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Complexity and the default risk of mortgage-backed securities

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ABSTRACT

We study the impact that lower complexity in bank securitisations has on mortgage quality and the securitisation structure. We find that mortgages issued after the announcement of new European regulation that aims to reduce deal complexity are characterised by up to 0.38% lower annual delinquency rates than in the pre-regulation period. Similarly, we show that mortgage securitisations that meet the new 'simplicity, transparency and standardisation' (STS) criteria have 0.77% lower annual delinquency rates and are more resilient to adverse macro-economic shocks. We find that the increased quality of the underlying loans outweighs the potential negative effects of thinner subordinated tranches in securitisations that comply with the new regulation. Overall, our findings suggest that the new European securitisation regulation has contributed to improving credit quality in the securitisation market in Europe.

1. Introduction

The complexity of the securitisation market was one of the key factors behind the Great Recession of 2007–2009.[1] Caballero and Simsek (2013) find that financial complexity can bring confusion and uncertainty, which in turn discourage investments in new assets.

As a result, complex markets are characterised by higher volatility, lower liquidity, and decreased trade efficiency relative to other markets (Carlin et al., 2013). Complexity is likely the primary cause behind the sharp decline in investors' trust in bank securitisations during and following the Great Recession. For instance, the amount of European asset-backed securities (ABS) placed with investors as a percentage of the total amount issued dropped from 70% before the start of the Great Recession to roughly 12% in 2008. More than 10 years later, the European securitisation market has yet to recover to the pre-crisis levels.[2]

This led the European Union to introduce a new regulation with the aim of reducing the complexity of securitisations. The new rules were finalised in 2017 and came into force in January 2018. They include a 'specific framework for simple, transparent and standardised securitisation' (The European Parliament and the Council, 2017). Whether the new regulation has helped to restore confidence in the ABS market is an open question. Understanding how the securitisation market has been affected by the new rules is particularly relevant in light of the renewed pressure exerted by the COVID-19 pandemic on the entire sector.

We contribute to the existing literature in three main ways. To the best of our knowledge, this is the first paper that empirically analyses the possible effects of the new ABS regulation on credit quality in the European residential mortgage-backed securities (RMBS) market. Residential mortgages are particularly relevant since they are the most popular ABS asset class in Europe, accounting for more than 41% of the European securitisation issuance volumes in 2020.[3] As can be seen in Fig. 1, residential mortgages originated after 2018 show a significantly lower one-year delinquency probability than those pooled before the regulation entered into force. The difference in annual delinquency rates is even stronger when we compare mortgages issued before and after the announcement of the new regulation in 2017, as shown in Fig. 2.

We show that changes in the ABS regulatory framework are responsible for a pre-pandemic decline in annual residential mortgage delinquencies in Europe of 34 basis points (bp) after controlling for

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[1] See, for example, Antoniades (2016); Dungey et al. (2011); Gorton (2009); Mian and Sufi (2009); Shin (2009); Fender and Mitchell (2009), among others.

[2] Source: AFME, Finance for Europe. Securitisation Data Report, European Structured Finance. Q4:2020.

[3] Source: AFME, Finance for Europe. Securitisation Data Report, European Structured Finance. Q4:2020.

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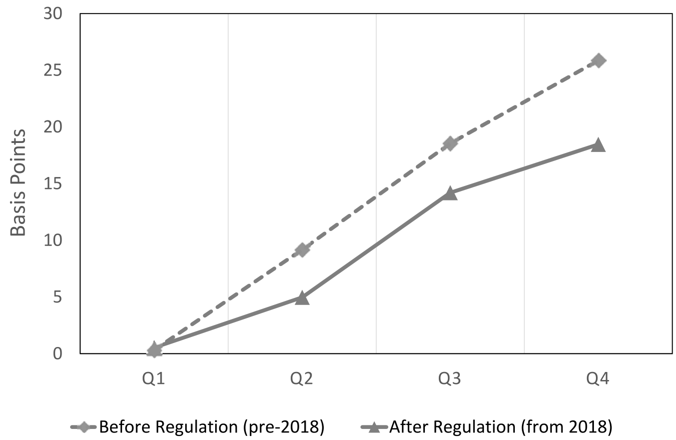

Fig. 1. Cumulative delinquency of residential mortgages, general provision sample. The figure shows the average cumulative delinquency rates of mortgages originated before and after the introduction of the 2018 European ABS regulation, with quarterly data. A mortgage is considered delinquent if it has defaulted or is in arrears for at least two consecutive quarters.

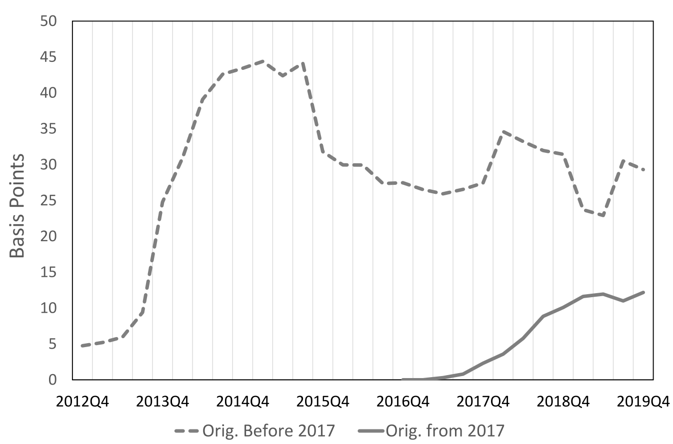

Fig. 2. Annual rolling average of quarterly delinquency rates of residential mortgages, general provision sample. The figure shows the annual average of quarterly delinquency rates of mortgages originated before and after the announcement of the European ABS regulation in 2017.

macro-economic conditions. This increase in mortgage quality is economically relevant as it represents 42% of the average delinquency rate (80 bp) over the entire observation period, 2013-2021. Our results contribute to the wider debate on the regulatory response to the financial crisis of 2008 (see, for example, Benetton et al., 2020; Fender and Mitchell, 2009 and Akseli, 2013) and, more specifically, to the literature that analyses the relationship between macro-prudential regulatory policies and mortgage defaults (e.g., Stanga et al., 2020).

Further, we investigate the influence of the new ABS rules on mortgage delinquencies. Our results show that the new ABS rules have an uneven impact on the delinquency rates of different types of mortgages. Despite the overall decline in delinquencies triggered by the new regulatory environment, mortgages categorized as under-collateralized—those with a loan-to-value (LTV) ratio exceeding 1—exhibited higher delinquency rates during the period following the introduction of the new ABS rules, up until the onset of the COVID-19 pandemic. However, as our baseline results indicate, this finding has a limited impact on the overall risk of RMBS. This is because the ban on 'cherry-picking' (Article 6) and enhanced investor due diligence (Article 5) may have constrained the securitisation of riskier loans. Our results complement those of studies that investigate how changes in banking regulation can substantially alter credit allocation across loan types and affect the credit practices of banks. For instance, Acharya et al. (2020), when analysing the effects of newly introduced limits on the loan-to-income and loan-to-value ratios in the Irish banking system, find that the most affected banks reallocate mortgage credit from low-income to high-income borrowers and to counties where borrowers tend to be more distant from those lending limits. Further, Klein et al. (2020) document that the transparency regime introduced in Europe in 2013[4] gives banks incentives to issue better performing and diversified ABSs.

Our second contribution to the literature focuses on examining the relationship between the securitisation structure and the severity of crisis periods. This analysis adds to existing research in the field (e.g., Covitz et al., 2013). We show that less complex securitisations that meet the new criteria of simplicity, transparency, and standardisation—called STS securitisations—perform significantly better than their non-STS counterparts with a 0.77% lower annual delinquency rate. Thanks to their superior characteristics, STS deals prove to be more resilient to the adverse shocks of the COVID-19 pandemic. However, it is important to acknowledge potential distorting effects that the introduction of STS securitisations may have on banks' and investors' behaviour. For instance, McGowan and Nguyen (2023) have raised concerns that the STS label may create a false sense of security, and investors may be prepared to fund riskier loans without requiring an adequate rate of return. Other studies (e.g., Coval et al., 2009), show that the increasing demand for high-rated securities, coupled with the possibility of transferring risk to outside investors, may lead to lax lending standards. On the other hand, the benefits of STS loans may outweigh these potential distortions. Covitz et al. (2013), among others, show that securitisation programs with stronger observable characteristics are less likely to experience runs in periods of crisis. Through our analysis of securitisation structures and tranche ratings, we demonstrate that securitisations compliant with the Simple, Transparent, and Standardised (STS) framework exhibit notable differences compared to non-STS deals. Specifically, STS deals typically have fewer tranches, with a smaller allocation to subordinated tranches. The presence of fewer and thinner tranches may pose risks for investors, as default risk can be transferred more easily to senior tranche holders. However, our findings indicate that despite these structural changes, STS deals continue to carry lower relative risk than their non-STS counterparts. Additionally, we present evidence demonstrating that tranches linked to STS deals are more likely to receive higher ratings from credit rating agencies. These results reinforce the argument that the observed changes are driven by improvements in the quality of underlying assets and modifications in the securitisation structure, rather than being solely influenced by the STS label.

Third, we contribute to the growing literature that analyses the impacts of the COVID-19 pandemic on the credit market. Recent studies tend to focus on the effects of the pandemic on credit supply (e.g., Horvath et al., 2023; Colak and Öztekin, 2021) and the effectiveness of policy interventions (e.g., Moulton et al., 2022; Sarker, 2020). We show that the COVID-19 pandemic led to an increase in residential mortgage delinquencies in Europe that started in the first quarter of 2020 and peaked in the third quarter of the same year. The rise in delinquencies is heterogeneous across countries and borrower characteristics. Specifically, our model shows that the default probability in our sample goes from an annualised 36 bp in Q4-2019 to 88 bp in Q1-2020, peaking at 109 bp in Q3-2020. However, the newly introduced STS securitisations prove to be effective in tackling the negative effects of the pandemic. Loans securitised in STS deals generally perform better than their non-STS counterparts, showing a 39 bp lower annual delinquency probability, and the gap increases to 77 bp when the COVID-19 period is considered. Indeed, the negative effects of the

[4] Starting January 2013, banks that use residential mortgage-backed securities in repo borrowing are required to report loan-level data in a detailed and standardised format set by the ECB. A bank that fails to adhere to this new transparency regime cannot borrow from the ECB's repo operations.

pandemic are much more contained for this new type of less-complex securitisation after controlling for loan and borrower characteristics. For instance, when considering loans issued in 2018, while the average quarterly delinquency rate of non-STS loans peaks at an annualised 141 bp in Q3-2020, the delinquency rate of STS loans is only around 15 bp in the same period. This is particularly relevant if we consider that the new STS criteria do not have implications for the quality of the securitised assets, as they only require that common standards of simplicity, transparency, and standardisation are met.

This paper is organised as follows. Section 2 introduces the new ABS regulation, Section 3 describes our sample, and Section 4 presents our methodology. We present our result in section 5, and the conclusions are found in Section 6.

2. The new European ABS regulation

Following its announcement in 2017, the new EU ABS regulation (Regulation [EU] 2017/2402) became effective on 1 January 2018. The regulation significantly reformed the EU securitisation market and introduced a framework for 'Simple, Transparent and Standardised' securitisations. The new regulation promotes the harmonisation of the ABS market through numerous provisions which can be grouped into (a) general provisions listed in Articles 1–17 which extend to all types of securitisations, and (b) provisions for Simple, Transparent, and Standardised securitisations in Articles 18–28, which define the criteria for this new class of ABS. Among the first group, the most relevant rules are as follows:

- *Improvement of investor due diligence*. Investors are now asked to monitor, among other things, the risk profile of an individual securitisation position and underlying exposures.
- *A ban on 'cherry-picking'*. Assets cannot be transferred to a Securitisation Special Purpose Entity which incurs higher losses than comparable assets that remain on the balance sheet of the originator.
- *Enhancement of transparency requirements*. The existing rules on disclosure to investors and competent authorities are harmonised and spelled out more in detail. Information on the ABS deal structure and underlying exposures shall be made available in a securitisation repository registered with the European Securities and Markets Authority (ESMA).
- *Inclusion of the criteria for credit-granting*. Loans granted after 2016 cannot be securitised whenever the required information cannot be verified by the originators (e.g., the income of self-employed borrowers).
- *Ban on re-securitisation*. It is now prohibited to issue ABS deals that include securitisation positions in their pool of underlying exposures.

