10 YEARS EUROPEAN DATAWAREHOUSE

EUROPEAN DATAWAREHOUSE

SUMMER RESEARCH UPDATE

12 SEPTEMBER 2022

ON TODAY'S CALL

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AGENDA

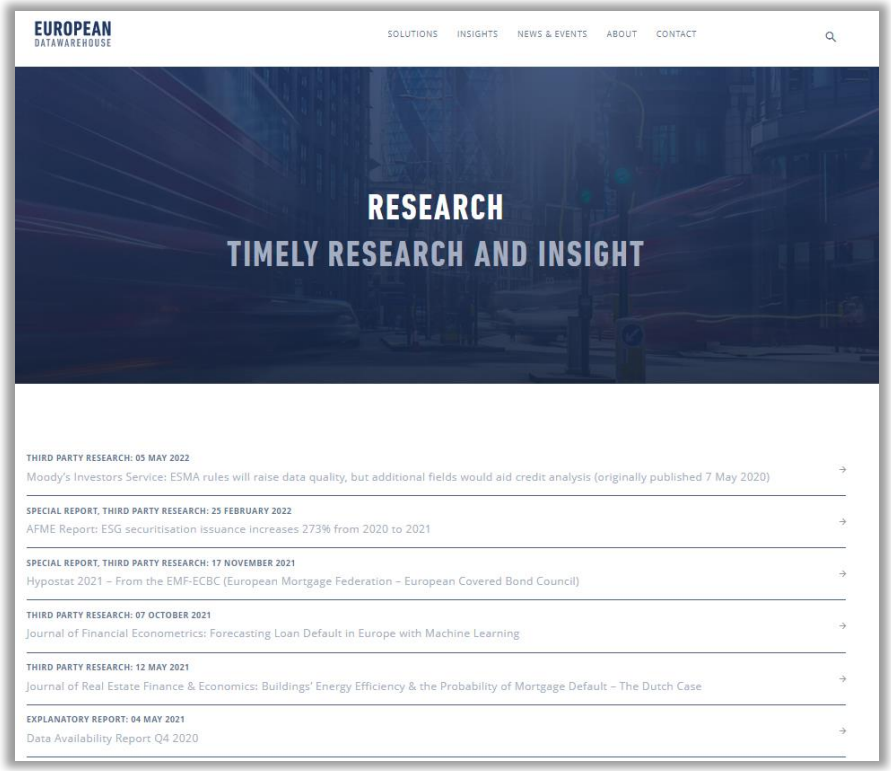
- INTRODUCTION
- PUBLICATIONS & RESOURCES
- EUROPEAN BENCHMARKING EXERCISE
- ADJUSTED DATABASE AND CALCULATED FIELDS
- LOAN PERFORMANCE VS ENERGY PERFORMANCE
- PERFORMANCE TRENDS
- CREDIT FIRE SALES: CAPTIVE LENDING AS LIQUIDITY IN DISTRESS - SERGIO MAYORDOMO (BANCO DE ESPAÑA)
- Q & A

PUBLICATIONS & RESOURCES

LUDOVIC THEBAULT, EUROPEAN DATAWAREHOUSE

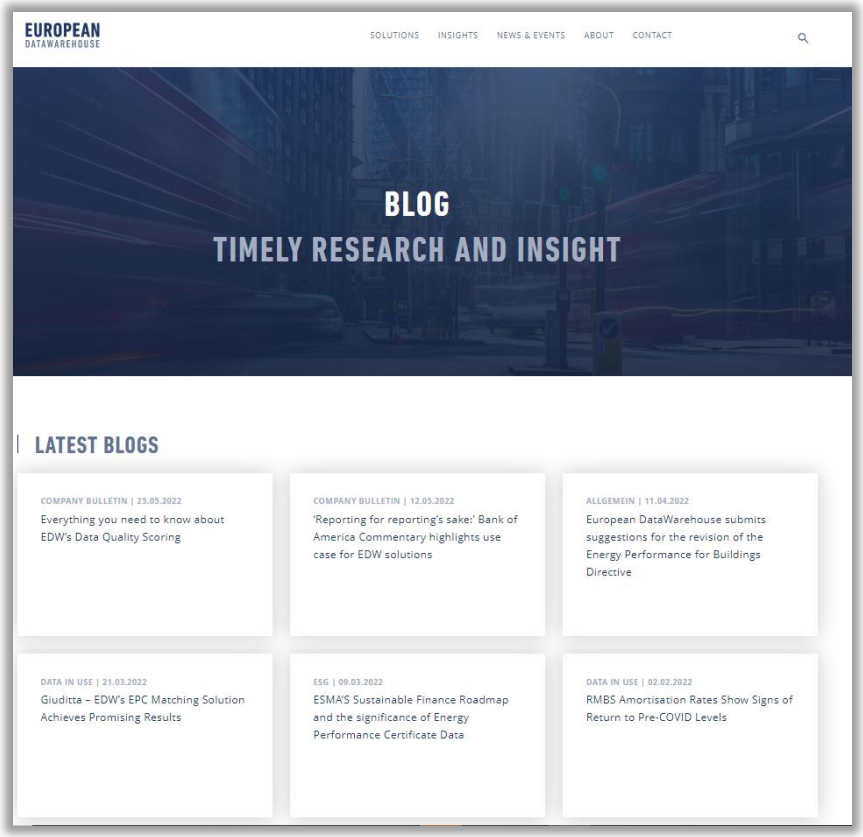
EDW RESEARCH ONLINE

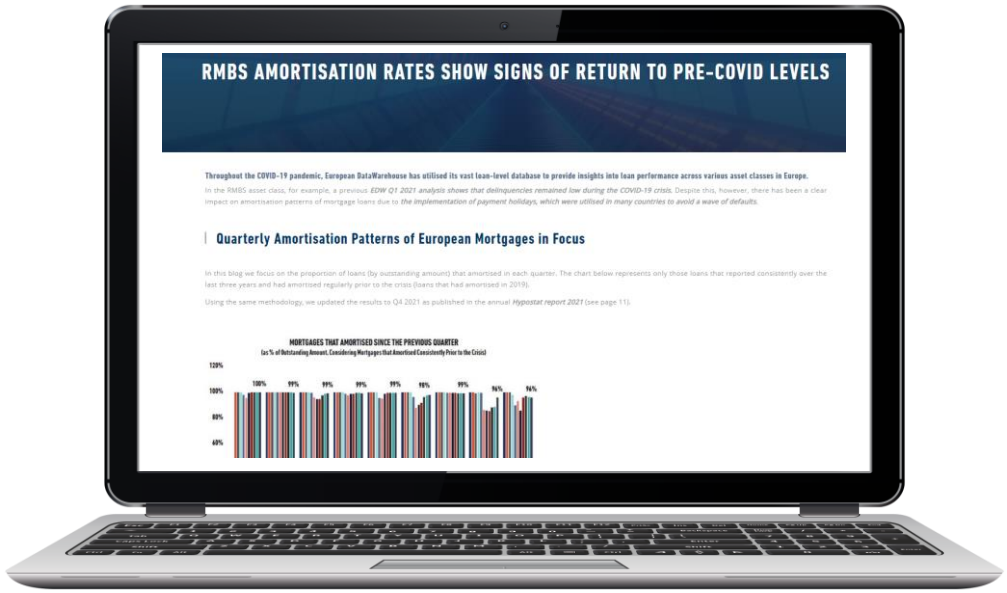
Publications, plus third party research: https://eurodw.eu/knowledge/research/



BLOG ARTICLES

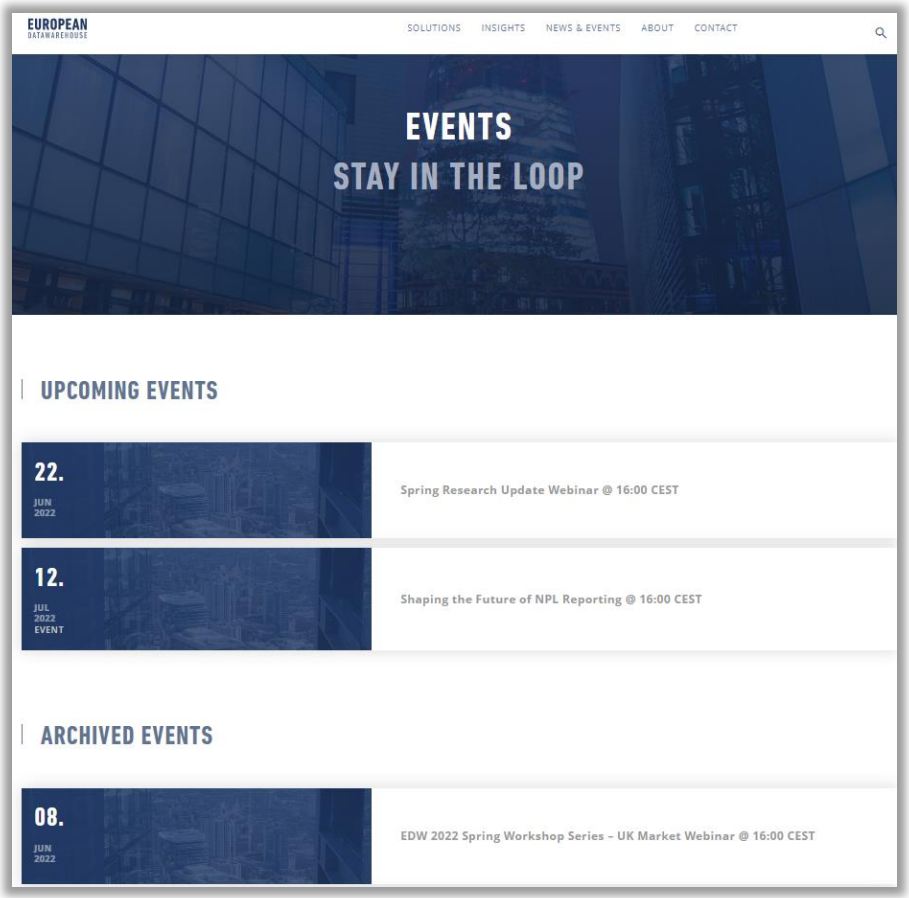
Concise, up-to-date articles & summaries: https://eurodw.eu/knowledge/magazine/

