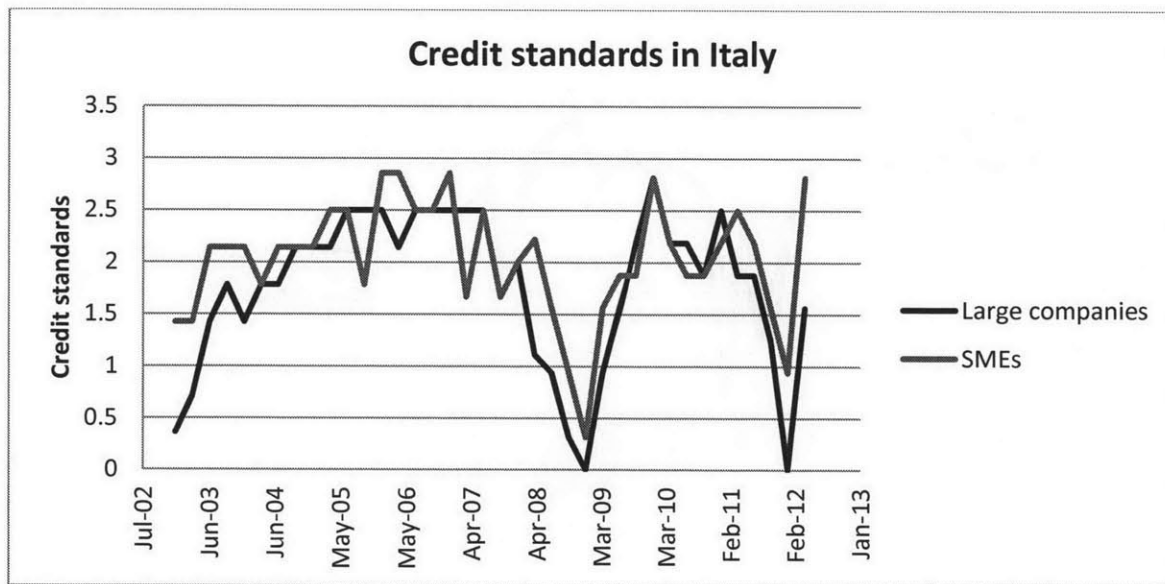
These graphs show that credit standards in the largest four European countries have evolved under similar trends.

b) Controls

I maintained the same controls as for the overall analysis: YoY GDP growth, long-term interest rates and credit spreads. For relatively similar credit standard trends as seen above,

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macroeconomic data shows a clearly divergent evolution these countries since 2009. This is pictured in the graphs below.

Figure 22, YoY GDP change by country
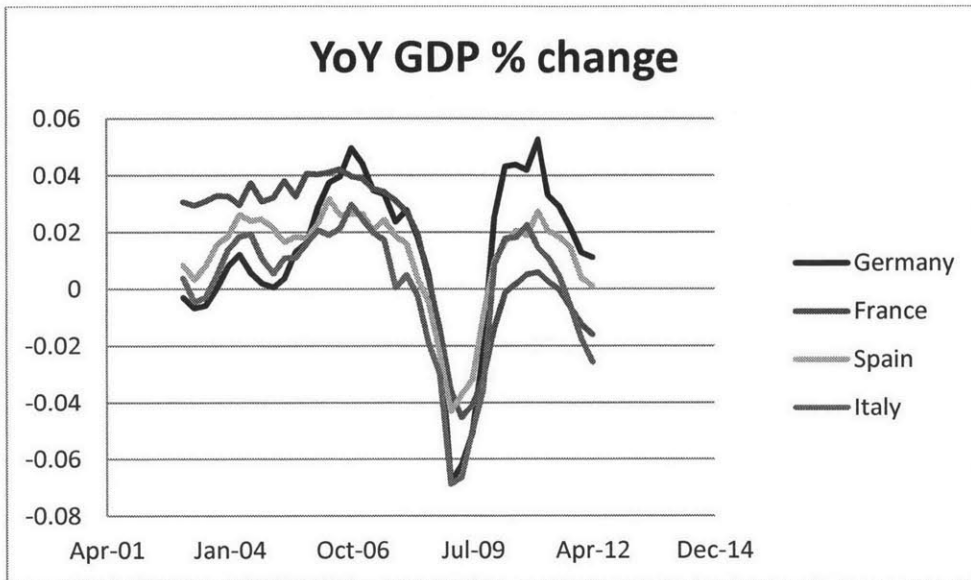
Figure 23, Long-term interest rates by country
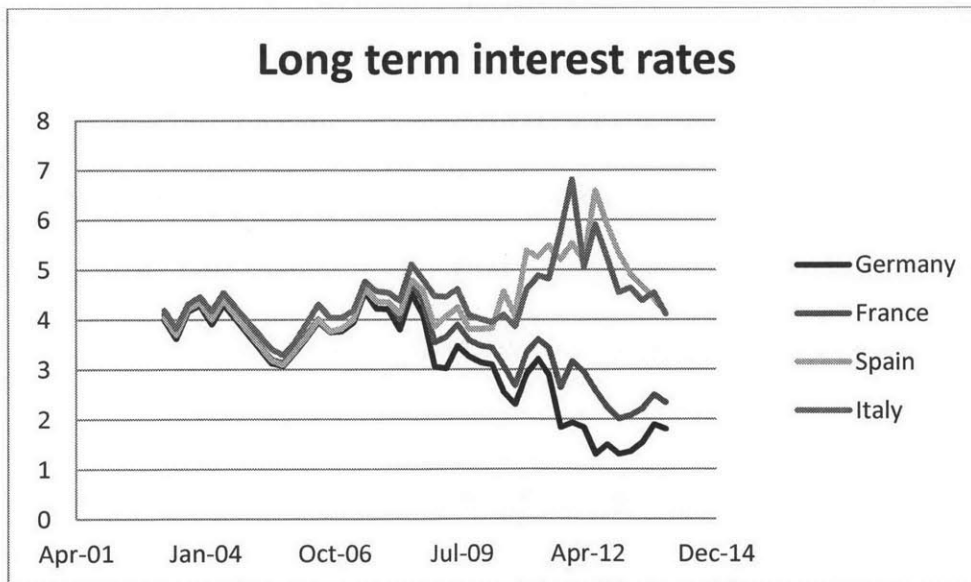
Figure 24, credit spreads by country