The second part of the regulation identifies the criteria that need to be met for a securitisation to be labelled as STS. Unlike other provisions of the new ABS regulation, which apply to all securitisations, the STS regime is optional. The criteria include requirements relating to the underlying assets (such as asset sale, asset homogeneity, origination standard), disclosure and verification (documentation content and clarity, external verification of underlying exposures) and transaction structure (risk retention compliance, interest rate and currency risk mitigation). The criteria do not necessarily imply that STS securitisations are less risky, but rather that the risk involved can be better assessed by a prudent and diligent investor. On the one hand, the decrease in complexity is likely to positively affect asset performance. For instance, Ertan et al. (2017) show that higher market comparability and information disclosure are associated with lower default rates of securitised loans. On the other hand, similarly to what happened to highly rated ABS tranches during the sub-prime crisis (Benmelech and Dlugosz, 2009), STS labels could be exploited to pass credit risk to third parties without adequate compensation, eventually incentivising the issuance of riskier loans. For these reasons, analysing the impact of this newly introduced securitisation type on the European credit market is particularly important.

3. Data sources and description

We retrieve our data from the European DataWarehouse (ED), the platform designated by the European Securities and Markets Authority (ESMA) in Europe for collecting and validating standardised loan-level data for asset-backed securities that are eligible for repurchase agreements with the ECB. Starting from January 2013, loan-by-loan information on residential mortgage-backed securities—those eligible to be accepted as collateral in Eurosystem credit operations—must be quarterly reported to this repository. For each loan, more than 150 variables can be reported by the originators of the securitisation, 55 of which are mandatory. These categories include borrowers' information, loan characteristics, information on the mortgaged property and performance indicators.

Our sample includes 40,295,781 quarterly observations, reported from 2012-Q3 to 2021-Q1. To alleviate concerns relative to possible reporting issues, such as missing quarterly observations, we employ annual data for our main regressions which allows us to obtain a more balanced panel. Results with quarterly data are reported in our robustness tests in Appendix B. Table 1 shows the final number of deals, tranches, loans and observations by country of origination. As can be noted in Panel A, the whole sample includes 8,961,130 annual observations, reported from 2013 to 2021, which corresponds to 3,997,044 loans.

The majority of RMBS deals used in Eurosystem credit operations are issued in Netherlands, France, Spain, and Italy. However, one should be careful when using this data to describe the Euro area residential mortgage market. For instance, Germany is the country with the fewest number of deals in our sample even though it has one of the most developed residential real estate markets. The reason that we have few observations in this case is because German loans are usually re-packaged in a type of covered bonds—called 'Pfandbriefe'—which is rarely reported to the ED (Gaudêncio et al., 2019). Despite the relatively low representation of German deals in our sample, we feel our data provides a sufficiently good coverage of the overall European RMBS market as it encompasses, for example, 26.45% of the total European RMBS issuance in 2020.[5]

To differentiate the impact on mortgage delinquencies of the general provisions from the one of the STS provisions we split our sample into a general provision subsample, which includes mortgages securitised from 2013 to 2019 (Table 1, Panel B), and a STS subsample, which includes mortgages securitised from 2018 to 2021 (Panel C). As shown in the table, the two sub-samples are similar in terms of loan distribution by country of origination. We first use the general provision sample to analyse the effects of the general provisions on the quality of securitised residential mortgages. Next, the STS sample is used to assess the impact of the STS provisions on mortgage delinquencies and the possible difference in quality between STS and non-STS securitisations during the COVID-19 pandemic.

Additionally, to analyse the effects of the new regulation on the securitisation structure, we obtained information on the tranching composition of the RMBS deals from their prospectuses. We then retrieved tranche-level characteristics from Refinitiv Eikon, such as the tranche rating at origination and the tranche balance, whenever available. Our final tranche-level sample includes 782 observations. Within this sample, 567 tranches were issued from 2013 to 2019 (general provision subsample), and 215 tranches from 2018 to 2021 (STS subsample).

[5] Source: AFME, Finance for Europe. Securitisation Data Report, European Structured Finance. Q4:2020.

Table 1
Distribution of securitised mortgages by country of origination. The table reports country distributions of securitisation deals, tranches, mortgage loans, and annual observations at the loan level across the whole sample (Panel A), the General provision subsample (Panel B), and the STS subsample (Panel C). The two subsamples overlap in 2018 and 2019. Only tranches with a non-missing rating at origination are reported in this table.

Panel (A): Full sample, from 2013 to 2020

Country of Origination	Deals	Tranches	Loans	Observations
Netherlands	98	320	1,026,506	2,282,395
France	27	48	1,230,701	2,349,192
Spain	41	64	439,218	1,344,009
Italy	42	104	442,117	1,029,704
Belgium	5	14	143,793	389,307
United Kingdom	37	140	207,073	503,021
Germany	3	0	314,464	572,654
Portugal	5	5	56,462	182,006
Ireland	23	87	136,710	308,842
Total	281	782	3,997,044	8,961,130

Panel (B): General provision subsample, from 2013 to 2019

Country of Origination	Deals	Tranches	Loans	Observations
Netherlands	80	208	721,117	1,622,397
France	22	38	991,249	1,952,896
Spain	36	61	411,770	1,310,758
Italy	39	95	318,607	756,700
Belgium	5	14	141,484	353,880
United Kingdom	30	103	141,426	387,579
Germany	3	0	314,464	572,654
Portugal	3	4	41,685	147,637
Ireland	15	44	96,271	244,118
Total	233	567	3,178,073	7,348,619

Panel (C): STS subsample, from 2018 to 2020

Country of Origination	Deals	Tranches	Loans	Observations
Netherlands	43	112	484,375	891,414
France	11	10	293,424	464,617
Spain	9	3	30,246	36,070
Italy	12	9	204,032	364,651
Belgium	1	0	39,719	74,715
United Kingdom	17	37	87,666	142,479
Portugal	3	1	34,708	95,983
Ireland	16	43	81,841	122,038
Total	112	215	1,256,011	2,191,967

3.1. General provision sample

After the exclusion of loans with missing values and outliers (for instance, loans with a balance at origination of 0), our first subsample of securitised mortgages includes $3,178,073$ loans, reported from 2013 to 2019, for a total of $7,348,618$ observations. These correspond to 233 RMBS deals, comprising 567 tranches.

In the summary statistics in Table 2, we show that 0.91% of the total number of loans of our general provision subsample is delinquent. In the general provision sample, the majority of mortgages (38.3%) features a fixed interest rate, while 25.6% have a full floating interest rate. Additionally, 33.9% of mortgages have a hybrid interest rate, where either fixed rates are periodically updated or a portion of the mortgage is financed at a fixed rate while another portion at a variable rate. Regarding the loans' payment type, 53.6% are structured as annuities, featuring fixed monthly instalments composed of varying interest and principal amounts. Furthermore, 62.0% of the loans were issued for purchase purposes, with re-mortgages accounting for 12.3%, renovations 7.3%, and construction 6.6%. Additionally, the model incorporates the loan's current interest rate, averaging at 2.68% across the entire subsample, along with the number of years remaining until maturity and the loan-to-value (LTV) ratio at origination. As far as the borrowers' information is concerned, we use the *Employment Status* (Vandell and Thibodeau, 1985; Quercia et al., 2012, among others), and a variable indicating whether more than one mortgage has been given to the same borrower in the sample (*Second Time Borrower*). In our dataset, 82.7% of the borrowers are employed, while the second most common category, self-employed, covers 10.1% of the sample. Unsurprisingly, only 1.2% of the observations are related to unemployed borrowers and 0.2% correspond to legal entities, that is, limited liability companies (LLC). In terms of macro-economic controls, we consider the one-year lagged country-specific unemployment rates and house price indexes (HPI). The relevance of these factors in driving loan defaults is not new in the literature on bank lending. For instance, it has been shown that periods of economic booms characterised by growing GDP and increasing house prices are associated with a fall in non-performing loans (Škarica, 2014; Ozili, 2015, among others). Other studies (e.g., Nkusu, 2011; Gyourko and Tracy, 2014), found that higher unemployment negatively affects borrowers' ability to repay loans.

3.2. STS sample

The second sample includes 1,256,011 loans, reported from 2018 to 2021, with a total of 2,191,967 annual observations. These correspond to 112 RMBS deals, comprising 215 tranches. Among these RMBS deals, 43 meet the new STS criteria.

Summary statistics are reported in Table 2. The STS sample does not significantly differ from the general provision sample in terms of loan composition. For instance, 0.67% of the loans in this sample are delinquent which is slightly lower than the 0.91% in the general provision sample. Similarly, the fraction of mortgages granted to employed borrowers is equal to 82.7% in the general provision sample and 83.0% in the STS sample. The most striking difference relates to the interest rate type. In the STS sample, there is a significantly higher proportion of loans with a hybrid interest rate, accounting for 43.7% compared to the general provision sample's 33.9%. Conversely, the STS sample exhibits a lower percentage of loans with a fixed interest rate, standing at 20.9% in contrast to the general provision sample's 38.3%. Finally, the change in the house price indexes averages at 5.75 during the STS sample period, which is much higher than the 0.16 average of the general provision sample period. This reflects a positive trend in house prices that was observed during the later part of the sample period. For instance, despite the pandemic in 2020, the annual growth rate of the European house price index reached levels that had not been recorded since 2007.[6]

4. Model specification

To measure the impact of the new ABS regulation on the quality of securitised loans, we use a panel-probit model. This approach, and its alternative logistic methodology, is generally used in the literature that analyses loan delinquencies (see, for instance, Cunningham and Capone, 1990; Vandell and Thibodeau, 1985; Jiang et al., 2014). Our baseline model, implemented on the general provision sample, is specified as follows:

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

where $\textit{Loan delinquency}_{i,t}$ is a binary variable that takes value 1 if loan i defaults or is in arrears for at least two consecutive quarters. Loan and borrower's characteristics are a set of dummy variables that we describe in Appendix A (Table 12). Macro-variables include country-specific changes in unemployment rates and house price indexes (HPI).

[6] Source: Eurostat, Housing price statistics - house price index.

Table 2
Sample characteristics. The table reports loan level averages for the variables used in the main regressions for the full sample and the general provision and STS sub-samples.

		Full sample	General provision subsample	STS subsample
	Sample Period	2013 - 2020	2013 - 2019	2018 - 2020
	No. of loans	3,997,044	3,178,073	1,256,011
	Variables	**Mean**	**Mean**	**Mean**
	Delinquent	0.008	0.009	0.007
	Securitised from 2018	0.314	0.138	1.000
	Originated from 2018	0.055	0.016	0.159
	Originated from 2017	0.108	0.030	0.306
	STS securitisation	0.150	\	0.477
Loan characteristics				
	Loan to Value	0.836	0.823	0.876
	Years to Maturity	17.9	15.7	25.7
	Interest Rate	2.639	2.683	2.385
Interest Type	Floating	0.278	0.256	0.329
	Fixed	0.345	0.383	0.209
	Hybrid	0.353	0.339	0.437
	Other	0.024	0.022	0.026
Payment Type	Annuity	0.617	0.599	0.680
	Linear	0.161	0.192	0.048
	Increasing	0.015	0.015	0.011
	Other	0.207	0.195	0.261
Purpose	Purchase	0.636	0.620	0.681
	Remortgage	0.120	0.123	0.120
	Renovation	0.074	0.073	0.074
	Construction	0.066	0.066	0.063
	Other	0.104	0.118	0.063
Borrower Characteristics				
	Second Time Borrower	0.245	0.242	0.256
Employment	Employed	0.828	0.827	0.830
	Unemployed	0.011	0.012	0.006
	Self Employed	0.103	0.101	0.109
	Legal Entity	0.002	0.002	0.002
	Student	0.002	0.001	0.002
	Pensioner	0.028	0.027	0.032
	Other	0.029	0.031	0.020
Macro-variables				
	ΔUnemployment	1.540	2.802	-0.007
	ΔHouse Price Index	1.942	0.168	5.752

These are lagged by one-year, as their effect on the defaults rate are not likely to be immediate (Gerardi et al., 2018).