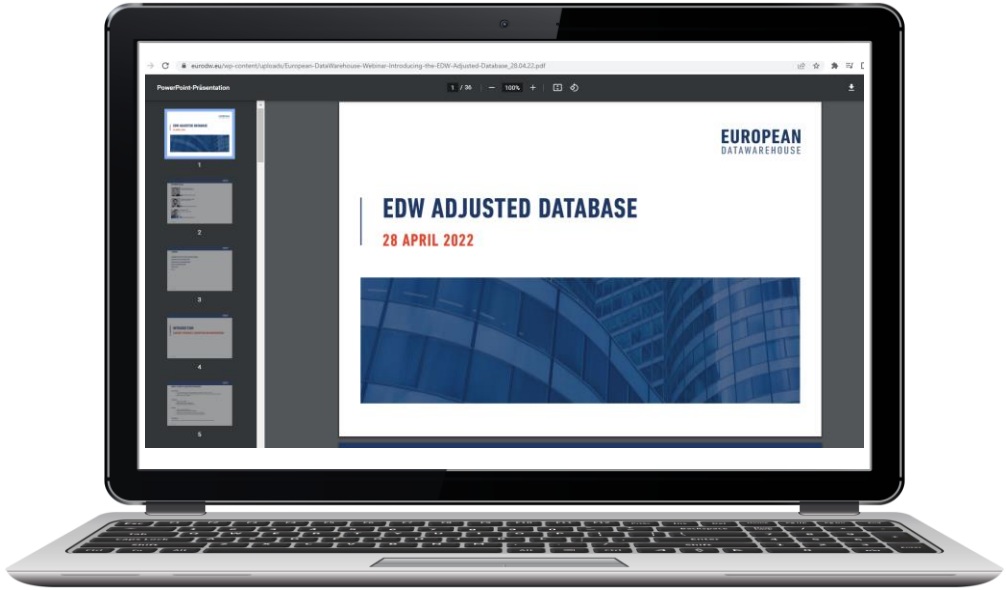




WEBINARS

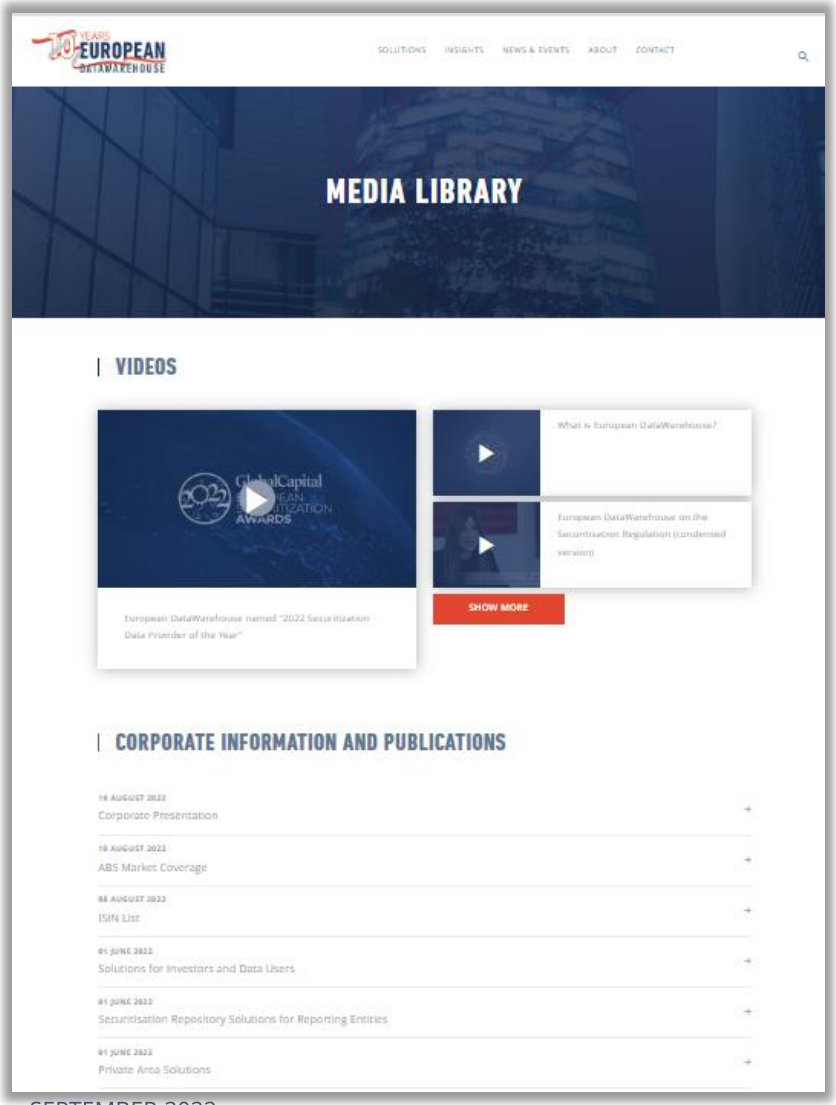
Archive of slides and recordings: https://eurodw.eu/news-events-and-multimedia/events/

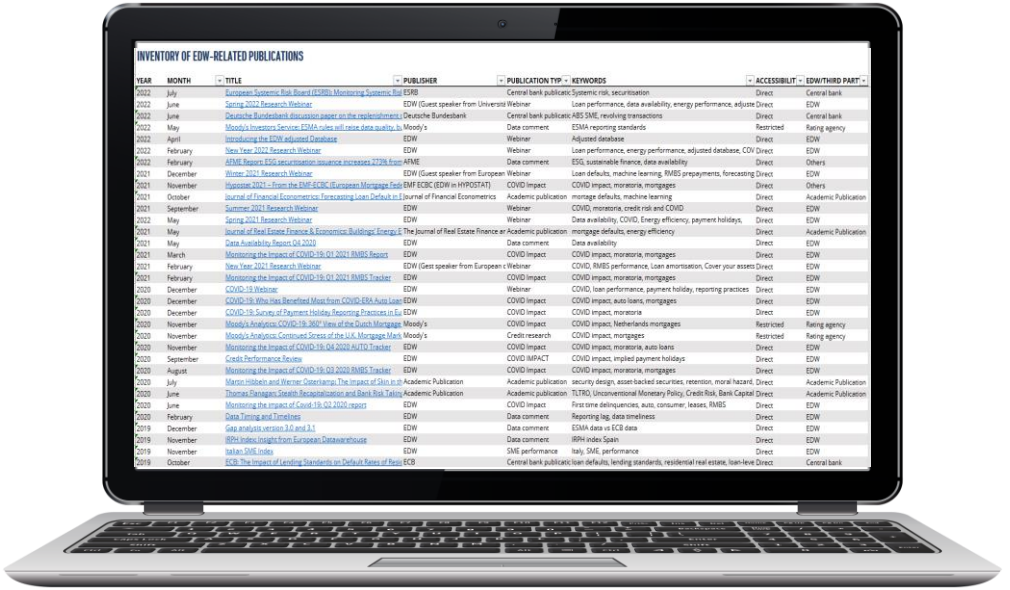




LIST OF PUBLICATIONS

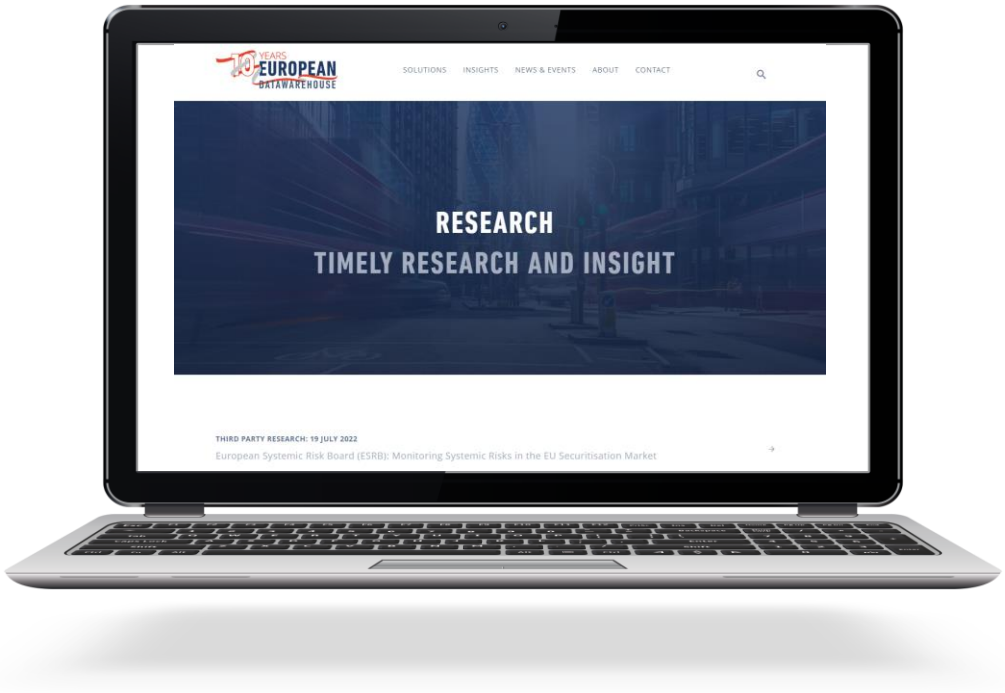
List of all publications and research available on website with links: https://eurodw.eu/about-us/media-library/





ESRB REPORT

Recently added: ESRB's 'Monitoring Systemic Risk in the EU Securitisation Market' report



EUROPEAN BENCHMARKING EXERCISE

(PRIVATE SECURITISATIONS REPORT)

LUDOVIC THEBAULT, EUROPEAN DATAWAREHOUSE

afme/ Finance for Europe

EUROPEAN DATAWAREHOUSE

TRUE SALE INTERNATIONAL

EUROPEAN BENCHMARKING EXERCISE

Last year, EDW co-authored a report on private securitisations with AFME and TSI

- EDW collects loan-level data for private securitisations but…
- No loan-level data was used for the private securitisation report
- Instead, EBE participating entities provided us with aggregated data which we used to make the tables shown in the report

Table 2 - Underlying Exposure Distribution by Asset Type

Asset Type	Asset Amount	Amount %
Trade Receivables	88.097	51%
Auto Loan or Leasing	46.711	27%
Equipment Leasing	6.359	4%
Other	31.849	18%
Total	**173.016**	**100%**

Table 3- Underlying Exposure Breakdown by Seller Country

Seller Country	Asset Amount	Amount %
Germany	41.355	24%
Great Britain	31.165	18%
France	21.926	13%
Italy	15.019	9%
else-EU27	14.855	9%
else-non EU27	33.327	19%
No data	15.369	9%
Total	**173.016**	**100%**

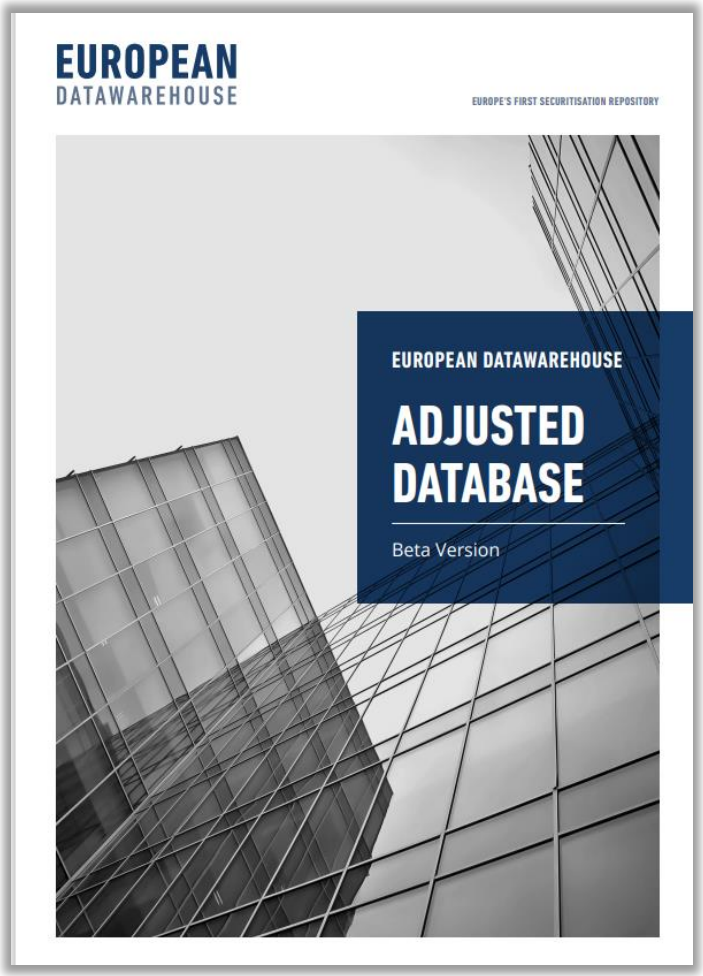
Source: European Benchmarking Exercise

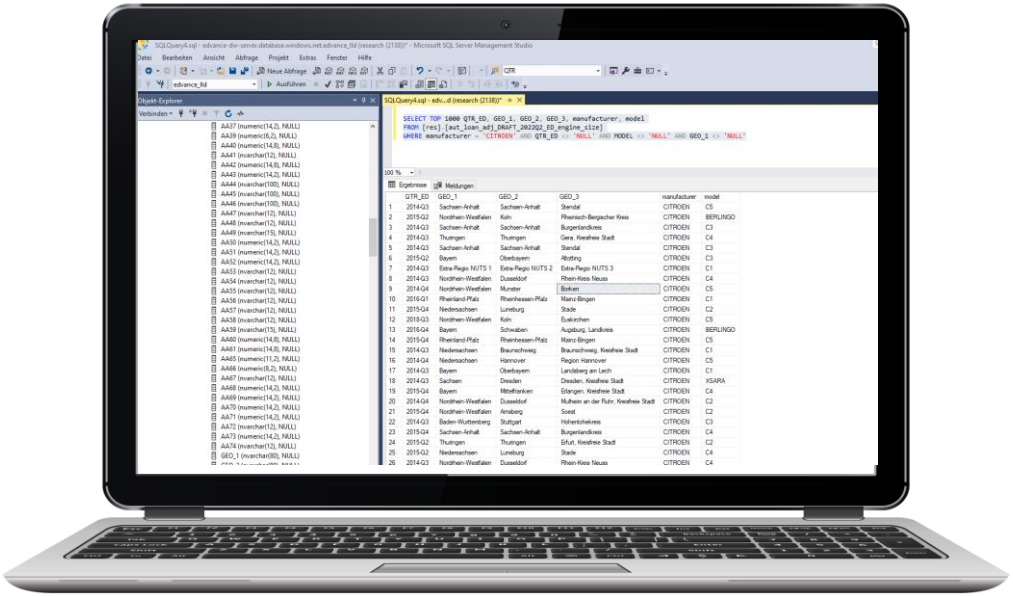
ADJUSTED DATABASE (ECB DATA ONLY)

LUDOVIC THEBAULT, EUROPEAN DATAWAREHOUSE

ADJUSTED DATABASE REPORT

Available soon online, or email enquiries@eurodw.eu to request a copy





CALCULATED FIELDS

EDW calculated fields are added to the adjusted database

- They are calculated from the existing information
- They do not replace the existing information
- They make query design and execution easier and faster
- They will make integration of ECB and the ESMA data easier
- More are under way…

	Auto	Consumer	Credit Cards	Leasings	RMBS	SME
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_ED	yes	yes	yes	yes	yes	yes
COUNTRY_ED	yes	yes	yes	yes	yes	yes
Manufacturer	yes	-	-	-	-	-
Model	yes	-	-	-	-	-
Fuel_Type	WIP	-	-	-	-	-
Engine_size	WIP	-	-	-	-	-

CALCULATED FIELDS

The following fields have been added:

- **COUNTRY_ED**
  - Is simply calculated from the EDCODE country indicator
  - Makes some queries simpler

