# Underpricing in the Eurozone Corporate Bond Market

Tobias Rischen and Erik Theissen

Conference "After the Crisis is Before the Crisis"
Vienna, April 11-12, 2019

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We all know about underpricing of equity IPOs

Average First Day Return and Aggregate Money Left On the Table, 1990-2016
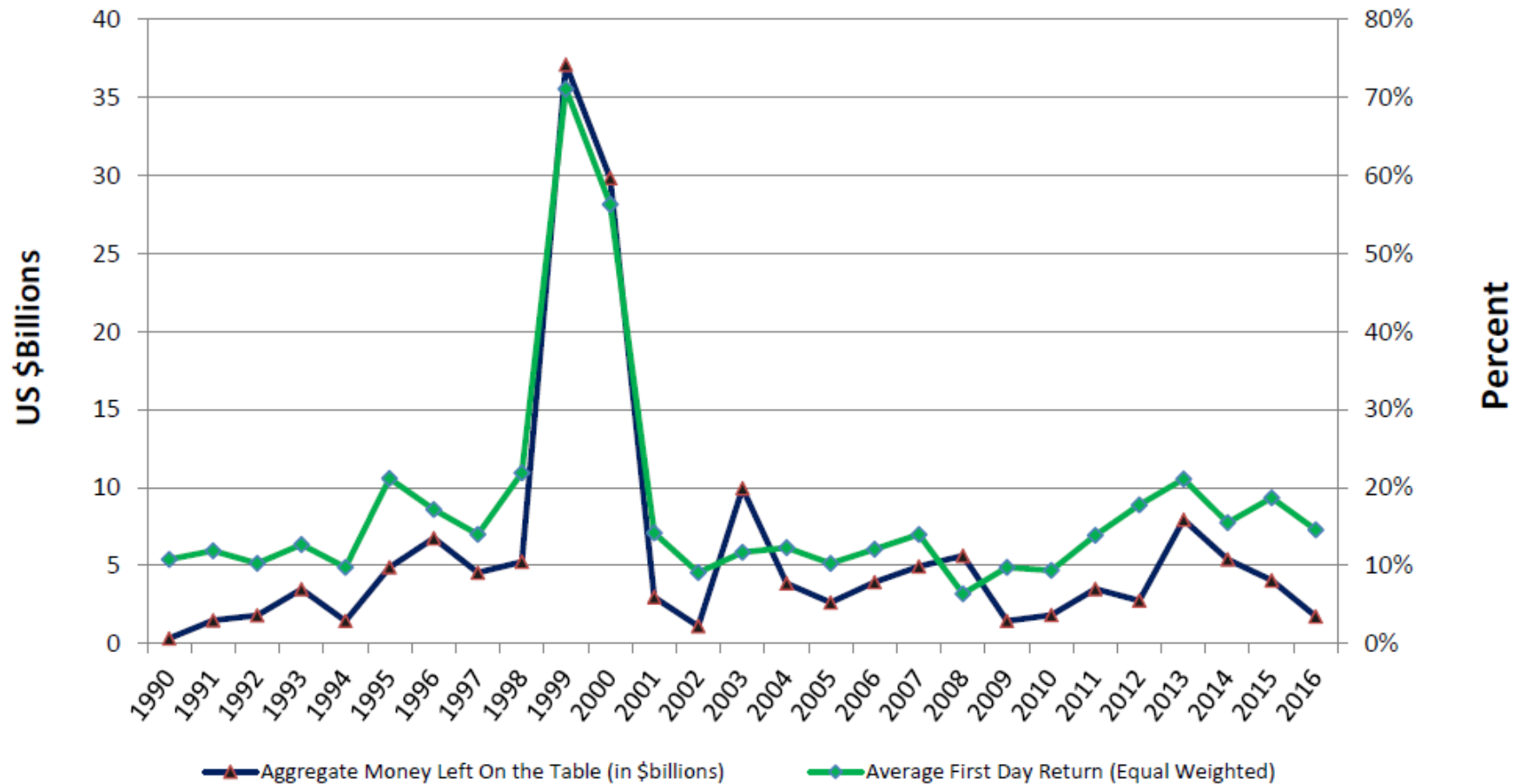
There is also underpricing in bond IPOs

- Documented for the US since the 1970s

- Evidence for European bond markets is scarce

- Bond underpricing is much smaller on a per-issue basis

- But sums up to large amounts of money left on the table

  - large issue volumes

  - frequent issues

- Bond underpricing affects the borrowing costs of issuers

General objective of the paper

- Provide the most comprehensive study so far of bond underpricing outside the US

- Analyze the determinants of underpricing

Specific research questions

- Did underpricing increase during the financial crisis?