Including these variables is particularly important as it allows us to distinguish between changes in default probabilities driven by the overall market and those driven by specific securitisation features. Since all loans in a deal are usually originated by the same bank, deal fixed effects allow us to control for RMBS deal-specific structural features and bank credit practices, while year fixed effects will capture changes related to the reporting period. To assess the impact of securitisation complexity on mortgage default rates during the STS sample period, we implement the following model:

$$\begin{aligned} &\mathit{Loan\ delinquency}_{i,t} = \alpha + \beta_1 \mathit{STS\ Securitisation}_i \\ &+ \beta_2 \mathit{Int.\ Rate\ at\ origination}_i + \beta_3 \mathit{Years\ to\ maturity}_{i,t} \\ &+ \gamma \mathit{Loan\ characteristics}_i + \delta \mathit{Borrower's\ characteristics}_i \\ &+ \theta \mathit{Macro\text{-}variables}_{i,t-1} + \mathit{Country\ FE} + \mathit{Year\ FE} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

where the *STS Securitisation* dummy identifies simple, transparent and standardised securitisations. By interacting *STS Securitisation* with the *Pandemic Period* dummy, which equals one for loans reported from 2020Q1 and zero otherwise, we analyse the performance of STS securitisation during the COVID-19 pandemic. To avoid collinearity issues, country fixed effects are used instead of the usual deal fixed effects. In all models we use clustered standard errors at the deal level.

Finally, to examine the impact of the new regulation on RMBS ratings and their securitisation structure, we utilise our tranche-level dataset and employ ordinal logistic models. This approach is commonly used in the literature to analyse credit ratings (e.g., Nickell et al., 2000 and De Moor et al., 2018), and allows us to estimate the tranche likelihood of being rated AAA – A3, BAA1 – BAA3 or BA1 – C (i.e., speculative). The models are specified as follows:

$$\mathit{Rating\ band}_i = \alpha + \beta_1 \mathit{Origination\ from\ 2018}_i + \varepsilon_i \tag{3}$$

$$\mathit{Rating\ band}_i = \alpha + \beta_1 \mathit{STS\ Securitisation}_i + \varepsilon_i \tag{4}$$

where $\mathit{Origination\ from\ 2018}_i$ and $\mathit{STS\ Securitisation}_i$ are binary variables that take value 1 if tranche i belongs to an RMBS deal originated from 2018 or labelled as STS, respectively. To account for the differences in the balance at origination of each tranche, we incorporate weighting in our analysis. This approach ensures that each tranche receives proportionate importance based on its relative value.

5. Results

5.1. The effects of the new ABS regulations' general provisions

First, by excluding from our analysis all deals that meet the STS requirements, we analyse the default risk impact of the general provision regulation. The results are reported in Table 3. In line with our expectations, mortgages issued from 2018, when the general provision rules entered into force, tend to have, on average, a 34 bp lower annual probability of being delinquent than those issued before the new regulation. The increase in quality is substantial when we consider that our sample includes loans securitised into RMBSs that are eligible for repurchase agreements with the ECB and, as a consequence, have a generally

Table 3
The effect of the new European ABS regulation on mortgage delinquency rates, general provision sample. Panel A, specification 1, reports panel probit regression results for the baseline model in Equation (1), which includes *Origination from 2018*, a dummy that identifies securitised mortgages originated after the introduction of the new European ABS regulation. In specification 2, *Origination from 2018* is replaced by *Securitisation from 2018*, a dummy that identifies mortgages securitised after the introduction of the new European ABS regulation. Panel B reports regression results when explanatory variables are gradually added to the model. The sample includes non-STS deals only. The definition of the remaining variables can be found in Appendix A. Sample period: 2013 to 2019. Robust standard errors are clustered at deal level. The symbols ***, **, and * denote significance at the 1%, 5% and 10% level, respectively.

Panel A: Baseline Model

Dep. Var.: Mortgage delinquency indicator	**Marginal Effect (bp)**	
	(1)	**(2)**
Origination from 2018	**-33.59****	
	(15.88)	
Securitisation from 2018		**11.65**
		(9.51)
Years to Maturity	11.93***	11.7***
	(2.82)	(2.82)
Interest Rate	0.03	0.03
	(0.02)	(0.02)
Loan-to-value		
0.6 ≤ LTV < 0.7	4.25**	4.23**
	(1.73)	(1.71)
0.7 ≤ LTV < 0.8	10.94***	10.93***
	(2.64)	(2.65)
0.8 ≤ LTV < 0.9	17.19***	17.14***
	(3.44)	(3.44)
0.9 ≤ LTV < 1	29.80***	29.73***
	(5.36)	(5.33)
LTV ≥ 1	39.78***	39.96***
	(6.50)	(6.39)
Interest Rate Type		
Floating Int. Type	23.13***	23.37***
	(4.08)	(4.13)
Hybrid Int. Type	3.82	3.52
	(5.37)	(5.30)
Other Int. Type	14.51**	15.03***
	(7.14)	(7.36)
Payment Type		
Linear Payment Type	-28.45***	-27.01***
	(7.88)	(8.14)
Increasing Payment Type	42.10***	42.19***
	(13.09)	(13.24)
Other Payment Type	2.86	3.41
	(3.53)	(3.55)
Purpose		
Remortgage Purpose	22.82*	22.39*
	(12.57)	(12.44)
Renovation Purpose	14.38***	14.33***
	(4.67)	(4.65)
Construction Purpose	-6.85*	-7.04**
	(3.58)	(3.45)
Other Purpose	42.27***	41.99***
	(9.84)	(9.82)
Borrower characteristics		
Second Time Borrower	2.12	1.78
	(3.39)	(3.38)
Unemployed	57.68***	57.52***
	(7.21)	(7.26)
Self-employed	48.30***	48.22***
	(4.78)	(4.77)
Legal Entity	112.23***	110.68***
	(40.11)	(39.96)
Student	-14.61	-14.96
	(9.33)	(9.27)
Pensioner	16.82**	16.85**
	(7.20)	(7.20)
Other employment	22.25***	22.24***
	(4.92)	(5.00)
Macro-variables		
ΔHouse Price Index	-2.51	-2.47
	(2.28)	(2.27)
ΔUnemployment	104.22	112.92
	(305.24)	(302.76)
Deal Fixed Effects	*Yes*	*Yes*
Time Fixed Effects	*Yes*	*Yes*
Observations	7,114,158	7,114,158
Pseudo R-squared	0.153	0.153

Table 3 (*continued*)

Panel B: Robusteness

Dep. Var.: Mortgage delinquency indicator	**Marginal Effect (basis points)**			
	(1)	**(2)**	**(3)**	**(4)**
Origination from 2018	-32.01	-32.78**	-33.17**	-33.59**
	(16.96)	(15.71)	(15.90)	(15.88)
Loan Characteristics		Yes	Yes	Yes
Borrower Characteristics			Yes	Yes
Macro-Variables				Yes
Deal FE	Yes	Yes	Yes	Yes
Annual FE	Yes	Yes	Yes	Yes
Obs.	7,114,158	7,114,158	7,114,158	7,114,158
Pseudo-R^2	0.145	0.149	0.153	0.153

high rating. To understand the magnitude of this improvement in credit quality, it is worth noting that the reduction in default rates far exceeds the average default rate of 5 bp for an Aa3-A1 rated bond, which is the average tranche rating in the general provision sample.[7] Interestingly, while the increase in quality is evident for newly originated loans, in specification 2 we find no evidence that loans securitised from 2018—but without any constraint on the time of origination—are characterised by any statistically significant change in delinquency rate. As a result, banks appear to have maintained a stable credit profile in their securitisations after the introduction of the new ABS regulation by mixing higher risk mortgages issued before the new rules with lower risk mortgages issued after the new rules.

The remaining coefficients of the model provide insight into the factors driving defaults and generally confirm what has been found in the literature. As expected, mortgages characterised by higher loan-to-value ratios at origination, as well as those with higher interest rates at origination, show, on average, larger delinquency rates. Specifically, as the loan-to-value ratio increases, the delinquency rates significantly increase in a monotonic way.

As far as the interest rate type is concerned, our results highlight that when interest rate uncertainty is higher, borrowers tend to default more. This is the reason that, on average, loans with a floating interest rate show higher default probabilities than those with a fixed interest rate (baseline for this variable). The amortisation schedule of principal and interest rates also plays a role in explaining mortgage defaults. Mortgages with increasing payment amounts (i.e. negative amortisation mortgages in which the borrower pays less than the interest due each month, resulting in a higher loan balance over time) are more likely to enter delinquency. On the contrary, delinquency rates are lower when instalments are decreasing over time (linear payment type). Finally, when borrowers' employment status is considered, the results show that loans given to self-employed workers and to the unemployed tend to default more than those granted to regular employed borrowers (which are the baseline), with 48.3 bp and 57.7 bp higher annual default rate. Interestingly, legal entities (LLC) show the highest delinquency risk. Although it is true that the limited liability structure of these borrowers may inherently result in higher default probabilities, it is important to consider that this category represents only 0.2% of our mortgage population. As a result, their credit behaviour becomes more challenging to generalise.

It is crucial to emphasize that, apart from LLC borrowers, European mortgage holders have no incentive to default in case of negative equity due to the full recourse nature of their mortgage contracts. This helps alleviate concerns regarding potential endogeneity in our model. As noted in the literature (e.g., Gupta and Hansman, 2022), borrowers with a

[7] The average for the general provision sample is 23.5 (rating equivalent), which corresponds to a rating between AA3 (24 rating equivalent) and A1 (23 rating equivalent). Default rates are taken from Moody's Investor Service (2021), Exhibit 43 'Average cumulative issuer-weighted global default rates 1983-2020'.

Table 4
The effect of the European ABS regulation announcement on mortgage delinquency rates, general provision sample. The table reports panel probit regression results for the baseline model in Equation (1), with dummies identifying alternative origination periods. The first specification distinguishes between mortgages originated from 1 January 2018 and those originated in 2017; the second specification identifies mortgages originated from 1 January 2017, the year in which the final draft of the new regulation was announced. Sample period: 2013 to 2019. The sample includes non-STS deals only. Robust standard errors are clustered at deal level. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Dep. Var: Mortgage delinquency indicator	**Marginal Effect (basis points)**	
	(1)	**(2)**
Origination from 2018	-41.18**	
	(16.48)	
Origination in 2017	-37.33***	
	(8.64)	
Origination from 2017		-38.13***
		(9.58)
Loan Characteristics	Yes	Yes
Borrower Characteristics	Yes	Yes
Macro-Variables	Yes	Yes
Deal and Time FE	Yes	Yes
Obs.	7,114,158	7,114,158
Pseudo-R^2	0.153	0.153

higher likelihood of default may intentionally choose riskier contract types, such as high loan-to-value (LTV), flexible rate, and interest-only mortgages. The selection of these contracts can serve as an indicator of the borrower's risk tolerance, potentially influencing their future decision to engage in strategic default (Byrne et al., 2017). However, the prevalence of full recourse mortgages in Europe significantly mitigates this potential source of endogeneity.[8]

Recourse mortgage holders lack the motivation to engage in strategic default as they remain personally liable for any negative equity in their mortgages. Consequently, they tend to prioritize mortgage payments over other expenses to avoid default (Gross et al., 2022; Hatchondo et al., 2013). This characteristic of recourse mortgages greatly reduces the relevance of endogeneity concerns associated with contract type selection within our European mortgage sample. This is because the propensity to default for a borrower with a recourse mortgage becomes inconsequential. Default is generally considered a last resort compelled by the borrower's inability to repay the mortgage, rather than a strategic decision made while the borrower is still capable of honouring the mortgage repayments.

