EUROPEAN
DATAWAREHOUSE

Q3 RESEARCH UPDATE

26 SEPTEMBER 2023

ON TODAY'S CALL

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AGENDA

PUBLICATIONS

DATA AVAILABILITY

ADJUSTED DATABASE/ALL IN ONE DATABASE

LOAN PERFORMANCE

GUEST SPEAKERS

- SAMUELE SEGATO: "COMPLEXITY AND THE DEFAULT RISK OF MORTGAGE-BACKED SECURITIES"

- FRANCESCO BENVENUTI: "ASYMMETRIC INFORMATION IN LOAN CONTRACTS"

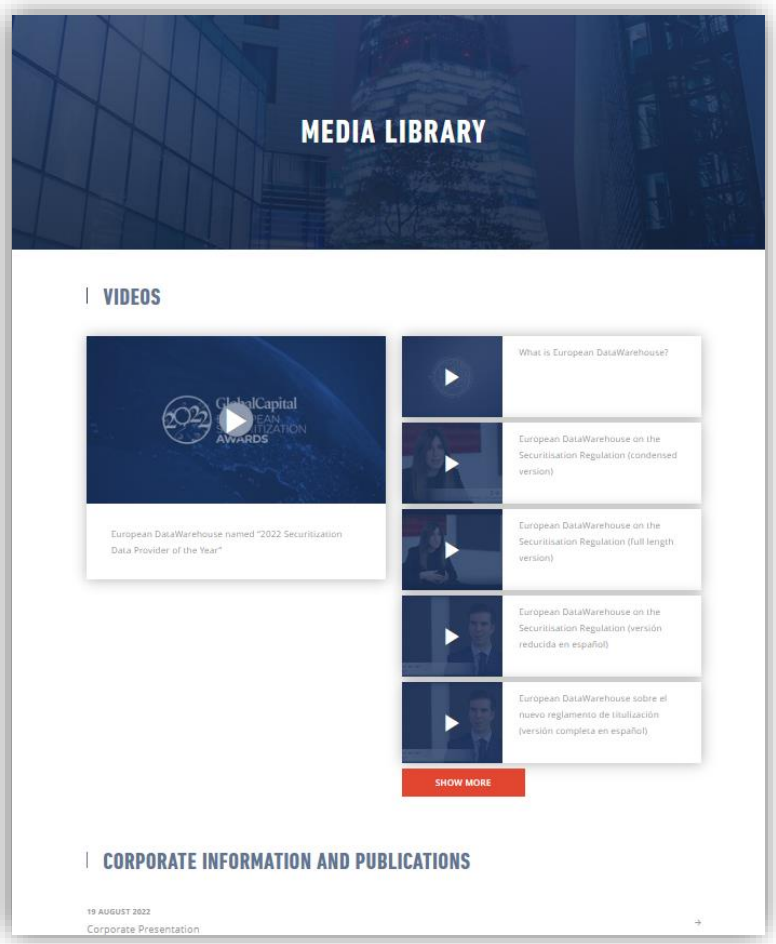
Q & A

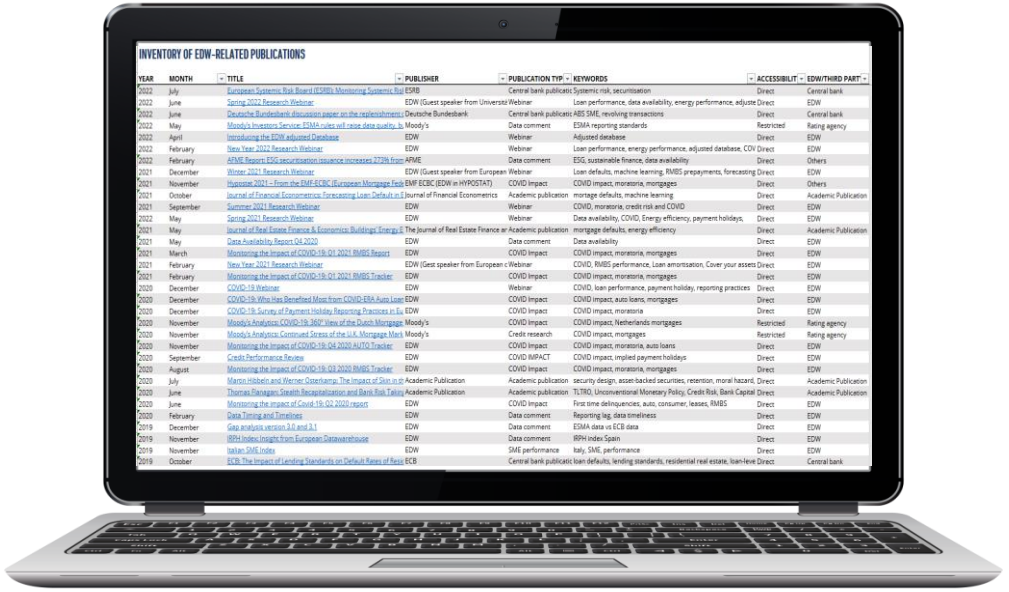
PUBLICATIONS

LUDOVIC THEBAULT, EUROPEAN DATAWAREHOUSE

LIST OF RESEARCH PUBLICATIONS

Our own publications, plus third-party research Media Library - European DataWarehouse (eurodw.eu)

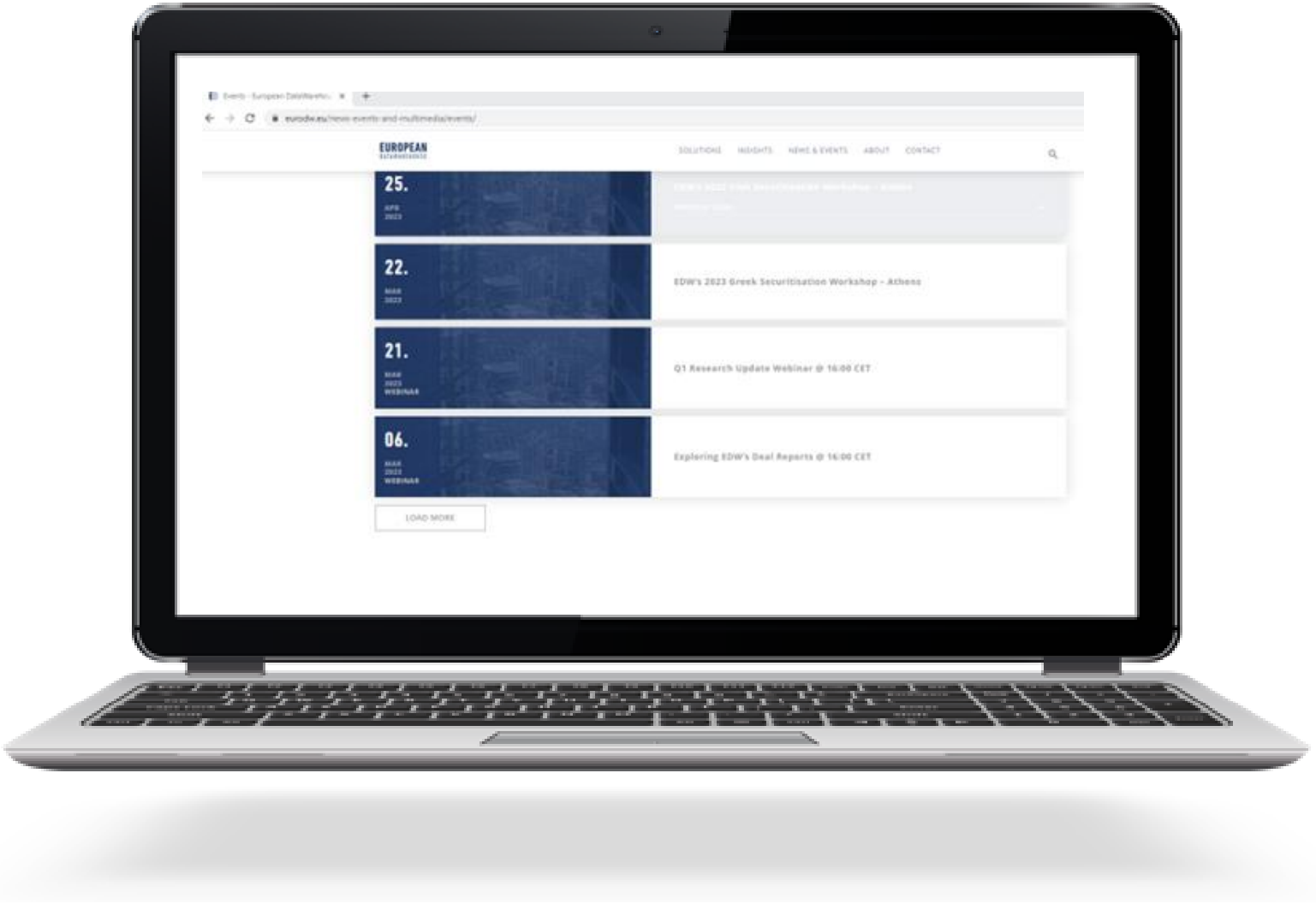




https://eurodw.eu/about-us/media-library/

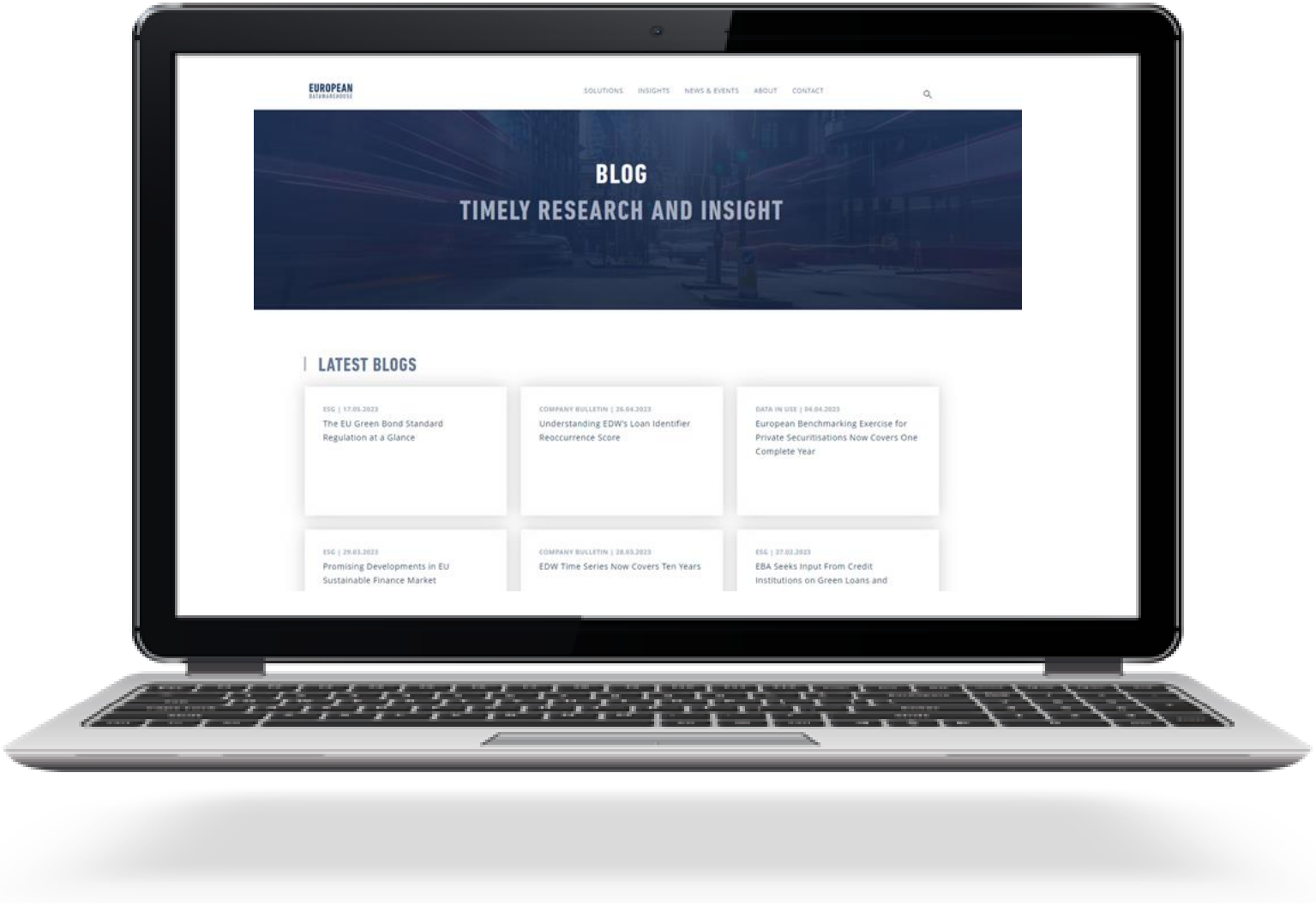
WEBINARS

The slides and recordings of our webinars https://eurodw.eu/news-events-and-multimedia/events/



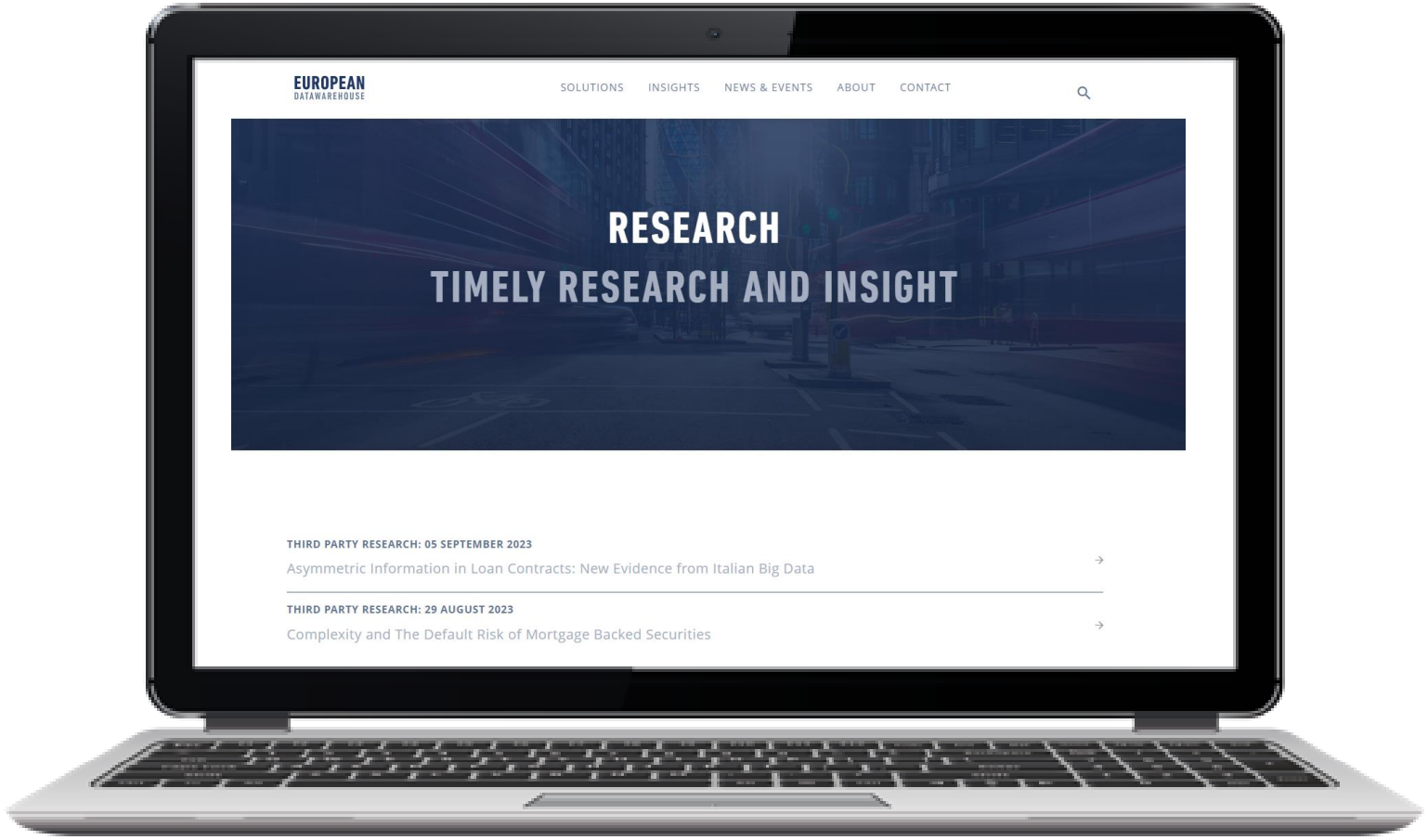
BLOG

Short articles on current topics https://eurodw.eu/knowledge/magazine//



RESEARCH SECTION

Our own publications, plus third-party research https://eurodw.eu/knowledge/research/



https://eurodw.eu/knowledge/magazine//

RECENTLY PUBLISHED

LUDOVIC THEBAULT, EUROPEAN DATAWAREHOUSE

EUROPEAN BENCHMARKING EXERCISE – UPDATED REPORT ON PRIVATE DEALS (1)

The European Benchmarking Exercise was updated and is posted on our website (joint publication AFME/TSI/EDW)

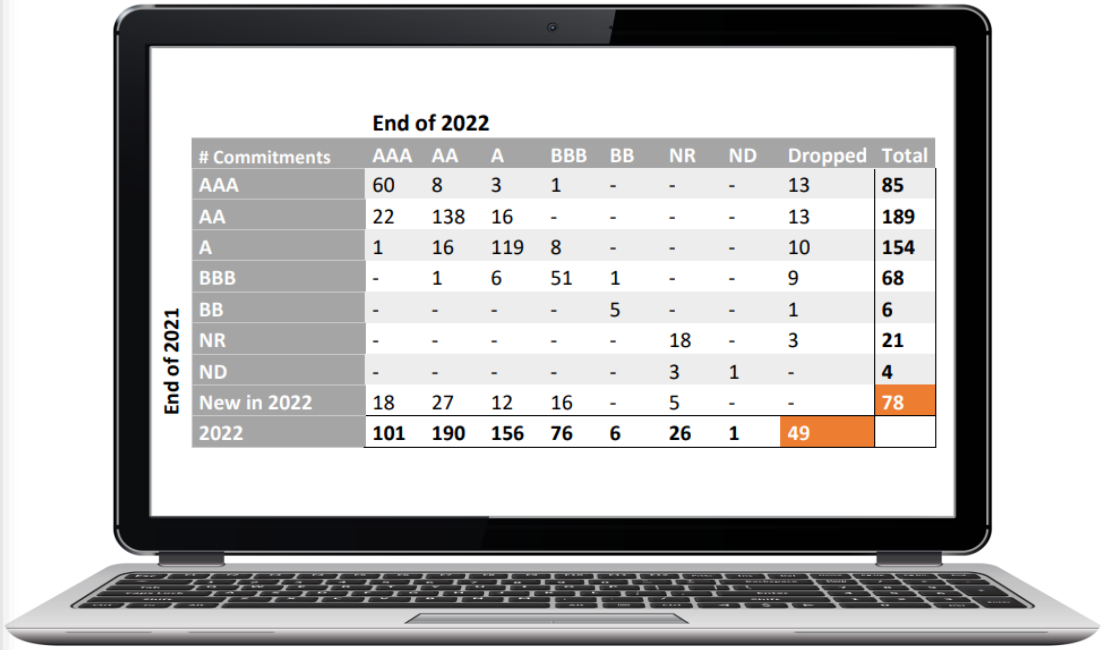
afme/ Finance for Europe

EUROPEAN DATAWAREHOUSE

TRUE SALE INTERNATIONAL

European Benchmarking Exercise (EBE)
for Private Securitisations
-
Report of H2-2022 Results
(September 2023)

Table of Contents



End of 2022

End of 2021 # Commitments	AAA	AA	A	BBB	BB	NR	ND	Dropped	Total
AAA	60	8	3	1	-	-	-	13	**85**
AA	22	138	16	-	-	-	-	13	**189**
A	1	16	119	8	-	-	-	10	**154**
BBB	-	1	6	51	1	-	-	9	**68**
BB	-	-	-	-	5	-	-	1	**6**
NR	-	-	-	-	-	18	-	3	**21**
ND	-	-	-	-	-	3	1	-	**4**
New in 2022	18	27	12	16	-	5	-	-	**78**
2022	**101**	**190**	**156**	**76**	**6**	**26**	**1**	**49**	

EUROPEAN BENCHMARKING EXERCISE – UPDATED REPORT ON PRIVATE DEALS (2)