- Did post-crisis changes in regulation affect underpricing?

- Did liquidity in the secondary market for corporate bonds change during / after the crisis (as suggested by some recent papers for the US market, e.g. Bao et al. 2016, Dick-Nielsen and Rossi 2016, Bessembinder et al. 2017)?

- Did the ECB's asset purchase programs affect underpricing?

Overview

Structure of the presentation

1. Motivation

2. Institutional Background

3. Data & Methodology

4. Results

5. Summary

- The bonds in our sample are issued in a bookbuilding procedure

- Underwriters have discretion as to how to allocate the bonds

- Underwriters usually also act as market makers in the secondary market

Post-crisis regulation

- Basel III, Dodd-Frank, Liikanen report

  - Most important, arguably: the "Volcker rule" restricting proprietary trading (exemptions for market makers exist but are considered to be ineffective, e.g. Duffie 2012)

- Why is that important in Europe?

  - US banks active in Europe comply with US regulation

  - European banks doing business in the US comply with US regulation

  - Compliance in anticipation of similar regulation in Europe (Liikanen report)

- No diff-in-diff because no unambiguous event date

ECB Asset purchase programs (APP)

- Three covered bond purchase programs (2009-2010, 2011-2012, since 2014)

- Public sector purchase program (since 2015)

- Corporate sector purchase program (since 2016)

- Programs differ w.r.t.
  - eligibility criteria
  - size
  - only secondary (PSPP) versus primary and secondary market purchases (all others)
  - transparency (ISINs of purchased bonds disclosed in PSPP and CSPP only)

| CBPP1 | CBPP2 | CBPP3 | PSPP | CSPP |
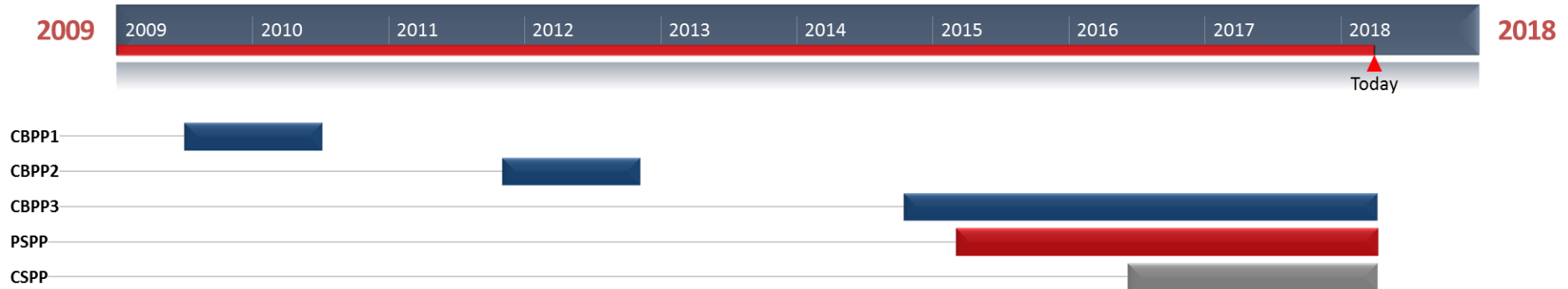
€ 60bn

16.4bn of which
37% in primary
market

214.4bn (32%)
1,458 bn (0%)
75.5bn (14%)
as of April 30, 2017

H1: Eurozone bond issues are underpriced

H2: Underpricing is positively related to variables measuring the riskiness, uncertainty on bond value, and informational asymmetries (→information-based explanations)

H3: Underpricing is more pronounced during the financial crisis

H4: Underpricing is lower if the issuer has gone through a bookbuilding procedure recently (→bookbuilding models)

H5: Underpricing is increasing in (expected) secondary market illiquidity of the bond (→liquidity-based explanations)

H6: Underpricing is higher post-crisis than pre-crisis

H7a: The ECB's asset purchase programs reduce underpricing

H7b: The ECB's asset purchase programs increase underpricing

Sample

- 5,703 Eurozone bonds issued between 2002 and 05/2017

- Issuers: Financial and non-financial firms, supranational institutions and agencies