The presence of recourse loans also mitigates the possibility that interest rate uncertainty could drive strategic defaults in our sample. To provide assurance that this is the case, we proxy for interest rate uncertainty by computing the volatility of the monthly Euribor, measured by the standard deviation of the previous 12 months with respect to the observation date (Sarkar and Ariff, 2002). This methodology, although backward looking, simulates the decisions an agent can make based on the historical information they possess. The results obtained when the volatility of the interest rate is used in place of the time fixed effects are consistent with our main findings (see Appendix D – specifications 6 and 7)

We further expand our results by analysing the quality at origination of mortgages issued from 2017. This allows us to investigate whether banks started to change their behaviour from the announcement of the new regulation in 2017, rather than from January 2018 when the new rules came into force. The results are reported in Table 4. Specification 1 in the Table shows that loans issued in 2017 exhibit a 37 bp reduction in annual delinquency probability compared to those issued prior to 1 January 2017. Likewise, loans issued from 1 January 2018, display a lower annual delinquency rate of 41 bp. More generally, as can be seen in specification 2, banks seem to have improved their credit practices since 2017, when the final draft of the regulation was announced, with loans originated from 2017 showing a 38 bp lower annual delinquency probability than those issued before 1 January 2017.[9]

Regarding this matter, a potential concern arises regarding the possibility that the improvement in loan quality may be driven by factors unrelated to the new ABS regulation. To address this concern, we conduct a series of robustness checks, which we present in Appendices B, C, and D. In Appendix B (Table 13), specifically for specifications 3 and 4 with quarterly data,[10] we demonstrate that our main findings remain consistent when we limit the analysis to the first two years of data available after a loan has been issued. This approach helps alleviate concerns that older loans might be overrepresented in the sample, and that more recently issued loans might exhibit lower delinquency rates simply due to a shorter reporting period. However, we acknowledge that the impact of loan securitisation timing may introduce additional complexities. As loans could potentially be securitised long after their origination, we recognize the potential for selection effects to arise. To address this concern, in Appendix C (Table 14), specification 4, we only include in the sample the first two annual observations after loan securitisation, rather than limiting the analysis to the first two years after origination. This approach mitigates any biases introduced by varying securitisation timelines and offers a nuanced perspective that complements our analysis in Appendix B.

Additionally, we address concerns regarding the representativeness of the loan and borrower information at origination used in our model. We provide evidence in Appendix B, specification 5, that by excluding the regulation period from the analysis (specifically, loans securitized from 2017), there is no significant decrease in delinquency rates observed for more recently issued loans (i.e., loans issued from 2015-Q1).

Furthermore, we show in Appendix C, that results hold when we apply additional loan exclusions to the sample. In specification 1, we exclude loans originated before 2010, that is, loans possibly originated over the credit bubble. In specification 2, we eliminate loans issued before 2013 to account for the possible effect of the increasing transparency introduced at the beginning of that year.[11] In specification 3, we exclude loans reported in 2013 and 2014 to account for possible confounding effects relative to the European sovereign debt crisis. Although the main effects of the sovereign debt crisis were experienced between 2010 and 2012, government bond spreads in Europe's periphery remained elevated in 2013 and 2014, which represent the first two years of our sample period, compared to pre-Great Recession levels. Finally, in Appendix D (Table 15), specifications 1 and 2, we have added the lagged country-specific GDP to the model to control for the possible effect of the business cycle on delinquencies. Our main results remain unchanged, as both the general provision regulation and the STS regulation samples demonstrate a statistically significant reduction in default rates. We also run our main model by replacing the time FE with the time-varying change in the Euribor index (3-months). This allows us to capture the impact of short-term interest rate fluctuations on the probability of default. The results are consistent with our main findings (Appendix D – specifications 3 and 4).

[8] See for further reference: https://www.stlouisfed.org/publications/regional-economist/july-2013/europe-may-provide-lessons-on-preventing-mortgage-defaults.

[9] As a robustness check, we show in Panel B, specification 1 and 2, that results hold when using quarterly data.

[10] To prevent identification issues arising from fewer available observations, the analyses in Appendix B are run with quarterly data.

[11] Starting January 2013, banks that use residential mortgage-backed securities in repo borrowing are required to report loan-level data in a detailed and standardised format set by the ECB.

Table 5
Borrower risk, loan-to-value and mortgage delinquency, general provision sample. The table reports panel probit regression results for the baseline model in Equation (1), in which employment status (specification 1) and loan-to-value ratios (specification 2) are interacted with the post-reform origination dummy. The sample includes non-STS deals only. Variable definitions are reported in Appendix A. Sample period: 2013 to 2019. Robust standard errors are clustered at a deal level. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Dep. Var.: Mortgage delinquency indicator	**Marginal Effect (bp)**	
	(1)	**(2)**
Origination from 2017	**-31.50***** **(6.95)**	**-31.38***** **(6.43)**
Unemployed	58.37*** (7.30)	57.87*** (7.24)
Self_Employed	49.07*** (4.87)	48.75*** (4.81)
Legal Entity	119.89*** (44.06)	114.30*** (39.87)
Pensioner	16.98** (7.43)	17.09** (7.30)
Other borrower	22.58*** (4.84)	22.57*** (4.90)
Unemployed * Orig. 2017	**11.36** **(12.07)**	
Self_Employed * Orig. 2017	**21.89**** **(8.80)**	
Legal Entity * Orig. 2017	**50.4** **(32.03)**	
Pensioner * Orig. 2017	**15.14** **(10.74)**	
Other borrower * Orig. 2017	**14.83** **(28.48)**	
$0.6 \leq LTV < 0.7$	4.28** (1.75)	4.48*** (1.75)
$0.7 \leq LTV < 0.8$	10.92*** (2.64)	11.08*** (2.71)
$0.8 \leq LTV < 0.9$	17.32*** (3.48)	17.45*** (3.50)
$0.9 \leq LTV < 1$	30.10*** (5.42)	30.32*** (5.47)
$LTV \geq 1$	39.95*** (6.45)	39.76*** (6.46)
$0.6 \leq LTV < 0.7$ * Orig. 2017		**-4.94** **(6.11)**
$0.7 \leq LTV < 0.8$ * Orig. 2017		**4.36** **(4.46)**
$0.8 \leq LTV < 0.9$ * Orig. 2017		**9.26** **(9.28)**
$0.9 \leq LTV < 1$ * Orig. 2017		**13.12** **(13.30)**
$LTV \geq 1$ * Orig. 2017		**35.45***** **(10.45)**
Loan Characteristics	Yes	Yes
Borrower Characteristics	Yes	Yes
Macro-Variables	Yes	Yes
Deal and Time FE	Yes	Yes
Obs.	7,114,158	7,114,158
Pseudo-R^2	0.153	0.153

Next, we explore the potential impact of the ban on cherry-picking and the increased investor due diligence, both of which are components of the general provision regulation, on banks' issuance of loans with 'risky' characteristics. The restriction on transferring loans with higher expected losses than those retained on the balance sheet to external entities may lead banks to shift the composition of their portfolios towards safer assets. At the same time, heightened investor awareness regarding the riskiness of underlying assets could incentivize banks to enhance the quality of securitized loans. To further explore this, we examine loan characteristics associated with higher delinquency probabilities across the entire sample. To do so, we employ our model and introduce interactions between the loan origination period and variables such as employment status and loan-to-value ratio, both of which are significant drivers of default based on our previous findings. The outcomes of this analysis are presented in Table 5, specifically specifications 1 and 2. In specification 1, the coefficients of the interactions between risky employment statuses (unemployed, legal entity, pensioner, and other borrowers) with 'Origination from 2017' are not statistically significant. This implies that loans originated from 2017 for these borrowers exhibit a risk reduction that is not statistically significantly different from other loans originated from 2017, i.e. -31.5 bp. However, the self-employed borrowers stand out as their interaction with 'Origination from 2017' shows a positive and statistically significant increase in default probability by 21.9 bp. Nevertheless, this increase is not substantial enough to offset the baseline reduction in default probability of loans originated from 2017. In summary, it can be concluded that the default risk for risky borrowers, following the introduction of the general provision regulation, has either decreased or remained unchanged. Moving to specification 2, we examine the interaction between different loan-to-value (LTV) ratios and 'Origination from 2017'. Again, all LTV ratios up to 100% demonstrate a risk reduction that is not statistically significantly different from other loans originated from 2017. However, loans with an LTV above 100% appear to exhibit a slight increase in risk. It is important to note that this subset of mortgages is relatively small, comprising only 14,142 loans, representing a mere 0.46% of our sample.

The interpretation of these findings may be improved by an analysis of the distribution of our mortgage population by employment status and year of origination (Fig. 3), and by loan-to-value bucket and year of origination (Fig. 4). The fraction of loans granted to self-employed applicants (represented in brown) consistently decreases following the implementation of the new ABS regulation. In contrast, there is a corresponding increase in the proportion of loans given to pensioners, who are relatively less risky (see Table 3). Similarly, when examining loan-to-value (LTV) ratios based on the year of origination, it is notable that the percentage of mortgages with an LTV ratio above 0.8 experiences a significant decline from 2017 to 2019. Although there is a partial rebound in 2020, its level remains below those seen prior to 2017. This reversal in trend can potentially be attributed to government initiatives enacted in response to the COVID-19 pandemic, such as mortgage forbearance programs and temporary relaxation of lending standards. Overall, these findings support the conclusion that the prohibition on cherry-picking may have motivated banks to reduce the proportion of loans with riskier characteristics.

5.2. COVID-19 and loan delinquencies

Despite the improved credit quality of securitised residential mortgages resulting from the recent ABS regulation, the credit risk landscape was significantly impacted by the COVID-19 pandemic. Banks faced heightened pressure on their credit portfolios, which in turn affected their stability. Governments worldwide implemented measures such as country-wide lockdowns and stimulus packages to mitigate the adverse effects of the pandemic. While these government policies appeared to have a generally positive effect on stocks (Narayan et al., 2021), the same cannot be said for credit instruments. As highlighted by Colak and Öztekin (2021), lockdown measures inadvertently strained borrowers, leading to a global increase in credit risk. This observation aligns with our mortgage population, which exhibits a substantial surge in delinquency rates even among loans originated after the implementation of the new regulation. Fig. 5, panel A, illustrates this trend, with the quarterly delinquency rate of loans issued in 2018 doubling from 3 bp in 2019-Q4 to 8 bp in 2020-Q1, peaking at 15 bp in 2020-Q3. Similar patterns emerge for loans originated in 2019 and 2020.

Borrowers have not all been equally affected by the pandemic, as illustrated in Fig. 5, Panel B. Unemployed and self-employed borrowers experienced the most significant increases in delinquency rates. For example, the delinquency rate for unemployed borrowers surged from 16 bp in 2019-Q4 to 123 bp in 2020-Q1. Similarly, self-employed borrow-

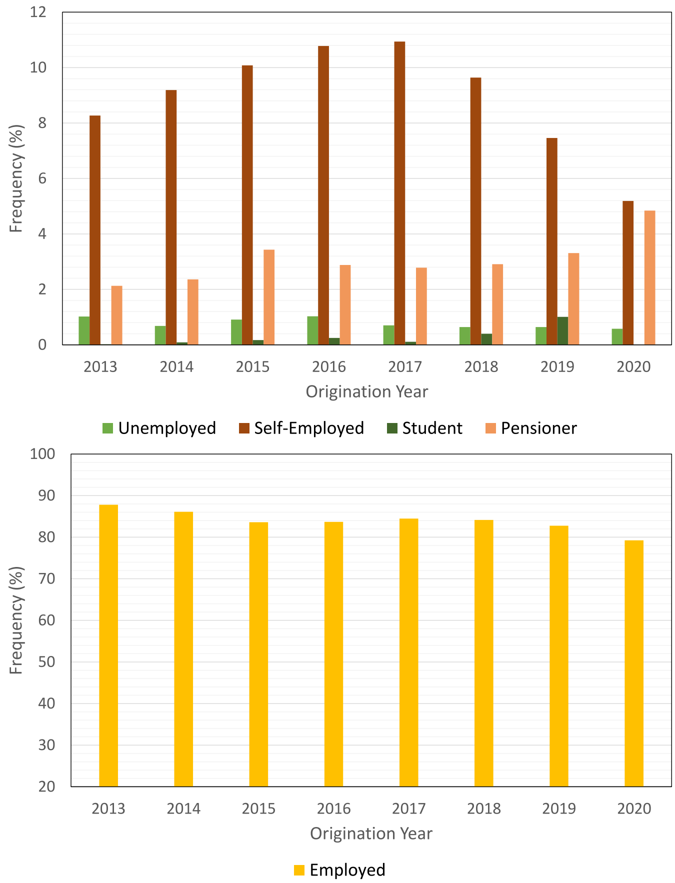

Fig. 3. Distribution of residential mortgages by employment status and year of origination. Figure A shows the distribution of unemployed, self-employed, student, and pensioner borrowers by year of origination. Figure B shows the distribution of employed borrowers by year of origination. (For interpretation of the colours in the figure(s), the reader is referred to the web version of this article.)