The European Benchmarking Exercise was updated and is posted on our website

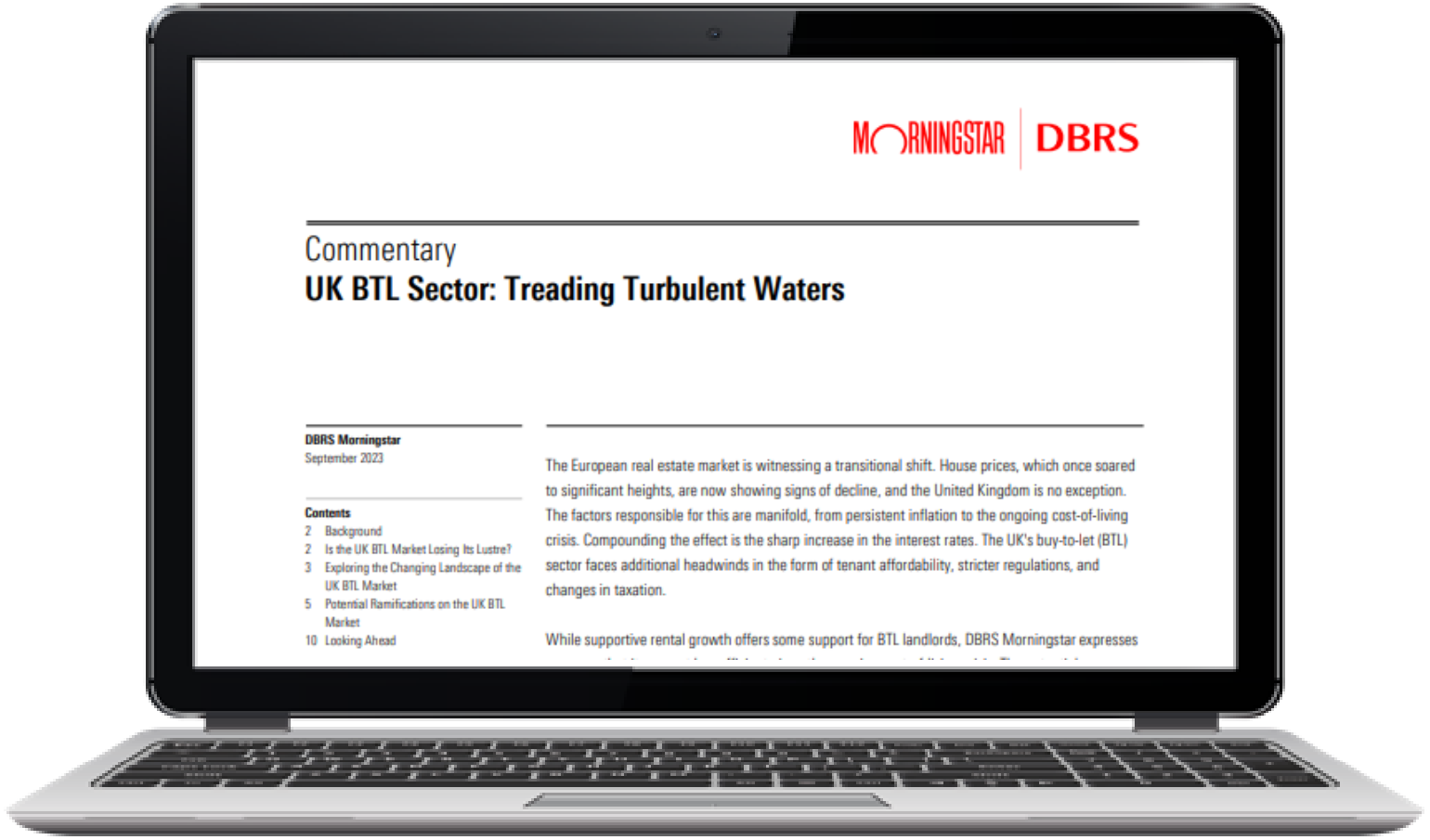
- Report co-authored with AFME and TSI
- Data provided in aggregated form by 12 banks from 6 EU countries
- Data received accounts for €73 billions in commitments (from €67 b. Previously)
- We estimate the amount of assets of private deals exceeds €196 billion
- Trade Receivables and Auto make up around 73% of the market, of which 36% and 91% respectively are funded through syndicated transactions
- Over 72% of private securitisation fund sellers in the EU
- Over 72% fund the real economy (the non-financial sectors of the economy)

Of all transactions by volume, 87% were undertaken by sellers with ratings of BBB and below at inception. In contrast, the average transaction rating is in the range A to AA. This shows that private cash securitisations provide a cost-effective means of financing for lower-rated sellers.

https://eurodw.eu/wp-content/uploads/EBE_2022-H1_Report-2023-03-22_final-2.pdf

RESEARCH SECTION

DBRS publication on the BTL sector (third party publication)



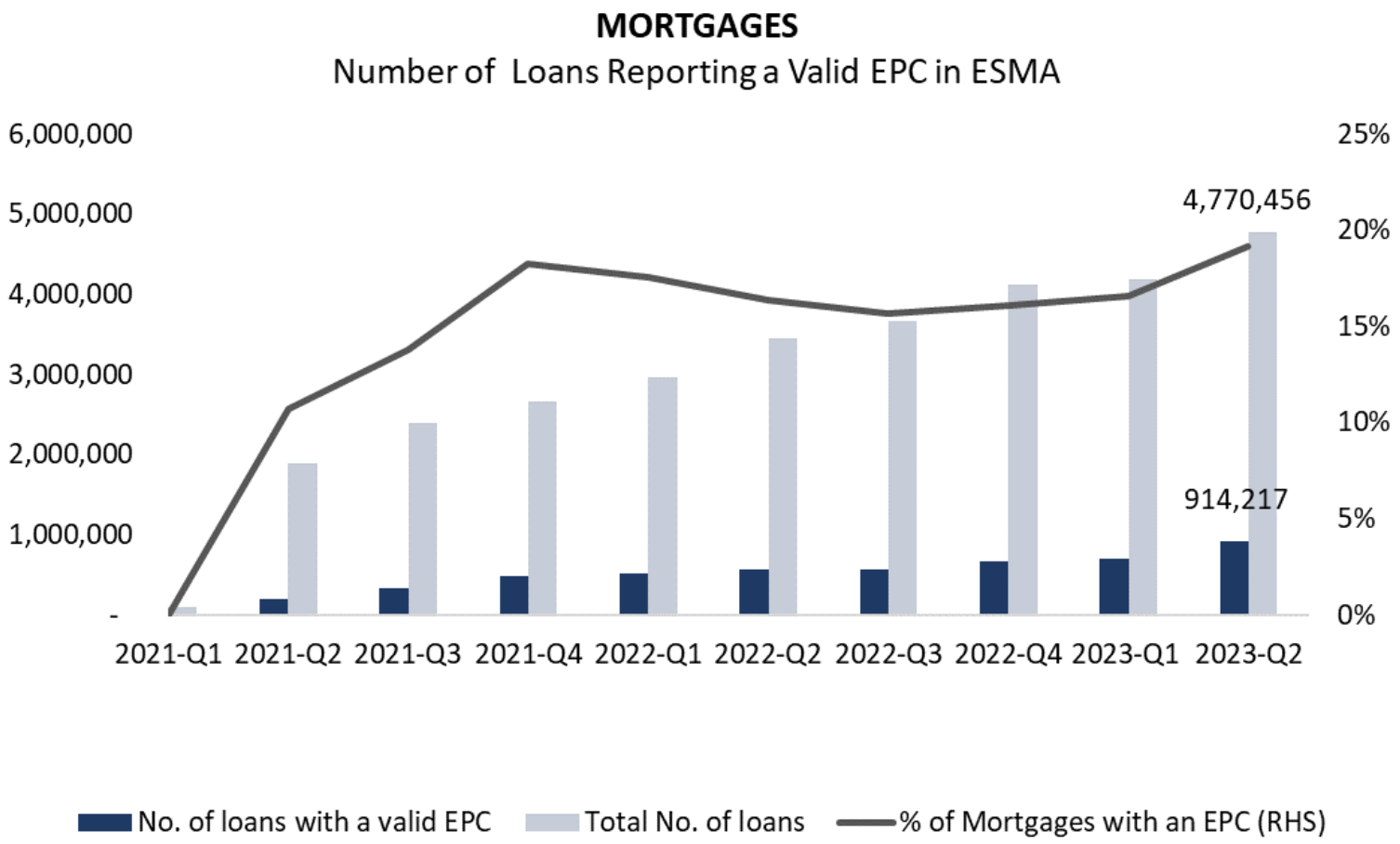
https://www.dbrsmorningstar.com/research/420444

DATA AVAILABILITY UPDATE

LUDOVIC THEBAULT, EUROPEAN DATAWAREHOUSE

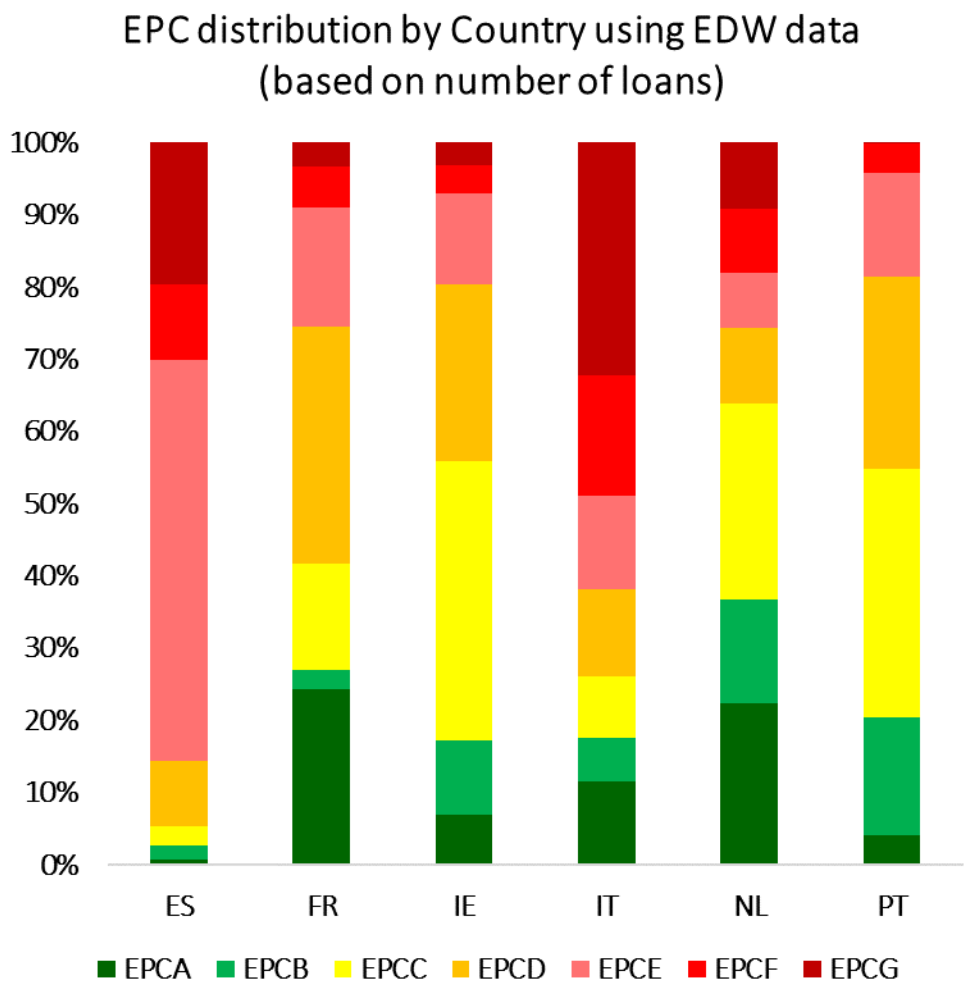
EPC DATA AVAILABILITY

Mortgages



EPC DATA AVAILABILITY

Mortgages



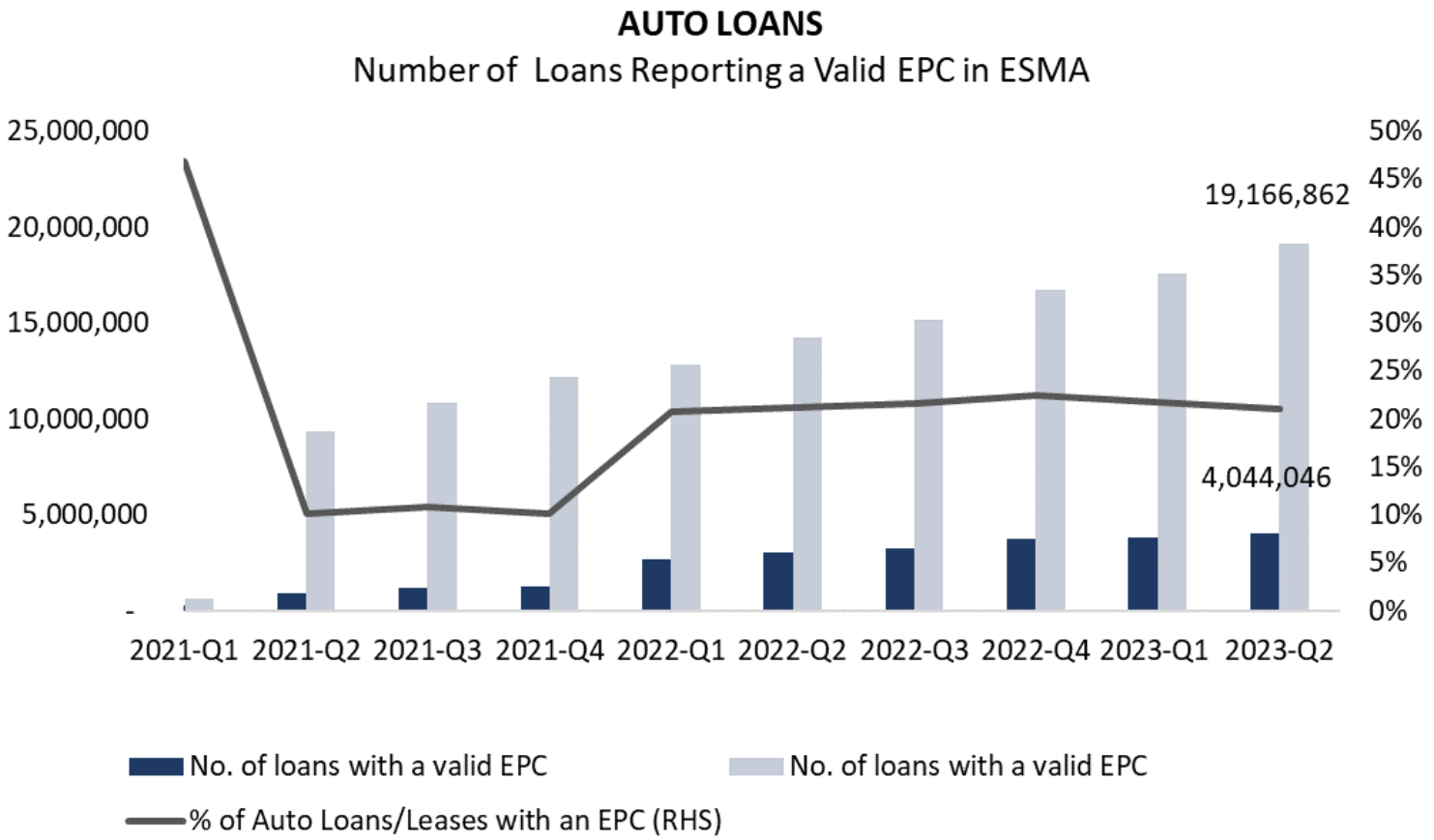
EPC thresholds by Country

kWh/m2/year	FR	DE	IE	IT	NL	PT	ES	UK
0-5	A	A+	A1	A4	A++	A+	A (=<34.1)	A (=<32)
5-10								
10-15								
15-20								
20-25		A	A2			A	B (=<55.5)	B
25-30								
30-35								
35-40				A3	A+			
40-45								
45-50	B	B	A3			B	C (=<85.4)	C
50-55				A2				
55-60								
60-65								
65-70		C	B1	A1	A (=<105)	B-	D (=<111)	
70-75								
75-80								
80-85								
85-90								
90-95								
95-100	C	D	B2 (=<125)	B	B (=<115)	C	E (=<136.6)	D (=<135)
100-110								
110-120					C			
120-130		E	B3	C	D (=<145)		F (=<170.7)	E
130-140								
140-150					E			
150-160	D	F	C1 (=<175)	D	F (=<175)	D		F
160-170								
170-180			C2					
180-190		G	C3 (=<225)	E		E		
190-200								
200-210			D1					
210-220								
220-230			D2	F	G	F	G	G
230-240								
240-250	E	H	E1					
250-260								
260-270			E2	G				
270-280								
280-290			F					
290-300								
300-310	F		G					
310-320								
320-330								
330-340								
340-350								
350-360								
360-370								
370-380								
380-390								
400-425								
425-450								
>450	G							