  - supranationals: e.g. European Investment Bank, Eurpean Financial Stability Facility

  - agency: e.g. KfW, Caisse Francaise de Financement Local

- Main data sources: Composite Bloomberg Bond Trader (CBBT, prioritized), TR Datastream Composite Price (CMPM)

- No transaction price data; data is based on dealer quotations reported voluntarily to Bloomberg / TR

- We use midpoints (main analysis) and bid prices (robustness)

Measuring underpricing

- Abnormal return (excess return over an appropriate value-weighted index; Bessembinder et al. 2009)

$$CAR_i(t_1, t_2) = R_i(t_1, t_2) - R_m(t_1, t_2) \quad R_i(t_1, t_2) = \frac{(P_{i,t_2} - P_{i,t_1}) + AI_{i,t_2}}{P_{i,t_1} + AI_{i,t_1}}$$

- essentially a standard event study with index-adjusted expected returns

- we use the appropriate issuer / maturity band / rating Markit iBoxx EUR subindex

- we use event windows of up to 40 days because of the pseudo underwriter hypothesis (Goldberg and Ronn 2013)

Event study results: Underpricing increases monotonically throughout the event window
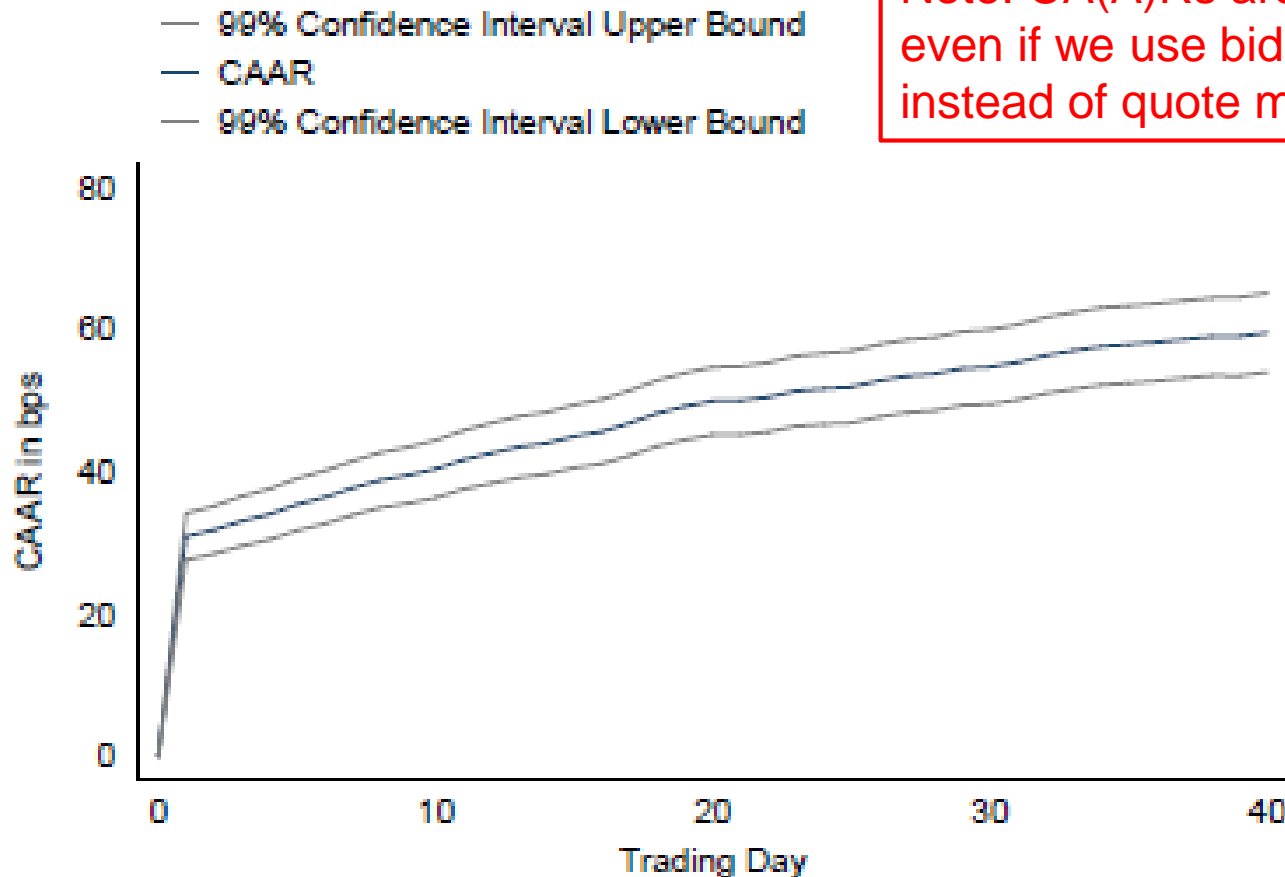
Note: CA(A)Rs are significant, even if we use bid prices instead of quote midpoints