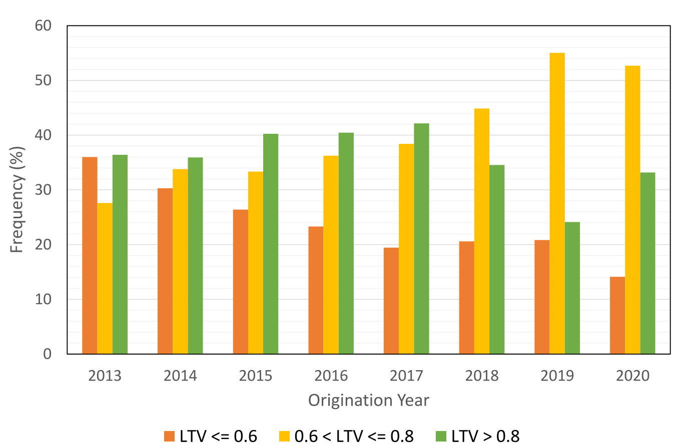

Fig. 4. Distribution of residential mortgages by loan-to-value bucket and year of origination.

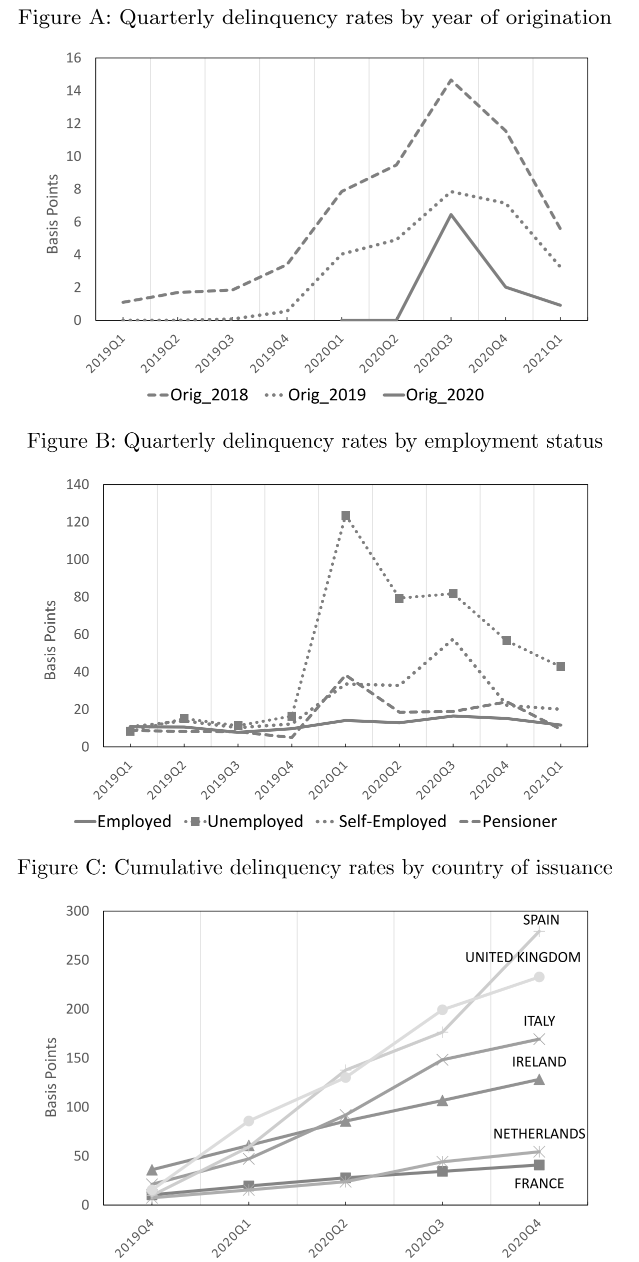

Fig. 5. The effects of the COVID-19 pandemic on loan delinquencies. The figures show the quarterly delinquency rate by year of origination (Figure A), by employment status (Figure B), and the cumulative delinquency rate by country of origination during the pandemic relative to the total number of active loans in Q4-2019 (Figure C).

ers witnessed a rise from 12 bp at the end of 2019 to 58 bp in 2020-Q3. In contrast, employed borrowers only saw a modest increase of 6 bp in delinquency rates in the same period. This can be attributed to employed borrowers being the primary beneficiaries of furlough schemes, which were widely implemented across Europe during the COVID-19 pandemic to address rising unemployment rates.[12]

Furthermore, the severity of the pandemic's impact on loan delinquencies appears to have been influenced by country-specific factors (Colak and Öztekin, 2021). As depicted in Fig. 5, Panel C, mortgage delinquency ratios varied significantly among the countries in our sample during the pandemic. For instance, in France, only 0.30% of active loans originated in 2019 became delinquent by the end of 2020. However, countries like Spain and the United Kingdom experienced default ratios above 2.1% during the same period. Interestingly, there appears

[12] See 'Pandemic takes toll on self-employed, parents and less well off', Financial Times. May 25, 2021.

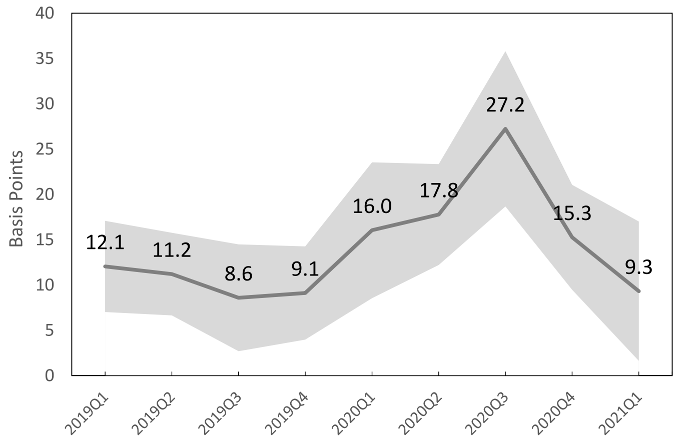

Fig. 6. Quarter fixed effects of loan delinquencies and COVID-19, The figure displays the marginal coefficients, along with their corresponding 95% confidence intervals computed using the delta method, of the quarter fixed effect in the probit regression model for loan delinquencies as defined in Equation (1). These coefficients were estimated using quarterly data.

to be a strong association between the severity of the pandemic in a country and loan delinquencies. Countries with changes in excess mortality rates below the European average (+11.7%), such as Ireland, France, and the Netherlands, exhibited lower delinquency rates. On the other hand, countries with significantly higher changes in excess mortality rates, such as Spain and Italy, displayed higher loan delinquency ratios during the pandemic.[13]

It is important to note that loan delinquencies do not automatically result in defaults, particularly given the extraordinary circumstances surrounding the pandemic. Payment holiday schemes have been widely implemented to alleviate the financial distress caused by the crisis. However, prolonged payment holidays could pose potential challenges for banks as debts accumulate over time.[14] Therefore, it is crucial to assess the extent of the COVID-19 pandemic's impact on loan delinquencies while controlling for loan characteristics, borrower information, and country-specific factors. To accomplish this, we estimate Equation (1) on the STS sample using quarterly data and quarterly fixed effects. The marginal effects of the quarter fixed effects are presented in Fig. 6. Our model confirms that the likelihood of delinquency began to rise in 2020-Q1 and reached its peak in 2020-Q3, with all coefficients for the year 2020 being statistically significant at a confidence level of 5% or higher. Specifically, the delinquency probability increased by 18 basis points from 2019-Q4 to 2020-Q3. However, it rapidly returned to pre-pandemic levels in the first quarter of 2021.

5.3. Simple, transparent and standardised securitisation

We then delve into the impact of the newly introduced STS securitisation standards on mortgage quality. STS labels are used to identify ABSs that are deemed 'simple' in terms of their underlying assets, 'transparent' in the information available to investors, and 'standardised' for easy comparison with other securitised structures. However, it's important to note that STS labels do not inherently indicate the quality of the underlying assets. This raises the concern that STS deals, despite their lower complexity, may include loans of subpar quality. The adherence to regulatory standards might mistakenly be interpreted by investors as a signal of higher credit quality, potentially making these deals more readily tradable. To address this concern, we narrow our analysis to RMBS deals subject to the new regulation (STS subsample), specifically those issued from 1 January 2018. This subsample consists of 1,256,011 loans, with 40.18% of them included in STS deals. As depicted in Table 6, STS deals share certain similarities with their non-STS counterparts in terms of loan composition, but they also exhibit distinct characteristics.

For example, the distribution of mortgages by borrower employment status is nearly identical between the two categories. However, notable distinctions arise when considering the interest rate type and loan-to-value ratios. Among non-STS loans, 31.6% have a floating interest rate, whereas only 8.6% of STS loans have a similar adjustable interest rate. Conversely, the proportion of loans with a fixed interest rate is considerably higher in STS deals (54.5% compared to 10.4% in non-STS deals). However, it should be noted that STS loans tend to have higher average loan-to-value ratios. Specifically, the fraction of loans with an LTV ratio above one is 34.8% in STS deals, whereas it is only 24.3% in non-STS deals. Additionally, in alignment with the new simplicity and standardisation criteria, STS deals exhibit significantly lower proportions of atypical loans, denoted as 'Other' in the table, in comparison to all loan characteristics. Furthermore, in addition to these structural differences, STS deals also appear to be characterized by better-performing underlying assets. Within our STS subsample, only 0.20% of STS loans experience delinquency, while the delinquency rate for their non-STS counterparts reaches 1.62% during the same period. To complement these findings, we employ Equation (2) on the STS subsample, thereby controlling for loan characteristics, borrower information, and macroeconomic conditions. The outcomes are presented in Table 7, where we exclude the pandemic period in specification 1 and analyze the full sample in specification 2. Upon analysis, it becomes evident that loans securitised in STS deals in 2018 and 2019, prior to the pandemic, exhibit an annual delinquency probability that is 39 basis points lower than their non-STS counterparts. Interestingly, when considering the entire 2018-2020 period, including the pandemic, the disparity in delinquency rates becomes even more pronounced. Specification 2 demonstrates that the delinquency rate for STS loans decreases by -77 basis points. These findings contradict the notion that STS securitisation may encourage banks to issue and securitise lower-quality loans. Instead, it appears that banks opt to securitise higher-quality loans when the ABS structure facilitates a more accurate and straightforward assessment of associated risks. Furthermore, the full output in specification 2 sheds light on the factors linked to an increase in delinquency probabilities during the 2018-2020 period. Notably, delinquencies in the period that includes the crisis predominantly stem from borrower characteristics and the loans' country of origination. For example, unemployed borrowers experience a 101 bp higher annual delinquency probability compared to employed borrowers, a significant deviation from the 34 basis point higher delinquency probability observed prior to the pandemic. Consistent with our earlier findings, delinquency rates are also found to be elevated for loans issued in Spain, Italy, and the United Kingdom.

To address potential concerns regarding different risk propensities between financial institutions issuing STS deals and those issuing non-STS deals, we conducted a separate analysis focusing on a sample comprising only banks that have issued both STS and non-STS deals. This restricted sample consists of 623,713 loan-level observations relative to 45 financial institutions. By running our main model (Equation (2)) on this restricted sample, we aim to determine whether banks specifically select safer loans for their STS deals. We report our results in specification 3, showing that loans securitised in STS deals show a 16 bp lower annual probability of delinquency than loans securitised in non-STS deals issued by the same group of financial institutions, in line with our main results.

Additionally, we have carried out a robustness analysis in which we control for a measure of country-specific government support during the Covid period. The measure is the Economic Support Index (ESI) which is part of the Oxford Covid-19 Government Response Tracker (Ox-

[13] Source: Eurostat, excess mortality - monthly data. Available at: https://ec.europa.eu/eurostat/databrowser/view/demo_mexrt/default/table?lang=en.

[14] See 'Analysis: Pandemic payment holidays mask wave of European problem debt', Reuters. November 11, 2020.

Table 6
Mortgage distribution by loan characteristics, STS sample. The table shows the distribution of residential mortgages for STS and non-STS securitisations across loan and borrower characteristics. Variable definitions are reported in Appendix A. Sample period: 2018 to 2020.