SOURCE: EDW RESEARCH

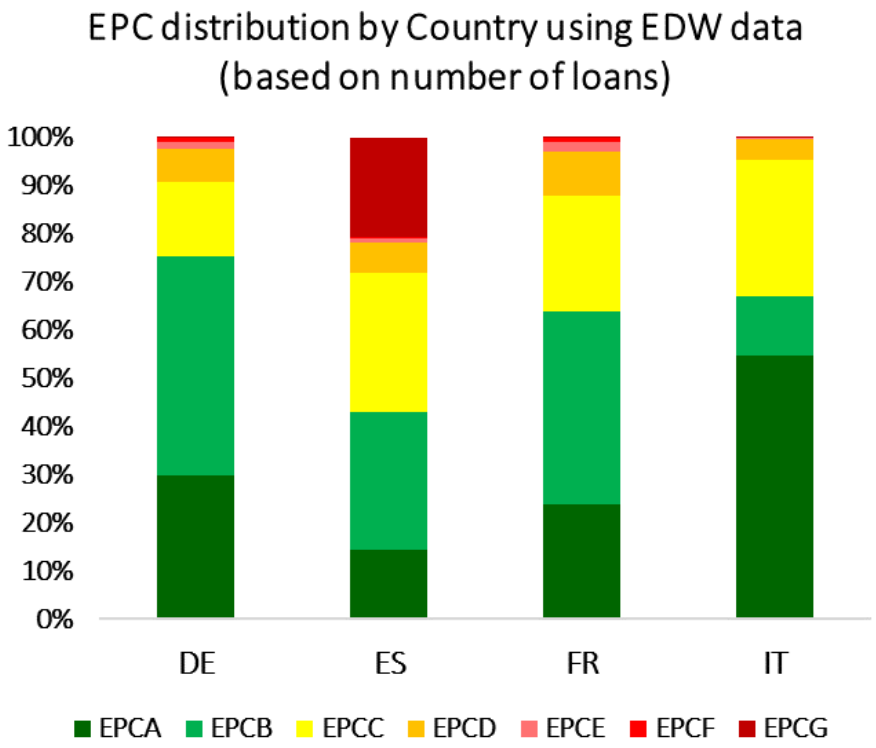
EPC DATA AVAILABILITY

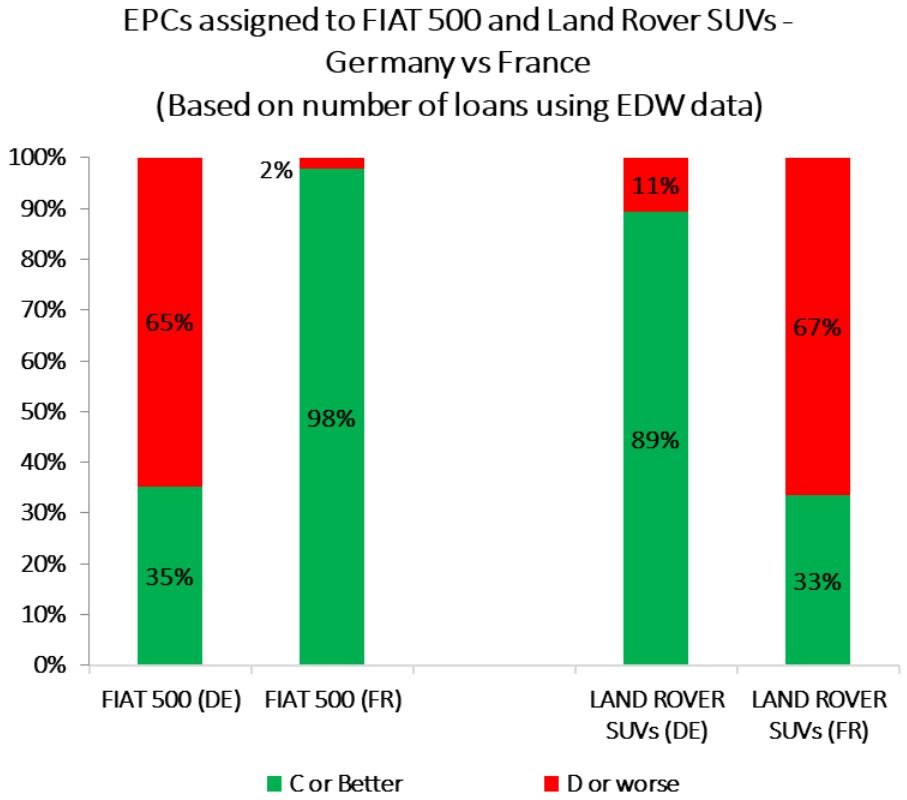
Auto loans



EPC DATA AVAILABILITY

Auto loans



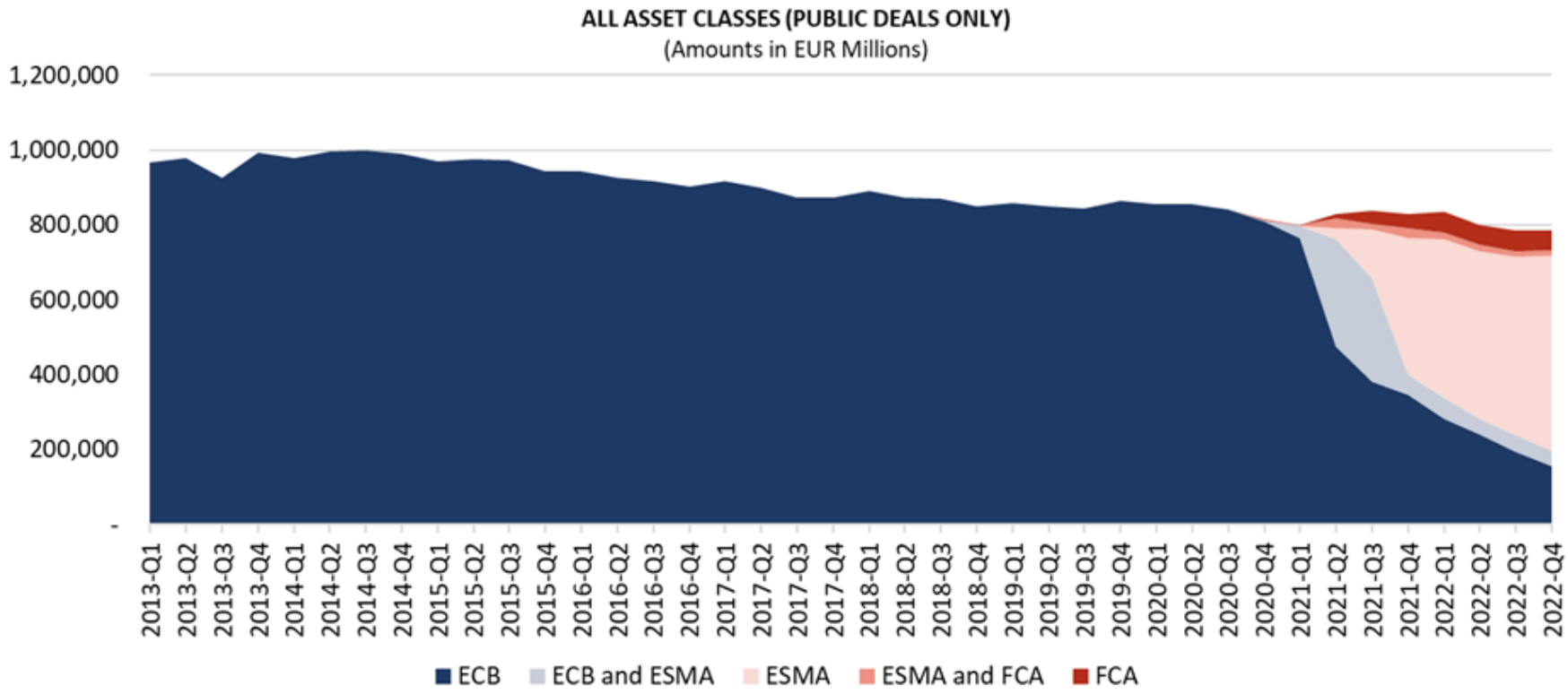


SOURCE: EDW RESEARCH

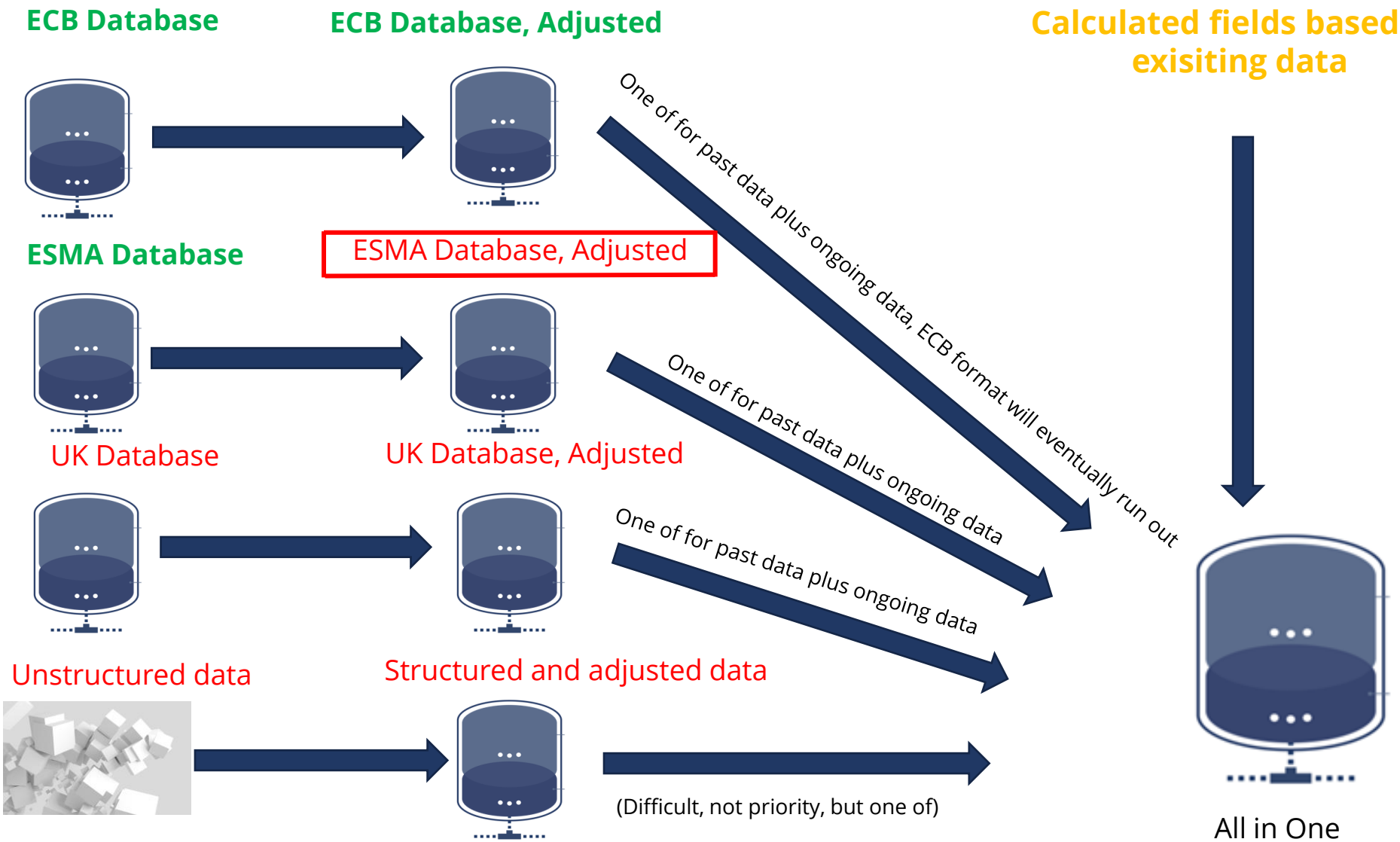
ALL IN 1 DATABASE

LUDOVIC THEBAULT, EUROPEAN DATAWAREHOUSE

ECB VS ESMA VS FCA DATA AVAILABILITY

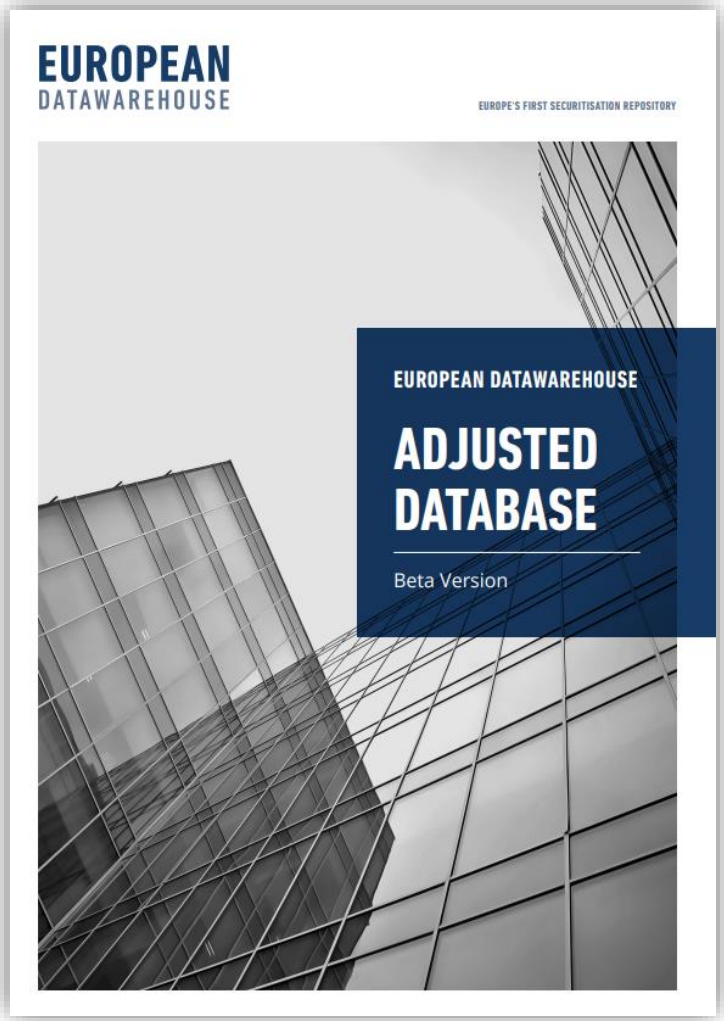


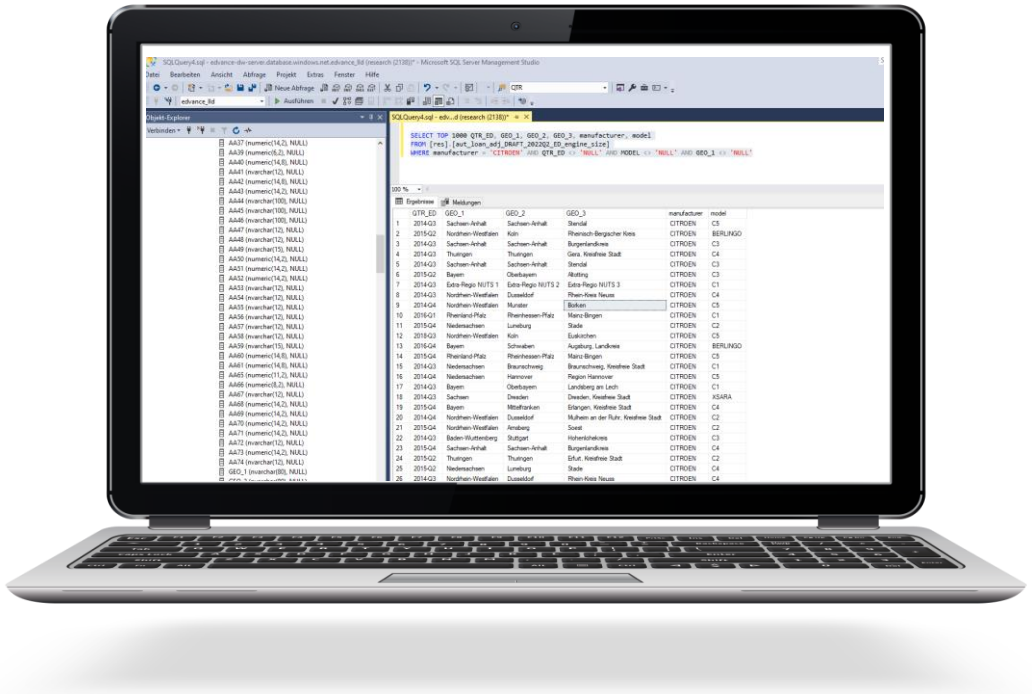
5 COMPONENTS



ADJUSTED DATABASE REPORT

Soon available online (or ask sales team directly)





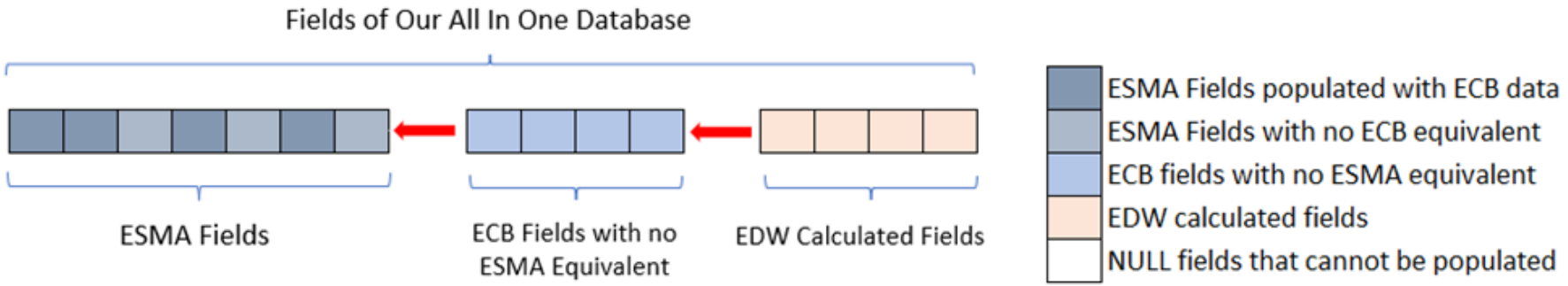
https://eurodw.eu/research_articles/edw-adjusted-database-beta-report/

LIST OF CALCULATED FIELDS AS OF SEPTEMBER 2023 IN ECB ADJUSTED DATABASE

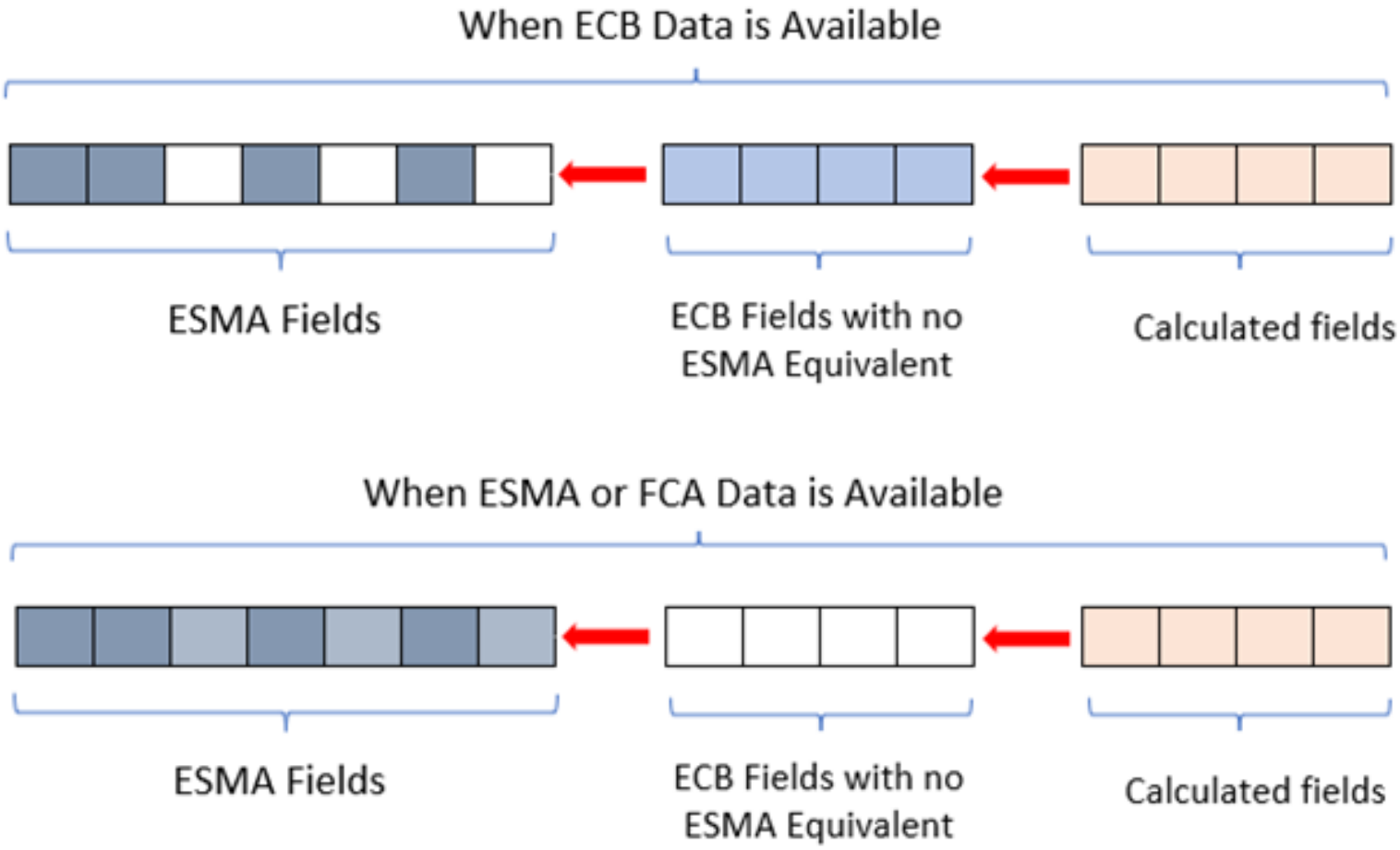
	AUTO	CONSUMER	CREDIT CARDS	LEASINGS	RMBS	SME
DATA_ORIGIN	yes	yes	yes	yes	yes	yes
EDCODE	yes	yes	yes	yes	yes	yes
PCD	yes	yes	yes	yes	yes	yes
GEO_1	yes	yes	yes	yes	yes	yes
GEO_2	yes	yes	yes	yes	yes	yes
GEO_3	yes	yes	yes	yes	yes	yes
QTR	yes	yes	yes	yes	yes	yes
COUNTRY	yes	yes	yes	yes	yes	yes
Manufacturer	yes	-	-	-	-	-
Model	yes	-	-	-	-	-
Fuel_Type	yes	-	-	-	-	-
Year_Registration	yes	-	-	-	-	-
Engine_size	yes	-	-	-	-	-
Vehicle_type	yes	-	-	-	-	-

STRUCTURE

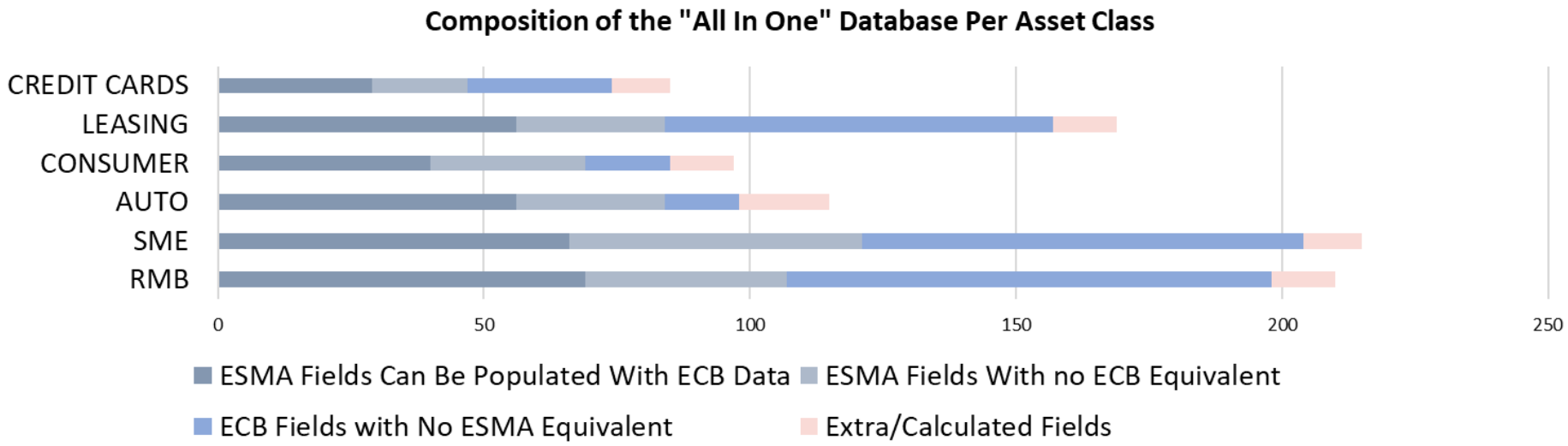
- To the ESMA fields, we add the ECB fields with no ESMA equivalent
- All the ESMA data can fit in
- All the legacy ECB data fits in