Event study results by issuer type:

Note: CA(A)Rs are significant for all issuer types; significance is confirmed in regression analysis with controls

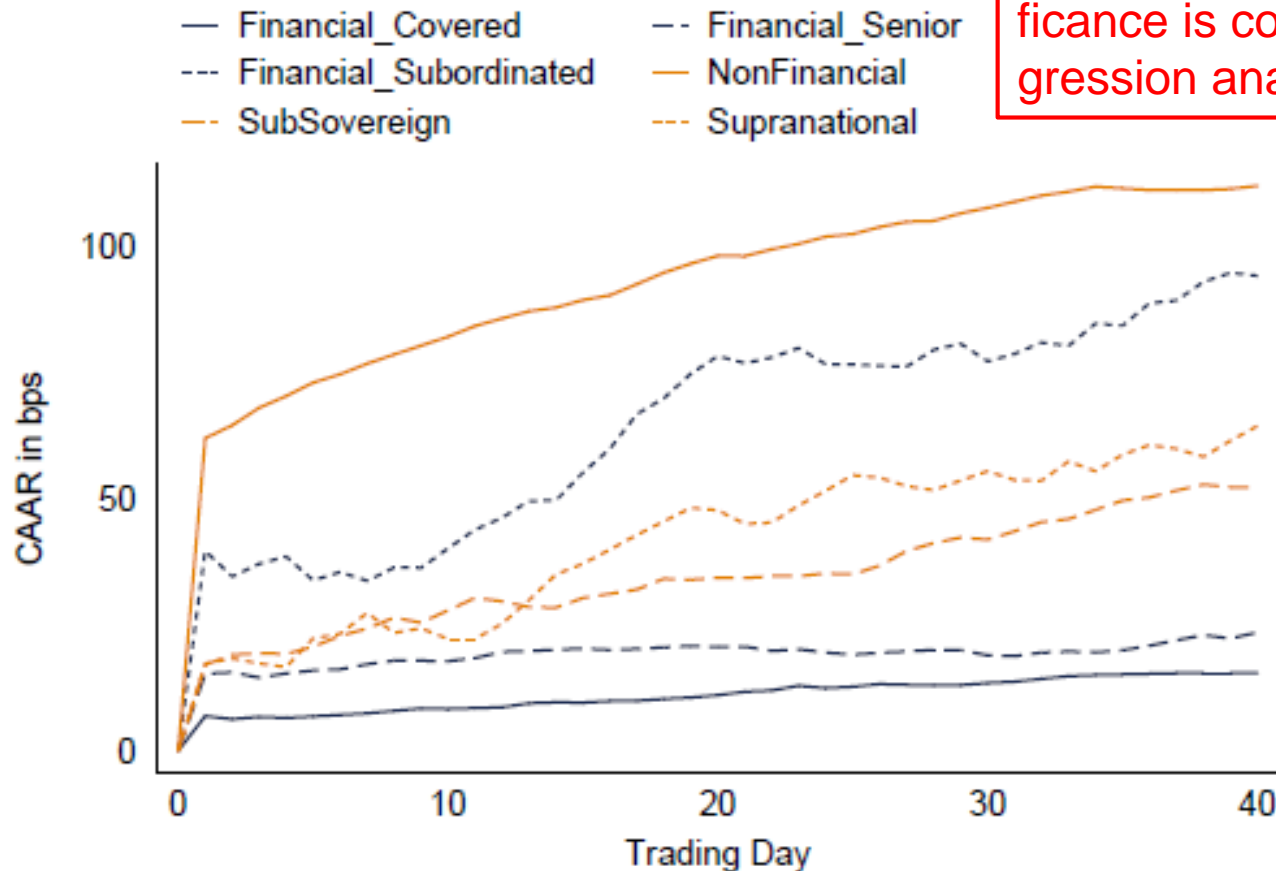Underpricing is inversely related to default risk:

	N	CAAR(0,1)		CAAR(1,40)		CAAR(0,40)	
		Mean	t-stat	Mean	t-stat	Mean	t-stat
Panel B: By Rating							
AAA	1565	4.883***	(2.99)	11.85***	(4.95)	16.73***	(5.61)
AA	779	18.38***	(6.24)	28.85***	(6.87)	47.22***	(9.19)
A	1430	33.19***	(13.46)	20.24***	(6.11)	53.43***	(12.85)
BBB	1278	47.48***	(17.91)	34.88***	(9.23)	82.36***	(17.82)
BB	282	78.52***	(10.64)	68.97***	(7.00)	147.5***	(12.11)
B	135	115.6***	(9.00)	139.5***	(7.96)	255.1***	(13.12)
CCC	25	55.11*	(2.00)	105.3*	(1.75)	160.5***	(2.96)
NA	208	32.90***	(2.87)	37.37***	(2.93)	70.27***	(4.39)

Note: Confirmed in regression analysis

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Test of theoretical predictions (H2, H4, H5)

	CAR(0,40)	CAR(0,40)	CAR(0,40)	CAR(0,40)
ln(Amount Issued)	17.42***	18.62***	18.10***	16.30***
	(3.41)	(3.31)	(3.38)	(3.55)
IBO	25.08***		26.73***	23.42***
	(3.11)		(3.32)	(2.96)
Time since last bond issue		3.62**		
		(2.03)		
Bond Upgraded			5.57	
			(0.77)	
Bond Downgraded			19.67**	
			(2.46)	
Bid-Ask-Spread				0.20
				(1.53)
Observations	5,545	4,533	5,545	5,424
Adjusted R-squared	0.120	0.087	0.122	0.122
Control Variables X_i	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Weekday FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes

Ratings etc. →

Test of theoretical predictions (H2, H4, H5)

- Support for information-based explanations
  - result on "IBO" consistent with bookbuilding models
  - result on rating changes inconsistent with signaling models
- No support for liquidity-based explanations
- Consistent with results for the US in Cai et al. (2007)

Crisis and post-crisis periods (H3, H6)
(control variables omitted from table)

	CAR (0,40)
In-Crisis	102.43***
	(8.25)
Post-Crisis	45.09***
	(4.47)
Observations	5,545
Adjusted R-squared	0.132

- Underpricing significantly higher during and post crisis

APP eligibility 1 (H7)

	(1) CAR(0,40)	(2) CAR(0,40)	(3) CAR(0,40)	(4) CAR(0,40)	(5) CAR(0,40)	(6) CAR(0,40)
In-Crisis	100.28***					103.95***
	(8.09)					(8.13)
Post-Crisis	38.00***					30.73***
	(3.52)					(2.73)
CBPP1 period	7.53					18.13
	(0.60)					(1.41)
CBPP1 eligible	-11.76					-29.13**
	(-1.42)					(-2.44)
CBPP1 period × eligible	30.69*					22.28
	(1.82)					(1.32)

⬆ Test of single model

Covered bond program 1:
Inconsistent, if anything,
higher underpricing

⬆ Joint test of all five
programs

APP eligibility 2 (H7)

	(1) CAR(0,40)	(2) CAR(0,40)	(3) CAR(0,40)	(4) CAR(0,40)	(5) CAR(0,40)	(6) CAR(0,40)
In-Crisis		114.18***	102.73***			103.95***
		(8.99)	(8.35)			(8.13)
Post-Crisis		47.62***	42.33***			30.73***
		(4.73)	(4.13)			(2.73)
CBPP2 period		45.94***				38.68***
		(3.82)				(3.00)
CBPP2/3 eligible		12.23	15.25*			35.95***
		(1.61)	(1.82)			(3.25)
CBPP2 period × eligible		-0.86				-1.59
		(-0.04)				(-0.07)
CBPP3 period			-13.72*			18.92
			(-1.77)			(1.49)
CBPP3 period × eligible			-12.34			-20.59**
			(-1.29)			(-2.18)

Covered bond program 2/3: Inconsistent, if anything, lower underpricing

Test of single model

Joint test of all five programs

APP eligibility 3 (H7)

	(1) CAR(0,40)	(2) CAR(0,40)	(3) CAR(0,40)	(4) CAR(0,40)	(5) CAR(0,40)	(6) CAR(0,40)
In-Crisis				99.08*** (8.06)		103.95*** (8.13)
Post-Crisis				37.36*** (3.65)		30.73*** (2.73)
PSPP period				-23.06*** (-3.37)		-9.67 (-0.84)
PSPP eligible				-17.44 (-1.42)		-14.42 (-1.16)
PSPP period × eligible				4.36 (0.21)		-5.71 (-0.29)

Public sector purchase program: no effect
Possible reason: Program does not allow primary market purchases

Test of single model

Joint test of all five programs

APP eligibility 4 (H7)

	(1) CAR(0,40)	(2) CAR(0,40)	(3) CAR(0,40)	(4) CAR(0,40)	(5) CAR(0,40)	(6) CAR(0,40)
In-Crisis					96.88***	103.95***
					(7.78)	(8.13)
Post-Crisis					35.98***	30.73***
					(3.49)	(2.73)
CSPP period					-46.51***	-41.32***
					(-5.57)	(-4.56)
CSPP eligible					21.89*	21.27*
					(1.93)	(1.73)
CSPP period × eligible					-24.21*	-27.18*
					(-1.73)	(-1.93)

Corporate sector purchase program:
Underpricing significantly lower

Test of single model

Joint test of all five programs

Results

Secondary Market Liquidity

Liquidity decreases slightly during the crisis. There is a much stronger decrease in the post-crisis period

	Bid-Ask-Spread	Bid-Ask-Spread	Bid-Ask-Spread
In-Crisis	3.80*		
	(1.81)		
Post-Crisis	13.95***		
	(6.82)		
In-Crisis × Non-Financial		1.84	
		(0.49)	
In-Crisis × Financial		6.39***	
		(2.78)	
In-Crisis × SSA		-1.25	
		(-0.52)	
Post-Crisis × Non-Financial		14.14***	
		(5.53)	
Post-Crisis × Financial		13.56***	
		(6.26)	
Post-Crisis × SSA		13.64***	
		(4.11)	
In-Crisis × Above-Median-Rating			5.55**
			(2.25)
In-Crisis × Below-Median-Rating			-0.75
			(-0.29)
Post-Crisis × Above-Median-Ratin			12.40***
			(5.80)
Post-Crisis × Below-Median-Ratin			13.53***
			(5.51)
Observations	5,424	5,424	5,424
Adjusted R-squared	0.278	0.277	0.277

Main results:

- Eurozone bond issues appear to be systematically underpriced

- The cross-section of underpricing is supportive of information-based explanations, and of bookbuilding models in particular

- Liquidity-based explanations are rejected

- Underpricing has increased during the crisis and remained at elevated levels post-crisis

- Secondary market liquidity has decreased significantly post-crisis, possibly in response to new regulation

- The ECB's asset purchase programs have, if anything, decreased underpricing

Backup Slides

Explanations of underpricing:

- Informational asymmetries

  - Winner's curse (Rock 1986)

  - Information provision during the bookbuilding process (Benveniste and Spindt 1989, Sherman and Titman 2000)

  - Signaling (Allen and Faulhaber 1989, Welch 1989)

- Expected secondary market liquidity (Booth and Chua 2006, Ellul and Pagano 2006)

How bonds are issued:

- Corporate (and agency) bonds are issued in a bookbuilding procedure

- Standard setter: International Capital Markets Association (ICMA)

"The primary market for corporate bonds is where the bond is created and initially sold to investors. Usually the corporate issuer will appoint a bank (or banks) as a lead manager, who will provide advice on the optimal timing, structure, and pricing of the issuance, as well as building a syndicate of other banks, all of whom will look to build investor interest in purchasing the bonds (known as 'book building'). Banks may also provide an 'underwriting' service, where they agree to take any unsold bonds onto their own books to hold or subsequently trade in the secondary market." (International Capital Market Association, 2014, p. 7)

How bonds are issued (contd.):

- Underwriters have discretion as to how to allocate the bonds
- Underwriters usually also act as market makers in the secondary market

"*Usually, market-makers in a particular bond are the same banks who are involved in the primary issuance of that bond, with secondary market-making being part of the 'pitch' to the corporate issuer to win the origination mandate, and as a component of the overall service package.*" (International Capital Market Association, 2016, p. 9)

Summary Statistics:

Fraction of non-financial issuers	**37%**
Agency / supranational issuers	**13%**
Covered bonds	**28%**
Subordinated Bonds	**3%**
Unrated	**4%**
Rating B - BBB	**29%**
First-time issuers	**15%**
Average duration	**6.33**
APP-eligible (all programs)	**12%**