- **Geographic names: GEO_1, GEO_2, GEO_3**
  - Calculated from the first digits of postcodes provided
  - Follows NUTS_1, NUTS_2, NUTS_3
  - NUTS optional for RMBS and SME in ECB reporting, but is standard in ESMA reporting

- **Quarter indicator: QTR_ED**
  - Data is provided monthly or quarterly
  - There is a risk to triple count deals that are reported monthly
  - Instead, select the submissions where QTR_ED is not NULL

SANITY CHECK FOR GEO_1, GEO_2, GEO_3

Generally, % of total loan amount outstanding should roughly mirror participation of country in GDP (e.g. France/RMBS)

GEO_1	SUM AR67 Q4 2019 %	GDP Millions %
Auvergne-Rhone-Alpes	12.6%	11.8%
Bourgogne-Franche-Comte	5.0%	3.3%
Bretagne	3.4%	4.3%
Centre -- Val de Loire	4.1%	3.2%
Corse	0.5%	0.4%
Grand Est	7.9%	6.8%
Hauts-de-France	7.7%	7.2%
Ile-de-France	22.3%	31.7%
Normandie	4.7%	4.0%
Nouvelle-Aquitaine	8.7%	7.6%
Occitanie	9.5%	7.4%
Pays de la Loire	5.3%	5.1%
Provence-Alpes-Cote d'Azur	8.4%	7.1%
	100.0%	100.0%

CALCULATED FIELDS IN THE AUTO ASSET CLASS

- **Manufacturer**
  - The current manufacturer field sometimes inaccurate
  - “Select distinct” on field AA44 (= manufacturer) = 112,000 results
  - There are not 112,000 manufacturers
  - “Select distinct” on calculated field ”Manufacturer” = 96 results

- **Model**
  - Calculated from the actual content of AA45 and AA44
  - Standardised so it can be easily interpreted

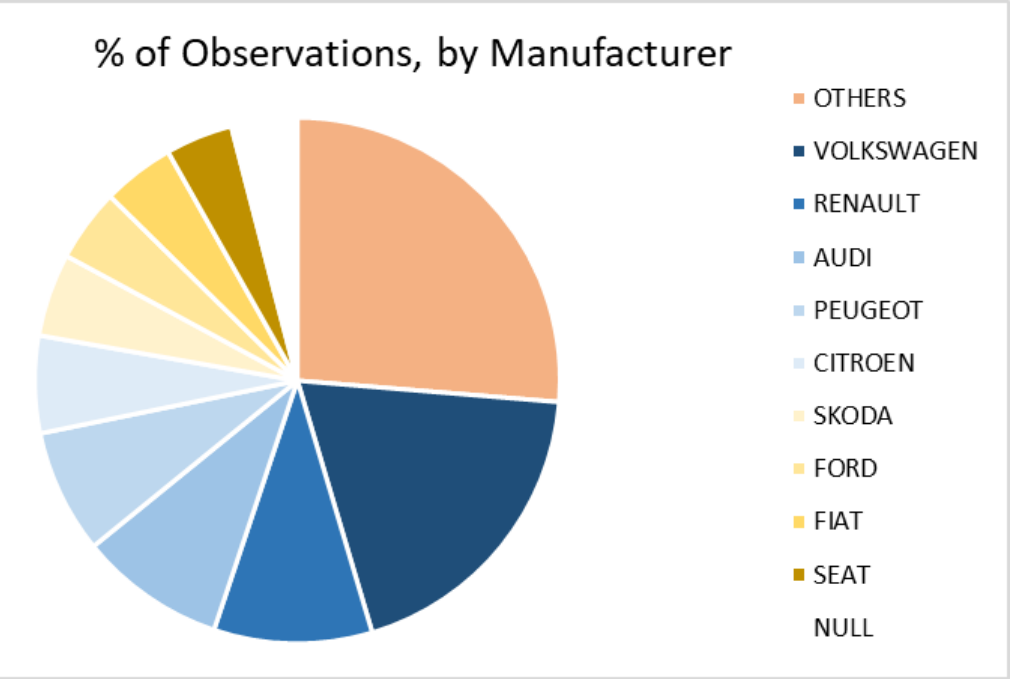
- **Fuel type**
  - Work in progress: to be calculated from AA44 (manufacturer), AA45 (model), AA46 (engine size)

- **Engine size**
  - Work in progress

CALCULATING MANUFACTURER

Calculated using AA44 (manufacturer) and AA45 (car model)

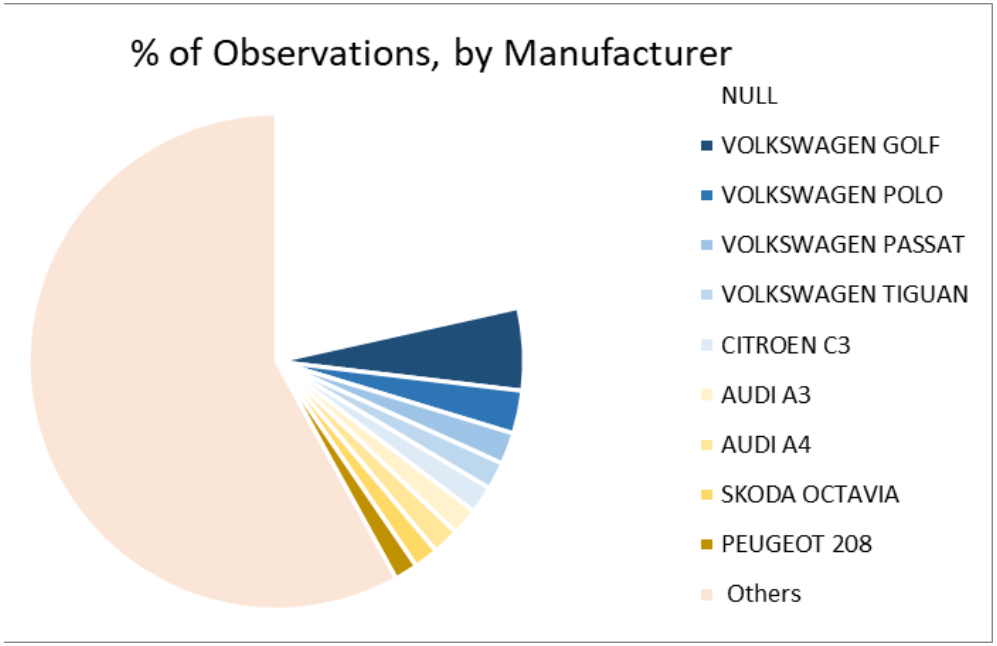
- "Select distinct" on field AA44 = 112,000 results
- 10,451 different entries in AA44 for cars that are identified as Volkswagen in the manufacturer field
  - AA44 sometimes contains full description of the car, entries in AA44 in 'VW','VWN','VOLK', 'VW Golf' etc.
  - Content is often contradicted in AA44 by the content in AA45 (e.g. captive selling a second hand car from other manufacturer)
- 96% of all observations have a calculated manufacturer (else NULL)



CALCULATING MODEL

Calculated using AA44 (manufacturer) and AA45 (car model)

- "Select distinct" on field AA45 (car model) = 819,663 results
- 12,694 different entries in AA45 for cars that are identified as "Golf" in the model field (5.4%)
  - AA45 sometimes contains full description of the car, listing all the options, engine type etc
  - 374 models registered in field model
- 96% of all observations have a calculated manufacturer (else NULL)



NEXT STEPS

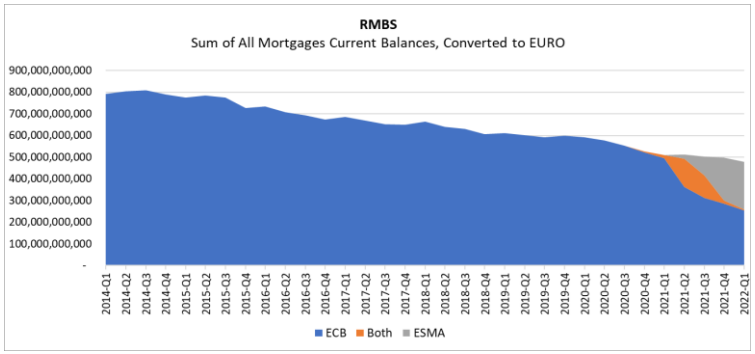
More calculated field additions are underway

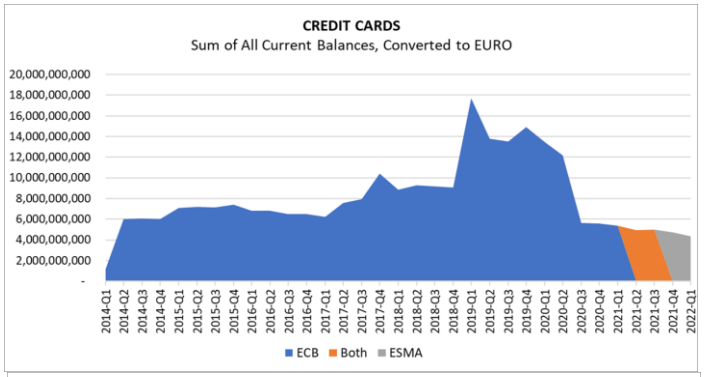
- **Vehicle type**
  - 2.6M observations also available for motorcycles, 500k for recreational vehicles, etc.
- **Engine size**
  - Rough indication of power
  - First step for fuel type in some cases
- **Fuel type**
  - Would mention if vehicle is diesel, petrol, plug in, mild Hybrid, or electric
  - Based on clues found in fields AA44 (manufacturer), AA45 (model), AA46 (engine size)
  - TDI = diesel, TFSI = petrol, etc.
  - A specific engine size with 3 digits for a manufacturer often points to a specific engine, either diesel or petrol

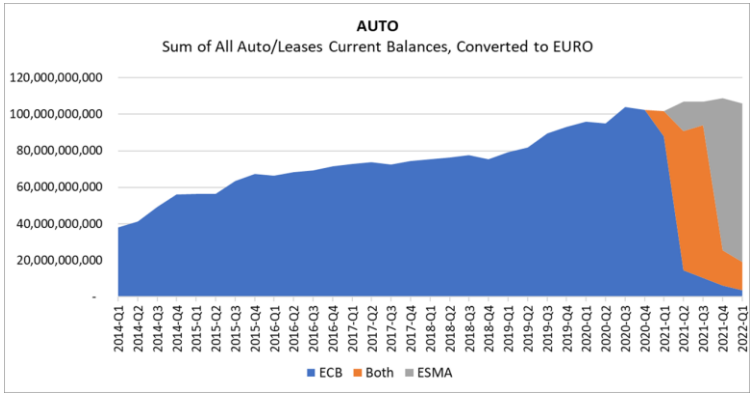
LOAN PERFORMANCE VS ENERGY PERFORMANCE

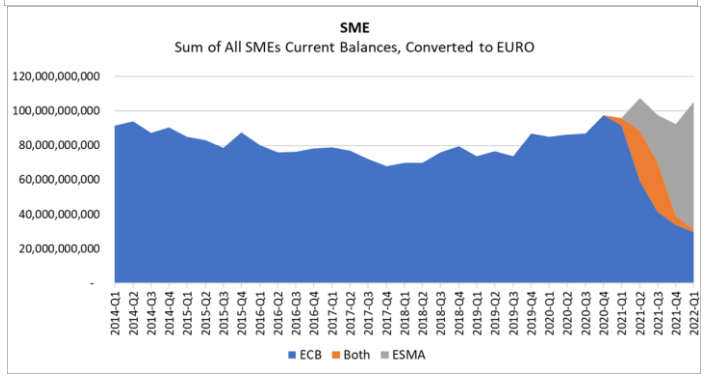
USMAN JAMIL, EUROPEAN DATAWAREHOUSE

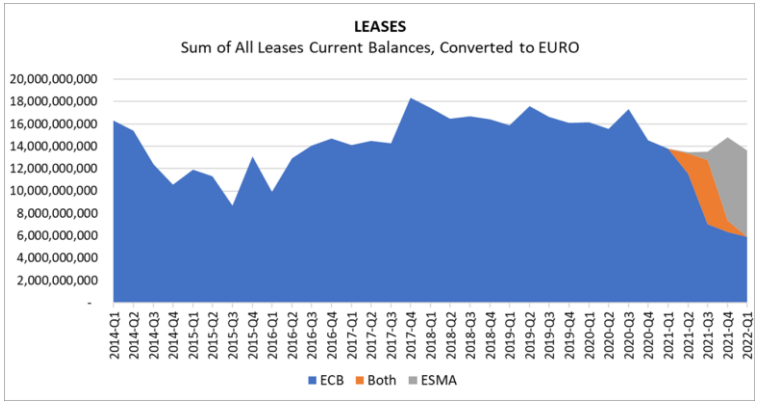
ESMA VS ECB DATA AVAILABILITY

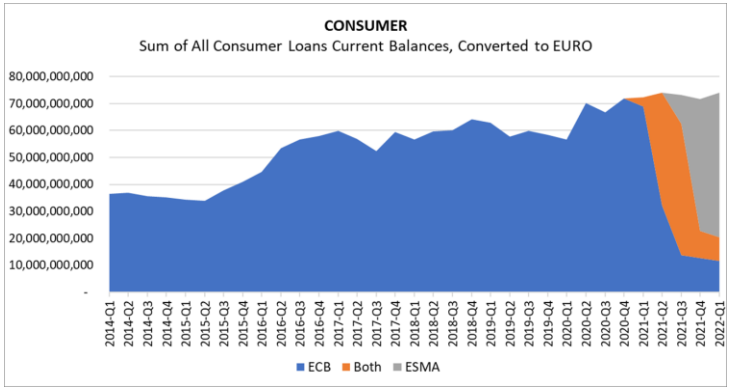












ENERGY PERFORMANCE CERTIFICATES ARE REQUIRED UNDER ESMA REGIME

ESMA Templates for loan-level data contain relevant fields for energy performance

