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 before and during the COVID-19 pandemic. We find that mortgages issued after the announcement of the new European regulation in 2017 that aims to reduce deal complexity are characterised by up to 0.10% lower delinquency rates before the COVID-19 crisis. Similarly, during the pandemic, while results are heterogeneous across countries and borrower characteristics, we show that mortgage securitisations that meet the new 'simplicity, transparency and standardisation' (STS) criteria, have 0.21% lower delinquency rates. Overall, our findings suggest that the new European securitisation regulation has contributed to improving the credit quality of the securitisation market in Europe.

Keywords — Asset-Backed Securities, STS Securitisation, Residential Mortgage-Backed Securities, