OFFICE OF FINANCIAL RESEARCH

The Market-Implied Probability of European Government Intervention in Distressed Banks

Richard Neuberg*, Paul Glasserman*, Benjamin Kay**, and Sriram Rajan**

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* Columbia University
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Introduction

- Expectations of government support for banks is here to stay.
- Michael Mussa (ex chief economist, IMF): “Governments cannot convince creditors of large banks that they will take losses if their bank fails.”
- Andrew Haldane (chief economist, Bank of England) response to whether “too big to fail” has been solved: “No.”

What can happen to a bank in distress?

1. Conventional default: bond holders take losses, firm fails
2. Bail-in: Bond holders take losses, firm survives
3. Bailout: Bond holders take no losses, firm survives

Contributions

- Use CDS market on European banks to measure market expectations of
  - bail-in or default on subordinate debt.
  - losses senior creditors would suffer, given the above.
- We find that since 2014 the likelihood of
  - default has risen,
  - bail-in has fallen, and
  - bailout has not simultaneously risen.
- Interpretation: European policymakers have signaled reduced expectations of government support through efforts such as the Bank Recovery and Resolution Directive (BRRD).

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Overview of Credit Default Swaps

- A CDS contract is insurance on defined credit events of an obligation (bond).
- CDS trade on subordinated and senior bonds.
- Value of a CDS:

$$\begin{aligned}\text{CDS spread} &= \text{conditional loss} \cdot \text{default intensity} \\ &= (1 - \text{recovery}) \cdot \text{default intensity}.\end{aligned}$$

- Under 2003 International Swaps Dealer (ISDA) definitions, credit events include: a missed payment, bankruptcy, or a restructuring.
- The recovery on the bond is determined in an auction following the credit event.

Recovery Interference and 2003 CDS

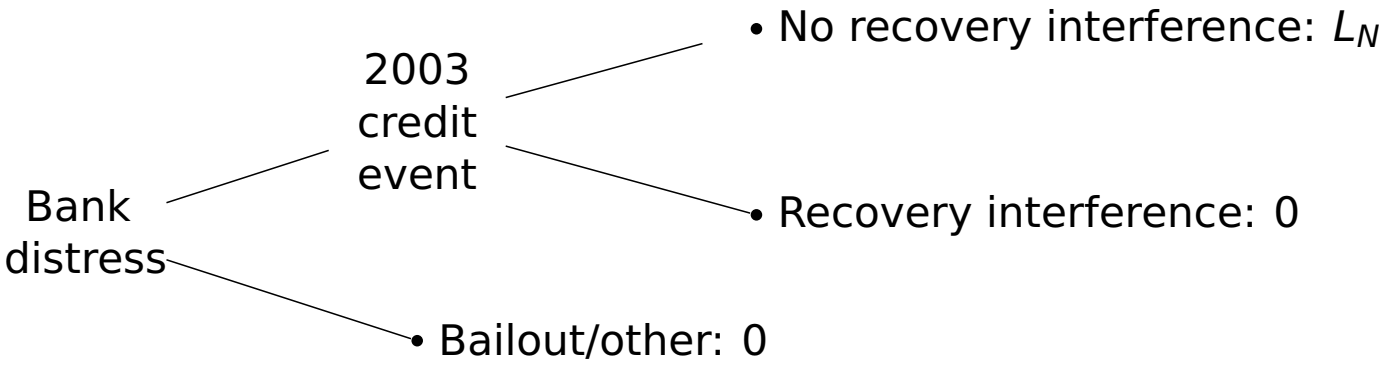

Figure : Possible payouts of the 2003 CDS following bank distress

- **Expropriation** (SNS Bank, 2013): subordinate bonds are involuntarily written down to 0 value; auction references senior bonds whose LGD is too low.
- **Orphaning** (Banco Espírito Santo, 2014): Breakup into "good" and "bad" banks raises legal succession issues. No bonds can be delivered, and auction fails entirely.

Government Intervention and 2014 CDS

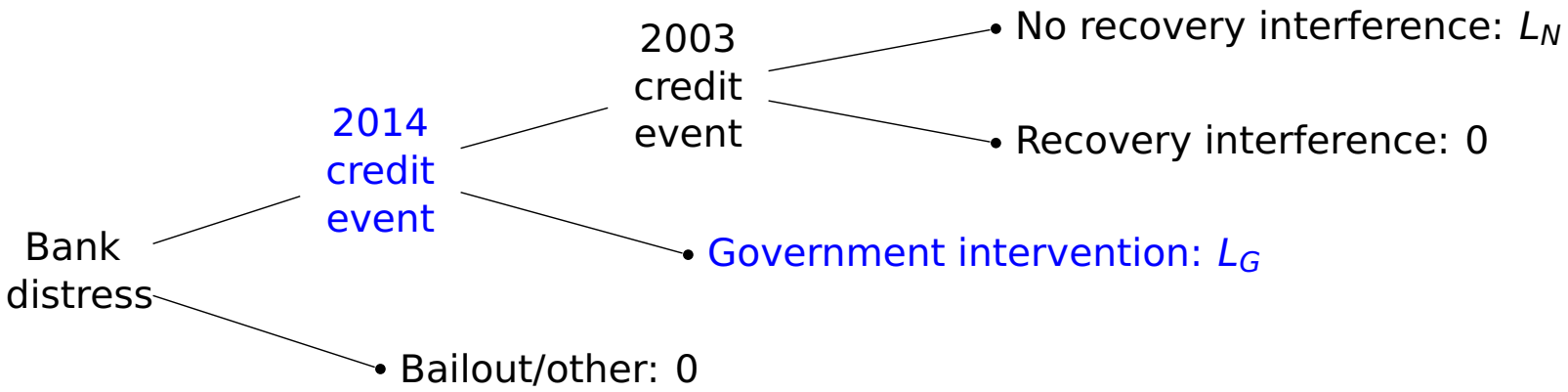

Figure : Possible payouts of the 2014 CDS following bank distress

- EU Banking Resolution and Recovery Directive (**BRRD**)
  - codifies that liabiities may be written down by the resolution authority; and
  - requires that the first 8% of losses must be realized by creditors before the states may inject funds.
- ISDA added a new credit event in 2014 called "government intervention" in a revision to credit default definitions.

Language of Default, Bail-in, and Bailout

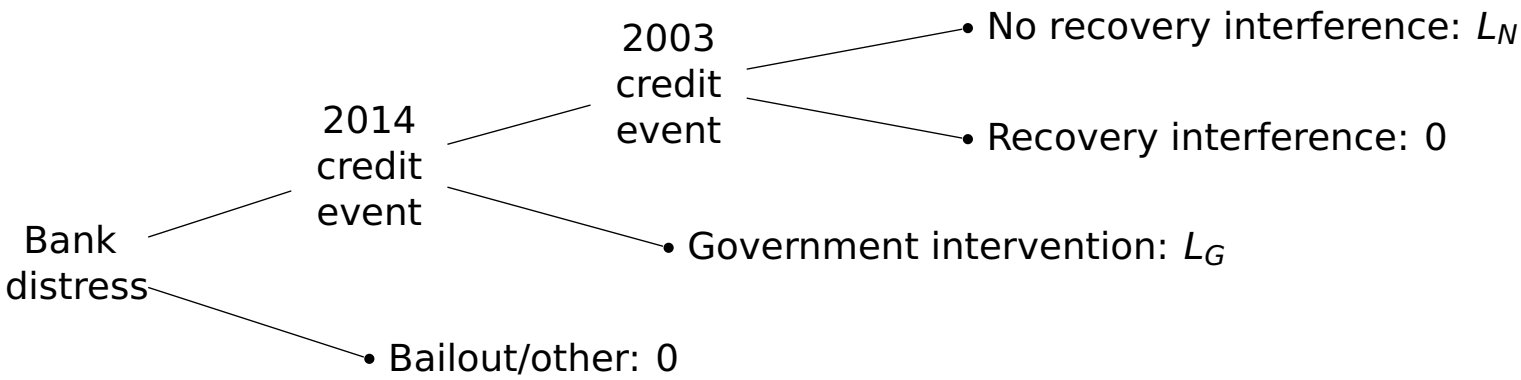

Figure : Possible payouts of the 2014 CDS following bank distress

We use some terminology:

- **2014 credit event**: either a 2003 credit event or a government intervention.
- **default**: event in which 2003 CDS and 2014 CDS both trigger and result in the same payment to protection buyers.
- **bail-in**: event for which a 2014 CDS pays more than a 2003 CDS in a 2014 credit event.
- In a **bailout**, nothing is lost on the underlying bond, so the CDS pays nothing for both 2003 and 2014 CDS.

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Measuring Bail-In Through the Relative Basis

- We denote the spread needed to protect against an event $\bullet$ by

$$\mathbb{S}(\bullet) = \mathbb{E}[\text{loss} \,|\, \bullet]\,\mathbb{P}(\bullet).$$

  The fraction of the spread needed to insure against $\bullet$, given an event $\star$, is $\mathbb{S}(\bullet \,|\, \star) = \mathbb{E}[\text{loss} \,|\, \bullet \cap \star]\,\mathbb{P}(\bullet \,|\, \star)$.

- We have that:

$$CDS^{2014} = \mathbb{S}(\text{default}) + \mathbb{S}(\text{bail-in})$$
$$CDS^{2003} = \mathbb{S}(\text{default}).$$

- We define their **relative basis** as:

$$\frac{CDS^{2014} - CDS^{2003}}{CDS^{2014}} = \mathbb{S}(\text{bail-in} \,|\, \text{2014 credit event})$$
$$= \mathbb{S}(\text{bail-in} \,|\, \text{distress, but no bailout}).$$

What is the Relative Basis? Why Use It?

- It is the fraction of total expected losses from distress, excluding default. Its value comes from bail-in and recovery interference events.
- Under a fixed recovery rate for default and bail-in, it is a conditional probability: $\mathbb{P}(\text{bail-in} \,|\, \text{distress, but no bailout})$.
- Virtues
  - Relative to structural bond pricing approaches, it is nearly model-free.
  - As a ratio of market prices, it is free of risk premia effects.

Data Sources

- We mainly rely on subordinate CDS quotes of 20 European banks from Markit. List
  - We also make use of quotes on senior bank and sovereign CDS.
- Prices reflect quotes: transaction data from Depository Trust & Clearing Corporation (DTCC).
- Additional supporting data from the Basel Committee on Banking Supervision, V-Lab, MSCI, and other sources.

Preview of Results

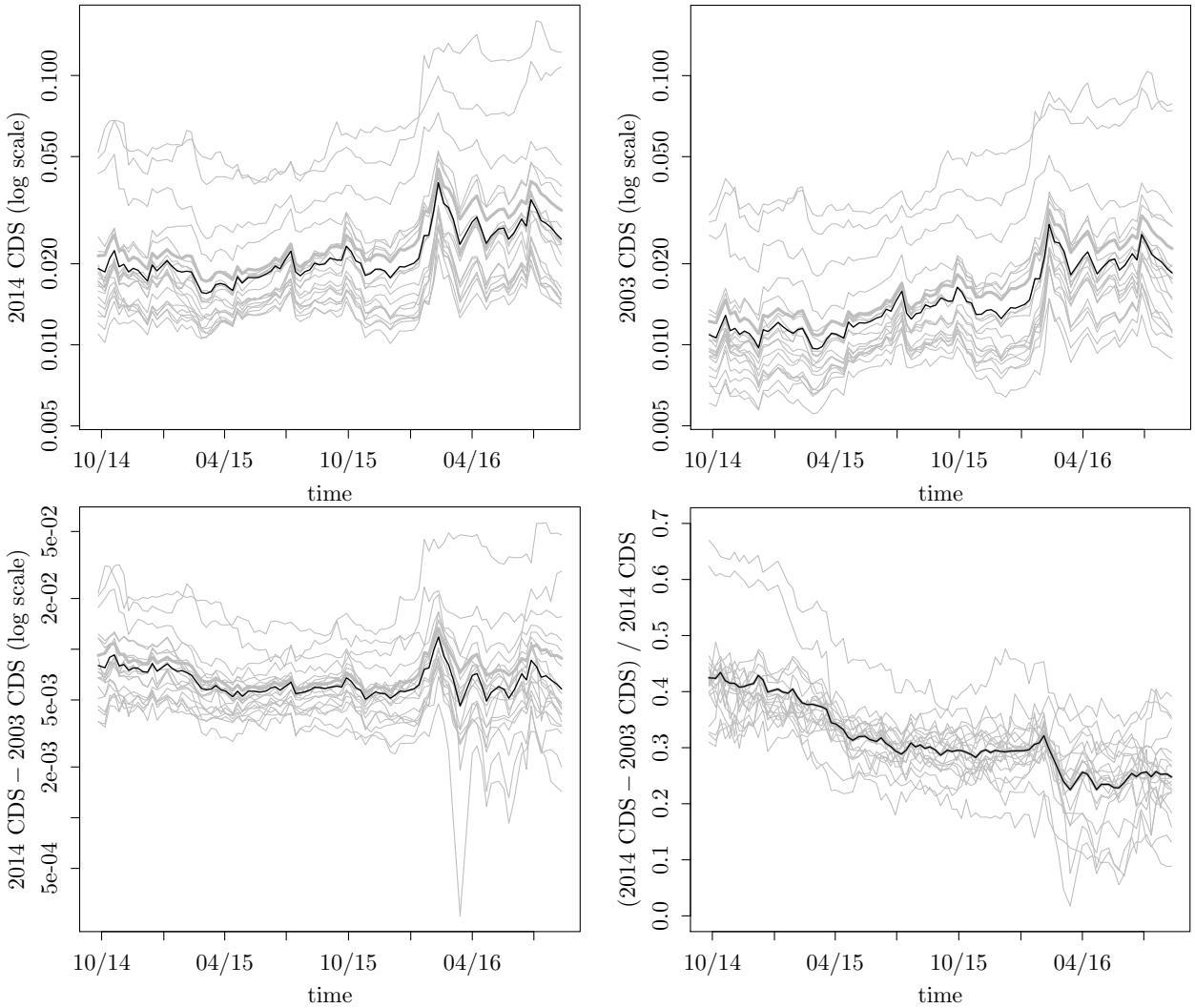

Figure : Five-year subordinated CDS^{2014} and CDS^{2003}, their basis, and relative basis, over time.

What Drives the Relative Basis?

$$\frac{CDS_{it}^{2014} - CDS_{it}^{2003}}{CDS_{it}^{2014}} = \alpha + \delta_i + \boldsymbol{\beta}^{\mathsf{T}} (\text{risk factors})_{it} + \tau_{it} + \varepsilon_{it}.$$

- δ_i are random effects. We don't seek to explain bank-specific variation, and instead hope for our risk factors to explain trends in the aggregate.
- the τ_{it} we use to model bank-specific systematic time trends (mean-zero Gaussian process prior).
- We estimate the regression using a Bayesian framework.

Parameter	Posterior mean	Posterior SD	95 % CI	$\frac{\text{posterior mean}}{\text{posterior SD}}$
$\beta_{\text{GSIB score}}$	0.26	0.17	$[-0.07, 0.58]$	1.5
$\beta_{\text{GSIB score / GDP}}$	0.14	0.17	$[-0.18, 0.47]$	0.85
$\beta_{\text{Partially state owned}}$	0.04	0.05	$[-0.07, 0.14]$	0.7
$\beta_{\text{Idiosyncratic}}$	0.16	0.01	$[0.14, 0.18]^*$	14.7
β_{CAPE}	-0.005	0.001	$[-0.008, -0.003]$	-2.5
$\beta_{\text{Sovereign spread}}$	-1.67	0.67	$[-2.99, -0.35]^*$	-2.5
$\beta_{\text{Relative SRISK}}$	0.21	0.16	$[-0.11, 0.53]$	1.3

What the Market Tells Us

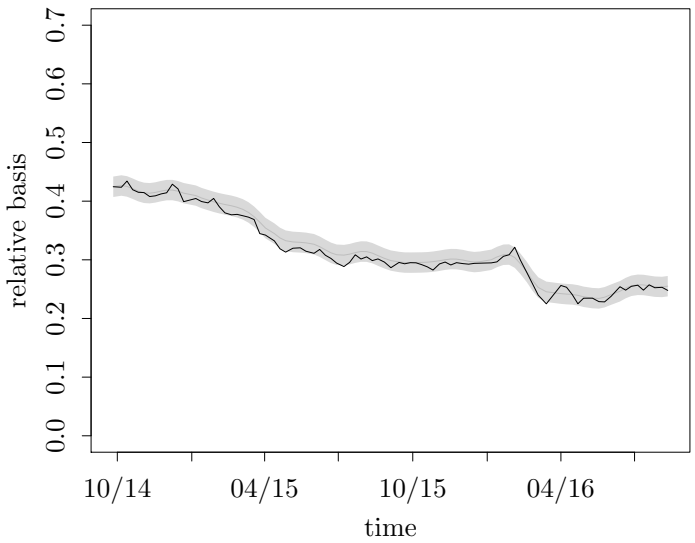

Figure : Average time trend in the relative basis netting out risk factors

- The conditional bail-in probability has decreased from over 40% to roughly 25%.
- Market participants view government intervention as less likely in failing banks.

The senior CDS–subordinated CDS ratio

- $CDS^{2014}_{\text{senior}}$ denotes the senior CDS spread under ISDA 2014 definitions. Then:

$$\frac{CDS^{2014}_{\text{senior}}}{CDS^{2014}} = \mathbb{S}(\text{losses on senior debt} \,|\, \text{any 2014 credit event})$$

- This measure of loss severity is always between zero and one. A value close to one indicates that, conditional on a loss to subordinated debt, senior debt would experience a similar loss, in percent.

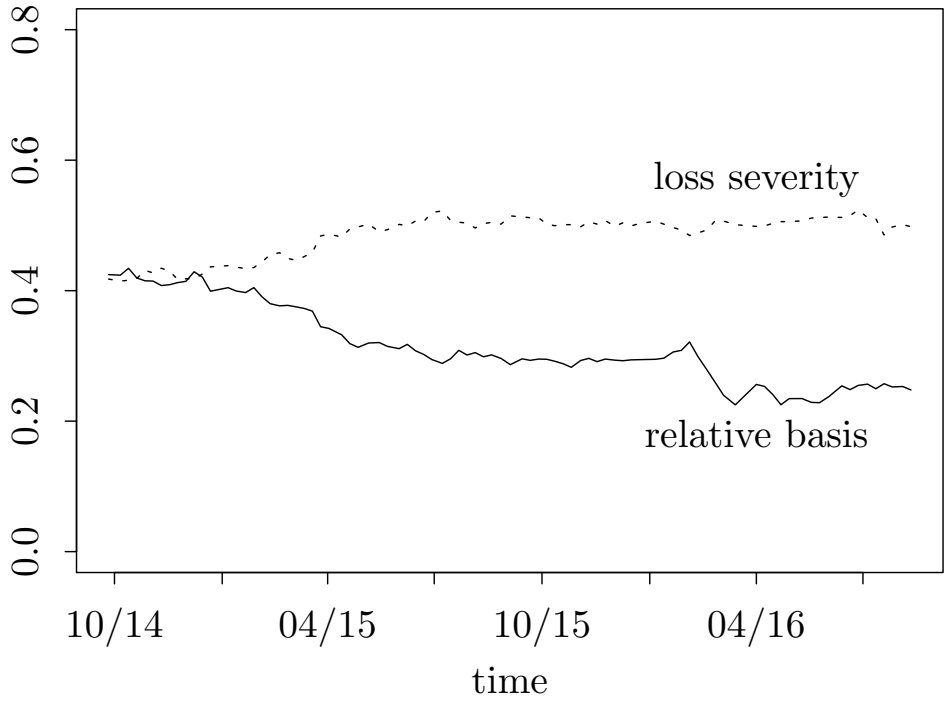

Figure : Average trend across all banks in senior–sub ratio and average trend in the relative basis.

- Both are highly correlated, in time and cross-sectionally.
- Implication: It has become more likely that senior bondholders, too, would suffer in a distress (without bailout).
- As with the relative basis trend, the senior / sub ratio can be interpreted as success or failure of the new regime.

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Evidence that bail-ins have not been replaced by bailouts

BRRD limits use of public funds: 1/4

- There now are legal obstacles to future bailouts
- The BRRD mandates that eight percent of a bank's liabilities need to be bailed in before the government may inject funds. Given prevailing capital structures at the 20 firms, this typically forbids bailouts of subordinated debt.
- While BRRD rules do not directly apply to Switzerland, Norway and Liechtenstein, market expectations are that their national resolution frameworks will treat failing banks similarly.

Evidence against bailout

Reduced expectations of subordinate debt: 2/4

- Rating agencies such as Moody's and Standard & Poor's sometimes uplift bank credit ratings in expectation of state support in distress
- Rating agencies in Europe are no longer supporting junior instruments in expectation of a reduced likelihood of government support.
- They have also significantly lowered their expectations of government support for senior debt.

Evidence against bailout

Bail-in association with sovereign health: 3/4

Earlier, we regressed the relative basis on risk factors:

Parameter	Posterior mean	Posterior SD	95 % CI	$\frac{\text{posterior mean}}{\text{posterior SD}}$
$\beta_{\text{GSIB score}}$	0.26	0.17	$[-0.07, 0.58]$	1.5
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- The association between the relative basis and the respective sovereign CDS spread is negative.
- A bail-in becomes relatively more likely when the sovereign is more able to afford a bailout.
- One may infer from this that bail-ins crowd out bailouts.

Evidence against bailout

Bailout measures are low and uncorrelated with the relative basis : 4/4

- If bailouts systematically replaced bail-ins, then we should observe a strong negative correlation between the relative basis and the likelihood of bailout given distress.
- We cannot directly observe $\mathbb{S}(\text{bailout} \,|\, \text{distress})$ in the market.
- We can, however, estimate

$$\begin{aligned} &\mathbb{S}^{\text{physical}}(\text{default} \cup \text{bail-in} \cup \text{bailout}) \\ &= L^{\text{physical}}_{\text{distress}} \cdot \mathbb{P}^{\text{physical}}(\text{distress}), \end{aligned}$$

  using annualized five-year PDs and LGDs from Moody's KMV.

- We calculate

$$r = \frac{\mathbb{S}^{\text{physical}}(\text{default} \cup \text{bail-in} \cup \text{bailout})}{\mathbb{S}(\text{default} \cup \text{bail-in})}.$$

- $\mathbb{S}(\text{default} \cup \text{bail-in})$: subordinated 2014 CDS spread
- Ratio is constructed from 2 different measures.
- A high value of r indicates a high bailout probability or a low risk premium.
- We remove dependency of r on the risk premium by taking, for each bank, the average value of r over time.
- Empirically, r is typically smaller than one (bank averages range from 0.29 for UBS to 1.02 for Commerzbank), so risk premium outweighs bailout premium.
- The empirical correlation between the average across time for r and for the relative basis is 0.02 ± 0.46.

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Summary

- We used unique features of the European CDS market to infer the chance of bail-in in distressed banks
- This conditional chance of a bail-in has strongly decreased over the last two years.
- We provided evidence that bailouts have not replaced bail-ins of late. Therefore, mostly defaults have replaced bail-ins.
- This suggests that the BRRD and other changes in the European policy environment have decreased expectations of government support of banks.

Thank you!

The “Brexit” vote

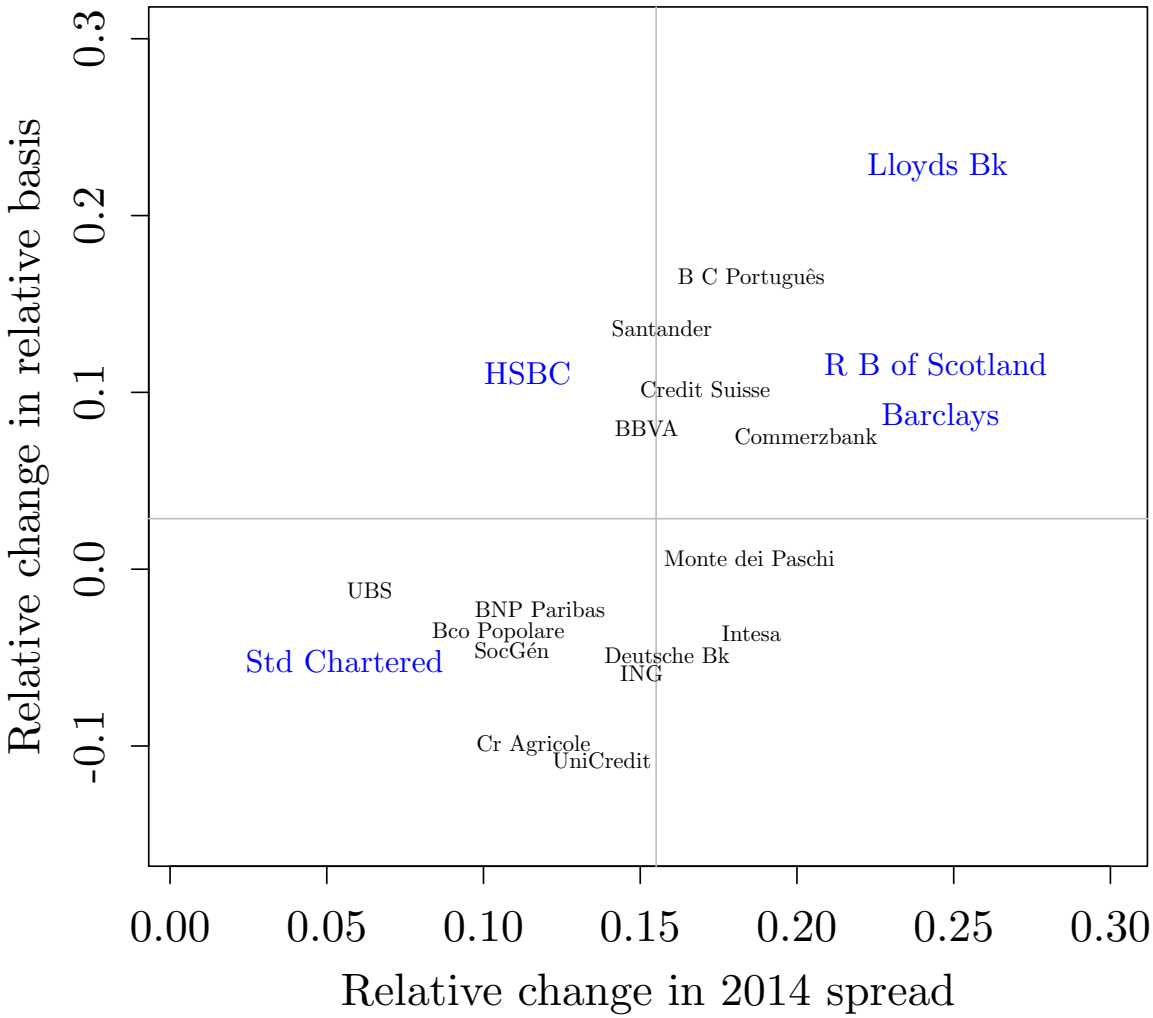

Figure : Relative change in 2014 spread and relative change in relative basis around the “Brexit” vote.

Table : United Kingdom income as share of total income for banks in the United Kingdom, and relative change in the relative basis around the Brexit vote.

Bank	United Kingdom income share	relative change in relative basis
Standard Chartered	$< 5\,\%$	$-5\,\%$
HSBC	$26\,\%$	$11\,\%$
Barclays	$48\,\%$	$8\,\%$
Royal Bank of Scotland	$88\,\%$	$11\,\%$
Lloyds Bank	$95\,\%$	$23\,\%$

List of Banks in Our Sample

We follow a standard value-at-risk metric for estimating initial margin (IM).

- Barclays Bank plc
- Monte dei Paschi di Siena SpA
- Banco Bilbao Vizcaya Argentaria SA
- Banco Comercial Portugues SA
- Banco Popolare SC
- Banco Santander SA
- BNP Paribas
- Commerzbank AG
- Credit Agricole SA
- Credit Suisse Group AG
- Deutsche Bank AG
- HSBC Bank plc
- ING Bank NV
- Intesa Sanpaolo SpA
- Lloyds Bank plc
- Royal Bank of Scotland plc
- Societe Generale
- Standard Chartered Bank
- UBS AG
- UniCredit SpA

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