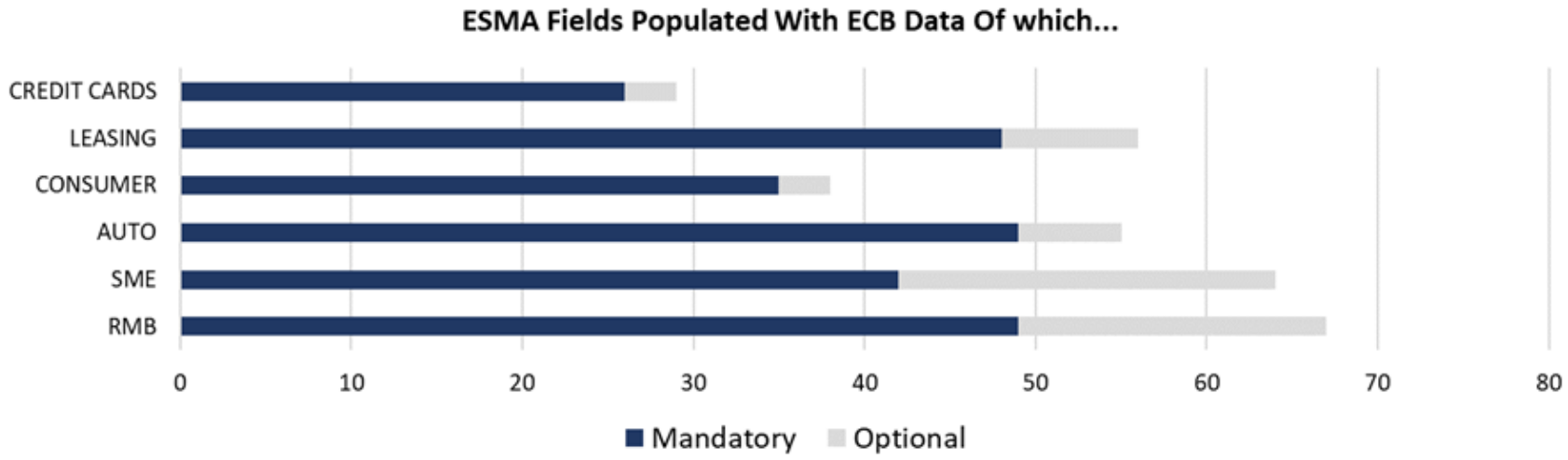
POPULATING THE ALL IN ONE DATABASE

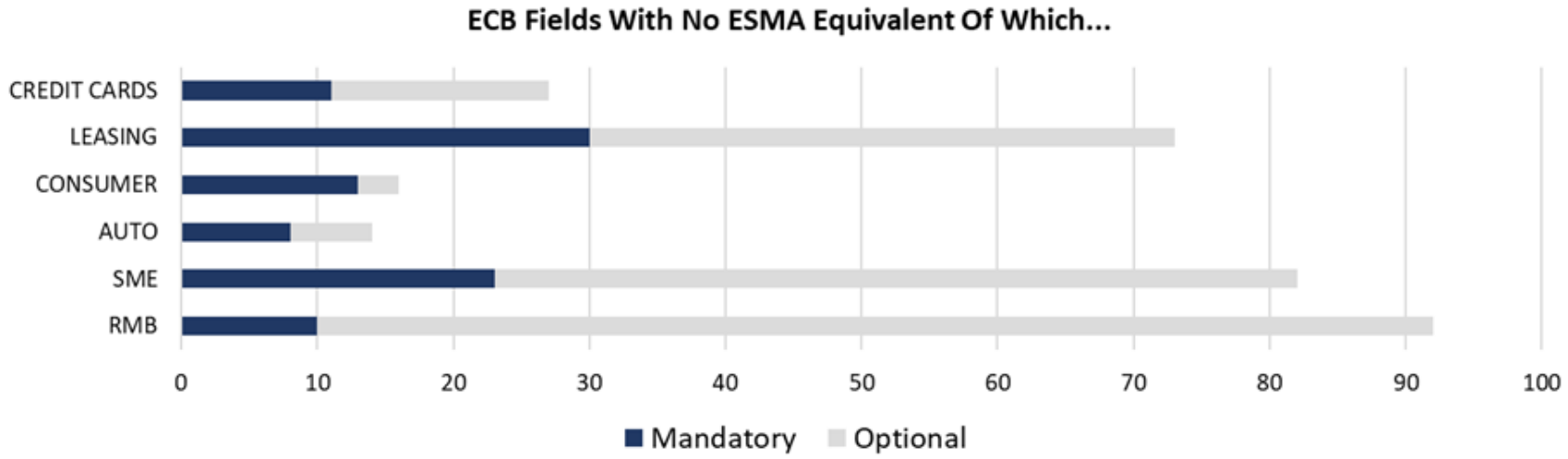


COMPOSITION OF THE TABLES BY ASSET CLASS



DATA CONTINUITY MANDATORY VS OPTIONAL FIELDS





ECB TO ESMA TRANSLATION

ECB		ESMA
Current Balance (AR67)	→	Current Principal Balance (RREL30)
Pool Cut-Off Date (AR1)	→	Data Cut-Off Date (RREL6)
Arrears Balance (AR169 - no amounts capitalised or fees...)	→	Arrears Balance (RREL67 - includes fees and amounts capitalised)
Origination Date (AR55 format YYYY-MM)	→	Origination Date (RREL23 - Day precision)

- Many fields fit “one to one” with a direct equivalent with same name and definition
- Some fields are defined somewhat differently but should generally be similar such as for the Arrears Balance which must include fees and capitalised amounts in ESMA...
- Dates in ECB often only had month precision, in ESMA day precision is required; we assume the 15th of the month

ECB TO ESMA TRANSLATION

ECB			ESMA	
Origination Channel (AR58)			**Origination Channel (RREL26)**	
Office / branch network	1	→	BRAN	Office or Branch Network
Central / Direct	2	→	DRCT	Central or Direct
Broker	3	→	BROK	Broker
Internet	4	→	WEBI	Internet
Packager	5	→	TPAC	Package
Third channel but underwriting processes performed 100% by the Originator	6	→	TPTC	Third Party Channel but Underwriting Perfromed Entirely by the Originator

- Some ECB fields have the same name and the same options as their ESMA equivalent and can therefore be translated 1 to 1.
- Data from the field AR58 goes 1 to 1 in the corresponding options of field RREL26 of the “All in One Database”

ECB TO ESMA TRANSLATION

ECB			ESMA	
Property type (AR131)			Poroperty type (RREC9)	
Residential (House, detached or semi-detached)	1	→	RHOS	Residential (House, detached or semi-d.)
Residential (Flat/Apartment)	2	→	RFLT	Residential (Flat/Apartment)
Residential (Bungalow)	3	→	RBGL	Residential (Bungalow)
Residential (Terraced House)	4	→	RTHS	Residential (Terraced House)
Multifamily house (...) with recourse to the borrower	5	→	MFHS	Multifamilly House
Multifamily house (...) without recourse to the borrower	6	→	MFHS	Multifamilly House
Partially commercial use	7	→	PCMM	Partial commercial use
Commercial/business use with recourse to the borrower	8	→	BIZZ	Commercial or business use
Commercial/business use without recourse to the borrower	9	→	BIZZ	Commercial or business use
Land only	10	→	LAND	Land Only
Other	11	→	OTHR	Other

- In this case, there is a loss of detail when switching from ECB to ESMA.
- The lost information is normally now stored in the new ESMA field “Recourse” (RREL76)

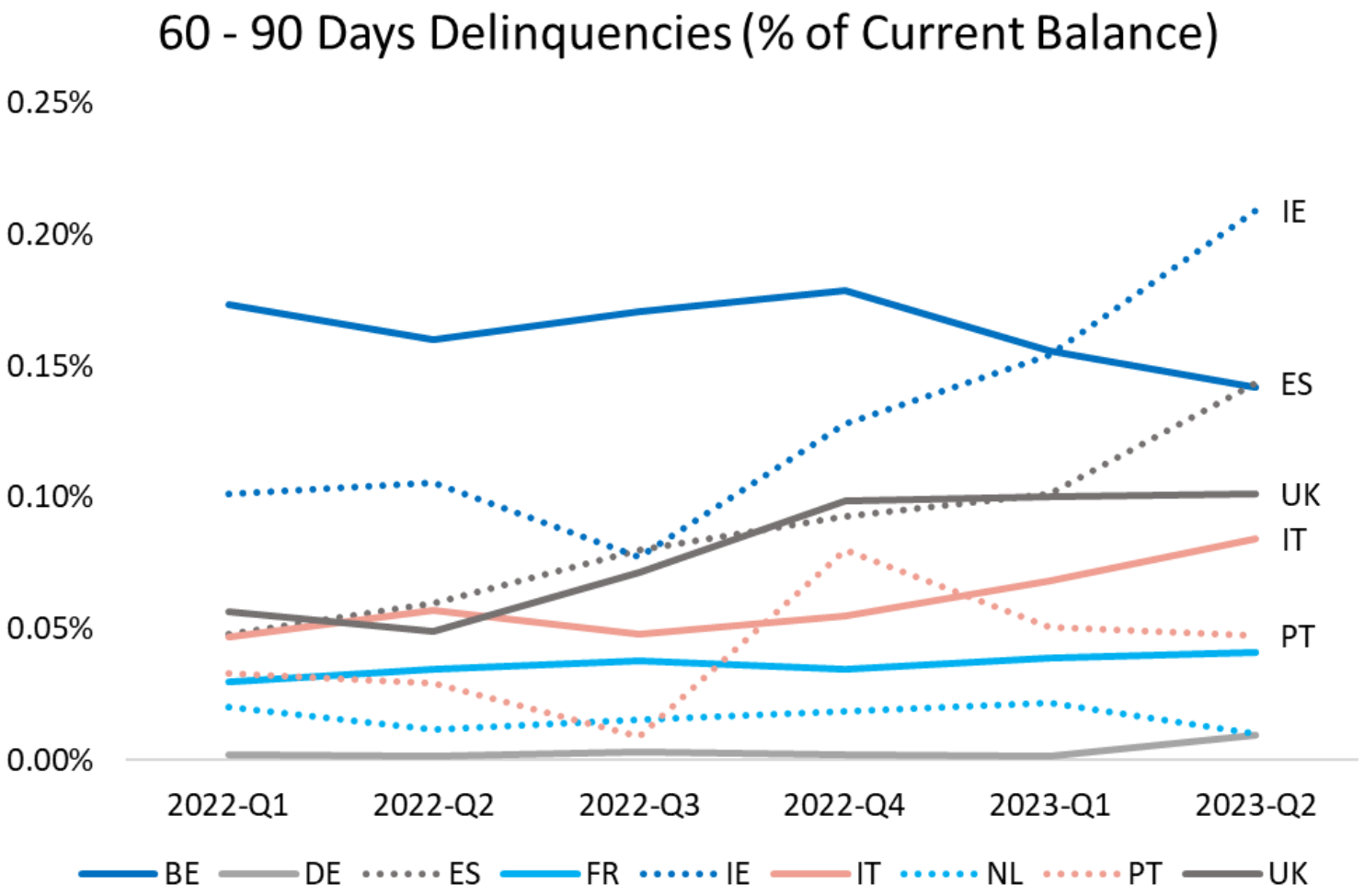
LOAN PERFORMANCE UPDATE

(2023-Q2 UPDATE)

USMAN JAMIL, EUROPEAN DATAWAREHOUSE

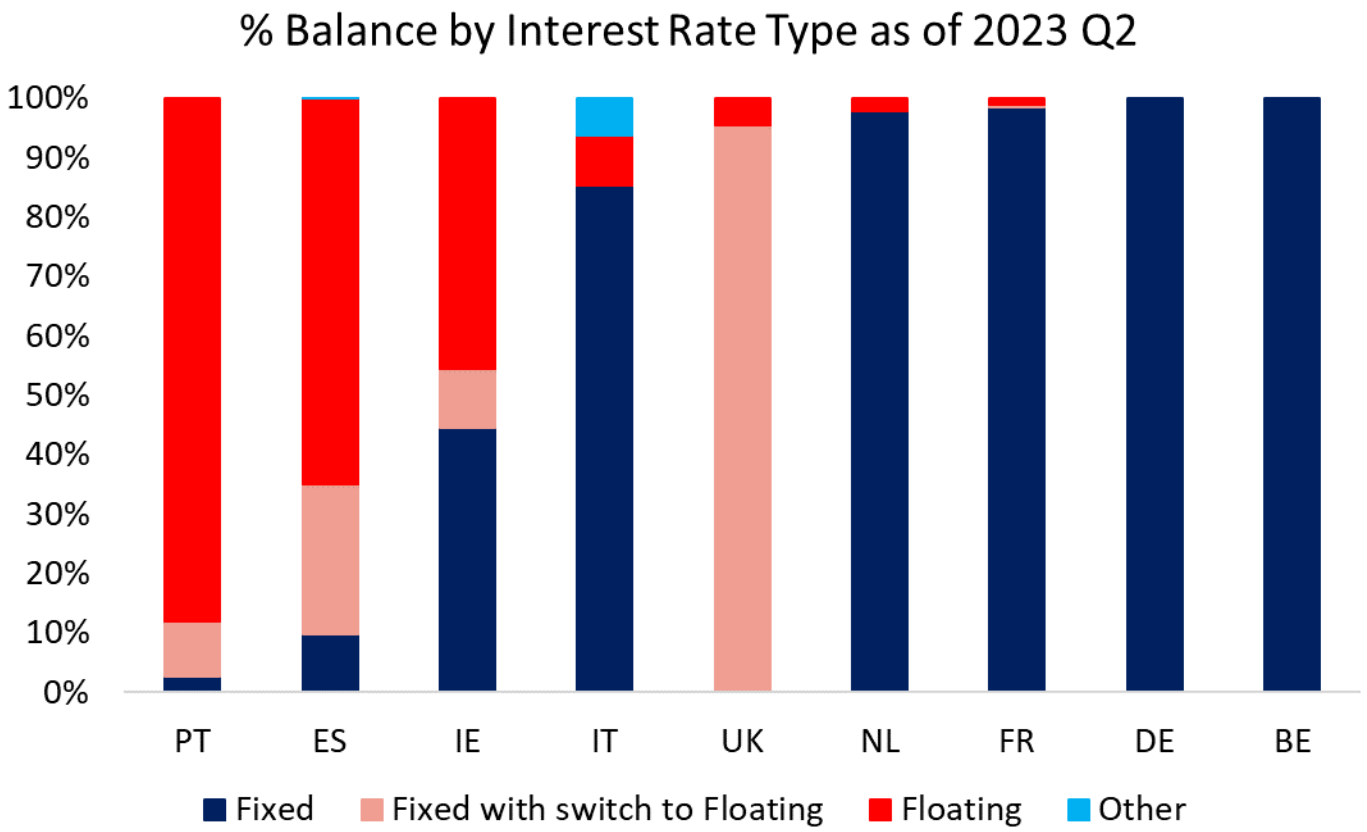
RMBS

Delinquencies have gone up slightly in some countries



RMBS

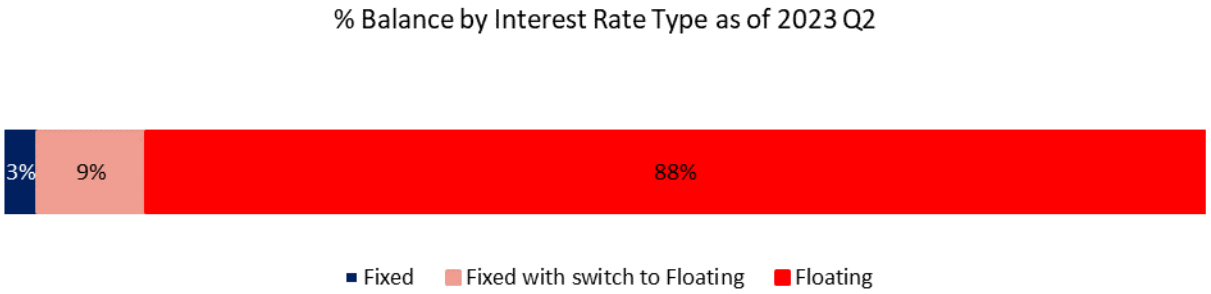
Floating Rate Mortgages are the norm for some countries while Fixed Rates for others

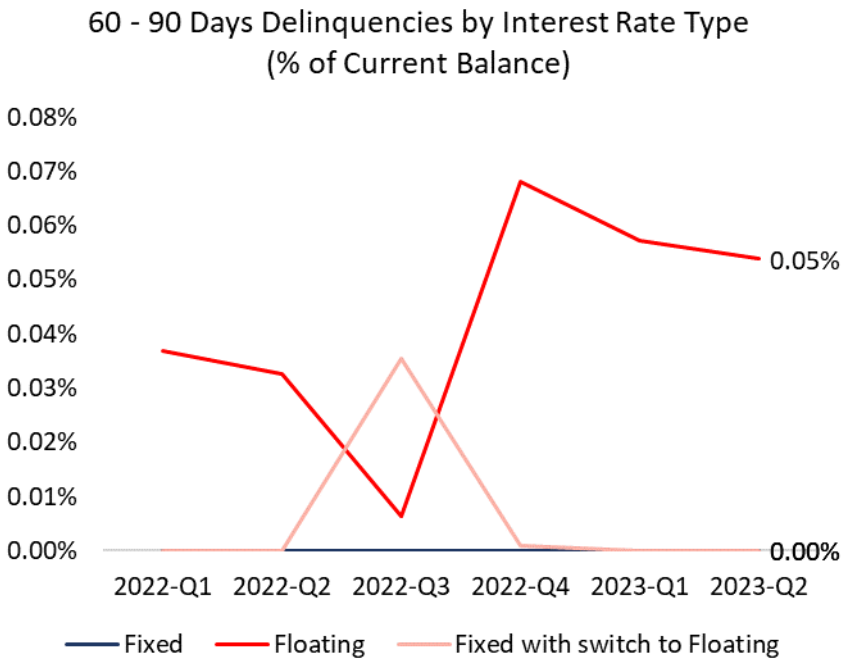


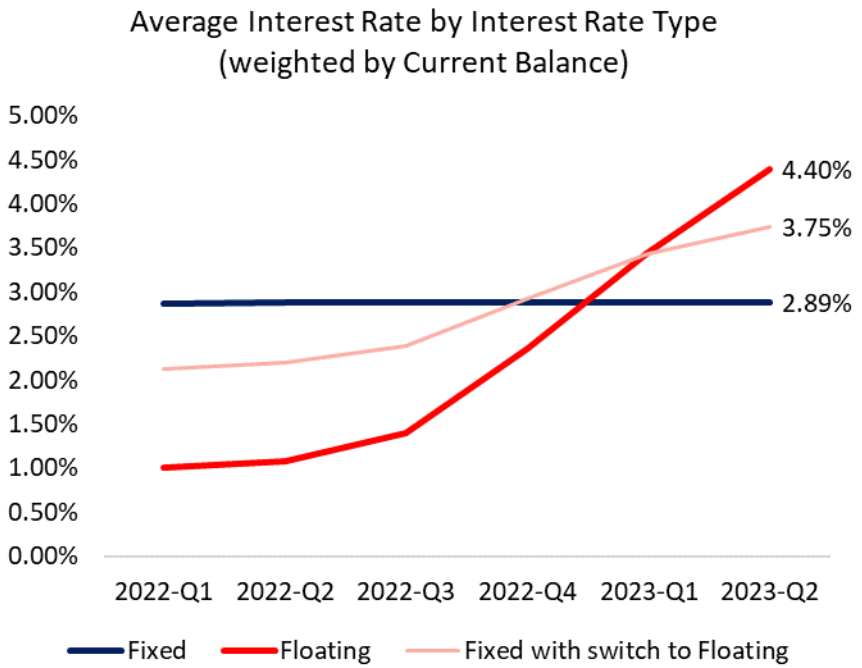
Are Floating Rate Mortgages driving Delinquencies??

RMBS

Portugal

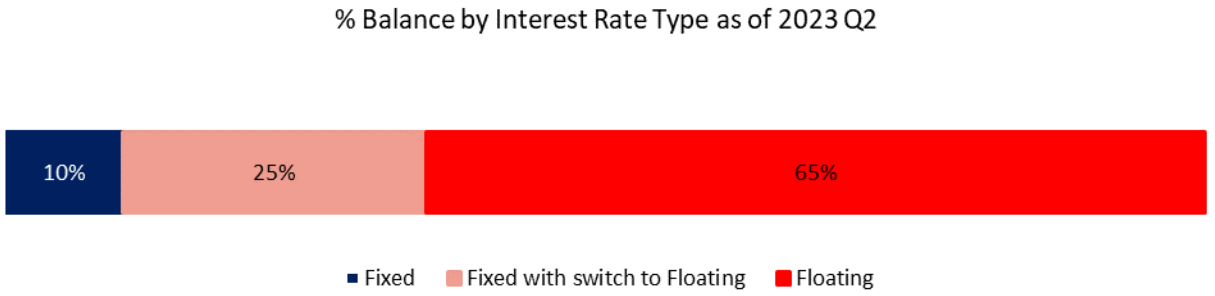


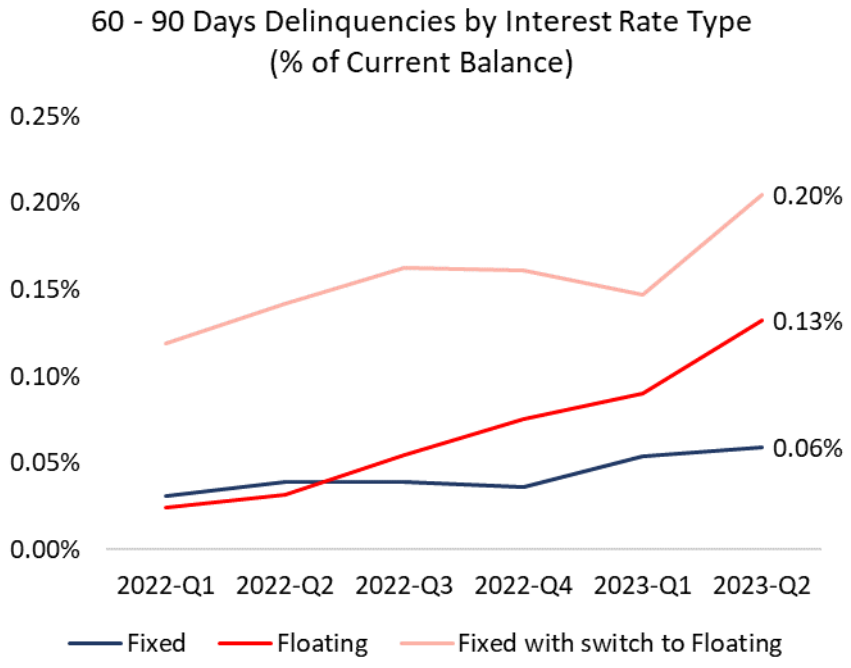


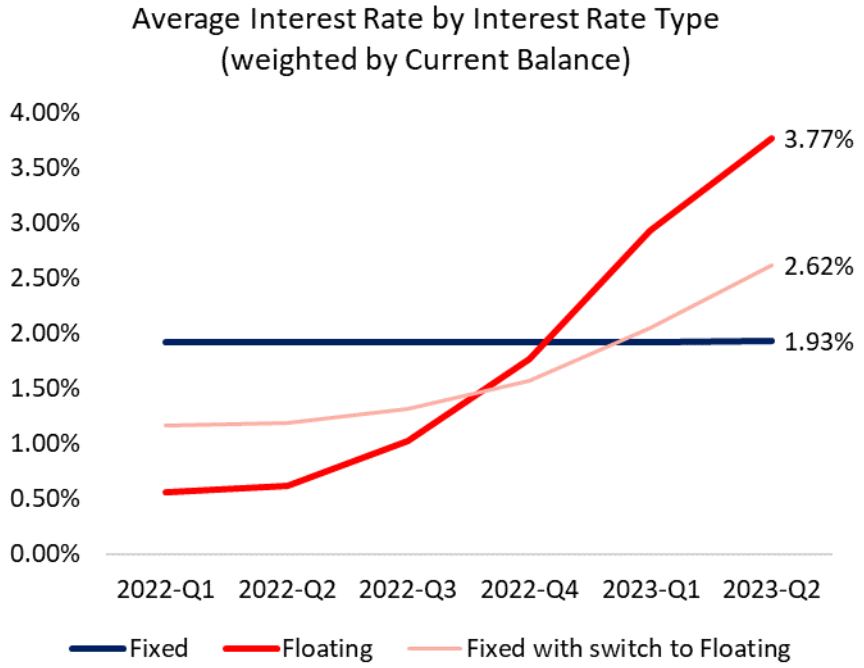


RMBS

Spain

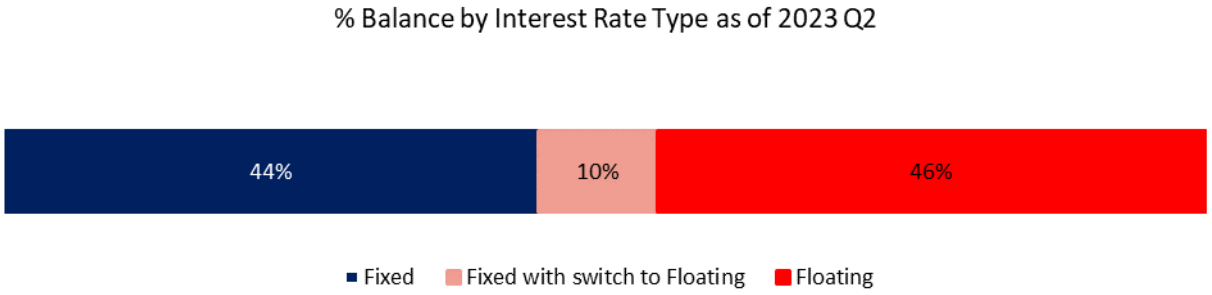

% Balance by Interest Rate Type as of 2023 Q2
10%
25%
65%
Fixed
Fixed with switch to Floating
Floating

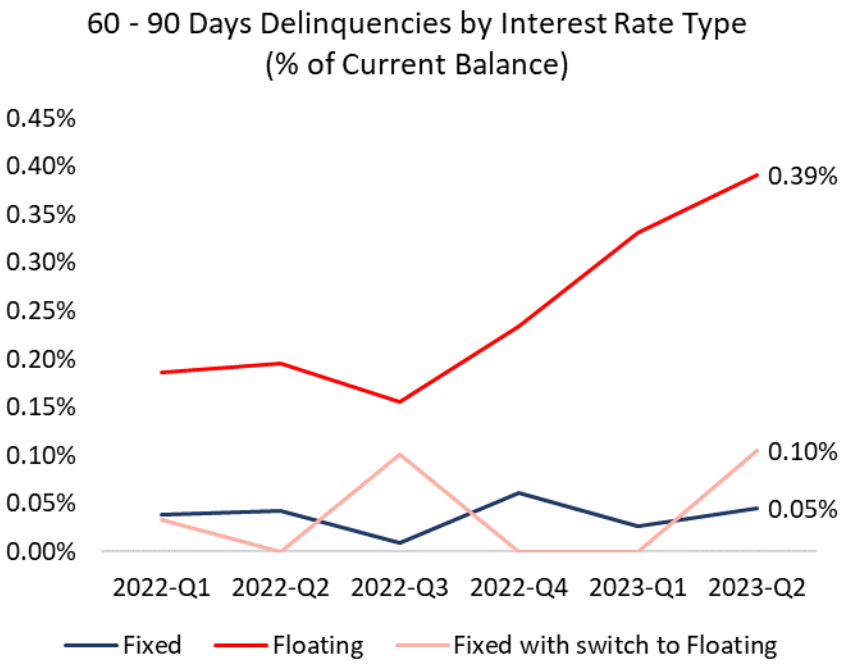

60 - 90 Days Delinquencies by Interest Rate Type
(% of Current Balance)
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
0.20%
0.13%
0.06%
2022-Q1
2022-Q2
2022-Q3
2022-Q4
2023-Q1
2023-Q2
Fixed
Floating
Fixed with switch to Floating

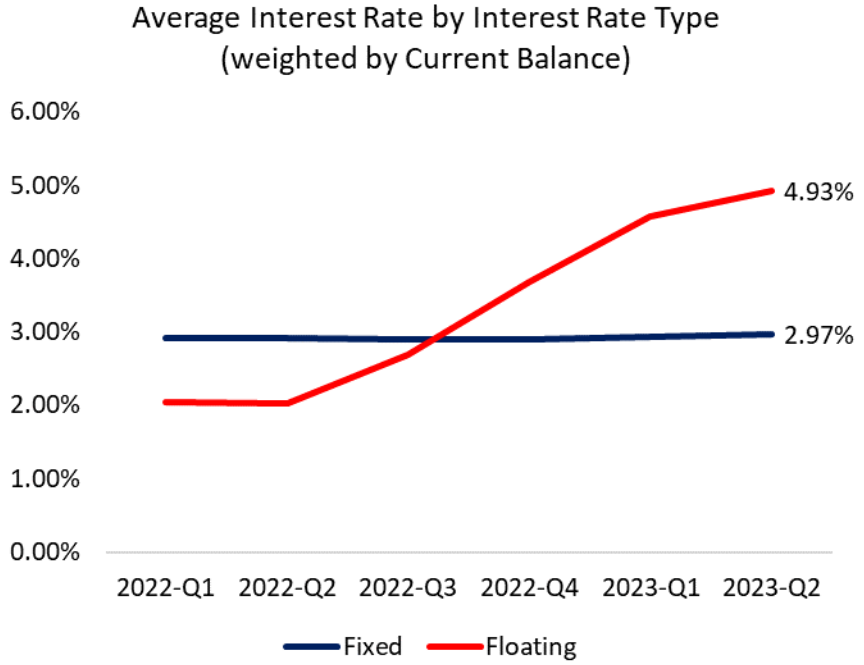

Average Interest Rate by Interest Rate Type
(weighted by Current Balance)
4.00%
3.50%
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
3.77%
2.62%
1.93%
2022-Q1
2022-Q2
2022-Q3
2022-Q4
2023-Q1
2023-Q2
Fixed
Floating
Fixed with switch to Floating

RMBS

Ireland

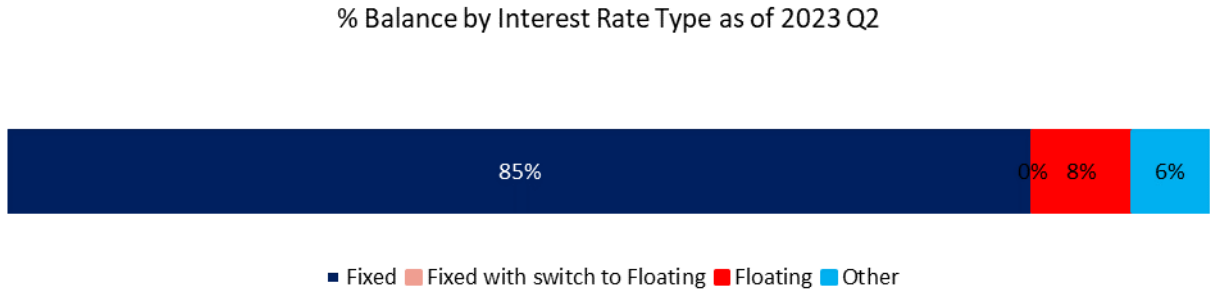


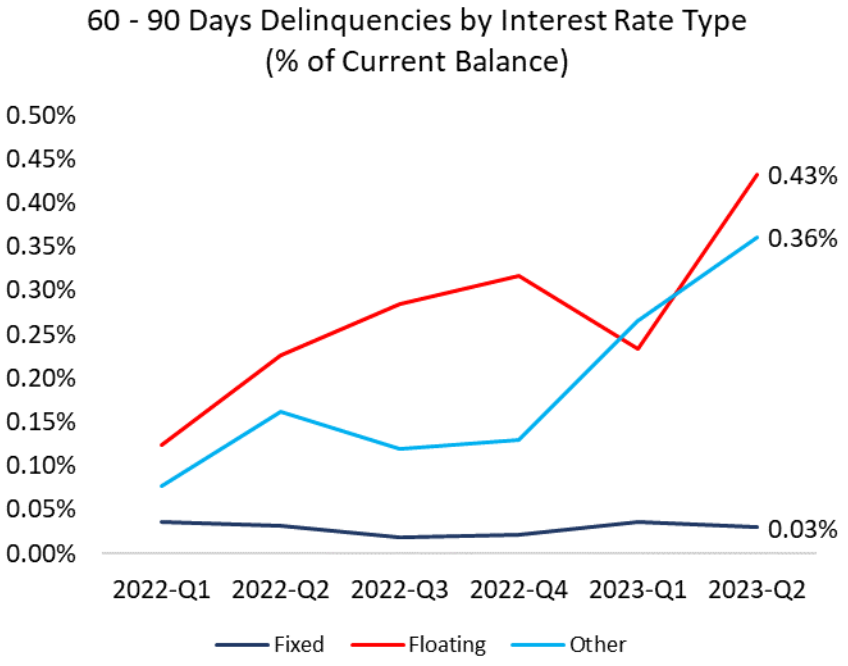


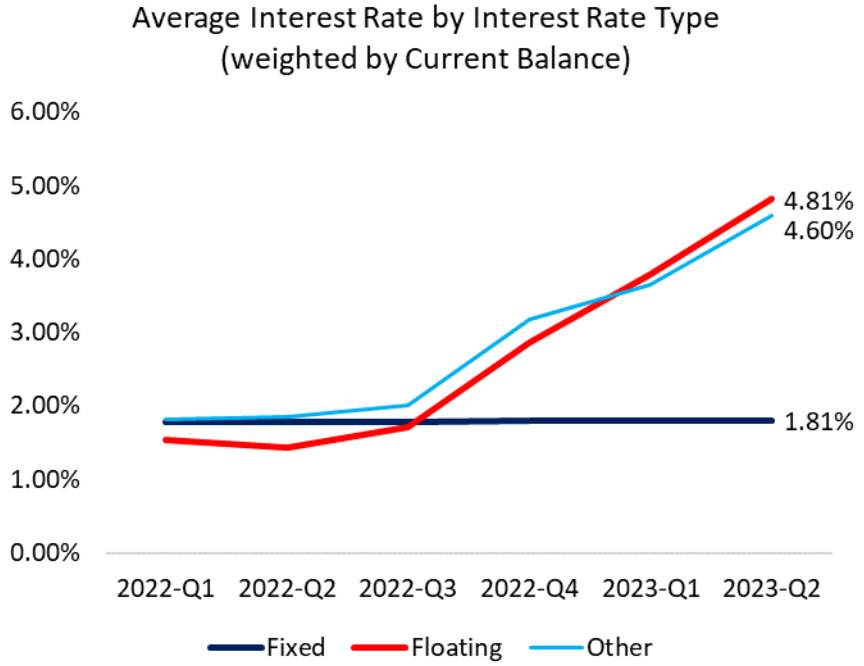


RMBS

Italy

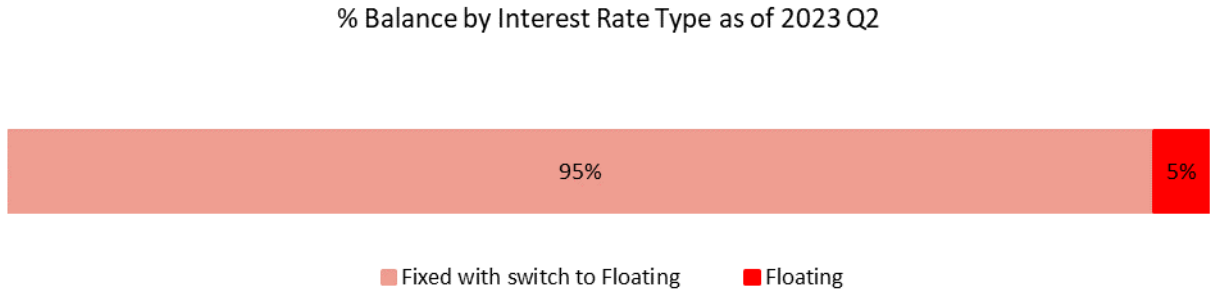

% Balance by Interest Rate Type as of 2023 Q2
85%
0%
8%
6%
Fixed
Fixed with switch to Floating
Floating
Other

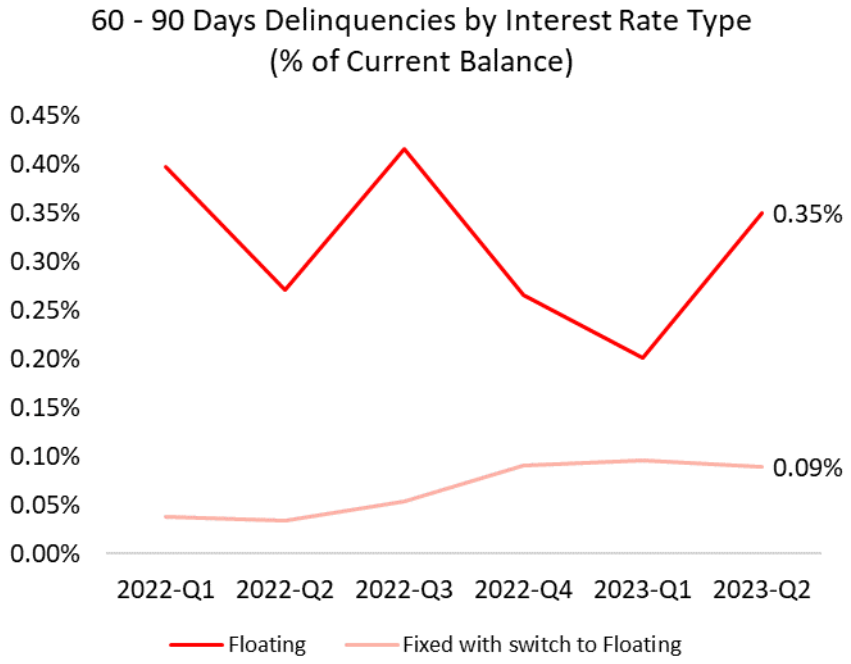

60 - 90 Days Delinquencies by Interest Rate Type
(% of Current Balance)
0.50%
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
0.43%
0.36%
0.03%
2022-Q1
2022-Q2
2022-Q3
2022-Q4
2023-Q1
2023-Q2
Fixed
Floating
Other

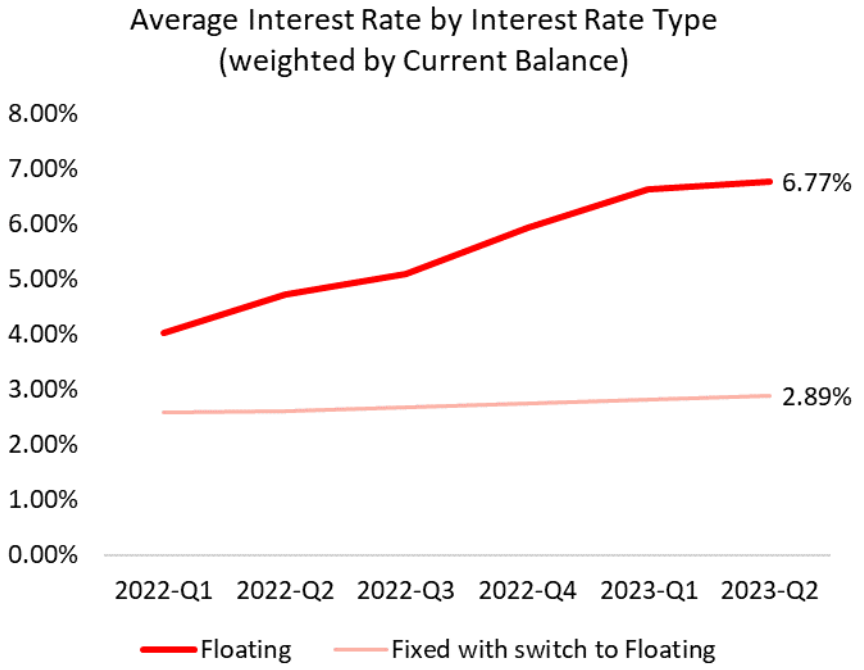

Average Interest Rate by Interest Rate Type
(weighted by Current Balance)
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
4.81%
4.60%
1.81%
2022-Q1
2022-Q2
2022-Q3
2022-Q4
2023-Q1
2023-Q2
Fixed
Floating
Other