General		**No. of Loans**	**Observations (%)**			
	non-STS	751,336	59.82			
	STS	504,675	40.18			
Employment		**Employed (%)**	**Unemployed (%)**	**Self_Employed (%)**	**Legal (%)**	**Other (%)**
	non-STS	79.59	0.63	11.00	0.21	8.47
	STS	87.80	0.46	8.95	0.00	2.78
Interest Rate Type		**Floating (%)**	**Fixed (%)**	**Hybrid (%)**	**Other (%)**	
	non-STS	31.58	10.40	56.50	1.52	
	STS	8.63	54.46	35.93	0.97	
Payment Type		**Annuity (%)**	**Linear (%)**	**Increasing Inst. (%)**	**Other (%)**	
	non-STS	56,61	9.06	0.01	34.32	
	STS	77.49	1.69	2.42	18.4	
Purpose		**Purchase (%)**	**Re-mortgage (%)**	**Renovation (%)**	**Construction (%)**	**Other (%)**
	non-STS	70.57	13.61	3.31	2.66	9.84
	STS	71.23	7.90	10.70	9.10	1.08
Loan-to-value		**LTV < 0.7 (%)**	**0.7 ≤ LTV < 0.8 (%)**	**0.8 ≤ LTV < 0.9 (%)**	**0.9 ≤ LTV < 1 (%)**	**LTV > 1 (%)**
	non-STS	29.43	14.43	18.09	13.76	24.28
	STS	22.23	10.86	13.47	18.66	34.78

CGRT).[15] The ESI measures 'if the government is covering the salaries or providing direct cash payments, universal basic income, or similar, of people who lose their jobs or cannot work' and 'if the government is freezing financial obligations (e.g. stopping loan repayments)' (Hale et al., 2022). This analysis softens possible concerns relative to the possibility that governments' extraordinary covid measures might have driven our STS sample results (see Appendix D – Specification 5).

In Fig. 7, we provide a closer examination of default rates in both STS and non-STS deals during the pandemic. When focusing on loans originated in 2018 (Panel A), we observe that while the quarterly delinquency rate for non-STS loans reaches a peak of 35 basis points in 2020-Q3, the delinquency rate for STS loans only reaches 4 basis points during the same period. Generally, the delinquency rate for non-STS loans increases by an average of 24 basis points from 2019-Q3 to 2020-Q3. In contrast, the delinquency rate for STS loans increases by only 3 basis points during the same period. We substantiate these findings by incorporating an interaction term between the variable 'STS Securitisation' and the variable 'Pandemic Period' into our model. The results of this analysis are presented in Table 8. As observed in specification 1, loans are more likely to be delinquent by approximately 46 basis points during the pandemic period. Notably, STS loans exhibit significantly lower delinquency rates compared to their non-STS counterparts. In specification 2, when we introduce the interaction between the variables 'STS Securitisation' and 'Pandemic Period', we observe that the positive impact of lower complexity in STS deals on delinquency rates is even more pronounced during the adverse shocks of the COVID pandemic. Overall, due to the higher quality of their underlying assets, STS deals appear to be more resilient in managing the negative effects of the pandemic, resulting in improved performance as financial instruments. These findings are significant, especially considering that the improved performance has been achieved by enhancing the simplicity, transparency, and standardisation of asset-backed securities, without imposing restrictions on the quality of the securitised loans.

[15] More information on the Oxford Covid-19 Government Response Tracker (OxCGRT) can be found at the following link: https://www.bsg.ox.ac.uk/research/covid-19-government-response-tracker.

5.4. The effects on the securitisation structure

Our analysis thus far has demonstrated an improvement in the quality of securitised loans due to the implementation of the new securitisation regulation. However, we have yet to examine whether this regulatory regime has also influenced the securitisation structure. It is crucial to address this question because while the enhancement in loan quality is positive, there may be a potential increase in overall securitisation risk, possibly stemming from changes in tranche composition and quality (Peña-Cerezo et al., 2019). To investigate this concern, our study specifically focuses on examining the impact of the new securitisation regulation on the securitisation structure. We accomplish this by comparing the structure of RMBS deals originated before and after the implementation of the regulation (see Table 9, Panel A) and by comparing the structure of STS and non-STS deals (see Table 9, Panel B).

Table 9 presents the average number of tranches, the average relative size of senior, mezzanine, and subordinated tranches, the average relative size of retained tranches, and the (value weighted) average deal rating for each subsample. To test the statistical difference between the analyzed groups, a two-tailed t-test is employed, with the null hypothesis assuming that the difference equals zero. The findings from Panel A suggest that RMBS deals issued after the regulation exhibit a higher average number of tranches (+1.0), which is highly statistically significant and a higher average deal rating (+1.3), significant at the 10% level. The results from Panel B indicate that STS deals have a statistically significantly lower number of tranches (-1.25), higher relative size of senior tranches (+3.7%), lower relative size of subordinated tranches (-3.9%), and a significantly higher average deal rating (+0.84) compared to non-STS deals. In all cases, there are no statistically significant differences in the percentage of retained tranches between the two groups.

The overall findings strongly indicate that the securitisation regulation has had a significant impact on the composition of RMBS deals, particularly within the STS deals group. The observed increase in the average deal rating aligns with the regulatory objective of promoting high-quality securitisations. However, the decrease in the number of tranches and the smaller subordinated tranches of STS securitisations could potentially pose risks for investors. This is because the default risk can more easily affect senior tranche holders, given the thinner subordinated tranches and fewer tranches available to absorb losses. To address this concern, we perform a stress-testing exercise to evaluate the expected losses for RMBS originators and tranche holders under various

Table 7
The effect of the STS regulation on mortgage delinquency rates. Panel A reports panel probit regression results for the baseline model in Equation (2). Our main variable of interest, *STS Securitisation*, is an indicator variable that takes the value of one if the mortgage belongs to an STS deal, and zero otherwise. The STS sample period spans from 2018 to 2020. In specification 1 we exclude the pandemic period. Specification 3 includes only originators that issued both STS and non-STS deals. Variable definitions are reported in Appendix A. Panel B reports results from Equation (2) for the full subsample period when explanatory variables are gradually added to the model. Robust standard errors are clustered at a deal level and reported in round brackets. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A: Baseline Model	**Marginal effect (basis points)**		
Dep. Var.: Delinquency Indicator	**(1)** **2018 to 2019**	**(2)** **2018 to 2020**	**(3)** **2018 to 2020**
STS Securitisation	**-39.32***** **(9.10)**	**-77.42***** **(20.65)**	**-15.95***** **(2.77)**
Years to Maturity	7.53 (6.87)	17.40*** (5.93)	4.20 (3.49)
Interest Rate	9.56*** (2.71)	17.63*** (5.03)	10.67*** (3.68)
Loan-to-value			
$0.6 \leq LTV < 0.7$	0.08 (3.06)	-10.30 (8.39)	1.58 (2.34)
$0.7 \leq LTV < 0.8$	1.90 (3.23)	-10.72 (10.05)	-2.61 (1.87)
$0.8 \leq LTV < 0.9$	6.80 (4.75)	-0.11 (11.18)	3.63 (3.22)
$0.9 \leq LTV < 1$	13.35** (5.96)	11.90 (11.32)	5.67* (3.19)
$LTV \geq 1$	35.30*** (8.43)	40.90*** (12.80)	14.50*** (4.66)
Interest Rate Type			
Floating Int. Type	19.69*** (6.42)	49.89*** (18.14)	38.89 (36.37)
Hybrid Int. Type	-6.58 (10.35)	-9.22 (10.17)	4.30 (19.27)
Other Int. Type	7.08 (12.24)	29.31* (16.60)	14.65 (25.42)
Payment Type			
Linear Payment Type	-17.85*** (6.42)	-17.15** (7.98)	-.259 (11.03)
Increasing Payment Type	30.51** (12.66)	7.88 (9.44)	24.17 (41.41)
Other Payment Type	-1.48 (4.37)	-1.68 (7.39)	-12.36*** (4.24)
Purpose			
Remortgage Purpose	6.04 (4.90)	-3.26 (7.65)	1.60 (5.36)
Renovation Purpose	-1.74 (4.22)	3.95 (6.70)	1.19 (3.08)
Construction Purpose	9.60 (12.55)	15.80 (15.38)	-3.73 (4.53)
Other Purpose	5.91 (4.28)	3.75 (7.61)	-18.24*** (3.58)
Borrower characteristics			
Second Time Borrower	-3.47 (2.58)	11.71 (9.27)	-1.21 (0.91)
Unemployed	34.06 (26.69)	100.81*** (29.02)	35.04 (31.30)
Self-employed	5.56 (5.87)	33.72*** (8.59)	7.10*** (2.23)
Legal Entity	41.66 (53.60)	183.97*** (6786)	-
Student	33.09 (42.92)	-8.66 (16.51)	-
Pensioner	0.75 (13.30)	14.01 (18.54)	-6.60 (8.88)
Other employment	36.89** (14.21)	65.48*** (13.54)	5.31 (20.45)
Country			
France	27.95*** (8.92)	68.29*** (21.77)	-
Ireland	61.57** (28.11)	74.68*** (26.12)	-

Table 7 (*continued*)

Panel A: Baseline Model	**Marginal effect (basis points)**		
Dep. Var.: Delinquency Indicator	**(1)** **2018 to 2019**	**(2)** **2018 to 2020**	**(3)** **2018 to 2020**
Italy	41.8	167.37**	-
	(29.83)	(75.29)	
Netherlands	42.97***	26.75***	-
	(16.15)	(5.30)	
Portugal	8.31	1.06	-
	(6.98)	(3.67)	
Spain	21.16	187.05***	-
	(25.7)	(45.24)	
United Kingdom	25.86**	97.59**	-
	(11.16)	(38.01)	
Macro-variables	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Originator Fixed Effects	No	No	Yes
Observations	1,024,924	2,147,141	623,675
Pseudo R-squared	0.064	0.107	0.044

Panel B: Robustness, 2018 to 2020

Dep. Var: Mortgage delinquency indicator	**Marginal Effect** **(basis points)**			
(1)	**(2)**	**(3)**	**(4)**	
STS Securitisation	-91.08***	-82.27***	-76.16***	-77.42***
	(30.18)	(22.81)	(20.02)	(20.65)
Loan Characteristics		Yes	Yes	Yes
Borrower Characteristics			Yes	Yes
Macro-Variables				Yes
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Obs.	2,147,141	2,147,141	2,147,141	2,147,141
Pseudo-R^2	0.0767	0.0975	0.104	0.107

Table 8

Effect of the STS regulation on mortgage delinquency during the pandemic. The table reports panel probit regressions results for the baseline model in Equation (2) with the addition of a pandemic period dummy and its interaction STS securitisation. The variable *STS securitisation* equals one if the mortgage belongs to an STS deal, and zero otherwise. The variable *Pandemic Period* is equal to one for mortgages reported from 2020, and zero otherwise. The definitions of the other variables are reported in Appendix A. Sample period: 2018 to 2020. Robust standard errors are clustered at a deal level. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Dep. Var: Loan delinquency indicator	**Marginal Effect** **(basis points)**	
	(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 FE	*Yes*	*Yes*
Obs.	2,147,141	2,147,141
Pseudo-R^2	0.099	0.102

scenarios. The default rate for each scenario is derived from the distribution of loan default rates within our sample of securitisations. By employing this methodology, we are able to analyze and assess the impact of different securitisation structures on the risk borne by investors and originators, particularly in relation to the risk levels associated with the underlying assets. The results of this analysis are presented in Table 10. The table presented provides a comparison of the expected losses for securitisations issued both before and after the implementation of the regulation. Additionally, it presents a comparison between the expected losses for STS and non-STS securitisations. Panel A of the table examines a scenario in which a loss given default (LGD) of 100% is assumed, meaning that no recovery from defaulted loans is anticipated, resulting in the complete loss of the invested capital. This serves to depict the worst-case scenario. In Panel B, a more realistic LGD of 68.5% is considered, with a corresponding recovery rate of 31.5%. The 68.5% LGD is calculated as a weighted average of the 25th percentile recovery

Table 9
Effect of regulatory changes on the tranche composition of residential mortgage securitisations. The table displays the changing composition of tranches in European residential mortgage-backed securitisations for both general provision and STS sub-samples. Panel A illustrates the difference between RMBS deals issued before and after the regulation, with a sample period from 2013 to 2019 and includes only non-STS deals. Panel B compares STS deals to non-STS deals with a sample period from 2018 to 2020. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A: General provision sample

	pre-regulation	**post-regulation**		
Variable description	**Mean (1)**	**Mean (2)**	**Difference (2) - (1)**	**p-value**
number of tranches	3.23	4.25	1.02	0.000***
senior tranches (%)	85.6	89.1	3.5	0.294
mezzanine tranches (%)	1.6	0.8	-0.8	0.594
subordinated tranches (%)	13	10	-3	0.3462
- of which retained tranches (%)	6.1	6.2	0.1	0.96
average tranche rating per securitisation (value weighted)	24.5	25.8	1.3	0.059*

Panel B: STS sample

	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 (value weighted)	25.6	26.5	0.84	0.002***

rates across the countries included in our sample, thereby providing a more representative estimate.[16]

Our findings indicate that non-STS securitisations can lead to significant losses for the originator and, in extreme scenarios based on our in-sample observations, for mezzanine and senior investors as well. For instance, when we consider default rates associated with securitisations in the 99th percentile of our sample and assume an LGD of 100%, we observe that non-STS senior, mezzanine, and subordinated tranche holders suffer losses of 5%, 100%, and 100% respectively. In contrast, investors holding STS tranches do not experience any losses in the same scenario. Similarly, when we consider a less extreme LGD of 68.5%, we find that non-STS subordinated tranche holders still face a substantial loss of 99.3%. Additionally, our tests demonstrate that, in all cases considered, the STS originator's retained tranche serves as effective default protection for all tranches issued to investors, regardless of their seniority. Overall, our evidence suggests that despite the thinner subordinated tranches in STS securitisations, the significantly lower default rates of the underlying assets result in reduced losses for both tranche holders and originators. Based on these results, we conclude that the new STS regulation effectively incentivises issuers to develop and promote securitisations with contained credit risk.