Credit spreads
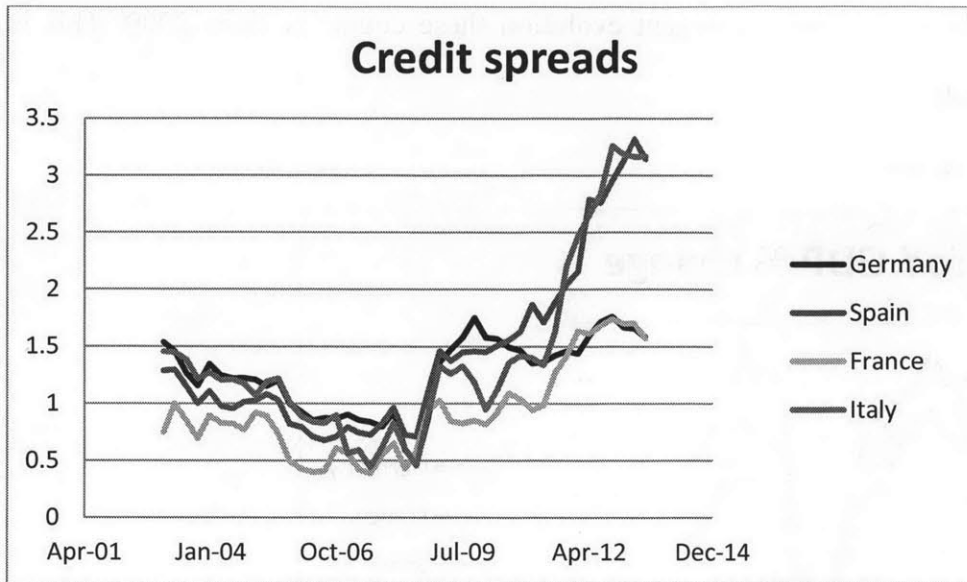
c) **Regression design**

$Ysmall\text{-}large = a + b*Control1 + b'*Control2 + b''*Control3 + c1*dummy\_pre08\_country1 + c2*dummy\_pre08\_country2 + c3*dummy\_pre08\_country3 + c4*dummy\_pre08\_country4 + c5*dummy\_pre08\_country5 + d1*dummy\_08\_country1 + d2*dummy\_08\_country2 + d3*dummy\_08\_country3 + d4*dummy\_08\_country4 + d5*dummy\_08\_country5, noconstant$

Y small-large: European banks' credit standards to SMEs in a given country and quarter minus European banks' credit standards to large enterprises in a given country and quarter (1-tightening, 5- easing, therefore a positive number means easier standards for SMEs than for large companies)

Control 1: year-on-year GDP % change, working day and seasonally adjusted, calculated per quarter

Control 2: Weighted average of credit spreads on loans from Financial Institutions to Non-Financial Corporations

Control 3: 10-year government bond interest rates

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Dummy_pre08_countryi: equal to 1 for quarters before January 2008 and 0 otherwise. For i from

1 to 5, respectively France, Germany, Italy, Ireland, and Spain

Dummy_08_countryi: equal to 1 for quarters after January 2008 and 0 otherwise. For i from 1 to

5, respectively France, Germany, Italy, Ireland, and Spain

d) Results

Figure 25, regression of credit standards pre and post Basel II by country

```
reg Creditstandardsmalllarge YoYGDP Creditspread LTinterestrate dummy_country1_pre08
dummy_country2_pre08 dummy_country3_pre08 dummy_country4_pre08 dummy_country5_pre08
dummy_country1_08 dummy_country2_08 dummy_country3_08 dummy_country4_08
dummy_country5_08, noconstant
```

Source	SS	df	MS		
Model	6.0855141	13	.468116469		
Residual	17.9299281	177	.101299029		
Total	24.0154422	190	.126397064		

Number of obs = 190
F(13, 177) = 4.62
Prob > F = 0.0000
R-squared = 0.2534
Adj R-squared = 0.1986
Root MSE = .31828

Creditstandardsmal~e	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
YoYGDP	-1.007864	1.102124	-0.91	0.362	-3.182859	1.167131
Creditspread	12.82664	7.050863	1.82	0.071	-1.087938	26.74122
LTinterestrate	-1.313353	2.864968	-0.46	0.647	-6.967244	4.340538
dummy_country1_pre08	-.1912286	.1398698	-1.37	0.173	-.4672556	.0847984
dummy_country2_pre08	.0015204	.1504169	0.01	0.992	-.295321	.2983617
dummy_country3_pre08	-.12639	.1814953	-0.70	0.487	-.4845633	.2317832
dummy_country4_pre08	.1448708	.153924	0.94	0.348	-.1588915	.4486332
dummy_country5_pre08	-.0448761	.1482746	-0.30	0.763	-.3374896	.2477374
dummy_country1_08	-.1967488	.1356745	-1.45	0.149	-.4644967	.0709992
dummy_country2_08	-.0267908	.1385762	-0.19	0.847	-.300265	.2466835
dummy_country3_08	-.0027418	.2386003	-0.01	0.991	-.4736093	.4681257
dummy_country4_08	.2160995	.1821009	1.19	0.237	-.1432689	.5754678
dummy_country5_08	.0908869	.1891845	0.48	0.632	-.2824606	.4642344

Table 12, Summary of regression results by country

Country	Pre Basel II	Post Basel II	*Difference*
France	-0.191	-0.197	*-0.006*
Germany	-0.002	-0.027	*-0.025*
Ireland	-0.127	-0.003	*0.124*
Italy	0.145	0.216	*0.071*
Spain	-0.045	0.091	*0.136*

By adding country data, we find the same conclusion as with overall EU data: when controlling for a number of factors, including splitting effects of the financial crisis by individual country, this regression does not suggest a greater contraction for loans to SMEs as opposed to large enterprises. More specifically, credit standards for SMEs compared with large companies have deteriorated in France and in Germany by 0.006 and 0.025, and have improved in Ireland, Italy, and Spain by 0.124, 0.071, and 0.136 respectively. Therefore, no clear conclusion can proven as to a stronger contraction in lending to SMEs.

When analyzing banks' credit standards, we find that the implementation of Basel II from 2008 onwards does not appear to have a specific effect on SME lending. Whether looking at overall EU data or individual country data for five large countries, we find that there is a credit contraction after 2008 controlling for GDP, without noticing a larger drop for SMEs than for large enterprises.

3) Demand side empirical analysis: from the SME's perspective

a) Data

The survey on access to finance of SMEs in the Euro Area (SAFE) covers micro, small, medium-sized and large firms and it provides evidence on the financing conditions faced by SMEs compared with those of large firms during the past six months. In addition to a breakdown into firm size classes, it provides evidence across branches of economic activity, euro area countries, firm age, financial autonomy of the firms, and ownership of the firms. The first wave of the survey was held in June-July 2009, until June 2013. The survey is run by the ECB every six months to assess the latest developments of the financing conditions of firms in the euro area.