RMBS

UK

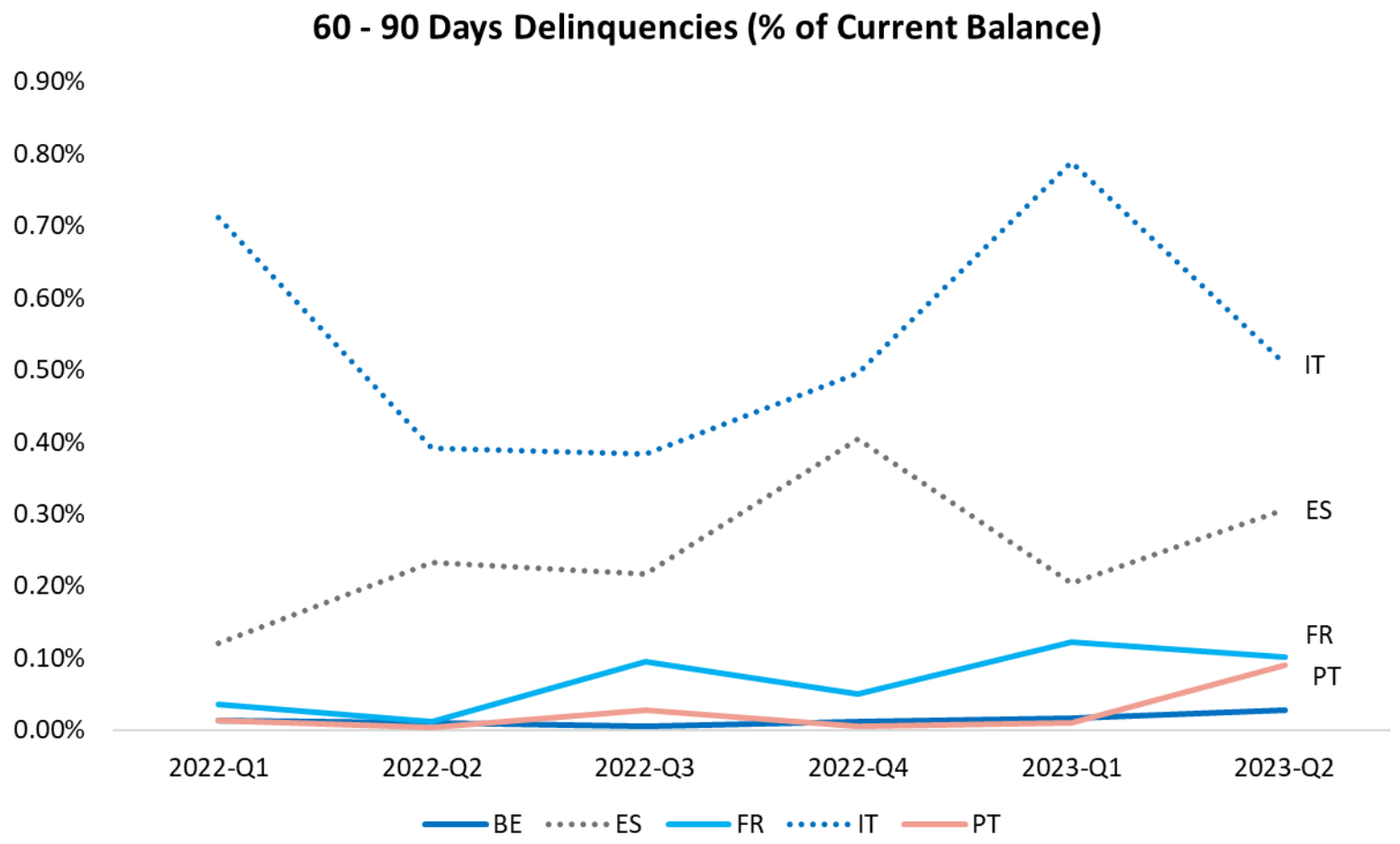

% Balance by Interest Rate Type as of 2023 Q2
95%
5%
Fixed with switch to Floating
Floating


60 - 90 Days Delinquencies by Interest Rate Type
(% of Current Balance)
0.45%
0.40%
0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
0.35%
0.09%
2022-Q1
2022-Q2
2022-Q3
2022-Q4
2023-Q1
2023-Q2
Floating
Fixed with switch to Floating


Average Interest Rate by Interest Rate Type
(weighted by Current Balance)
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
6.77%
2.89%
2022-Q1
2022-Q2
2022-Q3
2022-Q4
2023-Q1
2023-Q2
Floating
Fixed with switch to Floating

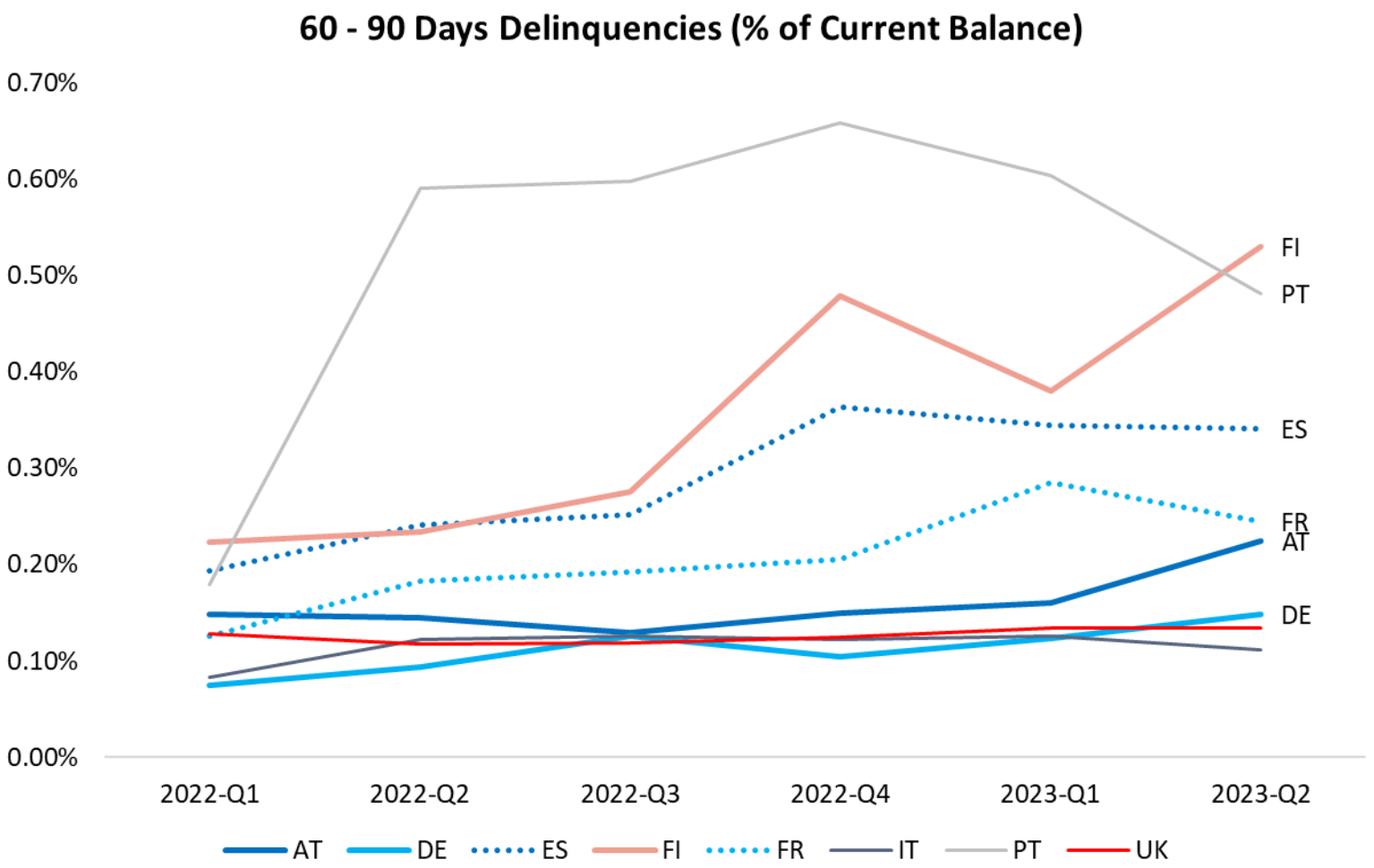
SME

Slightly elevated delinquency levels for Spain and Italy



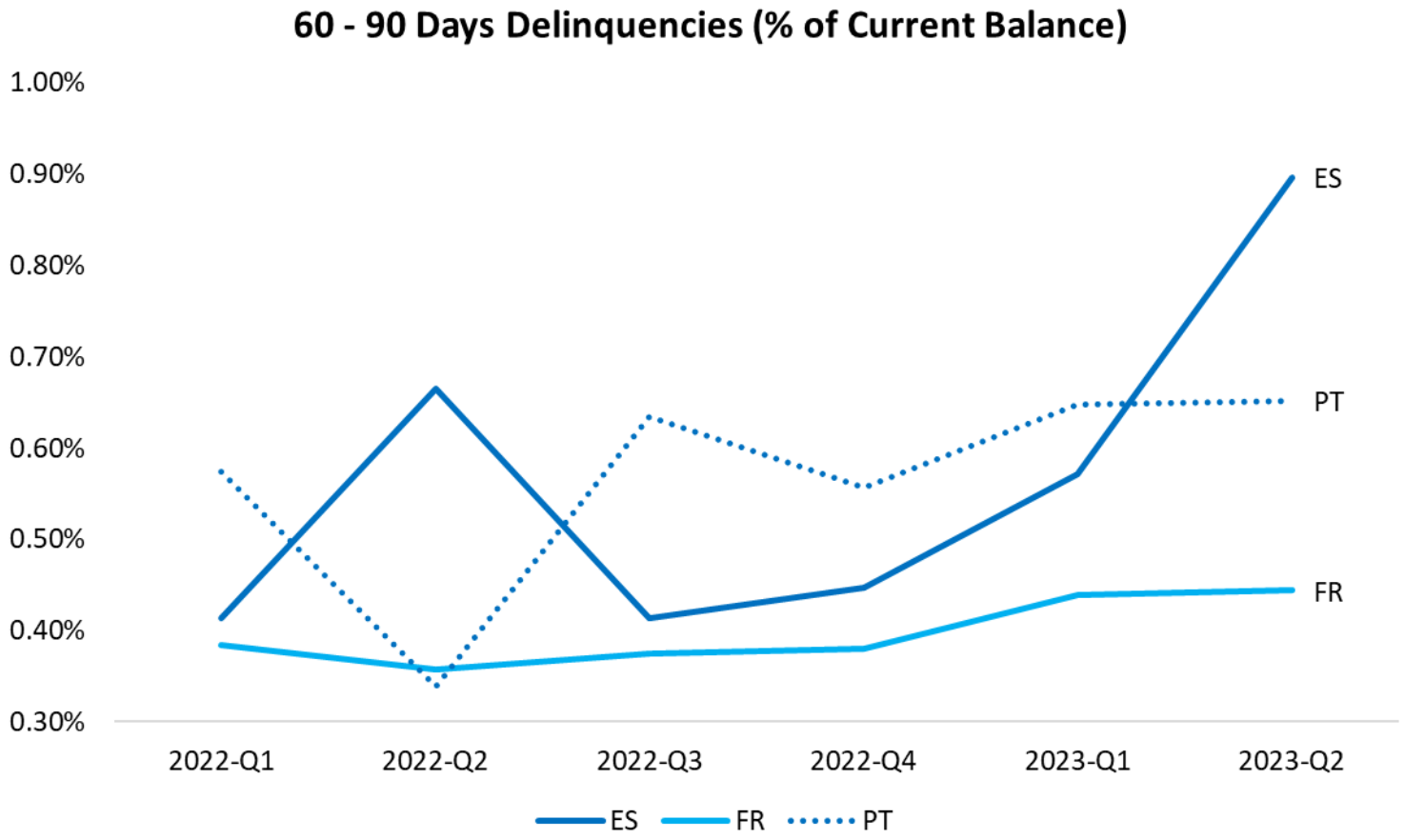
AUTO

Delinquency levels are on the up in most countries



CREDIT CARDS

Delinquency levels are rising a little



can be seen as a first sign for distress!!

Complexity and the default risk of mortgage-backed securities

The Journal of Banking and Finance, Volume 155, October 2023.
View Article

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European DataWarehouse - Q3 Research Update Webinar

Introduction

In this study, we examine the effects of the 2018 European securitisation regulation on mortgage quality and securitisation structures.

- Mortgages issued after the new regulation exhibit improved credit quality, resulting in reduced annual delinquency rates.
- Mortgage securitisations meeting the new 'simplicity, transparency, and standardisation' (STS) criteria show 0.77% lower annual delinquency rates and greater resilience to economic shocks.
- STS securitisations typically have fewer tranches with a smaller allocation to subordinated tranches than their non-STS counterparts.
- The improved quality of underlying loans outweighs potential negative effects of thinner subordinated tranches in compliant securitisations. This is reflected in higher ratings at origination.

The Securitisation Process

The securitisation process was blamed for the detrimental role it played during the 2008 financial crisis (*Shin, 2009*).

- The ABS market was so **complex**, that even rating agencies **failed to accurately portray default risk** before the global financial crisis (*DeHaan, 2017*).
- The increasing **demand for high rated securities**, matched with the possibility to **transfer risk** to outside inventors, led banks to **lax their lending standards** (*Coval, Jurek & Stafford, 2009*).
- Banks active in securitisation tended to **take substantially more risk** than non-securitising ones (*Keys at al., 2009*).
- Banks active in securitisation were **less involved in the ex-post monitoring** of the loans (*Wang & Xia, 2014*).

The Securitisation Process

Placed vs Retained Asset-Backed Securities over the total amount of issued ABSs in Europe.

The new ABS Regulation

Following its announcement in 2017, the new ABS regulation (*Regulation (EU) 2017/2402*) entered into force in 2018, significantly reforming the EU ABS market.

It promotes the harmonisation of the securitisation market through numerous provisions, which can be grouped in:

- General Provisions (Articles 1-17)
- Provisions for Simple, Transparent and Standardised Securitisation (Articles 18-28)

The new ABS Regulation - STS Securitisation

Simple, Transparent & Standardised Securitisation (STS) (Articles 18-28)

- Unlike the general provisions, the STS regime is optional.
- There are now two different classes of EU securitisation: STS and non-STS, differentiated on the basis of whether they meet the STS criteria or not.
- The criteria relate to simplicity, transparency and standardisation of the ABS deals rather than to the quality of the underlying assets involved.

There should be no implication that STS deals are safer, but rather that a prudent and diligent investor will be able to better analyse the risk involved.

The new ABS Regulation - STS Securitisation

The effects of this newly introduced securitisation type on the quality of the securitised loans are uncertain:

- On the one hand, higher simplicity, transparency and standardisation are likely to positively affect assets performance (e.g., *Ertan et al., 2017*).
- On the other hand, STS labels may have distorting effects on banks' behaviour (*McGowan and Nguyen, 2020*). STS labels may create a false sense of security on investors who may be prepared to fund riskier loans without requiring an adequate rate of return.

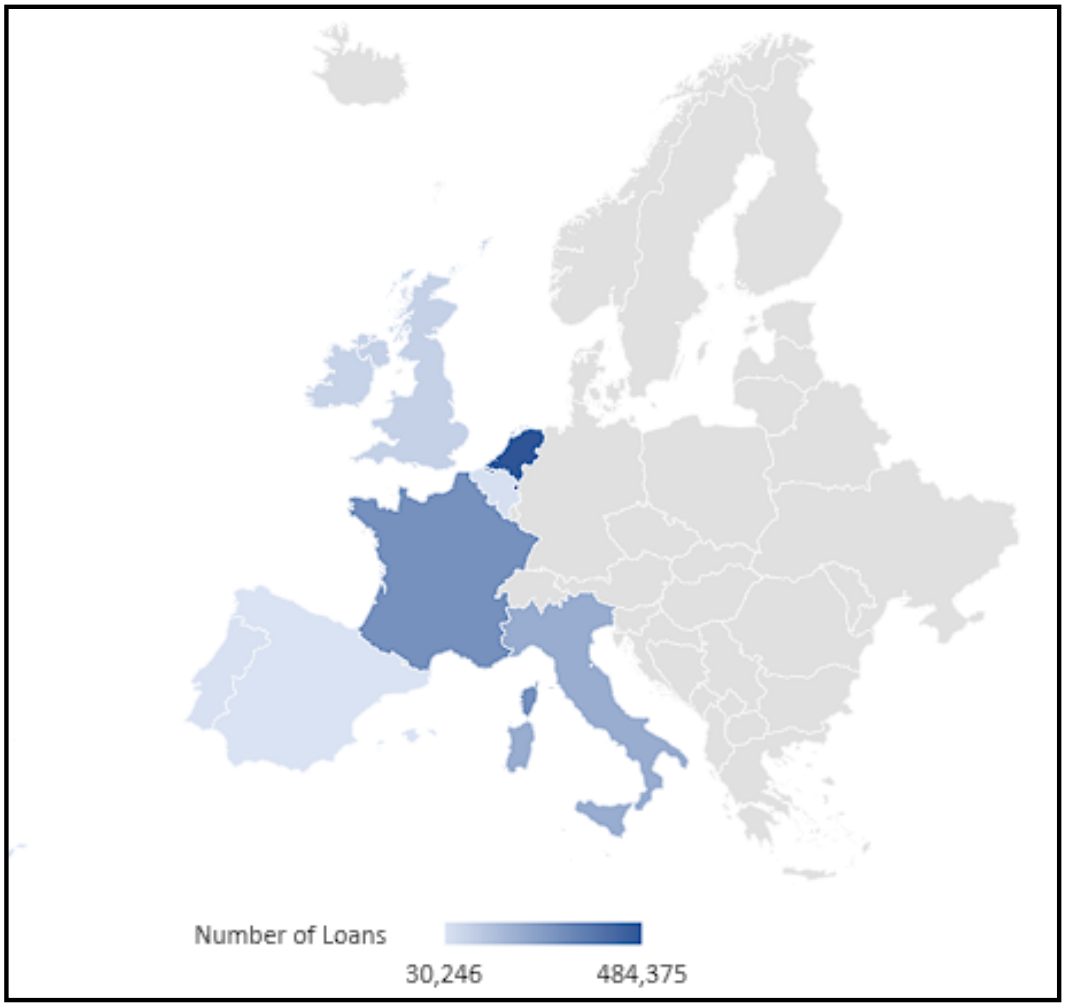
Data and Methodology

We retrieve our data from the **European DataWarehouse**, the designated depository in Europe for collecting and validating loan-level data for asset-backed securities.

- For each loan, more than 150 variables can be reported by the originators, 55 of which are mandatory.
- Our sample consists of 8,961,130 annual observations, reported from 2013 to 2020. These correspond to 3,997,044 loans that have been securitised within Residential Mortgage-Backed Securities (RMBS).
- The EDW also provides information on the tranching composition, which is subsequently linked to tranche-level characteristics sourced from Refinitiv Eikon to access additional data when available. Our final tranche-level dataset includes 782 observations.

Data and Methodology

Focusing on the post-regulation period, the sample includes 1,256,011 loans securitised in RMBS deals from 2018 to 2020.



Around 40% of the loans are securitised in deals defined as STS according to the ESMA STS register.

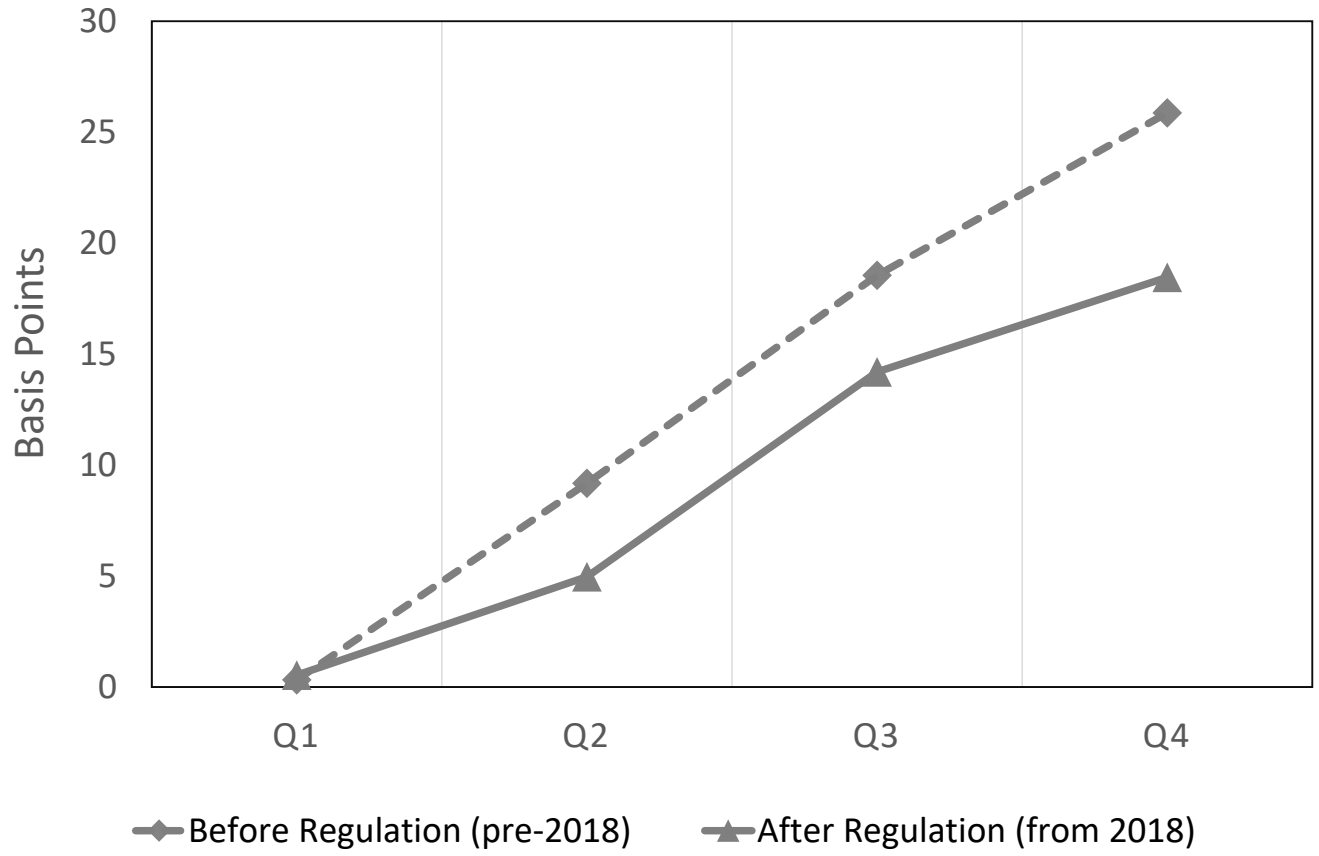
Data and Methodology

- We analyse loan delinquencies through a panel-probit model.
- The variable *Loan Delinquency* takes the value of one each time a loan is in arrears for at least two consecutive quarters.

$$\begin{aligned} \textit{Loan delinquency}_{i,t} = \alpha &+ \beta_1 \textbf{Origin. from 2018}_i + \beta_2 \textit{Int. Rate}_i + \beta_3 \textit{Years to Mat.}_{i,t} \\ &+ \gamma \textit{Loan characteristics}_i + \delta \textit{Borrower's characteristics}_i \\ &+ \theta \textit{Macro-variables}_{i,t-1} + \textit{ABS deal FE} + \textit{Year FE} + \varepsilon_{i,t} \end{aligned}$$

$$\begin{aligned} \textit{Loan delinquency}_{i,t} = \alpha &+ \beta_1 \textbf{STS Securitisation}_i + \beta_2 \textit{Int. Rate}_i + \beta_3 \textit{Years to Mat.}_{i,t} \\ &+ \gamma \textit{Loan characteristics}_i + \delta \textit{Borrower's characteristics}_i \\ &+ \theta \textit{Macro-variables}_{i,t-1} + \textit{ABS deal FE} + \textit{Year FE} + \varepsilon_{i,t} \end{aligned}$$

Cumulative delinquency rates of residential mortgages, before the COVID-19 pandemic.

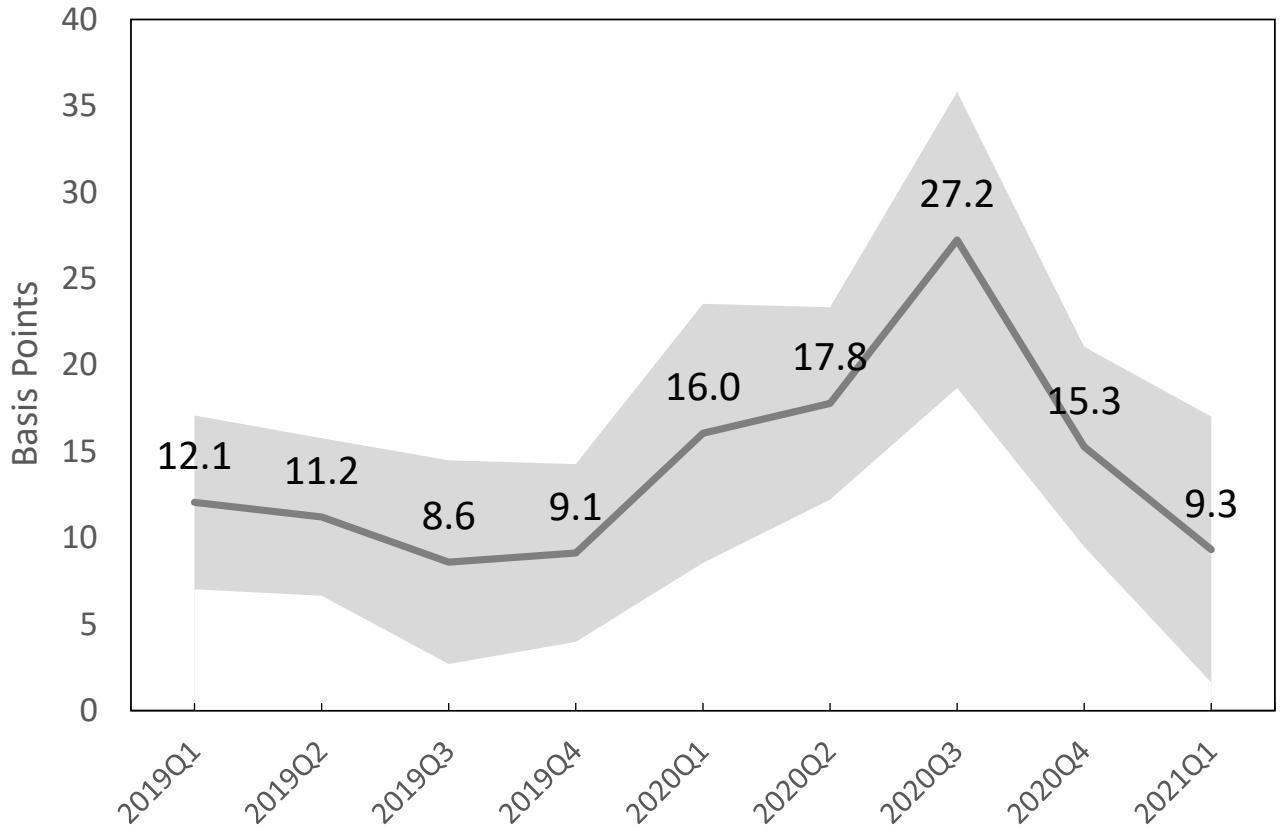


Our model also confirms that loans originated from 2018 show an average lower annual PD of 33.6 bp after controlling for loan/borrower characteristics and macroeconomic variables.

The effects of the COVID-19 pandemic

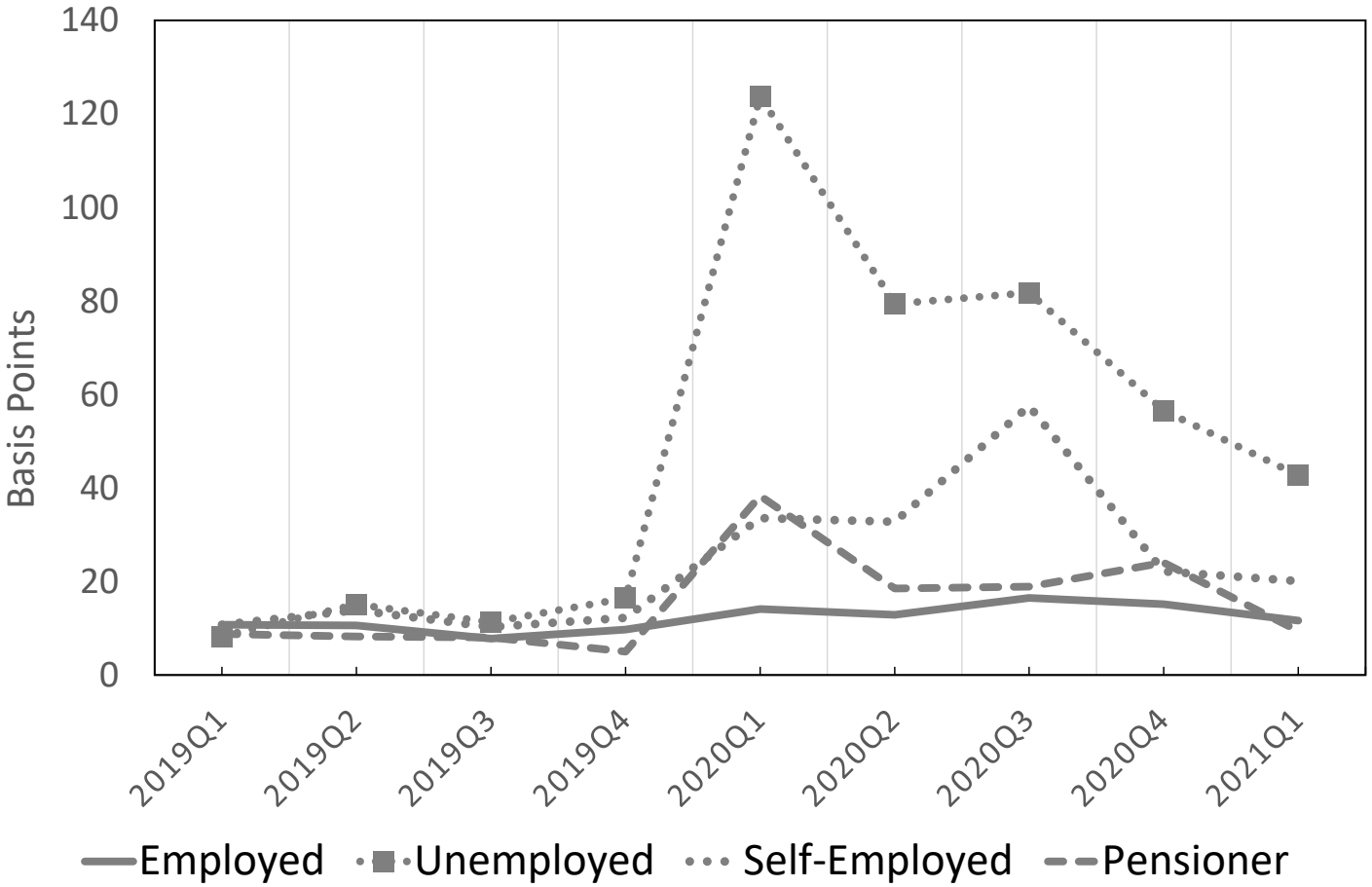
The COVID-19 pandemic provides a unique opportunity to analyse the difference in performance between loans securitised in STS deals and non-STS deals during adverse economic conditions.

Fixed effect marginal coefficients of the probit regression model and their 95% confidence intervals.

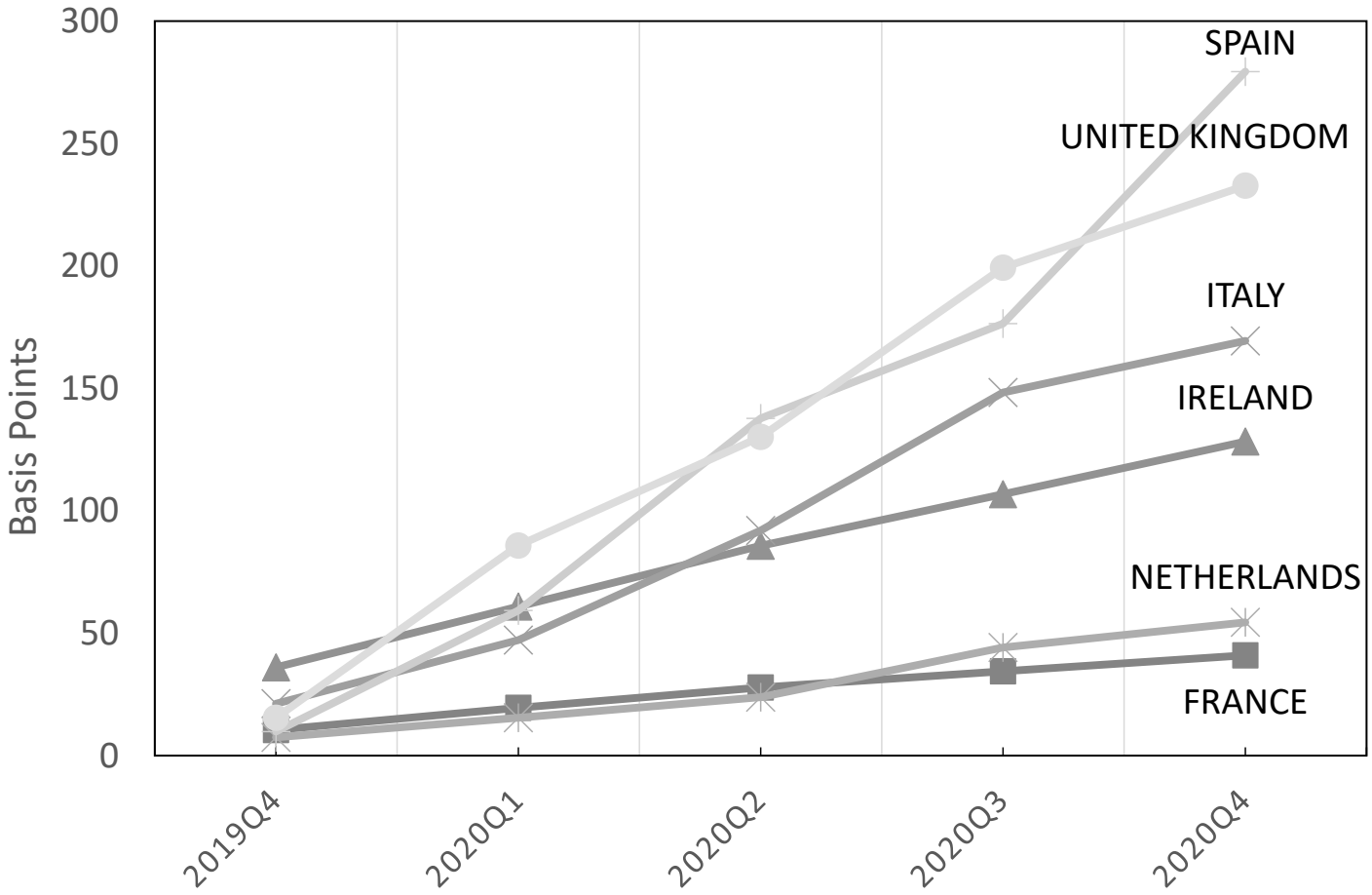


The effects of the COVID-19 pandemic

Quarterly delinquency rate by employment status.

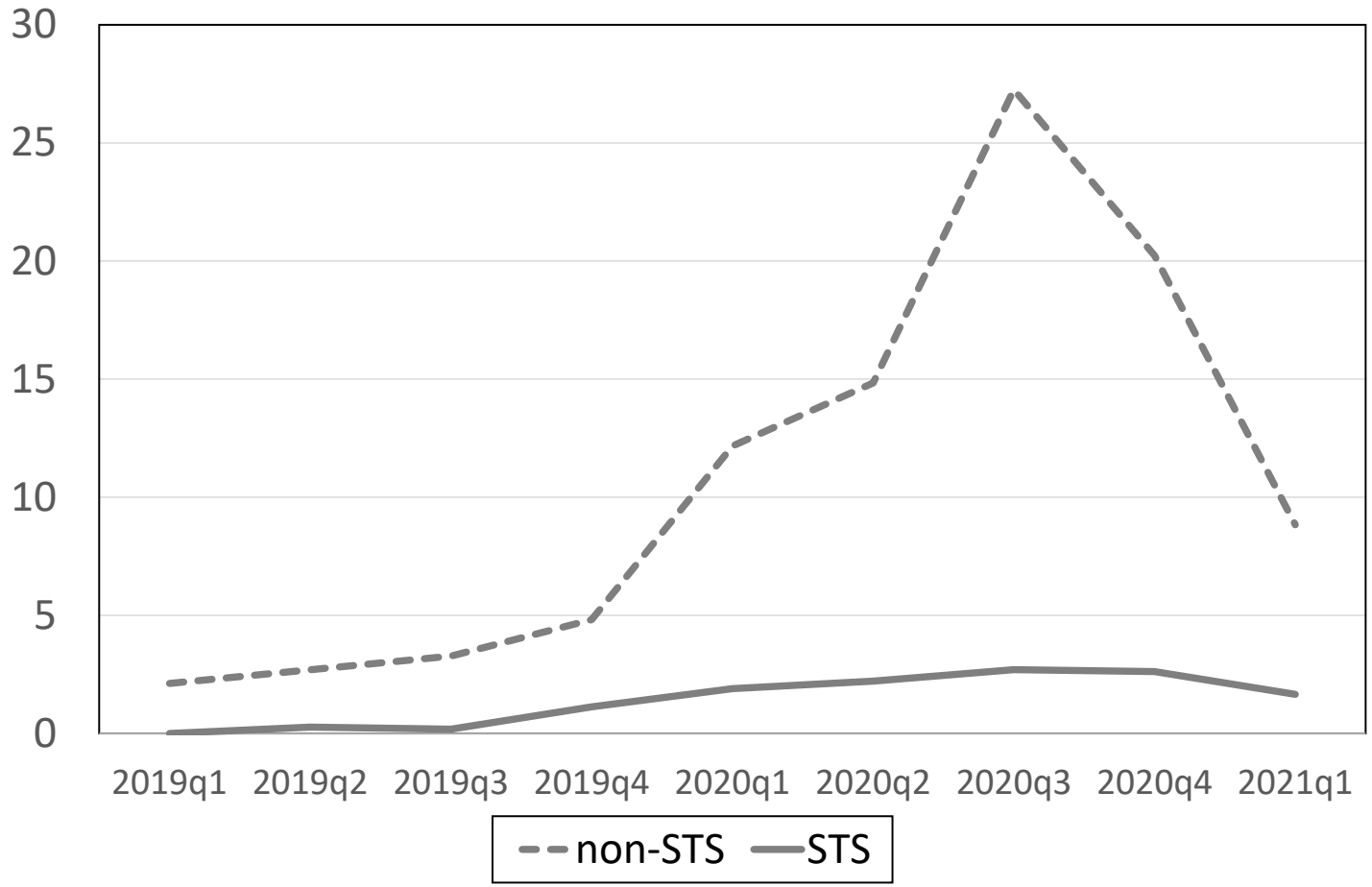


Cumulative delinquency rate by country of origination relative to the total number of active loans in 2019q4.



Simple, Transparent and Standardised securitisation

Quarterly delinquency rate for STS and non-STS securitisation.



The effect of the STS regulation on mortgage delinquency rates.

Dependent Variable: Loan delinquency		
Variable	**Basis Points (bp)**	
	2018 to 2019	2018 to 2020
STS Securitisation	-43.43***	-79.67***
	(9.66)	(20.31)
Loan characteristics	yes	yes
Borrower characteristics	yes	yes
Macro-Variables	yes	yes
Country fixed effects	yes	yes
Time Fixed Effects	yes	yes
Observations	1,024,924	2,147,141
Pseudo R-squared	0.065	0.107

The effect of the STS regulation on mortgage delinquency during the pandemic.

Dependent Variable: Loan Delinquency		
Variables	**Marginal Effect (bp)**	
	(1)	(2)
STS Securitisation	-74.35***	-25.37***
	(20.92)	(8.37)
Pandemic Period	46.00***	44.99***
	(13.20)	(12.74)
*STS Securitisation * Pandemic Period*		**-84.60*** **
		(22.64)
Loan characteristics	yes	yes
Borrower characteristics	yes	yes
Macro-Variables	yes	yes
Country fixed effects	yes	yes
Observations	2,147,141	2,147,141
Pseudo R-squared	0.099	0.102

Simple, Transparent and Standardised securitisation

We now focus on our tranche-level dataset to investigate the effects of the STS regulation on the securitisation structure of residential mortgage-backed securitisations.

	Non-STS	**STS**		
Variable description	**Mean (1)**	**Mean (2)**	**Difference (2) – (1)**	**p-value**
number of tranches	5.07	3.82	-1.25	0.011**
senior tranches (%)	86.7	90.4	3.7	0.021**
mezzanine tranches (%)	1.1	1.5	0.4	0.461
subordinated tranches (%)	12	8.1	-3.9	0.027**
- of which retained tranches (%)	5.3	4.7	-0.6	0.595
average tranche rating* per securitisation	25.6	26.5	0.84	0.002***

* This is the variable *Rating equivalent* from Eikon, which ranges from 1 to 27, with 27 corresponding to AAA.

Simple, Transparent and Standardised securitisation

- The default risk can more easily affect senior tranche holders, given the thinner subordinated tranches and fewer tranches available to absorb losses.
- We perform a stress-testing exercise to evaluate the expected losses for RMBS originators and tranche holders under various scenarios.
- The default rate for each scenario is derived from the distribution of loan default rates within our sample of securitisations.

LGD=100%			**Exp. loss to investors**			**Exp. loss to originator**
			Tranches			
Parameter	**Securitisation**	**Def. Rate %**	**Senior**	**Mezz.**	**Subordinated**	**Retained**
Average	Non-STS	1.49%	0.0%	0.0%	0.0%	28.1%
	STS	0.29%	0.0%	0.0%	0.0%	6.2%
90% qnt	Non-STS	3.94%	0.0%	0.0%	0.0%	74.2%
	STS	0.65%	0.0%	0.0%	0.0%	13.8%
95% qnt	Non-STS	5.42%	0.0%	0.0%	1.7%	100.0%
	STS	0.79%	0.0%	0.0%	0.0%	16.9%
99% qnt	Non-STS	17.45%	5.0%	100.0%	100.0%	100.0%
	STS	1.14%	0.0%	0.0%	0.0%	24.2%

Simple, Transparent and Standardised securitisation

- To supplement our findings, we utilise a simple ordinal logistic model to estimate the likelihood of tranches being rated AAA – A3, BAA1 – BAA3, or BA1 – C (i.e., speculative).