Measuring underpricing (2)

- Abnormal yield change = (-1)(Change in YtM of bond - Change in YtM of corresponding index)

- Under a flat term structure abnormal returns and abnormal yield changes are related by

$$YC_i = -\frac{(1+Y)R_i}{D_i}$$

- Thus, abnormal yield changes essentially only imply a rescaling (yield changes are much smaller)

- Focus of paper and presentation: abnormal returns

Underpricing increases monotonically throughout the event window:

$CAR(t_1,t_2)$	N	Mean	SE	99% Confidence Interval	t-stat	% positive $CAR(t_1,t_2)$
CAR(0,1)	5703	30.89	1.27	[27.62; 34.16]	24.37	66.93%
CAR(0,2)	5703	31.80	1.30	[28.46; 35.15]	24.47	66.23%
CAR(0,3)	5703	33.05	1.36	[29.55; 36.54]	24.39	66.11%
CAR(0,4)	5703	34.01	1.38	[30.46; 37.56]	24.69	66.18%
CAR(0,5)	5703	35.38	1.41	[31.74; 39.03]	25.01	66.18%
CAR(0,10)	5703	40.35	1.57	[36.32; 44.39]	25.77	66.51%
CAR(0,20)	5703	49.91	1.84	[45.16; 54.66]	27.08	66.54%
CAR(0,30)	5703	54.68	2.03	[49.46; 59.9]	26.99	65.91%
CAR(0,40)	5703	59.48	2.15	[53.93; 65.02]	27.63	65.28%

Robustness Check: Abnormal Yield Changes
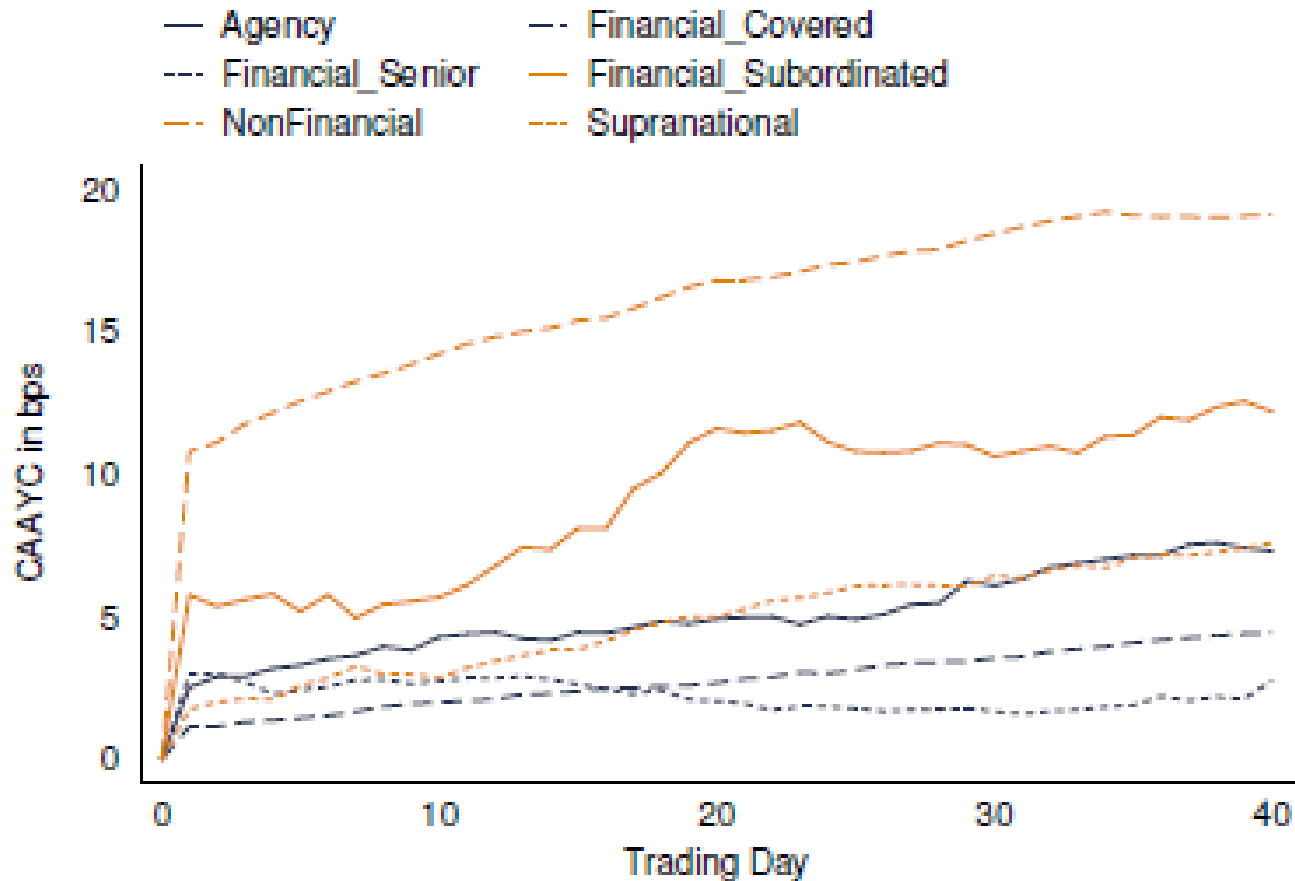
CAARs are significant for all issuer types (H1):