The aim is to compare the availability of bank loans and trade credit financing for SMEs and for large enterprises since the implementation of Basel reforms in 2008. Data is based on answers to the question *"For each of the following ways of financing, would you say that their availability has improved, remained unchanged or deteriorated for your firm over the past 6 months?"* Answers are given on a 3 point scale: improved, remained unchanged, deteriorated. Results are split into 5 categories: SMEs (divided into medium, small and micro), and large enterprises. Data is also split into countries: Germany, Italy, France, Spain, and others.

b) Analysis

Figure 26, Access to bank financing by enterprises size from 2009 to 2013

```
. sum SMEsloans Largefirmsloans Microloans Smallloans Mediumloans Totalloans

    Variable |    Obs       Mean    Std. Dev.      Min        Max
  -----------+--------------------------------------------------------
    SMEsloans |     45   -.1610378    .1318638   -.5104913    .0675256
  Largefirms~s |     45   -.1076532     .185969   -.5527152    .2741495
    Microloans |     45   -.2208513    .1479915   -.5787057    .0303461
    Smallloans |     45   -.1497913    .1555776    -.761759    .1133179
   Mediumloans |     45   -.1367053    .1471872    -.587063    .0882816
  -----------+--------------------------------------------------------
    Totalloans |     45    -.144197    .1479164   -.5010648    .1182364

. sum SMEstradecredit Largefirmstradecredit Microtradecredit Smalltradecredit Mediumtradecredit Totaltradecredit

    Variable |    Obs       Mean    Std. Dev.      Min        Max
  -----------+--------------------------------------------------------
  SMEstradec~t |     45   -.0869254    .0945822     -.41537    .0460473
  Largefirm~it |     45   -.0518655    .1007881   -.3052086    .1715181
  Microtrade~t |     45   -.1048085    .1069614   -.4162138     .063354
  Smalltrade~t |     45   -.0842335    .0993419   -.4599243    .0505665
  Mediumtrad~t |     45   -.0792298      .09749   -.3498319    .0591589
  -----------+--------------------------------------------------------
  Totaltrade~t |     45   -.0749719    .0898859   -.3863563    .0658682
```

Figure 27, availability of bank loans and trade credit for SMEs in Europe
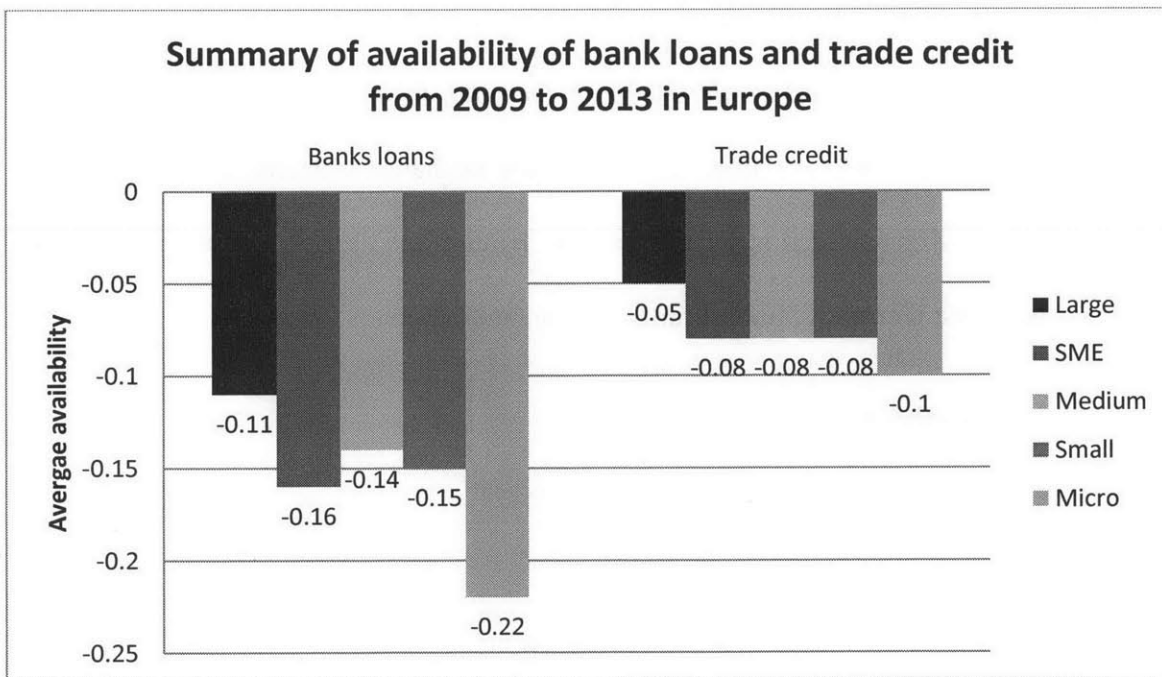
Figure 28, availability of loan financing in the Euro Area

Availability of loan financing in the Euro Area
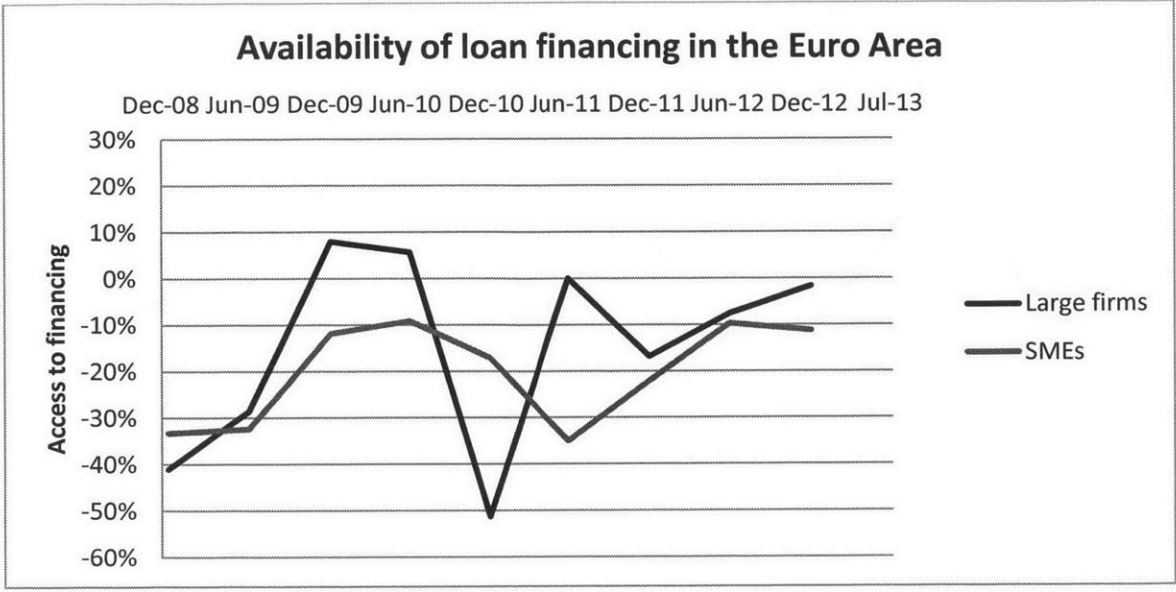
Figure 29, availability of loan financing in Germany

Availability of loan financing in Germany
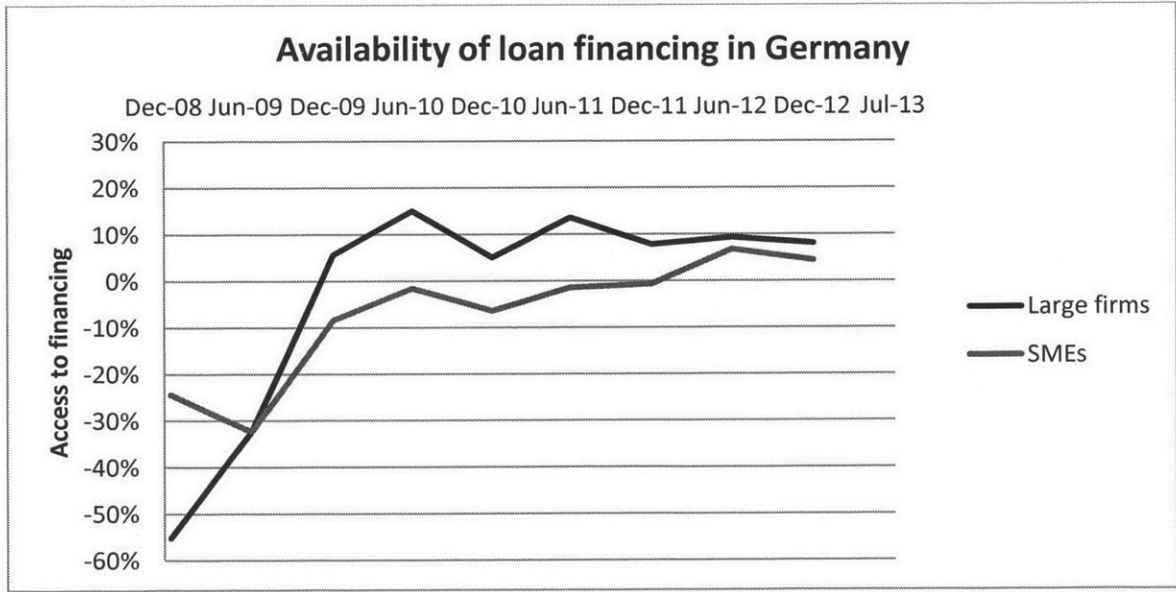
Figure 30, availability of loan financing in France
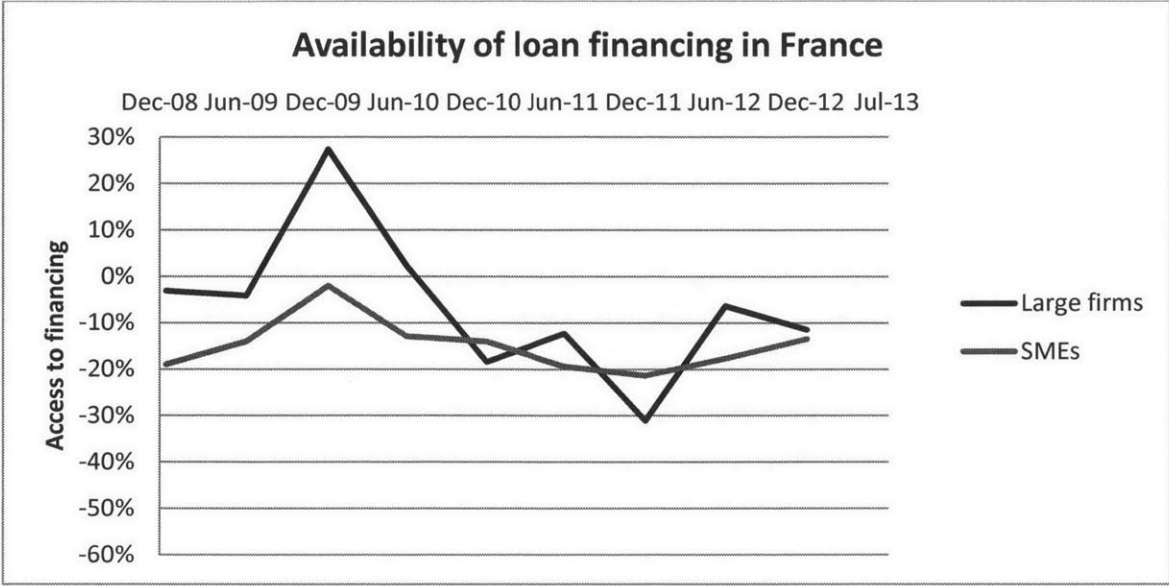
Figure 31, availability of loan financing in Spain
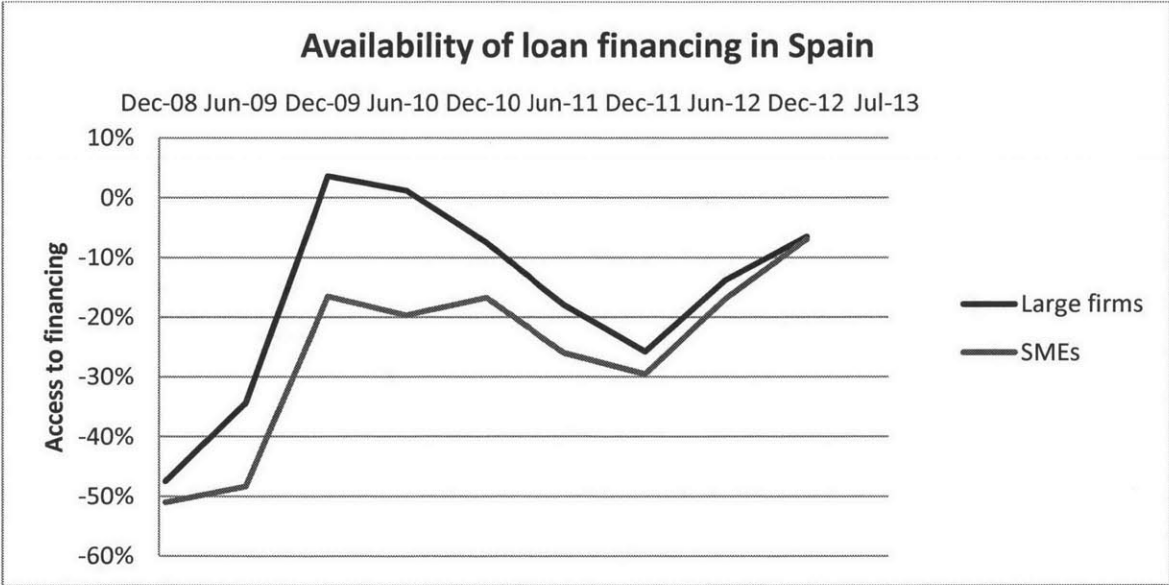
Figure 32, availability of loan financing in Italy