- Fields RREC10 and RREC11 for underlying loans in RMBS:

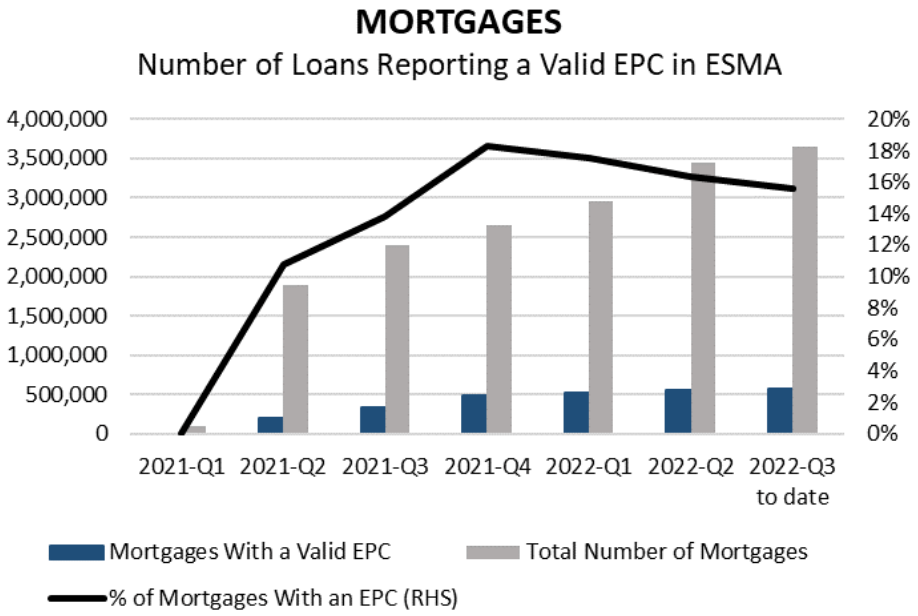
RREC10	Energy Performance Certificate Value	The energy performance certificate value of the collateral at the time of origination: A (EPCA) B (EPCB) C (EPCC) D (EPCD) E (EPCE) F (EPCF) G (EPCG) Other (OTHR)
RREC11	Energy Performance Certificate Provider Name	Enter the full legal name of the energy performance certificate provider. The name entered must match the name associated with the LEI in the Global Legal Entity Foundation (GLEIF) database.

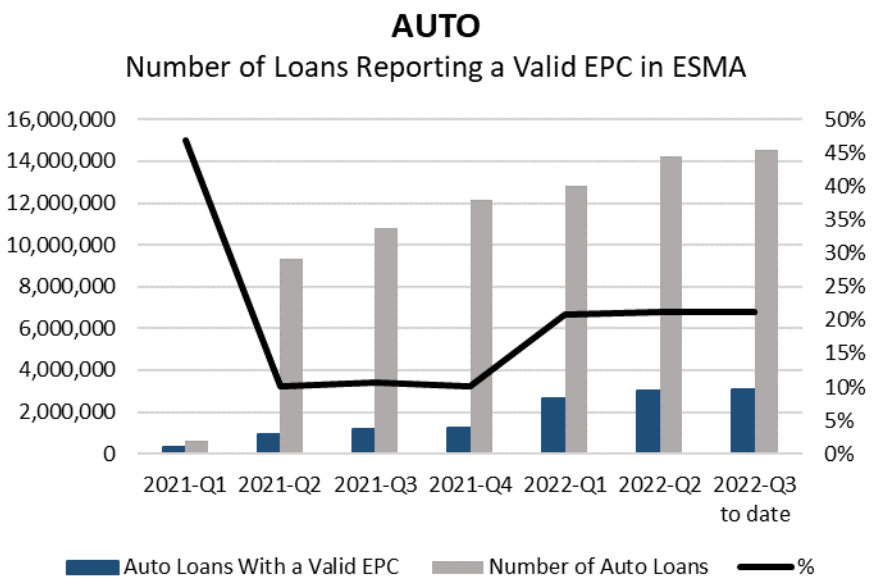
- Fields AUTL57 and AUTL58 for underlying loans in AUTO ABS:

		Other (OTHR)
AUTL57	Energy Performance Certificate Value	The energy performance certificate value of the collateral at the time of origination: A (EPCA) B (EPCB) C (EPCC) D (EPCD) E (EPCE) F (EPCF) G (EPCG) Other (OTHR)
AUTL58	Energy Performance Certificate Provider Name	Enter the full legal name of the energy performance certificate provider. The name entered must match the name associated with the LEI in the Global Legal Entity Foundation (GLEIF) database.

ENERGY PERFORMANCE CERTIFICATES – HOW MUCH DATA IS AVAILABLE?

Data availability for EPCs is stagnating

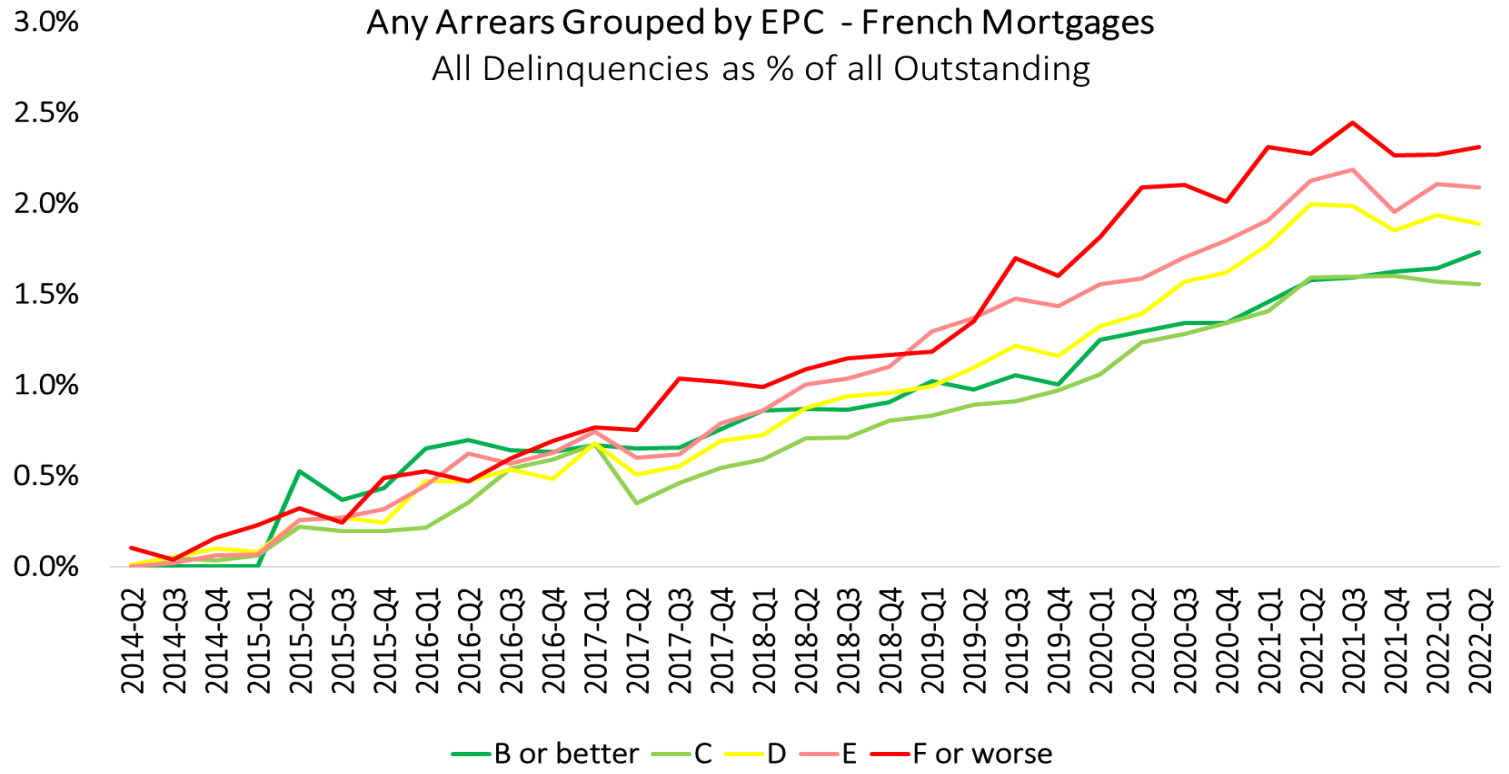




LOAN PERFORMANCE VS ENERGY PERFORMANCE (ALL LTV CATEGORIES)

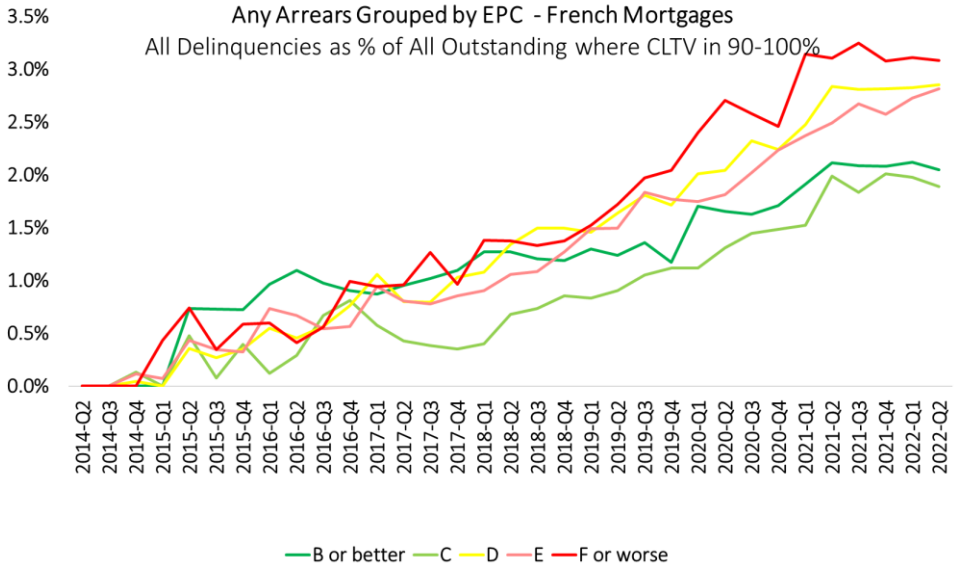
Making a performance chart using ESMA and ECB data

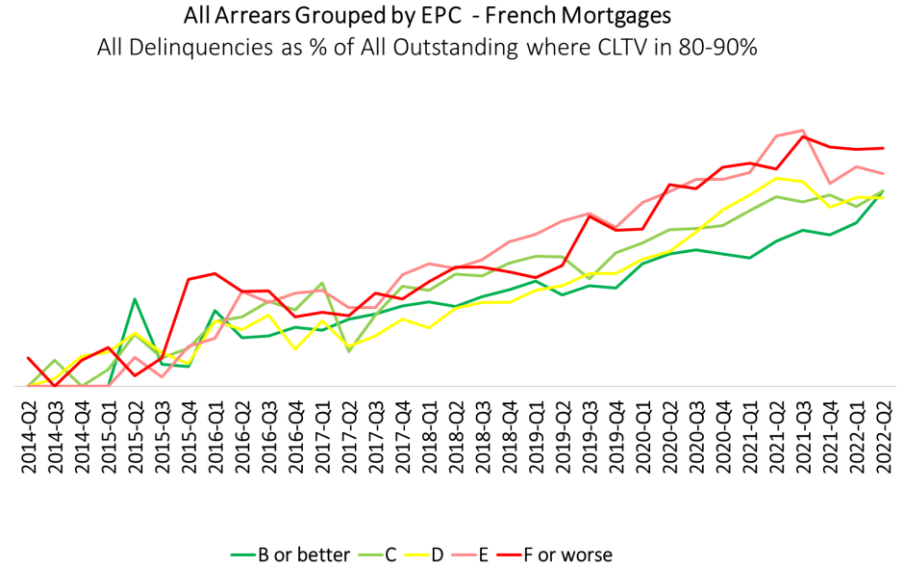
- French mortgages with historical data available in ECB format and recent data available in ESMA format (including non-NULL EPCs), and for which loan identifiers are the same in ECB & ESMA format
- B & C EPCs seem to perform better than D, E & F

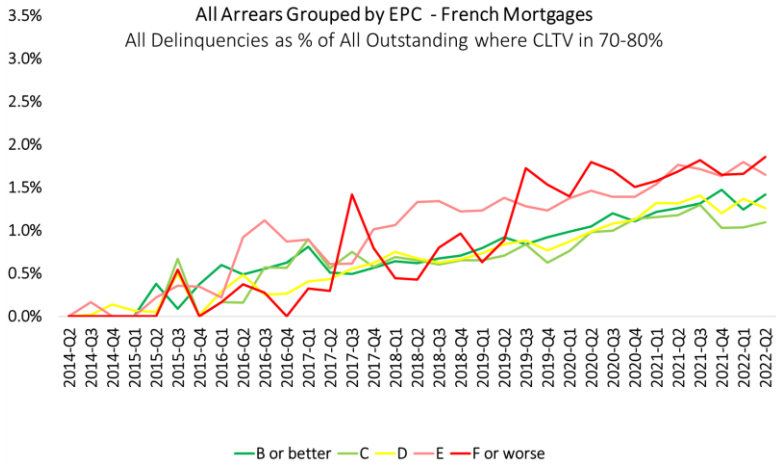


INFLUENCE OF THE CLTV

The observation holds for several levels of CLTV and is strongest for high CLTVs







CAVEAT

More work is needed before drawing conclusions...

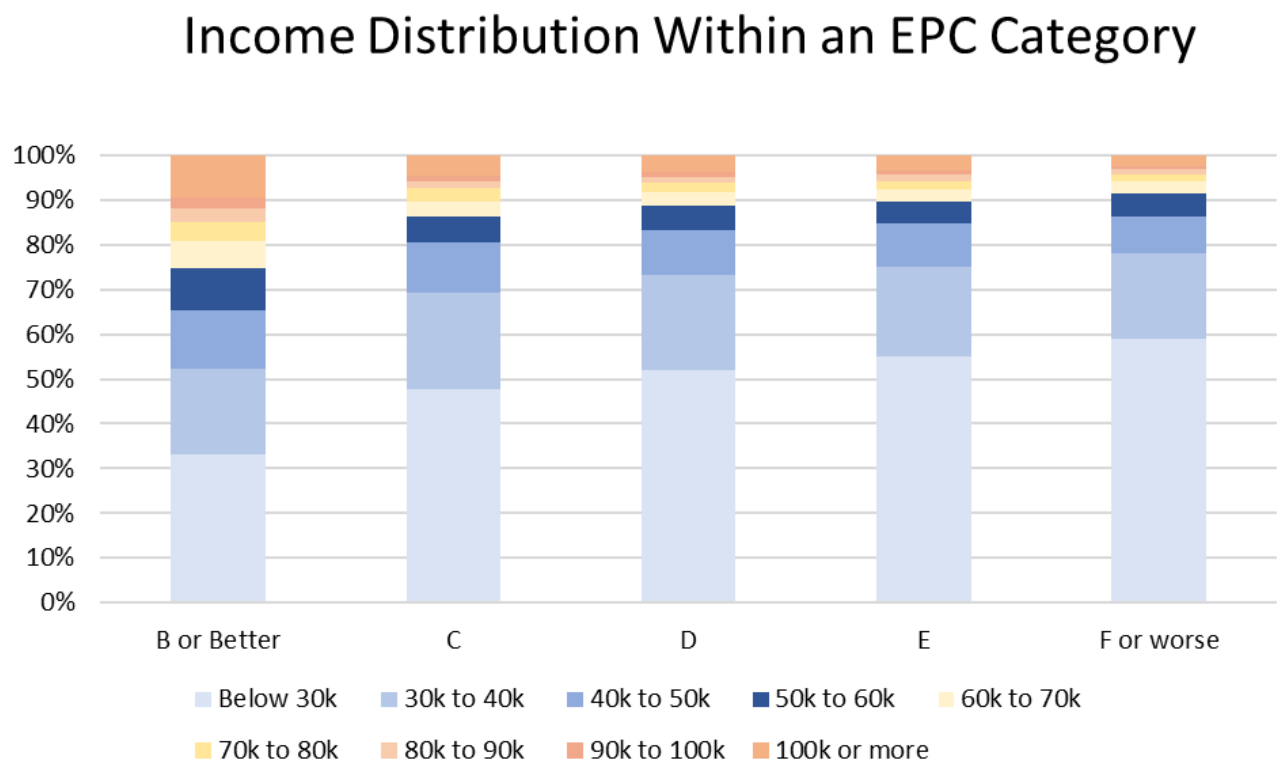
- **Limitations**
  - Too little data from too few data providers
  - Most properties in categories B & C reflect mostly new properties
  - An index should focus on one delinquency bucket only (e.g. 30-60 days arrears)
  - Quality limitations of the data in ESMA format

- **How to improve the index**
  - Add deals where EPCs are available but where loan IDs in ECB vs ESMA do not match
  - Add deals where no EPCs will become available
  - Compare EPC with other known factors that matter

OTHER RELATED OBSERVATIONS: EPC VS INCOME

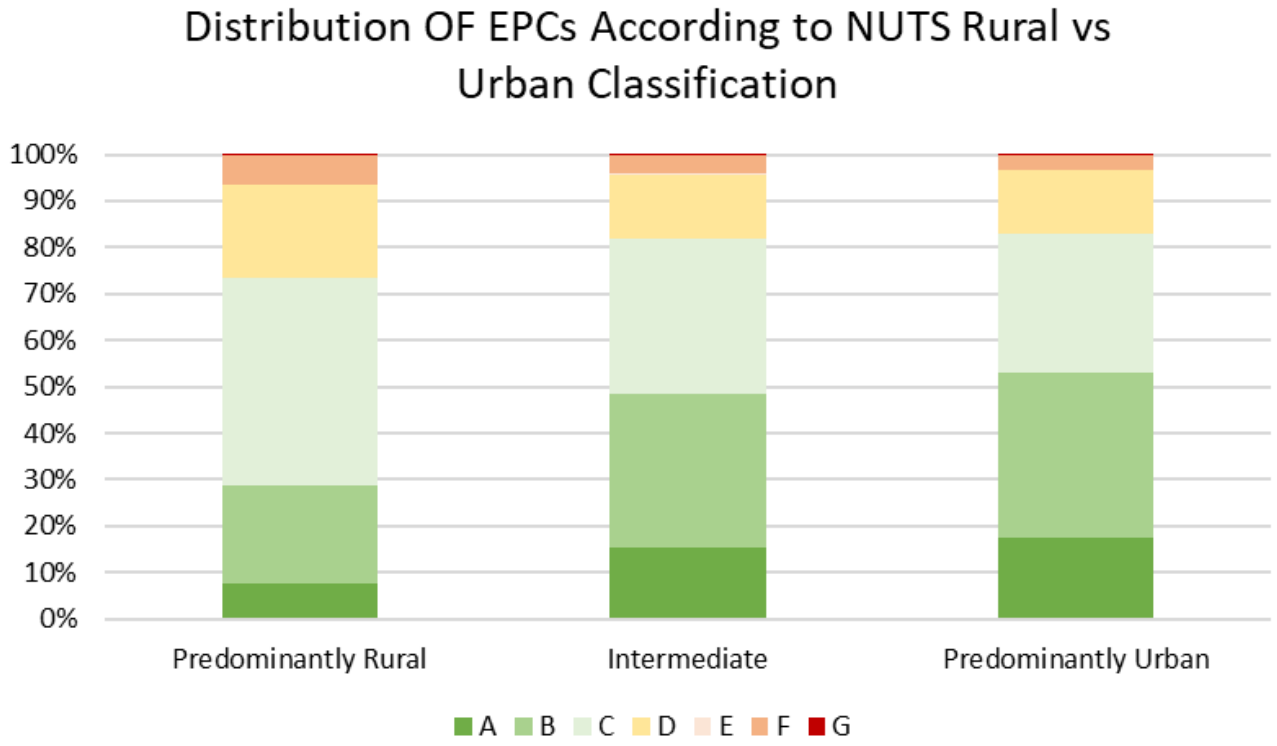
EPCs reflect more than just energy performance

- French mortgages selected with historical data available in ECB format and recent data available in ESMA format (including non-NULL EPCs).
- CAVEAT: this is not a good index because many factors need to be considered



OTHER RELATED OBSERVATIONS: URBAN CLASSIFICATION

- F & G EPCs can also be indicators of old, poorly maintained properties with high maintenance costs
- Urban vs Rural classification could also be relevant



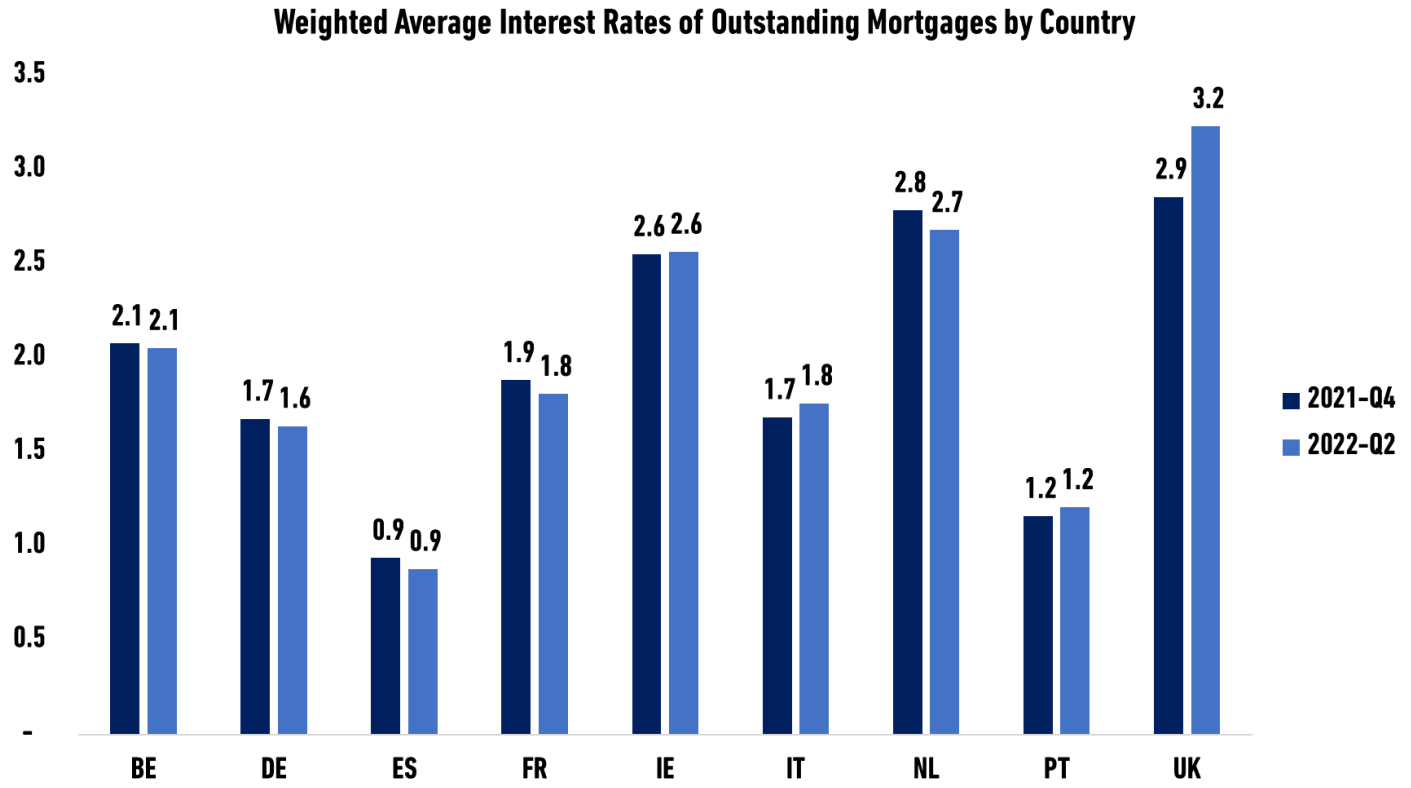
PERFORMANCE TRENDS

LUDOVIC THEBAULT, EUROPEAN DATAWAREHOUSE

INTEREST RATES INCREASING ACROSS EUROPE

Impact already evident in the UK where benchmark rate has risen from 0.1 to 1.75 since December

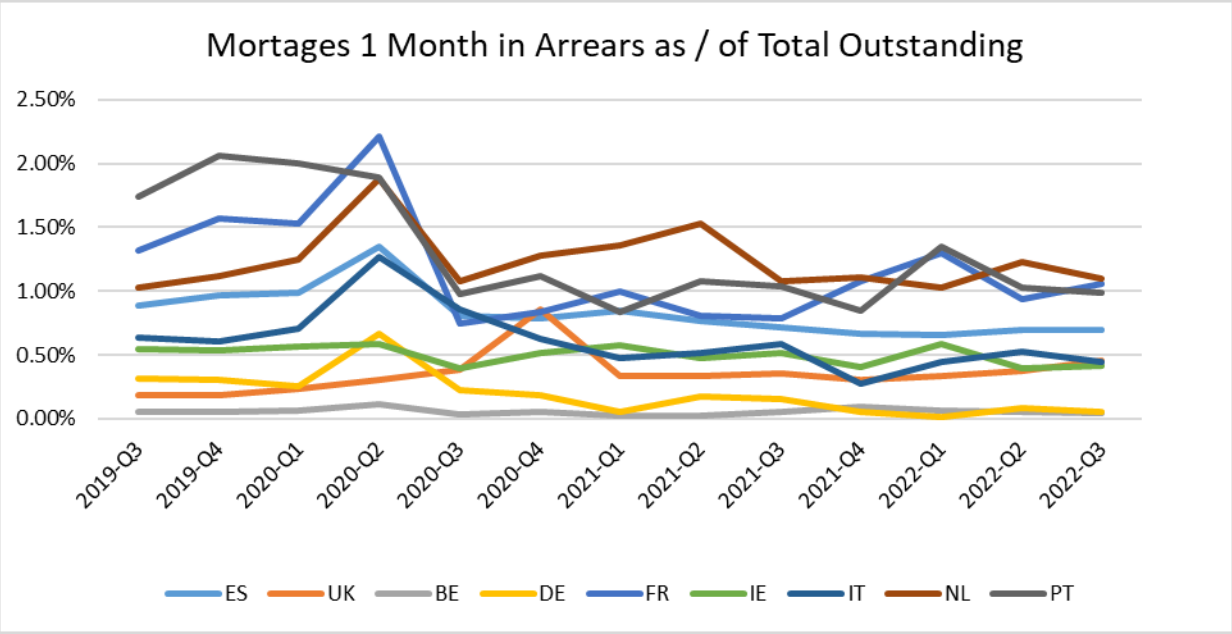
- Benchmark rates from national central banks rising across Europe
- Many borrowers with existing variable rate mortgages (or with expired fixed rate periods) have suddenly been faced with increased monthly payments.



LOOKING INTO RMBS DEALS

A one-month delinquency index is calculated for deals with data as of July

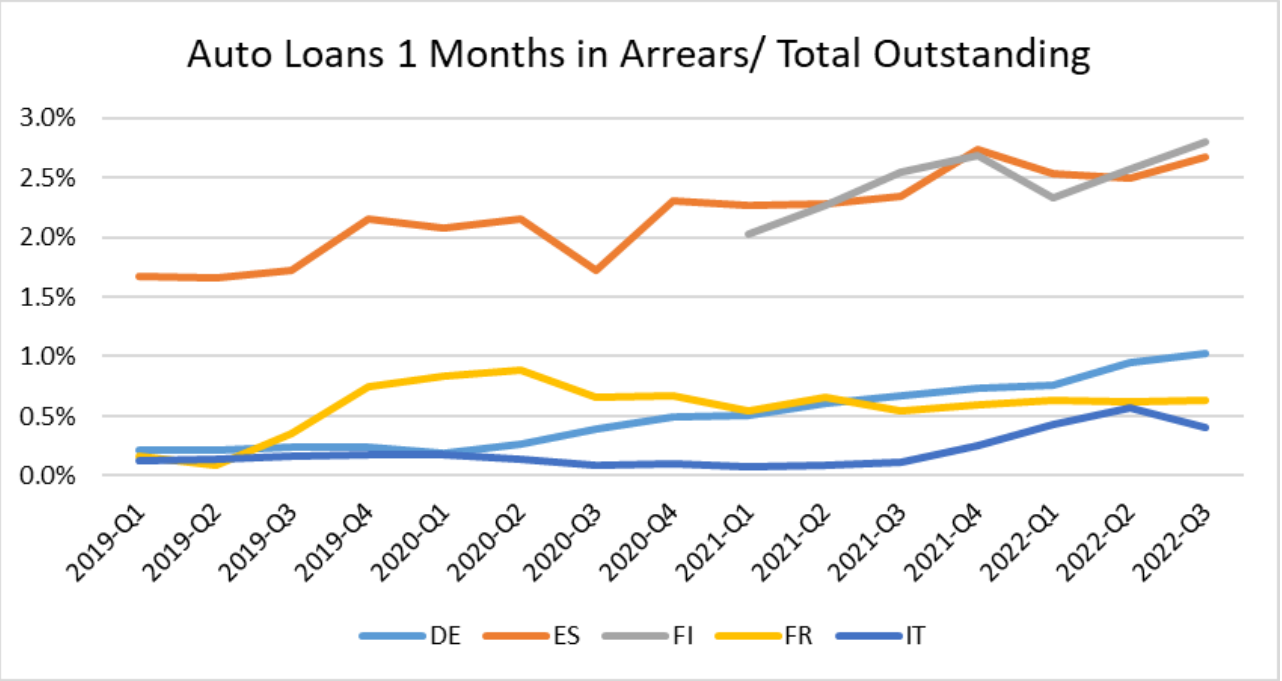
- One month in arrears is the delinquency indicator that would react first
- A relatively small sample, with €44 billion across 9 countries (47 deals)
- Mostly deals reporting on a January/April/July/October basis, Q3 = July
- The COVID wave of delinquencies is visible in Q2 (occurred in March, appears in April data)
- For now, no increase in delinquencies for mortgages as of July



LOOKING INTO AUTO DEALS

A one-month delinquency index is calculated for deals with data as of July

- One month in arrears is the delinquency indicator that would react first
- A relatively small sample, with €5 billion across 9 countries (17 deals only)
- Mostly deals reporting on a January/April/July/October basis, Q3 = July
- For now, no increase in delinquencies for Auto loans/leases as of July



CREDIT FIRE SALES: CAPTIVE LENDING AS LIQUIDITY IN DISTRESS

SERGIO MAYORDOMO, BANCO DE ESPAÑA

BANCO DE ESPAÑA
Eurosistema

CREDIT FIRE SALES: CAPTIVE LENDING AS LIQUIDITY IN DISTRESS

Matteo Benetton[1], Sergio Mayordomo[2], Daniel Paravisini[3]

[1] University of California, Berkeley
[2] Banco de España
[3] London School of Economics

European DataWarehouse Webminar

- Long-standing academic debate on the mechanisms through which **financial shocks** are transmitted to the economy

- Existing analyses of Global Financial Crisis focus on role of innovations in **stand-alone financial institutions** (securitization, liability maturity shortening)

- Secular trend in the market for consumer credit: **internalization of financial intermediation by durable good manufacturers**
  - Rise of captive finance companies for cars (Benmelech et al, 2017); real estate (Stroebel, 2016); equipment (Murfin and Pratt, 2019)

"GM Financial is inherently cash generative during a downturn."

— General Motors CFO, CNBC, May 11, 2020

THIS PAPER

- Question:
  - Does **vertical integration** of manufacturing and credit provision affects the propagation of **financial shocks from manufacturers/lenders to consumers**?
- Context
  - European car manufacturers and their integrated captive lenders
- Approach
  - Look at **credit terms - lending standards by captive and stand-alone lenders** (within car model - region - month), when **manufacturer faces liquidity shortage**
  - **Quasi-natural experiment**: Volkswagen emissions scandal raised cost of funding of all manufacturers × fraction of bonds maturing
  - Calibrated **model for quantification and comparison with "traditional" fire sale**

MECHANISM: IN RESPONSE TO A LIQUIDITY SHORTAGE...

Standalone manufacturer or lender

Borrow (e.g. Credit lines)	Cut investment Sell inventory - Change product price (Fire Sale)

Integrated manufacturer-lender

Borrow (e.g. Credit lines)	Cut investment Increase down payment Sell inventory - Change product price (Fire Sale) - Relax lending standards

"A fire sale is essentially a forced sale of an asset at a dislocated price", Shleifer and Vishny (2011)

"A credit fire sale is a forced sale of an asset bundled with financing at dislocated contract terms"

OUTLINE

Data and Descriptive Statistics

Credit Fire Sales: Stylized Evidence

Volkswagen Emission Scandal Quasi-experiment

Quantification of Credit Fire Sales

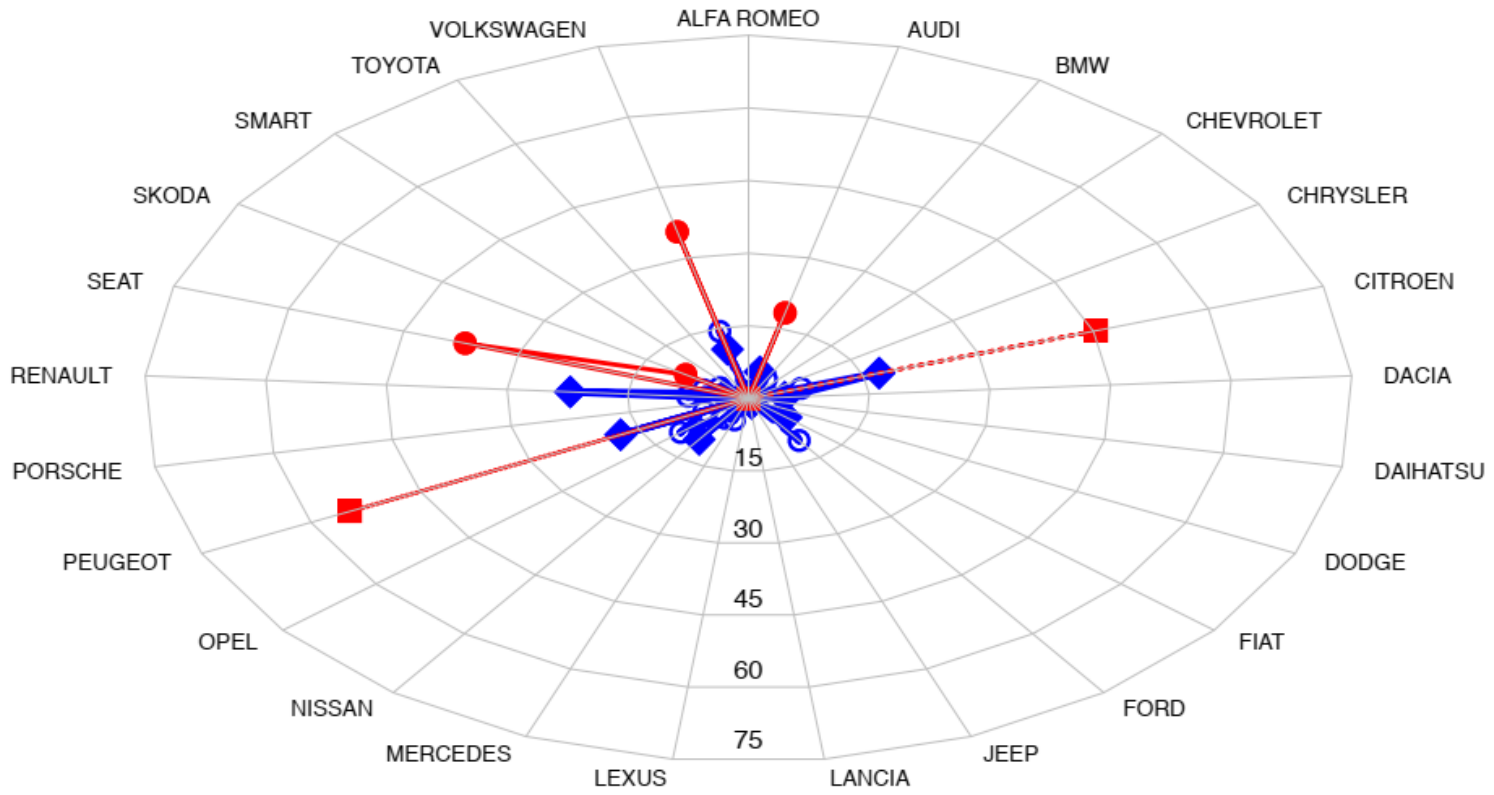
Conclusions

Data and Descriptive Statistics

DATA

- European Data Warehouse: Securitised car loans
  - Originated between Dec-2013 and Dec-2017
  - 9 captive lenders (e.g., Ford, Peugeot, Volkswagen)
  - 5 standalone banks (e.g., Santander, BNP Paribas)
- Analysis: **Used** car sales by manufacturers with captive lender
  - Focus on selling of inventory (ignore manufacturing costs)
  - 41% loans granted by stand-alones (new: only 6%)
  - 1.2M standard amortizing fixed-rate car loans to individuals (no leases)
  - Domiciled in France, Germany, Italy and Spain; 272 models/25 brands
- Additional data:
  - Lenders balance sheet at subsidiary level (SNL)
  - Car manufacturer CDS (Reuters)
  - Individual debt securities (Dealogic)

LOAN PORTFOLIO OF STANDALONE AND CAPTIVE LENDERS



Center is at 0

DESCRIPTIVE STATISTICS BY LENDER TYPE

BANCO DE ESPAÑA
Eurosistema

	Captive lenders			Diversified banks			Difference
	Mean	SD	N	Mean	SD	N	
Panel A: Loan terms and car value							
Interest (%)	6.81	2.17	681,633	5.26	1.94	473,817	1.55***
Maturity (Months)	47.98	17.38	681,633	55.22	19.89	473,817	-7.24***
Size (euro)	8,508	5,304	681,633	10,235	5,945	473,817	-1,727***
Car value (euro)	13,711	6,094	681,633	12,445	6,469	473,817	1,265***
LTV (%)	64.22	30.41	681,633	85.13	25.71	473,817	-20.90***
Panel B: Ex - ante risk measures							
Income (euro)	36,352	9,479,542	640,971	35,180	69,096	472,588	1,172
Paid-employed (0/1)	0.82	0.38	681,633	0.80	0.40	473,817	0.03***
Self-employed (0/1)	0.04	0.19	681,633	0.10	0.30	473,817	-0.06***
Unemployed (0/1)	0.02	0.14	681,633	0.00	0.05	473,817	0.02***
Student (0/1)	0.01	0.09	681,633	0.01	0.07	473,817	0.00***
Pensioner (0/1)	0.11	0.31	681,633	0.10	0.30	473,817	0.01***
Verified (0/1)	0.35	0.48	681,633	1.00	0.02	473,817	-0.6***
Panel C: Ex - post risk measures							
In arrears (0/1)	0.05	0.22	681,633	0.04	0.20	473,817	0.01***

Other Employement: Student, pensioner, unemployed or self-employed.

Seasoning: Securitization occurs only one year after origination, average seasoning is 15 months

Reg

LOAN TERMS SUGGESTIVE OF CAPTIVE LENDER MARKET POWER

- Captive lenders offer worse terms than stand-alone banks
  - Higher rate, lower maturity, lower loan-to-value
  - Even after controlling for observable borrower characteristics and model/location/time

- Service differentiation (one-stop-shop, no income verification), provide credit to borrowers banks do not service, etc.

→ Scope for adjusting lending terms without being fully competed away by standalone banks (segmented markets, imperfect substitutes).

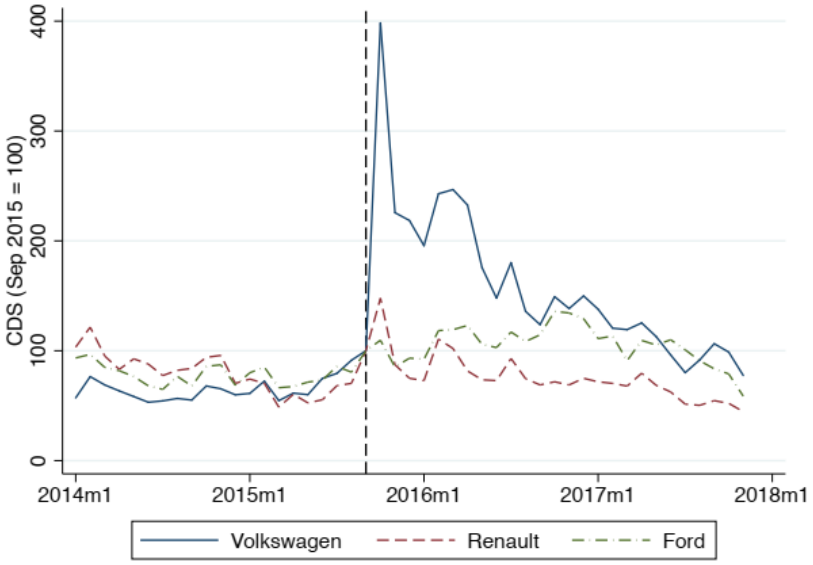
LIMITATIONS

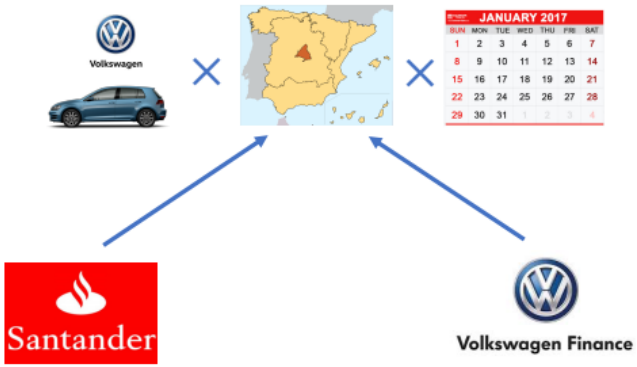
- Conditional on securitization
  - Manufacturer liquidity may also affect securitization probability
  - However, median loan is securitized 12 months (average 18) after issuance
  - Our focus: contemporaneous loan and CDS price variation
- Focus on the car financing
  - No data on contracts between manufacturer and dealers
  - Around 70% of European car dealers practice exclusive dealing (Nurski and Verboven, 2016)

Credit Fire Sales: Stylized Evidence

CAPTIVE CONTRACT TERM DISLOCATION AND MANUFACTURER CDS

- Benchmark: Stand-alone lender, within model/region/time
  - When Volkswagen's CDS price increases...
  - … compare terms offered by Volkswagen Financial Services relative to Santander...
  - ... to buy a Volkswagen Golf, in Madrid, in January 2017.





FIXED-EFFECTS SPECIFICATION

- α captures change in captive relative to stand-alone, in periods when the manufacturer CDS increases

$$y_{ilbmt} = \alpha \; Manuf.CDS_{bt} \; x \; Captive\ lender_l + \theta X_{ilt} + \gamma_l + \gamma_{bmt} + \epsilon_{ilbmt}$$

  - **Dependent variables** y_{ilbmt} for a car loan to borrower *i* by lender *l* for brand-model *b* in market *m* at time *t*:
    - *Loan terms (Rate, maturity, loan-amount) and car price*
    - *Ex-ante risk measures (income, verified, employment type)*
    - *Ex-post risk measures (arrears)*
  - γ_{bmt}: interacted brand-model, market and time fixed effects
  - γ_l: lender fixed effects
  - X_{ilt}: borrower and time-varying lender controls

CHANNEL: LIQUIDITY NEEDS

- **Idea:** Manufacturer's liquidity needs are higher at times when high fraction of existing bonds matures

- **Sample split:** Fraction of bonds expiring in *t* is in the top 75-th percentile of the distribution

MATURING BONDS: SAMPLE SPLIT

	Contract Terms				Lending standards			
	Rate	Maturity	Loan Size	Car value	Income	Other employment	Income verified	Arrears
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: High liquidity need manufacturers								
Manuf. CDS × Captive Lender	0.292***	-0.032**	-0.040*	-0.002	-0.042***	0.020*	-0.117***	0.030***
	[0.069]	[0.014]	[0.023]	[0.018]	[0.009]	[0.012]	[0.031]	[0.010]
Avg Dep Var	6.18	3.867	8.895	9.422	9.983	.185	.564	.060
R^2	0.808	0.476	0.548	0.666	0.442	0.319	0.836	0.313
Observations	144,407	144,407	144,407	144,407	220,563	220,563	220,563	118,476
Panel B: Low liquidity need manufacturers								
Manuf. CDS × Captive Lender	0.113***	-0.004	-0.012	-0.003	0.005	0.021***	-0.040***	0.005
	[0.043]	[0.006]	[0.010]	[0.009]	[0.005]	[0.006]	[0.008]	[0.006]
Avg Dep Var	6.124	3.868	8.954	9.349	10.083	.181	.636	.052
R^2	0.824	0.442	0.554	0.659	0.486	0.334	0.904	0.319
Observations	465,375	465,375	465,375	465,375	682,679	682,679	682,679	449,309
Fixed effects:								
Model-Region-Time-Income	YES	YES	YES	YES	NO	NO	NO	NO
Model-Region-Time	NO	NO	NO	NO	YES	YES	YES	YES
Lender	YES	YES	YES	YES	YES	YES	YES	YES
Age-Time	NO	NO	NO	NO	NO	NO	NO	YES
Additional controls:								
Lender-time	YES	YES	YES	YES	YES	YES	YES	YES
Borrower	YES	YES	YES	YES	NO	NO	YES	YES

Credit score

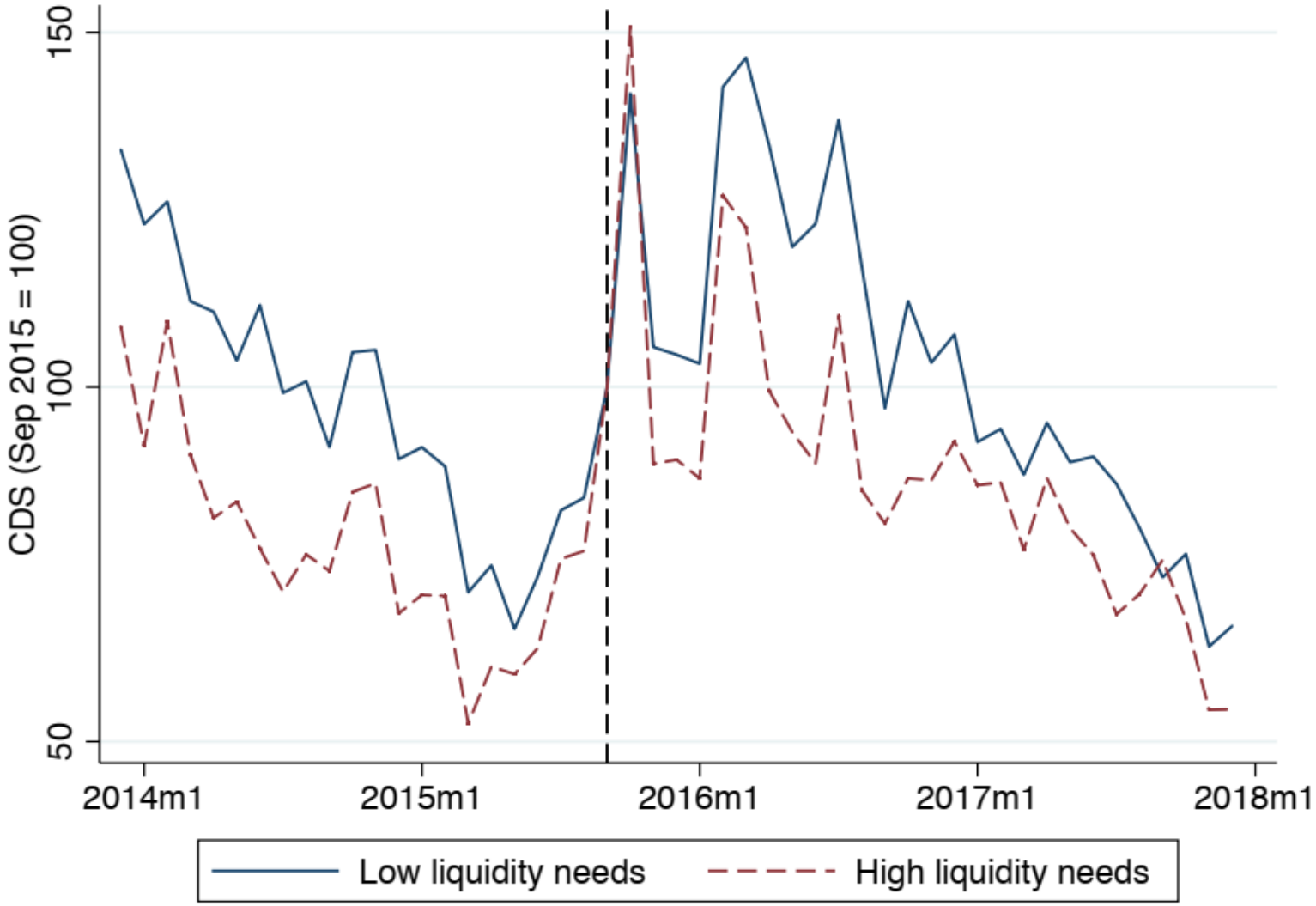
Volkswagen Emission Scandal
Quasi-experiment

- Volkswagen Quasi-experiment:
  - Sep 2015: U.S. Environmental Protection Agency found “defeat device" in diesel-engine vehicles
  - Volkswagen: CDS price × 4; Other manufact.: CDS up 50% on average
- **Idea:** short-term CDS price change for **other brands** is due to aggregate uncertainty and not due to unobserved manufacturer-specific shock
- **Implementation**
  - Classify other brands into high- and low-liquidity needs using % of maturing bonds in Pre
    - *High liq. need: Ford, Mercedes and Renault*
    - *Low liq. need: Toyota, Fiat, Opel, Peugeot and BMW*

- **Implementation (cont'd)**
  - Exclude all brands manufactured by VW group (Volskwagen, Audi, Porsche, Seat, and Skoda)
    - *Two-month window before (Pre) and after (Post) VW event*
  - For each subsample (high and low liquidity needs), estimate:

$$y_{ilbmt} = \boldsymbol{\alpha Post\ x}\ \textbf{Captive}_{\boldsymbol{l}} + \theta X_{ilt} + \gamma_l + \gamma_{bmt} + \epsilon_{ilbmt}$$