	N	CAAR(0,1)		CAAR(1,40)		CAAR(0,40)	
		Mean	t-stat	Mean	t-stat	Mean	t-stat
Complete Sample	5,703	30.89***	(24.37)	28.59***	(16.66)	59.47***	(27.63)
Panel A: By Issuer Type							
Financial (Covered)	1573	6.912***	(4.29)	8.456***	(3.76)	15.37***	(5.39)
Financial (Senior)	1156	15.32***	(5.47)	8.230**	(2.06)	23.55***	(5.08)
Financial (Subord.)	140	39.64***	(3.05)	54.53***	(3.12)	94.17***	(4.56)
Sub-Sovereign	576	17.05***	(5.01)	35.19***	(6.33)	52.24***	(8.01)
Supranational	176	17.27***	(2.81)	47.10***	(4.78)	64.38***	(5.37)
Non-Financial	2082	62.04***	(26.52)	49.96***	(16.32)	112.0***	(29.01)

Note: Confirmed in regression analysis

Robustness: Underpricing based on bid quotes

	N	CAAR(0,1)		CAAR(1,40)		CAAR(0,40)	
		Mean	t-stat	Mean	t-stat	Mean	t-stat
Complete Sample	5,579	16.11***	(12.45)	24.99***	(14.28)	40.90***	(19.22)

Higher underpricing for first-time issuers:

	N	CAAR(0,1)		CAAR(1,40)		CAAR(0,40)	
		Mean	t-stat	Mean	t-stat	Mean	t-stat
Panel C: By IBO/SBO							
IBO	850	65.65***	(16.96)	52.89***	(10.86)	118.5***	(18.46)
SBO	4853	24.80***	(18.97)	24.33***	(13.36)	49.13***	(22.00)

Note: Confirmed in regression analysis

Higher underpricing in-crisis and post-crisis:

		CAAR(0,1)		CAAR(1,40)		CAAR(0,40)	
	N	Mean	t-stat	Mean	t-stat	Mean	t-stat
Panel D: By Time Period							
Pre-Crisis	878	1.130	(0.42)	7.925***	(2.64)	9.055**	(2.15)
In-Crisis	307	31.73***	(5.63)	66.50***	(9.08)	98.23***	(10.40)
Post-Crisis	4518	36.62***	(25.31)	30.03***	(14.89)	66.64***	(26.86)

Notes:

Crisis: Q3/2007 - Q1/2009

Confirmed in regression analysis, see below

No clear picture with respect to the asset purchase programs:

	N	CAAR(0,1)		CAAR(1,40)		CAAR(0,40)	
		Mean	t-stat	Mean	t-stat	Mean	t-stat
Panel E: By Asset Purchase Program Eligibility							
CBPP1	116	16.83***	(4.62)	17.85*	(1.84)	34.67***	(3.29)
CBPP2	72	38.68***	(3.88)	5.451	(0.32)	44.13**	(2.07)
CBPP3	281	12.63***	(3.45)	13.57***	(3.58)	26.20***	(4.90)
PSPP	65	21.72**	(2.25)	29.63**	(2.01)	51.35***	(2.84)
CSPP	177	34.75***	(5.11)	38.48***	(5.73)	73.23***	(7.67)
None	4992	32.11***	(23.00)	29.65***	(15.64)	61.76***	(26.06)

Secondary Market Liquidity - Graph