Availability of loan financing in Italy
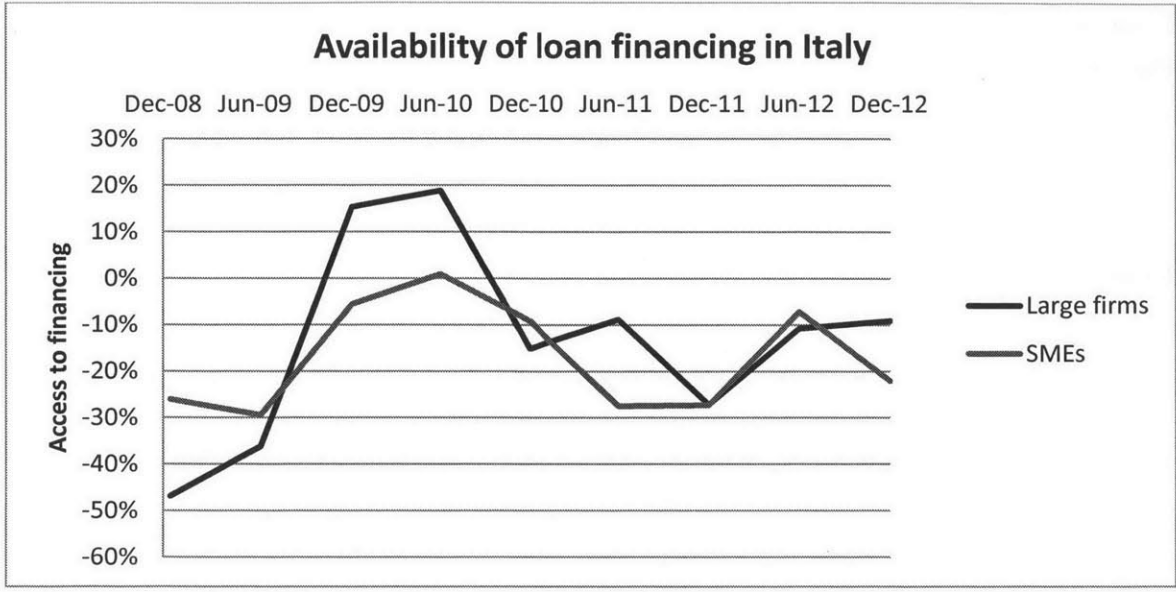
Note: Access to financing on a weighted average scale (-1 access deteriorated, 0- remained unchanged, 2- improved)

c) Results

The previous results show that SMEs have had more difficulty in accessing credit than large corporates since 2009, with a 16% drop for loans and an 8% drop for trade credit, as opposed to 10% an 5% respectively for large enterprises. Furthermore, we find that this effect is amplified when the size of the enterprise shrinks.

The analysis above shows us that SMEs have been more affected than large corporates since the financial crisis, with an amplification effect as the firm shrinks in size. However, the data from the SME survey does not allow us to say whether this is due to Basel reforms, since data is only provided from 2009 onwards, which is after the regulation took place.

4) Demand and supply side comparative empirical analysis: combining the banks' and the SME's perspectives

a) Overall effect of banks' credit standards on SME lending

i. Data

The objective of this section is to compare bank lending standards with SME access to financing. The ECB provides semi-annual survey data collected within enterprises from January 2009 until January 2012 for both large enterprises and SMEs. The survey asks them how their access to lending from banks has evolved. The survey directed towards SMEs compiles answers to the following question: *"For each of the following ways of financing (namely bank loans), would you say that their availability has improved, remained unchanged or deteriorated for your firm over the past 6 months?"*. Individual country data can be found for France, Germany, Spain, and Italy, taken 7 semesters, and for both large and small companies, yielding a total of 56 data points. The survey directed towards banks studied in the previous section compiles quarterly answers from January 2003 until March 2012 to the following question (Q1): *"Over the past three months, how have your bank's credit standards as applied to the approval of loans or credit lines to enterprises changed?"* I combined the results from both of these surveys over the January 2009- 2012 period to see whether the effects of banks' credit standards have effectively been translated to SMEs' ability to access financing.