	Marginal Effect		
Rating band	*AAA - A3*	*BAA1 - BAA3*	*BA1 - C (speculative)*
STS	0.038**	-0.012**	-0.026**
	(0.016)	(0.006)	(0.013)
Obs.		163	
Pseudo-R^2		0.075	

Conclusions

In this study, we explore the role of lower ABS deal complexity during periods of macro-economic uncertainty. To do so, we analyse the effects of the new European ABS regulation, which entered into force in 2018

- Our study demonstrates that the general provisions of the regulation have led to an improvement in mortgage quality and a reduction in mortgages with "risky characteristics".
- Our findings indicate that less complex ABS deals outperformed their non-STS counterparts during the Covid-19 pandemic.
- Our research provides evidence that the enhanced loan quality in STS deals outweighs the potential effects on securitisation structure, resulting in significantly higher tranche ratings at origination.

Thank you

Samuele Segato
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Appendix - Robustness checks

- Main results with quarterly data.
- STS results on a sample of originators issuing both STS and non-STS securitisations.
- Sample restriction to the first two years after loan origination.
- Sample restriction to the first two observations per loan.
- Exclusion of loans securitised from 2017.
- Exclusion of loans originated before 2010.
- Exclusion of loans originated before 2013.
- Inclusion of country-specific lagged GDP.
- Inclusion of lagged 3-month Euribor index.
- Inclusion of measure of country-specific government intervention during Covid pandemic (ESI Index).
- Inclusion of lagged standard deviation of 3-month Euribor index.

Asymmetric information in loan contracts: New evidence from Italian big data

Francesco Benvenuti

Department of Economics and Business Economics and CREATES
Aarhus University

Joint work with: Monica Billio, Michele Costola, Marco LiCalzi
(Ca' Foscari University)

European DataWarehouse Research Webinar

26 September 2023

The Problem

- Consider the Loan to Value (LTV) of a loan:

$$\text{LTV} = \frac{\text{Loan Amount}}{\text{Collateral Value}}.$$

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Research question

Is a higher LTV associated to a higher interest rate in loan contracts?

- The answer to this question is not straightforward.
- It is an open problem in the economic literature, because asymmetric information influences this relation and can alter the intuitive reasoning.
- Indeed, this problem is related to the asymmetries which characterize a contract (asymmetric information).
- For instance, the bank is not informed on some features of the borrower.

Loan to Value and interest rate

- In the plot below, there is not a clear trend between the Original LTV and the interest rate margin.

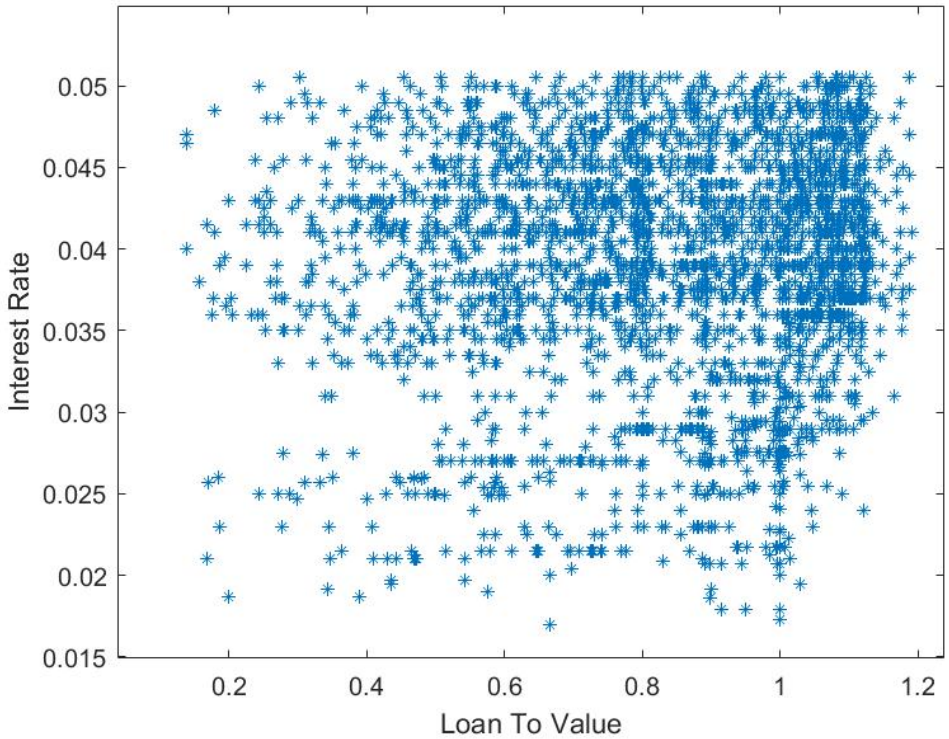

Figure 1: Cartesian plot of the Original LTV (x-axis) and interest rate margin (y-axis), from Italian loan data available on European DataWarehouse.

Agenda

- Literature review.
- We propose a simple model to consider:
  1. Perfect information.
  2. Moral hazard.
  3. Adverse selection.
- Econometric analysis of loan contracts (data from the European DataWarehouse).
- Conclusions.

Agenda

Loan contracts and collateral

We want a deeper understanding of:

- What happens to the interest rate margin of loan contracts when collateral of a higher value is required?
- How this link is influenced by information asymmetries, which are characteristics of loan contracts.
- What are the conclusions of the theoretical and the empirical literature on this topic?
- Can a simple model provide any insights on this topic? What do real data tell us?

Literature review: Contrasting conclusions

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- For instance: The presence of transaction and liquidation costs; a different expected return of the borrower's investment; a different evaluation of the collateral.

A major reference

- A seminal work is *Stiglitz, J. E. and Weiss, A. (1981)* where borrowers with higher wealth and who can provide more collateral, are also prone to invest in high risk projects, decreasing the advantage of banks. Collateral can lower the bank's return.

Our contribution

- We adapt the well-known principal-agent model to the specific case of loan contracts.
- In this model the agent acts in place of the principal. Are the interests of the agent the same as the principal?
- In other words, the principal (the bank) is affected by the actions of the agent (the borrower).

Our contribution

- We adapt the well-known principal-agent model to the specific case of loan contracts.
- In this model the agent acts in place of the principal. Are the interests of the agent the same as the principal?
- In other words, the principal (the bank) is affected by the actions of the agent (the borrower).
- We do not provide an unambiguous relation between collateral and interest rates of loan contracts.
- We focus on some general features of contracts.

Results

- A summary of our results is given by the following diagram.
- Compared to the well known prisoner's dilemma, the states are not the same for all "players".

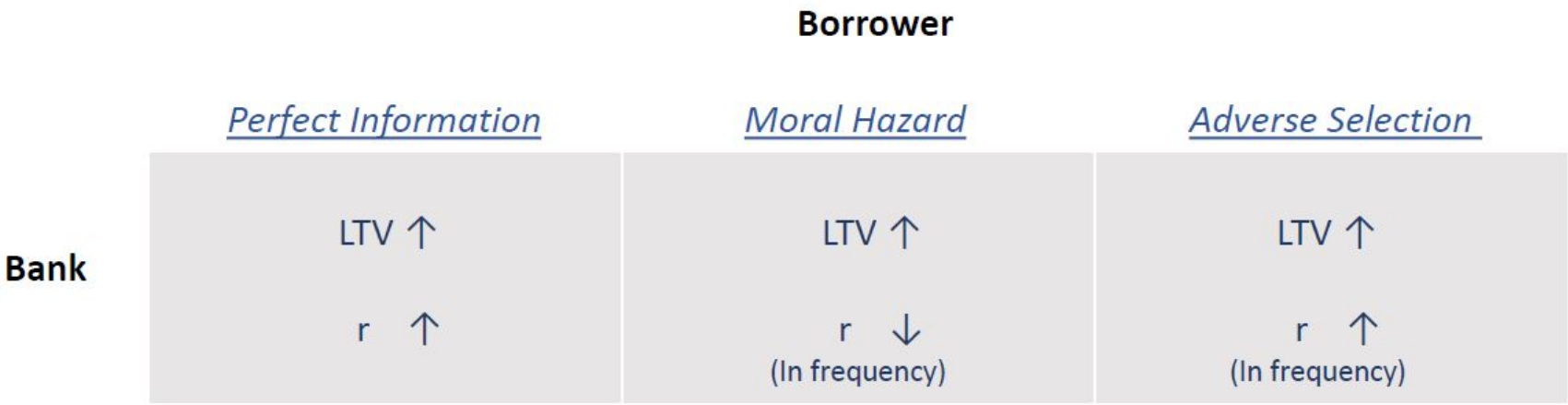

Figure 2: The different links between the LTV and the interest rate (r), depending on the scenario considered.

A result based on the risk-return trade off

- In the paper we show that, in our model, under symmetric information a higher collateral C corresponds to a lower interest i.

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Intuition

The risk of a borrower does not change when C increases.

A result based on the risk-return trade off

- In the paper we show that, in our model, under symmetric information a higher collateral C corresponds to a lower interest i.

Intuition

The risk of a borrower does not change when C increases.
Given a fixed expected maximum return without collateral, the same value can be obtained applying lower interest rates if collateral is provided by borrowers.
Since a higher C increases the expected return, i must decrease.

Asymmetric information

Asymmetric information

Moral hazard

- Now the agent actively chooses the effort e, associated with the investment of the borrowed money, which cannot be controlled directly by the bank.
- In this scenario a collateral requirement can be used by the bank to force the borrower to increase e.
- Under moral hazard, a higher collateral requirement can be associated with a higher interest (it is a "penalization").

Asymmetric information

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Adverse selection

- Two types of borrowers: Good (less likely to default) and Bad.
- The bank does not know who are the good borrowers: collateral can act as a signal.
- Interest can be lower with higher collateral.

Empirical analysis

Dataset from the European DataWarehouse

- The data set analyzed is very peculiar compared with the previous literature on the subject.
- The data are provided by **European DataWarehouse**.
- It is a huge collection of microeconomic data for millions of Italian loan contracts, collected for each single borrower associated with a residential mortgage-backed security.
- In particular the dimension of the available data is $1,147,311$ prior to cleaning.

Variables

Variables available for each loan contract

- We include both quantitative and qualitative variables.

Variables

Variables available for each loan contract

- We include both quantitative and qualitative variables.
- Quantitative variables: Interest rate margin, Original LTV, Original balance, Loan term, Borrower's income.
- Qualitative variables: nine variables related to the borrower and to the loan type, such as employment status or interest rate type.
- We remove outliers and missed values.

Histogram of the Loan to Value

- Histogram of the Original LTV ratio. The median is around 0.8; a lower proportion of loans have a LTV ratio higher than 1, i.e. the amount of loan is higher than the appraised property value.

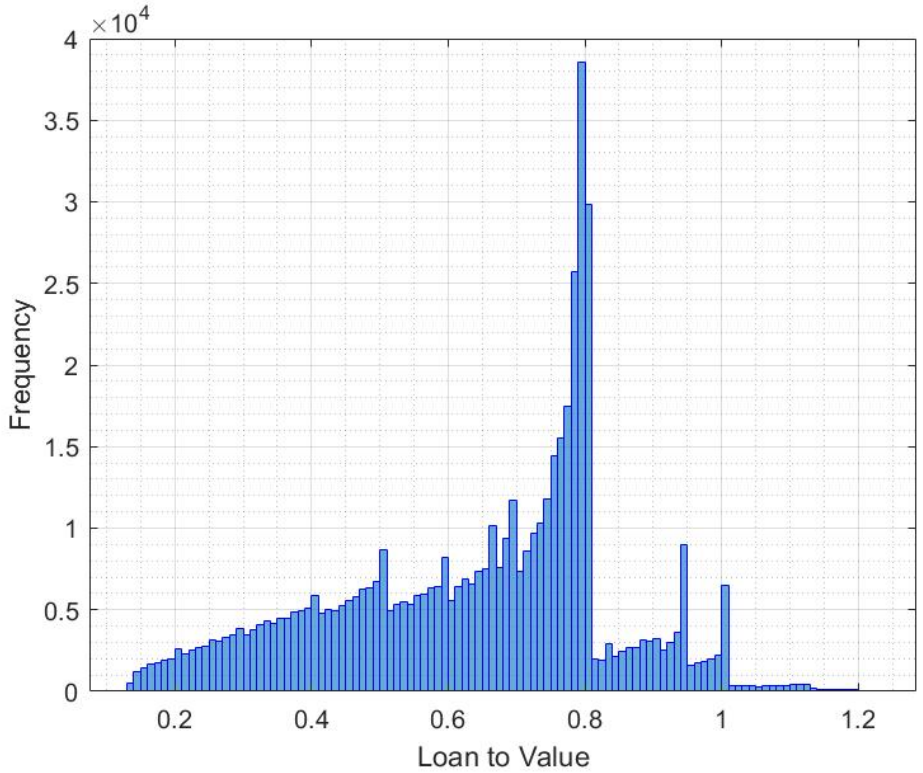

Figure 3: Histogram of the original LTV ratio.

Cluster analysis

Groups of data

- The relation between interest rate margin and collateral can be examined by looking at the cluster analysis of the original loan to value - interest rate margin variables.
- The K-means clustering partitions the data set into K disjoint sets of related data.
- The 'relation' is quantified by the distance from the cluster center.

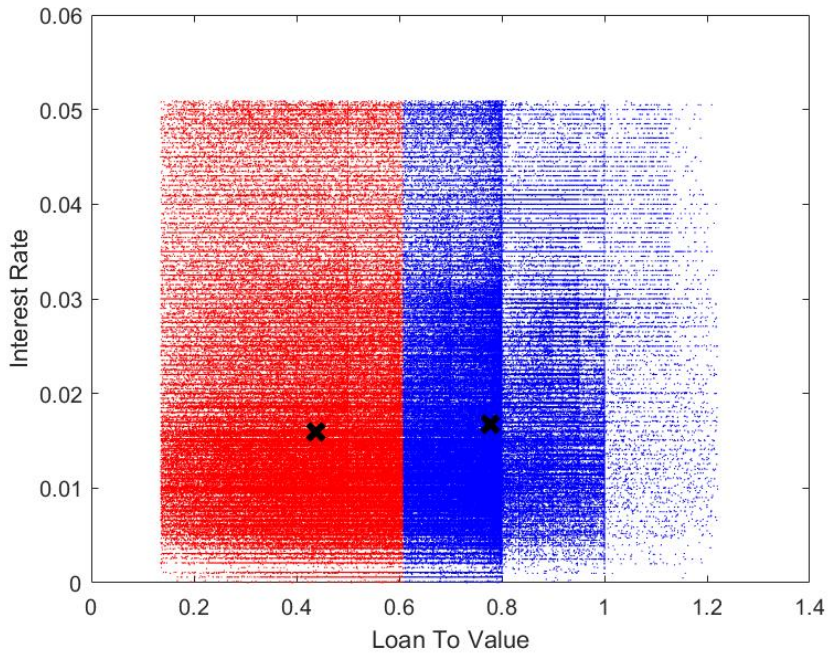

Figure 4: Cluster analysis with 2 centroids.

Cluster analysis

Groups of data

- A similar finding holds increasing the number of centroids.
- It would be interesting to study what happens with 10 centroids (future research).

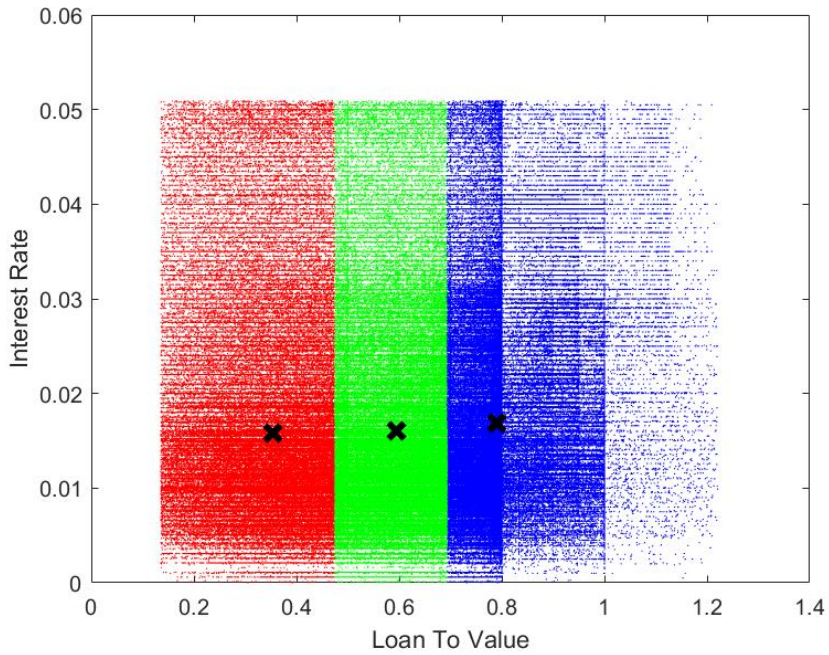

Figure 5: Cluster analysis with 3 centroids.

Biplot

Geometrical interpretation of the first two principal components

- We apply the PCA to data.
- The first two principal axes are both positive for the primary income and the original balance, while the loan term and the Original LTV have a negative second component.
- This supports the conjecture of a (slightly) positive link between the amount granted and the collateral required.

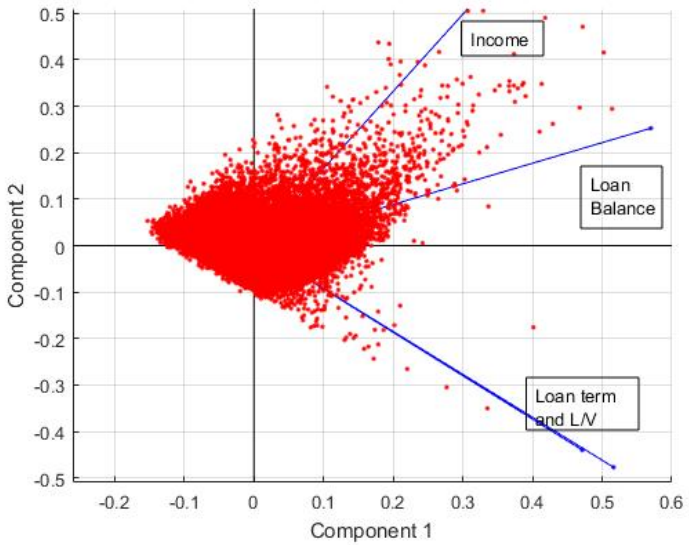

Figure 6: Biplot.

Supervised analysis

- We use a classical linear regression model, where we include both the quantitative and the categorical variables.

Regression for the interest rates

$$interest\ rate_{i,t} = c + \boldsymbol{\beta} \cdot Borrower\ Controls_i + \boldsymbol{\gamma} \cdot Loan\ Controls_i + \varepsilon_{i,t},$$

- We also include the 3 months EURIBOR which is considered a reference for the offered interest rate in the European Interbank market.
- We run different specifications, depending on the availability of the data. For instance, the first specification (above 70% of observations available) involves $433,786$ observations.

Results

Table 1: Results of the regression analysis.

Interest rate	(1)	(2)	(3)
Loan to value ratio	0.00003***	-0.00002***	-0.00003***
	[0.00000]	[0.00000]	[0.00001]
Original balance	-0.00381***	-0.00300***	-0.00009
	[0.00004]	[0.00012]	[0.00021]
Loan term	0.00000***	-0.00000**	0.00001***
	[0.00000]	[0.00000]	[0.00000]
Borrower's income	0.00030***	0.00090***	-0.00066***
	[0.00003]	[0.00010]	[0.00015]
Debt to income		-0.00000***	0.00006
		[0.00000]	[0.00004]
EURIBOR 3M	0.00086***	0.00264***	0.00143***
	[0.00007]	[0.00017]	[0.00027]

Results

Table 2: Results of the regression analysis.

Borrower type FE	Yes	Yes	Yes
Employment status FE	Yes	Yes	Yes
Resident	No	Yes	Yes
Repayment method FE	Yes	Yes	Yes
Payment frequency FE	Yes	Yes	Yes
Payment type FE	Yes	Yes	Yes
Interest rate type FE	Yes	Yes	Yes
Lien	No	No	Yes
Property type FE	Yes	Yes	Yes
Origination year FE	Yes	Yes	Yes
SE	Rob.	Rob.	Rob.
Observations	433,786	55,883	7,949
R-squared	0.51021	0.54609	0.81818

Conclusions

Summary and future research plan

- We have studied the open problem regarding the effect of collateral on interest rates of loan contracts, which is strictly connected to the theory of asymmetric information.
- The link collateral-interest rate in loan contracts is ambiguous, and it cannot be decided a priori.
- It is one of the few works in the literature on this topic which analyzes such a large amount of specific microeconomic data.
- The game theory discussion embeds past and more detailed models; we obtained the same conclusions based on few intuitive principles.
- We leave to future research the extension of this research to a multi-country level or regional level (heterogeneity across Italy).

SAVE THE DATE:
8TH NOVEMBER

(WEDNESDAY FROM 1 PM TO 6 PM)

GREEN AUTO SECURITIZATION WORKSHOP

IN FRANKFURT @ GOETHE UNIVERSITY

SEPTEMBER 2023


Q&A

THANK YOU//CONTACT US

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