To supplement our findings, we conduct a further analysis of the tranche ratings at the origination stage within the RMBS sample. If the observed changes in the securitisation structure did not lead to higher ratings at origination, it would indicate a minimal impact of the new regulation on the overall quality of the securitisation. Fig. 8 illustrates the value-weighted distribution of tranche ratings at origination, categorized by subsample. It is evident that the regulatory measures have had a positive influence on tranche ratings. For instance, 73% of RMBS tranches originated after the new regulation hold a AAA rating, compared to the 52% of pre-regulation tranches. Similarly, 79% of STS tranches possess a AAA rating, contrasting with the 61% of non-STS tranches. To further validate the impact of the regulation on rating improvements, we utilize a simple ordinal logistic model to estimate the likelihood of tranches being rated AAA – A3, BAA1 – BAA3, or BA1 – C (i.e., speculative). To consider variations in the balance at origination for each tranche, we incorporate weighting in our analysis, giving proportional importance to each observation based on its relative size. The results of this analysis are presented in Table 11. The results indicate that RMBS tranches issued after the implementation of the new regulation exhibit a significantly higher probability of receiving a rating of AAA – A3, while demonstrating a reduced likelihood of being assigned a BAA1 or lower rating. Similarly, comparable patterns are observed for tranches associated with STS deals when compared to their non-STS counterparts.

6. Conclusions

In this study, we investigate the impact of the new securitisation regulation implemented in 2018 on securitised residential mortgages. To accomplish this, we analyze loan-level data obtained from the European DataWarehouse, which serves as the designated platform in Europe for collecting information related to asset-backed securities used in repurchase agreements. Our findings reveal that loans securitised in RMBS deals issued after the announcement of the regulation exhibit a 38 basis point lower annual probability of default. This improvement in quality is noteworthy, considering that the loans in our sample are already of high quality. Furthermore, we demonstrate that banks have actively reduced the quantity of loans with high loan-to-value (LTV) ratios following the enforcement of the new regulatory regime. There has also been a decrease in the proportion of loans granted to self-employed borrowers. Concurrently, the origination quality of the most 'standard' loans—those with low LTV ratios and those held by employed borrowers—has improved.

Next, we explore the impact of the COVID-19 pandemic on the European credit market. Residential mortgages experience a rise in delinquency rates starting from 2020-Q1 and peaking in 2020-Q3. However, the effects vary across borrower characteristics and countries. Self-employed and unemployed borrowers are particularly affected by these unusual circumstances. Additionally, countries that have been severely hit by the pandemic exhibit higher increases in delinquency rates. Despite this credit deterioration, we demonstrate that the new STS (Simple, Transparent, and Standardised) standards introduced by the 2018 ABS regulation have helped mitigate the adverse effects of the pandemic. Loans pooled in STS deals exhibit a 77 basis point lower probability of delinquency, addressing concerns that STS labels, which do not differentiate based on underlying asset quality, may incentivise banks to securitise riskier loans. Furthermore, we find that STS loans demonstrate greater resilience to the adverse shocks of the COVID-

[16] Source: European Banking Authority (2020) Report on the Benchmarking of National Loan Enforcement Frameworks. https://www.eba.europa.eu/sites/default/documents/files/document_library. UK is not included as data on recoveries could not be obtained.

Table 10
Estimated expected loss for originators and tranche holders: stress testing exercise. The table presents the expected loss for RMBS originators and investors (senior, mezzanine and subordinated tranche holders) under different scenarios in both general provision (GP) and STS samples. The default rates for each scenario are derived from the distribution of loan default rates within our sample of securitisations (average, 90%, 95% and 99% quantiles). Expected losses to the subordinated traches are expressed as a percentage of the tranche value net of the retained tranche ("Sub. minus retained"), which is considered separately. In Panel A, a 0% recovery rate (LGD = 100%) is assumed, while in Panel B, a 31.5% recovery rate (LGD = 68.5%) is applied. The recovery rate in Panel B is calculated as the weighted average of the 25th percentile recovery rates across the countries included in our sample, with the exception of the UK, where data on recoveries could not be obtained (Source: European Banking Authority, 2020). The general provision (GP) sample period is from 2013 to 2019 and includes only non-STS deals. The STS sample period is from 2018 to 2020 and includes both STS and non-STS deals.

Panel A: LGD = 100%					**Expected loss to investors**			**Expected loss to originator**
					Tranches			
Sample	**Sub-sample**	**Parameter**	**Regulation**	**Default rate %**	**Senior**	**Mezzanine**	**Sub. minus retained**	**Retained**
GP sample	Pre-reg.	Average	GP	0.98%	0.0%	0.0%	0.0%	16.1%
	Post- reg.		GP	0.52%	0.0%	0.0%	0.0%	8.4%
	Pre-reg.	90% qnt	GP	2.71%	0.0%	0.0%	0.0%	44.5%
	Post- reg.		GP	1.23%	0.0%	0.0%	0.0%	19.8%
	Pre-reg.	95% qnt	GP	3.96%	0.0%	0.0%	0.0%	65.0%
	Post- reg.		GP	1.92%	0.0%	0.0%	0.0%	31.0%
	Pre-reg.	99% qnt	GP	7.65%	0.0%	0.0%	22.5%	100.0%
	Post- reg.		GP	7.21%	0.0%	0.0%	26.5%	100.0%
STS sample	Post- reg.	Average	Non-STS	1.49%	0.0%	0.0%	0.0%	28.1%
	Post- reg.		STS	0.29%	0.0%	0.0%	0.0%	6.2%
	Post- reg.	90% qnt	Non-STS	3.94%	0.0%	0.0%	0.0%	74.2%
	Post- reg.		STS	0.65%	0.0%	0.0%	0.0%	13.8%
	Post- reg.	95% qnt	Non-STS	5.42%	0.0%	0.0%	1.7%	100.0%
	Post- reg.		STS	0.79%	0.0%	0.0%	0.0%	16.9%
	Post- reg.	99% qnt	Non-STS	17.45%	5.0%	100.0%	100.0%	100.0%
	Post- reg.		STS	1.14%	0.0%	0.0%	0.0%	24.2%

Panel B: LGD = 68.5%					**Expected loss to investors**			**Expected loss to originator**
					Tranches			
Sample	**Sub-sample**	**Parameter**	**Regulation**	**Default rate %**	**Senior**	**Mezzanine**	**Sub. minus retained**	**Retained**
GP sample	Pre-reg.	Average	GP	0.98%	0.0%	0.0%	0.0%	11.1%
	Post- reg.		GP	0.52%	0.0%	0.0%	0.0%	5.7%
	Pre-reg.	90% qnt	GP	2.71%	0.0%	0.0%	0.0%	30.5%
	Post- reg.		GP	1.23%	0.0%	0.0%	0.0%	13.6%
	Pre-reg.	95% qnt	GP	3.96%	0.0%	0.0%	0.0%	44.5%
	Post- reg.		GP	1.92%	0.0%	0.0%	0.0%	21.3%
	Pre-reg.	99% qnt	GP	7.65%	0.0%	0.0%	0.0%	85.9%
	Post- reg.		GP	7.21%	0.0%	0.0%	0.0%	79.6%
STS sample	Post- reg.	Average	Non-STS	1.49%	0.0%	0.0%	0.0%	19.3%
	Post- reg.		STS	0.29%	0.0%	0.0%	0.0%	4.2%
	Post- reg.	90% qnt	Non-STS	3.94%	0.0%	0.0%	0.0%	50.9%
	Post- reg.		STS	0.65%	0.0%	0.0%	0.0%	9.5%
	Post- reg.	95% qnt	Non-STS	5.42%	0.0%	0.0%	0.0%	70.0%
	Post- reg.		STS	0.79%	0.0%	0.0%	0.0%	11.5%
	Post- reg.	99% qnt	Non-STS	17.45%	0.0%	0.0%	99.3%	100.0%
	Post- reg.		STS	1.14%	0.0%	0.0%	0.0%	16.6%

Table 11
Effect of regulatory changes on tranche ratings. The table presents the estimation of ordered logit regressions using value-weighted observations, with the thresholds of the dependent variable identifying different rating bands. The first variable of interest, utilized in specification 1, is the dummy variable 'Origination from 2018'. This specification focuses on the tranche-level general provision sub-sample spanning from 2013 to 2019. The second variable of interest, employed in specification 2, is the dummy variable 'STS securitisation'. This specification examines the tranche-level STS sub-sample covering the period from 2018 to 2020. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

	Marginal Effect	
	Orig. from 2018	**STS**
Rating band	(1)	(2)
AAA - A3	0.029**	0.038**
	(0.013)	(0.016)
BAA1 - BAA3	-0.002**	-0.012**
	(0.001)	(0.006)
BA1 - C (speculative)	-0.027**	-0.026**
	(0.012)	(0.013)
Obs.	425	163
Pseudo-R^2	0.043	0.075

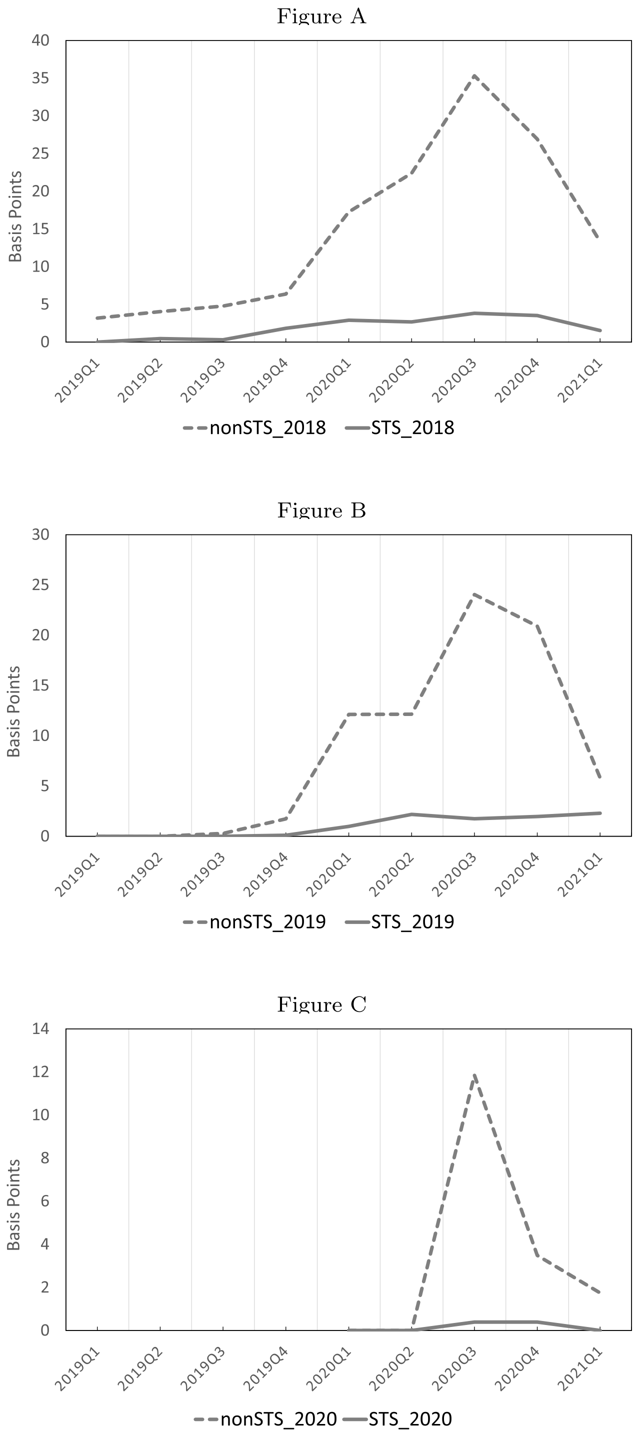

Fig. 7. Loan delinquencies and COVID-19: STS vs non-STS securitisations. The Figure show quarterly delinquency rates of STS and non-STS securitisations for mortgages originated in 2018 (Figure A), 2019 (Figure B) and 2020 (Figure C).