Figure 33, comparison of banks' credit standards with SME access to lending
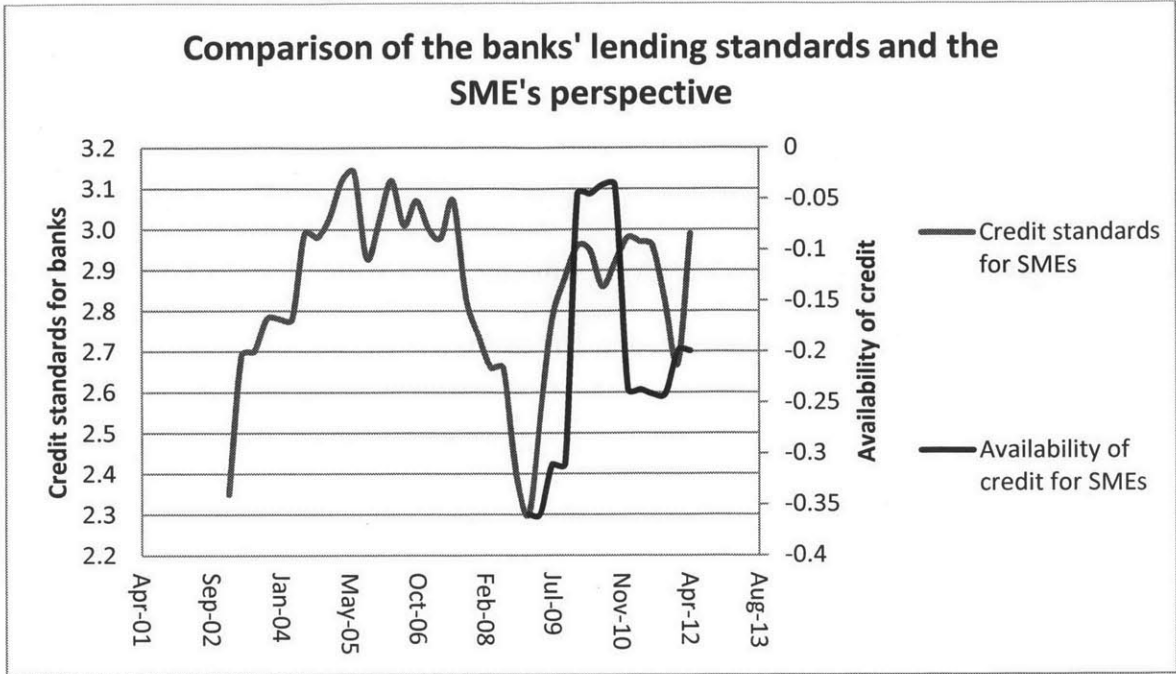
Figure 34, comparison of banks' credit standards with large corporates' access to lending
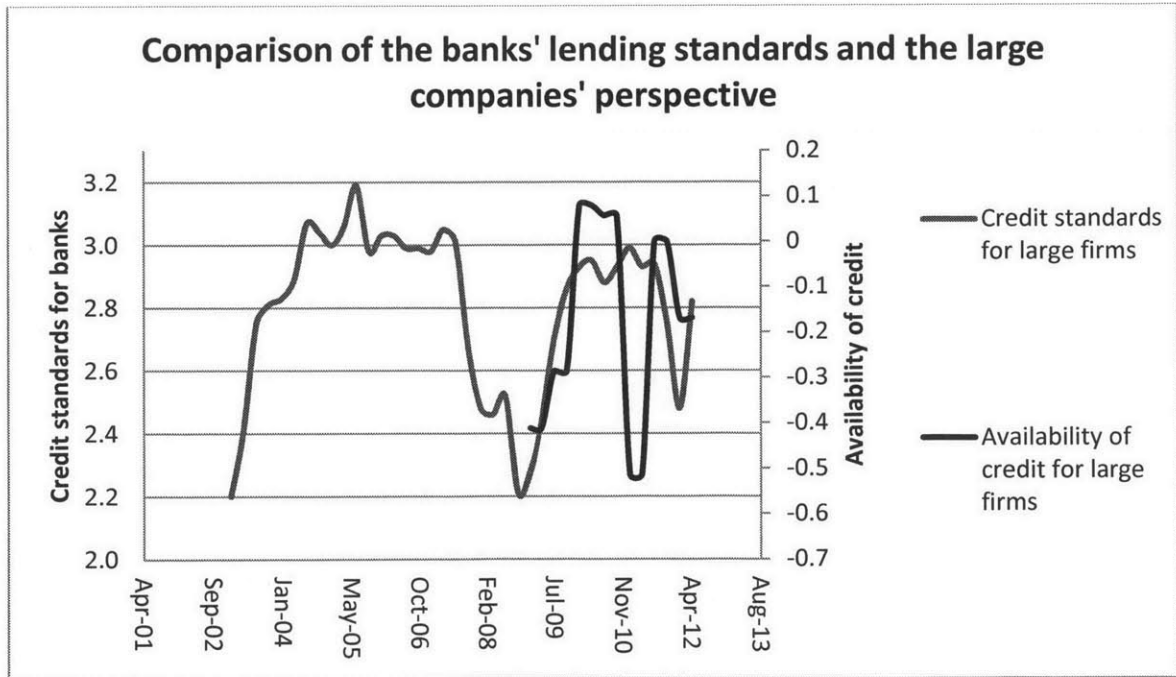
ii.   Regression design

YSMEsurvey = a + b*Control1 + b'*Control2 + b''*Control3 + c1*dummy_SME + c2*banksurveyQ1 + c3* dummy_SME* banksurveyQ1

YSME survey: availability of bank financing for large and small companies from their own perspective, in a given country and during a given semester, on a scale of -1 to 1 (where -1 is more increased difficulty in access to financing, and 1 is easing)

Control 1: year-on-year GDP % change, working day and seasonally adjusted, calculated per quarter

Control 2: 10-year government bond interest rates

Control 3: Weighted average of credit spreads on loans from Financial Institutions to Non-Financial Corporations

Dummy_SME: equal to 1 for SMEs and 0 otherwise

Banksurvey_Q1: European banks' credit standards to SMEs in a given country and semester on a scale of 1 to 5 (1- tightening, 5- easing, therefore a positive number means easier standards for SMEs)

Dummy_SME*Banksurvey_Q1: interaction variable equal to 1 if the company is an SME, multiplied by the average credit standard for the SME in a given country and during a given quarter

iii. Results

Figure 35, regression SME access to lending with banks' credit standards

reg SMEsurveyaccesstofinancing YoYGDP Creditspread LTinterestrate dummy_SME
SMEsbanksurveyQ1 dummy_SME_bankcreditstandard

Source	SS	df	MS		
Model	.865154323	6	.144192387	Number of obs =	56
Residual	1.00087186	49	.020425956	F(6, 49) =	7.06
				Prob > F =	0.0000
				R-squared =	0.4636
				Adj R-squared =	0.3980
Total	1.86602619	55	.033927749	Root MSE =	.14292

SMEsurveyaccesstofinancing	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
YoYGDP	2.429511	.7053394	3.44	0.001	1.012078	3.846943
Creditspread	-14.00474	6.184252	-2.26	0.028	-26.43246	-1.577023
LTinterestrate	2.074381	1.98043	1.05	0.300	-1.905442	6.054205
dummy_SME	-.0149965	.1248896	-0.12	0.905	-.2659715	.2359785
SMEsbanksurveyQ1	.1079657	.0384184	2.81	0.007	.0307611	.1851704
dummy_SME_bankcreditstandard	-.0283752	.0528172	-0.54	0.594	-.1345154	.077765
_cons	-.2135338	.1521092	-1.40	0.167	-.5192086	.092141

There seems to be an effective translation from banks' credit standards to the ability of SMEs to access loans, reflected by a statistically significant coefficient of 0.11. However the interaction factor of the dummy variable for SMEs with banks' overall credit standards is equal to -0.03, and is not statistically significant. This tells us that banks' credit standard does not have a particularly strong translation to SMEs access to loans compared with large enterprises.

b) The effect of banks' capital constraints on SME access to lending

i. Data

In order to understand the potential impact of Basel II capital reforms, I chose to analyze the specific effect of banks' capital positions on SMEs' ability to access financing, as well as the impact of collateral provided by SMEs on the loans they received, which are two aspects evaluated under Basel II. To do this, I looked into the bank lending ECB survey results to the question (Q2): *"Over the past three months, how have the following factors affected your bank's*

credit standards as applied to the approval of loans or credit lines to enterprises?", where

factors are:

1. **Costs related to your bank's capital position**

2. Your bank's ability to access market financing

3. Your bank's liquidity position

4. Competition from other banks

5. Competition from non-banks

6. Competition from market financing

7. Expectations regarding general economic activity,

8. Industry or firm-specific outlook

9. **Risk on the collateral demanded**

I focused on the questions 2.1 and 2.9, namely the effects of capital constraints and risk on the collateral demanded. I then aligned these results with the survey directed towards SMEs which compiles answers to the following question: *"For each of the following ways of financing (namely bank loans), would you say that their availability has improved, remained unchanged or deteriorated for your firm over the past 6 months?".* For answers to questions 2.1 and 2.9 from the bank lending survey, I found country data for Germany, France, Spain, and Italy regarding large enterprises, and country data for Germany, France, and Spain regarding SMEs. Combined with the semi-annual data from the SME survey, I have data points for each semester from January 2009-2012, so 7 quarters. This yields 49 data points in total.