HIGH- AND LOW-LIQUIDITY NEEDS ~ ↑ IN CDS



CREDIT FIRE SALES DURING THE VOLKSWAGEN EMISSION SCANDAL

	Contract Terms				Lending standards			
	Rate	Maturity	Loan Size	Car value	Income	Other employment	Income verified	Arrears
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: High liquidity need manufacturers								
Post × Captive Lender	0.359***	-0.088***	-0.096**	-0.063	-0.025*	0.003	0.000	0.012**
	[0.094]	[0.022]	[0.045]	[0.044]	[0.013]	[0.015]	[0.000]	[0.006]
Avg Dep Var	5.716	3.916	8.918	9.279	9.987	.118	.453	.034
R^2	0.867	0.428	0.484	0.649	0.466	0.273	1.000	0.283
Observations	21,811	21,811	21,811	21,811	31,157	31,157	31,157	25,531
Panel B: Low liquidity need manufacturers								
Post × Captive Lender	0.013	-0.022	-0.019	0.003	-0.006	0.009	0.037***	-0.003
	[0.080]	[0.016]	[0.024]	[0.017]	[0.014]	[0.009]	[0.013]	[0.007]
Avg Dep Var	5.716	3.916	8.918	9.279	10.104	.195	.647	.052
R^2	0.763	0.409	0.540	0.635	0.463	0.266	0.781	0.318
Observations	28,549	28,549	28,549	28,549	41,888	41,888	41,888	30,811
Fixed effects:								
Model-Region-Time-Income	YES	YES	YES	YES	NO	NO	NO	NO
Model-Region-Time	NO	NO	NO	NO	YES	YES	YES	YES
Lender	YES	YES	YES	YES	YES	YES	YES	YES
Age-Time	NO	NO	NO	NO	NO	NO	NO	YES
Additional controls:								
Lender-time	YES	YES	YES	YES	YES	YES	YES	YES
Borrower	YES	YES	YES	YES	NO	NO	YES	YES

EFFECTS ON QUANTITY AND SHARE OF RISKY BORROWERS

- Captive lenders neither increase nor decrease the number of cars financed (it applies to those with high and low liquidity needs)…
- … but those with high liquidity needs increase their share of low income borrowers relative to standalone lenders

	Number of Cars (log)		Low income borrowers (%)		Low credit score borrowers (%)
Manufacturer liquidity need	Low	High	Low	High	
	(1)	(2)	(3)	(4)	(5)
Post × Captive Lender	0.028	0.019	0.004	0.025*	0.028**
	[0.023]	[0.020]	[0.014]	[0.015]	[0.011]
Fixed effects:					
Model-Region-Time	YES	YES	YES	YES	NO
Lender	YES	YES	YES	YES	YES
Model-Time	NO	NO	NO	NO	YES
Region-Time	NO	NO	NO	NO	YES
Additional controls:					
Lender-Time	YES	YES	YES	YES	YES
Borrower	NO	NO	NO	NO	YES
Avg Dep Var	.998	1.052	.484	.466	.158
R^2	0.681	0.711	0.601	0.625	0.209
Observations	11,755	7,393	11,755	7,393	10,781

BACK-OF-THE-ENVELOPE CALCULATION FOR HIGH LIQUIDITY NEEDS MANUFACTURERS

- We calculate the **change in future revenue** implied by the (statistically significant) point estimates **using the average loan as a baseline**

- Despite the higher interest rate, **expected revenues decline by about €950** relative to the baseline due to **lower amounts and higher expected arrears**

- To **gain an additional €1 in cash today** high-liquidity-need manufacturers **loose €0.15 in expected future revenue over four years (3.8% annualized rate)**

Quantification of Credit Fire Sales

QUANTIFICATION EXERCISE

- Goal: benchmark the cash generated by a credit fire sale with cash generated by regular fire sale (lowering the price of cars)
- Why do we need some structure?
  - Too many margins changing for a simple back-of-the envelope
  - Counterfactual world w/o captive not observed in the data
- Ingredients
  - Car market: differentiated producers
  - Credit market: high- and low-risk borrowers, segmented between captive and standalone lenders
  - Captives maximize joint lending + car sales profits
- Result
  - Average Credit Fire Sale creates same amount of cash than a 12% car price drop

Conclusions

CONCLUSIONS

- Identify and quantify **Credit fire sale**
  - An augmented version of an old mechanism
  - Distressed manufacturers/lenders improve cash position by changing loan terms and lowering lending standards
  - Open question: does it extend to trade credit?
- **Vertical integration** of manufacturing and financing changes how **shocks** to durable-good manufacturers affect credit and consumption
  - Negative shock leads to credit expansion to riskier borrowers
  - Short-run: mitigates real effect of shock
  - Long-run: more defaults imply distressed households and manufacturers

Appendix

WHY CAPTIVE LENDERS EXIST?

- **Price discrimination**
  - Vendor financing profitable for price discriminate between cash and credit customers (Brennan et al., 1988)
- **Asymmetric information**
  - Better product and/or customer knowledge, higher repossession value relative to other creditors (Banner, 1958; Petersen and Rajan, 1997; Stroebel, 2016)
- **Coase conjecture**
  - Manufacturers signal or commit to high future resale values for their product line (Murfin and Pratt, 2019)
- **Liquidity provision in distress**
  - Captive finance allows flexibility to adjust cash flow following shocks

CONTRIBUTION

- **Captive finance rationales**: Discrimination, information, Coase conjecture, search + source of liquidity
  - Brennan, Maksimovic, Zechner (1988); Stroebel (2016); Murfin and Pratt (2019); Argyle, Nadauld, Palmer (2018);
- **Car finance:** Effect of distress/regulation on supply + risk taking
  - Benmelech, Meisenzahl, Ramcharan (2017); Melzer and Schroeder (2017)
- **Fire sales**: liquidity shock dislocate asset prices + loan terms when asset bundled with financing
  - Pulvino (1998); Shleifer and Vishny (2010, 2011); Coval and Stafford (2007)
- **Lending channel**: liquidity shock tightens bank credit supply + reversed for captives
  - Khwaja and Mian (2008), Jimenez et al. (2012, 2014), Agarwal et al. (2018)

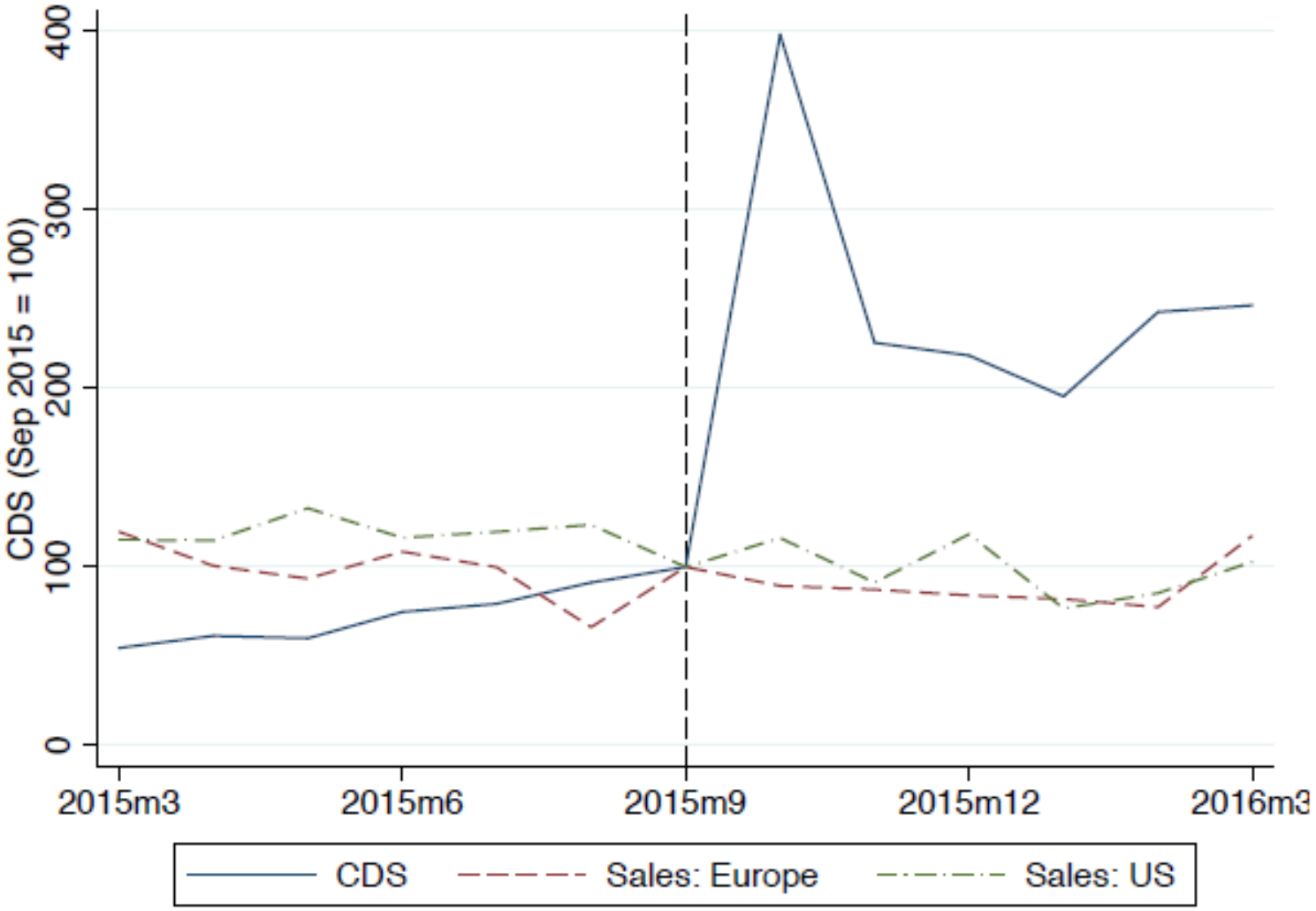
- Concern: Heterogeneous demand shift can deliver (some of the) same results
  - Suppose VW tests reduces demand by rich borrowers and increases demand by poor borrower
  - Cannot explain why captive lender terms deviate from bank for the same model-region-time..
  - But some complicated price discrimination story…
- One approach
  - Exclude VW event (CDS price change concurrent with demand shock)
  - Income/Employment/Verification/Car price bin fixed-effects

VW SCANDAL: LARGE " CDS , BUT SMALL # CAR SALES

- In Europe for Volkswagen cars relative to other brands

VW SCANDAL: LARGE " CDS , BUT SMALL # CAR SALES

- For Volkswagen cars both in Europe and US



MATURING BONDS: SAMPLE SPLIT – CREDIT SCORE

	Low credit score borrowers (%)	
Manufacturer liquidity needs	High	Low
	(1)	(2)
Manuf. CDS × Captive Lender	0.021**	0.003
	[0.010]	[0.002]
Fixed effects:		
Model-Time	YES	YES
Region-Time	YES	YES
Lender	YES	YES
Additional controls:		
Lender-Time	YES	YES
Borrower	YES	YES
Avg Dep Var	.153	.149
R^2	0.179	0.234
Observations	44,650	106,714

- Manufacturers
  - N differentiated single-product producers (indexed by *j*)
  - Common marginal cost *k* and fixed cost *K*
  - Set price p_j to maximize profits

$$\Pi_j(p_1, \dots, p_N) = (p_j - k)D_j(p_1, \dots, p_N) - K$$

- Buyers (discrete choice)
  - M potential buyers (indexed by *i*)
  - Values car v_{ij}, drawn from iid distribution *f*(*v*)
  - Surplus from purchasing car *j*: $b_{ij} = v_{ij} - p_j$
  - Fraction purchasing car *j* given by:

$$\Pr(b_{ij} \geq max_{k \neq j} b_{ik}) = \int_{k \neq j} \Pi\left[F(p_k - p_j + v)\right] f(v) dv$$

- Borrowers
  - Fraction γ is low risk (L), $1 - \gamma$ is high risk (H)
  - L always repays, H always defaults
  - Fraction goes to captive; $1 - \alpha$ to standalone
- Lenders
  - Borrow at rate *r* and incur origination cost *c* per $ loan
  - Observe signal *s* about borrower type from normal distribution $G_{L/H} \sim N(\mu_{L/H}, \sigma)$, where $\mu_L > \mu_H$
  - Obtain per $ profits:

$$\Pi_b(s_b) = P(L|s)(i - r) + \big(1 - \mathrm{P(L|s)}\big)(\mathrm{d} - \mathrm{r}) - \mathrm{c}$$

    - *where d is the recovery value in case of default*
  - Set interest rate $i < \bar{\imath}$ based on borrower signal *s*

$$\boldsymbol{i(s) = \frac{(r + c) - \big(1 - P(L|s)\big)d}{P(L|s)}}$$

- Loan Market
  - Standalone bank acceptance threshold set profits = 0 at max rate $\bar{\iota}$

$$\Pi_b(s_b) = 0 \rightarrow P(L|\bar{s}_b) = \frac{c + r - d}{\bar{\iota} - d}$$

  - Captive bank acceptance threshold set joint profits = 0 at max rate $\bar{\iota}$

$$(p - k) + l\Pi_j(s_j) \rightarrow P(L|\bar{s}_j) = \frac{c + r - d - \frac{p - k}{l}}{\bar{\iota} - d}$$

  - Fraction of approved buyers:

$$(1 - \alpha)\underbrace{[\gamma(1 - GL(\bar{s}_b)) + (1 - \gamma)(1 - GH(\bar{s}_b))]}_{Approval\ rate\ standalone\ lender} + \alpha\underbrace{[\gamma(1 - GL(\bar{s}_j)) + (1 - \gamma)(1 - GH(\bar{s}_j))]}_{Approval\ rate\ captive\ lender}$$

- Car Market
  - Obtain number of manufacturer *N* and car price $p_j = p$ solving for symmetric Nash-Bertrand


Q&A

THANK YOU//CONTACT US

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