19 crisis. While non-STS loans experience an average increase of 45 basis points in their annual delinquency ratio during the pandemic period, loans securitised in STS deals exhibit an 85 basis point lower annual probability of delinquency in the same period. Finally, we examine how the securitisation regulation has significantly impacted the structure of RMBS deals, particularly within the STS deals group. These changes could potentially increase the risk for investors as the default risk is more easily transferred to senior tranche holders when there are fewer and thinner tranches. However, we provide evidence that the improved loan quality in STS deals outweighs these potential drawbacks, as reflected in significantly higher tranche ratings at origination. One limitation of our analysis is the unavailability of loan-level data for mortgages originated and retained by lenders in their portfolios. This restricts our examination to loans that have been originated and subsequently securitised. Future research should aim to incorporate additional loan-level data to gain a more comprehensive understanding of the impact of securitisation regulation on the broader mortgage market.

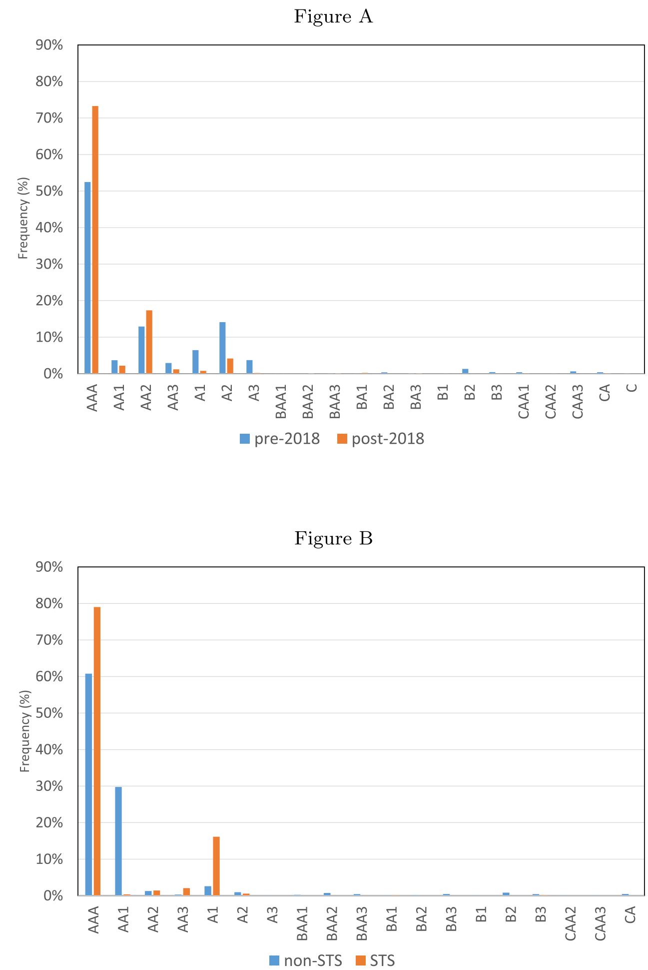

Fig. 8. Rating distribution of MBS tranches. Figure A shows the credit rating distribution of mortgage-backed securitisation tranches in the general provision sample. Figure B shows the credit rating distribution in the STS sample. All observations are value-weighted.

CRediT authorship contribution statement

Monica Billio: Conceptualization, Methodology, Supervision. **Alfonso Dufour:** Conceptualization, Methodology, Supervision, Writing – review & editing. **Samuele Segato:** Conceptualization, Data curation, Formal analysis, Methodology, Software, Writing – original draft, Writing – review & editing. **Simone Varotto:** Conceptualization, Methodology, Project administration, Supervision, Writing – review & editing.

Data availability

The authors do not have permission to share data.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to improve the grammar and flow of the text. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Appendix A

Table 12
Variable definitions

Variable	Definition
Loan Performance	
Delinquent	An indicator variable equal to one if the loan has defaulted or entered delinquency for at least two consecutive quarters, and zero otherwise.
Regulation indicators	
Originated from 2018 (2017)	An indicator variable equal to one if the loan has been originated from 1 January 2018 (1 January 2017), and zero otherwise.
Originated in 2017	An indicator variable equal to one if the loan has been originated from 1 January 2017 to 31 December 2017, and zero otherwise.
STS Securitisation	An indicator variable equal to one if the loan is securitised in deals defined as STS according to the ESMA STS register, and zero otherwise.
Covid-19 indicators	
Pandemic Period	An indicator variable equal to one for loans reported from 2020-Q1, and zero otherwise.
Loan's characteristics	
Loan to Value	A categorical variable indicating whether the loan-to-value ratio belongs to the following ranges: (0–0.6] baseline, (0.6–0.7], (0.7–0.8], (0.8–0.9], (0.9–1], above 1.
Years to Maturity	The natural logarithm of the number of years remaining until maturity.
Interest Rate	Current loan's interest rate in percentage points.
Interest Rate Type	A categorical variable indicating whether the loan has a fixed interest type (baseline), floating, hybrid, or other less frequent interest rate type specifications.
Payment Type	A categorical variable indicating whether the loan is an annuity with fixed instalments (baseline), or whether its amortisation schedule is linear (with decreasing instalments), increasing (with first payments including only a portion of the interest that will later be charged), or other less frequent payment type specifications.
Purpose	A categorical variable indicating whether the loan has been issued for purchase purposes (baseline), remortgage, renovation, construction, or other less frequent purpose specifications.
Borrower's characteristics	
Second Time Borrower	An indicator variable equal to one if the loan is not the first loan a borrower gets from a given bank, and zero otherwise.
Employment	A categorical variable indicating whether the borrower is employed (baseline), unemployed, self-employed, is a legal entity (limited liability company), a student, a pensioner, or other less frequent employment specifications.
Macro variables	
ΔUnemployment	One-year lagged country-specific change of the unemployment rate.
ΔHouse Price Index	One-year lagged country-specific change of the house price index.
Tranche-level characteristics	
Rating band	A categorical variable indicating whether a tranche is rated AAA - A3, Baa1 - Baa3 or Ba1 - C (i.e., speculative grade). Ratings from different rating agencies are slotted into each band according to the variable *Rating equivalent* from Eikon (the variable ranges from 1 to 27, with 27 corresponding to AAA).
Originated from 2018	An indicator variable equal to one if the tranche belongs to a deal that has been issued on or after 1 January 2018, and zero otherwise.
STS Securitisation	An indicator variable equal to one if the tranche belongs to a deal defined as STS according to the ESMA STS register, and zero otherwise.
Tranche balance	Tranche balance at origination

Appendix B

Table 13
The effects of the ABS regulation on loan delinquencies with quarterly data. This table reports panel probit regression results for the baseline models in Equation (1) and Equation (2), with quarterly data. The general provision sample is used in specifications 1 - 5. The sample is restricted to the first two years after loan origination in specifications 3 and 4. In specification 5 we further exclude loans securitised from 2017-Q1. The sample includes non-STS deals only. Sample period: 2013 to 2019. The STS sample is used in specification 6. Sample period: 2018 to 2020. Variable definitions are reported in Appendix A. Robust standard errors are clustered at deal level. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Dep. Var.: Loan delinquency indicator	**Marginal Effects (basis points)**					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Origination from 2018	-15.24**	-18.37***	-6.27***	-5.65***		
	(3.30)	(6.63)	(1.07)	(1.12)		
Origination in 2017		-9.91***		-9.95***		
		(2.65)		(2.70)		
Origination from 2015					-1.04	
					(0.95)	
STS						-21.56***
						(4.70)
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Macro-variables	Yes	Yes	Yes	Yes	Yes	Yes
Deal FE	Yes	Yes	Yes	Yes	Yes	No
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country Time FE	No	No	No	No	No	Yes
Observations	31,710,814	31,710,814	5,899,735	5,899,735	3,819,223	10,910,110
Pseudo-R^2	0.137	0.137	0.189	0.191	0.188	0.089

Appendix C

Table 14
The effect of the new regulation on loan delinquency rates: alternative general provision sample periods. This table reports panel probit regression results for the baseline models in Equation (1) and Equation (2). In specification 1, we exclude loans originated before 2010. In specification 2, we exclude loans originated before 2013. In specification 3, we exclude deals originated in 2013 and 2014. In specifications 4 and 5 we only include the first two observations per loan. The general provision sample, 2013 to 2019, is used in specifications 1-4 and includes non-STS deals only. The STS sample, 2018 to 2020, is used in specification 5. Variable definitions are reported in Appendix A. Robust standard errors are clustered at deal level. Robust standard errors are clustered at deal level. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Dep. Var.: Loan Delinquency indicator	**Marginal Effects (basis points)**				
	(1)	(2)	(3)	(4)	(5)
Origination from 2017	-18.10***	-10.10**	-37.20***	-47.58***	
	(6.21)	(4.44)	(9.41)	(13.48)	
STS					-77.51***
					(20.73)
Loan characteristics	Yes	Yes	Yes	Yes	Yes
Borrower characteristics	Yes	Yes	Yes	Yes	Yes
Macro-variables	Yes	Yes	Yes	Yes	Yes
Deal FE	Yes	Yes	Yes	Yes	No
Time FE	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	Yes
Observations	4,104,857	2,454,218	6,702,056	4,942,727	2,147,141
Pseudo R-squared	0.186	0.237	0.150	0.179	0.104

Appendix D

Table 15
The effect of the new regulation on loan delinquency rates with controls for business cycle, market interest rates, COVID related government interventions and interest rate uncertainty. This table reports panel probit regression results for the baseline models in Equation (1) and Equation (2). Additional controls include country-specific lagged GDP (DeltaGDP), lagged 3-month Euribor index (DeltaEuribor 3m), a measure of country-specific government intervention during the Covid pandemic (ESI Index), the lagged standard deviation of 3-month Euribor index (DeltaEuribor 3m stdev). The general provision sample, 2013 to 2019, is used in specification 1, 3 and 6, with the exclusion of STS deals. The STS sample, 2018 to 2020, is used in specification 2, 4, 5 and 7. Robust standard errors are clustered at deal level. The symbols ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively

Dep. Var.: Loan delinquency indicator	**Marginal Effects (basis points)**						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Origination from 2018	-33.60**		-39.23**			-39.06**	
	(15.88)		(15.64)			(15.70)	
STS		-72.26***		-63.66***	-79.41***		-72.35***
		(20.10)		(21.56)	(20.48)		(20.86)
DeltaGDP	Yes	Yes	No	No	No	No	No
DeltaEuribor_3m	No	No	Yes	Yes	No	No	No
ESI Index	No	No	No	No	Yes	No	No
DeltaEuribor_3m_stdev	No	No	No	No	No	Yes	Yes
Other characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal FE	Yes	No	Yes	No	No	Yes	No
Time FE	Yes	Yes	No	No	Yes	No	No
Country FE	No	Yes	No	Yes	Yes	No	Yes
Observations	7,114,158	2,147,158	7,114,158	2,147,158	2,147,158	7,114,158	2,147,158
Pseudo-R^2	0.153	0.101	0.151	0.083	0.107	0.152	0.098

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