Figure 36, effect of banks' capital position on credit standards

Effect of bank's capital position on credit standards
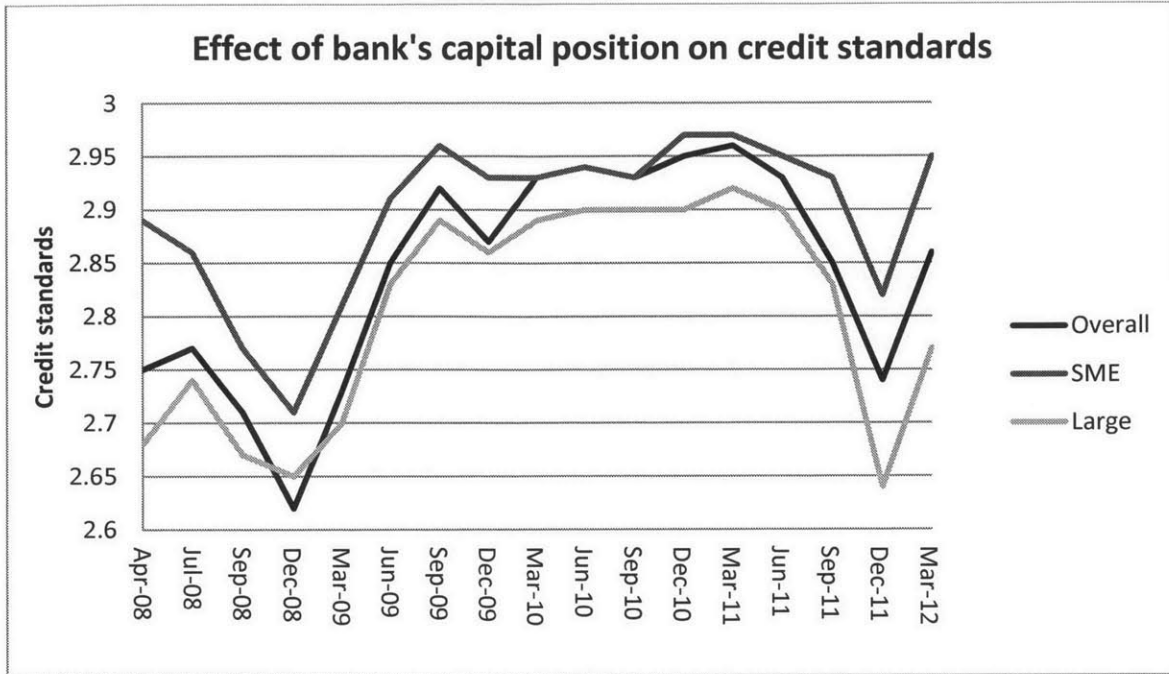
Figure 37, effect of banks' capital constraints on credit standards

Comparison of the effect of banks' capital constraints and SME access to loans

ii.   **Regression design**

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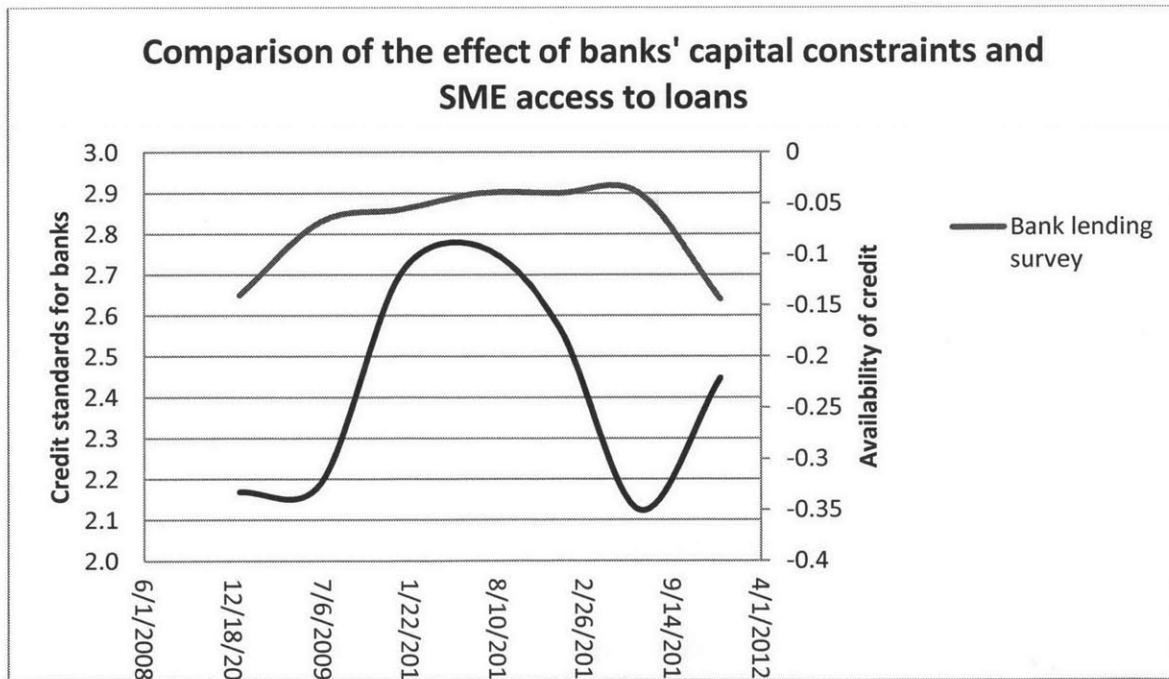
I ran two regressions, one focusing on the effect of banks' capital position, the other on the collateral required.

Regression 1

$YSMEsurvey = a + b*Control1 + b'*Control2 + b''*Control3 + c1*dummy\_SME + c2*banksurveyQ2.1 + c3*dummy\_SME*banksurveyQ2.1$

Regression 2

$YSMEsurvey = a + b*Control1 + b'*Control2 + b''*Control3 + c1*dummy\_SME + c2*banksurveyQ2.9 + c3*dummy\_SME*banksurveyQ2.9$

YSME survey: availability of bank financing for large and small companies from their own perspective, in a given country and during a given semester, on a scale of -1 to 1 (where -1 is more increased difficulty in access to financing, and 1 is easing)

Control 1: year-on-year GDP % change, working day and seasonally adjusted, calculated per quarter

Control 2: Weighted average of credit spreads on loans from Financial Institutions to Non-Financial Corporations

Control 3: 10-year government bond interest rates

Dummy_SME: equal to 1 for SMEs and 0 otherwise

Banksurvey_Q2.1: effect of costs related capital constraints on European banks' credit standards to enterprises in a given country and semester on a scale of 1 to 5 (1- weak effect, 5- strong effect)

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Dummy_SME*Banksurvey_Q2.1: interaction variable equal to 1 if the company is an SME, multiplied by the effect of costs related European banks' capital constraints on credit standards given country and semester

Banksurvey_Q2.9: effect of the risk on the collateral demanded for loans on European banks' credit standards to enterprises in a given country and semester on a scale of 1 to 5 (1- weak effect, 5- strong effect)

Dummy_SME*Banksurvey_Q2.9: interaction variable equal to 1 if the company is an SME, multiplied by the effect of the risk on the collateral demanded for loans on European banks' credit standards in a given country and semester

iii. Results

Figure 38, regression SME access to lending with banks' capital position

reg SMEsurveyaccesstofinancing YoYGDP Creditspread LTinterestrate dummy_SME SMEbanksurveyQ21 dummy_SME_bankcapitalposition

Source	SS	df	MS
Model	.695849987	6	.115974998
Residual	1.06659291	42	.025395069
Total	1.7624429	48	.03671756

Number of obs =	49
F(6, 42) =	4.57
Prob > F =	0.0012
R-squared =	0.3948
Adj R-squared =	0.3084
Root MSE =	.15936

SMEsurveyaccesstofinancing	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
YoYGDP	2.979411	.8586541	3.47	0.001	1.246577	4.712245
Creditspread	-20.27432	8.172197	-2.48	0.017	-36.76648	-3.782156
LTinterestrate	.9625863	2.416889	0.40	0.692	-3.914892	5.840065
dummy_SME	-.0939014	.3690223	-0.25	0.800	-.8386185	.6508157
SMEbanksurveyQ21	.1039917	.1100799	0.94	0.350	-.1181586	.326142
dummy_SME_bankcapitalposition	-.005614	.1295913	-0.04	0.966	-.2671399	.2559119
_cons	-.1260365	.3502257	-0.36	0.721	-.8328206	.5807476

There also appears to be an effective translation from banks' capital constraints to the ability of SMEs to access loans, reflected by a coefficient of 0.10, although the low statistical significance of 35% p-value cannot allow us to infer specific conclusions. However the interaction factor of the dummy variable for SMEs with the impact of capital constraints on banks' credit standards is equal to -0.006, and is not statistically significant. This tells us that banks' capital constraints do not have a specific translation to SMEs access to loans compared with large enterprises.

Figure 39, regression SME access to lending with banks' required collateral

reg SMEsurveyaccesstofinancing YoYGDP Creditspread LTinterestrate dummy_SME SMEbanksurveyQ29 dummy_SME_bankcollateral

Source	SS	df	MS		
				Number of obs =	42
				F(6, 35) =	3.62
Model	.53256536	6	.088760893	Prob > F	= 0.0068
Residual	.858597551	35	.024531359	R-squared	= 0.3828
				Adj R-squared =	0.2770
Total	1.39116291	41	.033930803	Root MSE	= .15662

SMEsurveyaccesstofinan~g	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
YoYGDP	2.945857	.9355309	3.15	0.003	1.046628	4.845085
Creditspread	-20.1131	9.406046	-2.14	0.040	-39.20839	-1.017816
LTinterestrate	-.0743943	3.014874	-0.02	0.980	-6.194915	6.046126
dummy_SME	-.3592212	.2119488	-1.69	0.099	-.7895002	.0710578
SMEbanksurveyQ29	-.0077032	.0341859	-0.23	0.823	-.0771044	.0616979
dummy_SME_bankcollateral	.0945937	.0728711	1.30	0.203	-.0533426	.24253
_cons	.2077365	.1572717	1.32	0.195	-.111542	.527015

No specific translation from the riskiness of collateral demanded by banks into the ability of SMEs to access loans comes through, as seen by an economically and statistically low coefficient. Furthermore, the interaction factor of the dummy variable for SMEs with the riskiness of collateral on banks' credit standards is equal to 0.094, and is not statistically significant. This tells us that banks' collateral requirements do not have a specific translation to SMEs access to loans compared with large enterprises.

The analysis above first shows us that the banks' point of view on credit standards and enterprises' access to credit converge. This holds for both large and small companies. However, the two factors which are subject to change under Basel II reforms, namely capital constraints and collateral demanded on loans, do not appear to have a specifically strong effect on SMEs access to financing compared to large companies. This leads us to infer that we still cannot prove a stronger effect on access to lending for SMEs than for large companies because of Basel II reforms.

V.   Conclusion

The literature review puts forward the idea that there still has been no evidence of a contraction in SME lending due to Basel II reforms. Despite incentivizing banks to shift their portfolios towards less risky assets, nothing suggests that these reforms affected SME loans in particular. These analyses are in line with the way Basel II reforms were designed in 2003. The Basel Committee's goal was, among other aspects, to avoid a contraction in SME lending. Therefore, the rules that were established gave banks the ability to make adjustments in the calculation of Risk-Weighted Assets for loans to SMEs, thus helping them reduce their capital requirements.

The theoretical part first looked into the differences between Basel I and Basel II, and compared how these changes affected each asset type. Results revealed that Basel II reforms have reduced capital requirements for SMEs in two ways: first, for loans to SMEs categorized as corporates, when these firms have a probability of default below a given threshold. Second, a number of

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SME loans can now be classified under retail products which benefit from reduced capital requirements. The theoretical analysis then looked into the different RWA calculation methodologies. Comparing capital requirements for large corporates and for SMEs, it appears that under the SAA methodology, Basel II requires higher capital for large sub-investment grade large corporates than for SMEs. Under the IRB methodology, which is applied by most large banks, SMEs always require less capital. Therefore, for a given PD, large corporates are only advantaged to the extent that they are investment grade under the SAA, and are always at a disadvantage under the IRB. Assuming that banks allocate capital for loans based on companies' PD regardless of regulatory requirements, this would imply that Basel II in itself should not have created a credit contraction for SMEs.

Empirically, it appears that the implementation of Basel II from 2008 onwards does not have a specific effect on SME lending, whether looking at overall European Union data or at individual country data, controlling for several macroeconomic factors which also affect credit availability. Also, when comparing the demand side with the supply side of credit, we can see that banks' credit standards converge with companies' effective access to credit. This holds for both large and small companies. Furthermore, we find that banks' capital constraints and collateral requirements, two specific dimensions of Basel II, do not have a stronger effect on SMEs as opposed to large companies.

Empirical evidence shows that SMEs have been highly affected by the financial crisis in terms of access to credit, with amplification in credit contraction as the firm shrinks in size. We can

nonetheless conclude that this reduction in availability of financing for SMEs does not stem from

Basel II reforms.

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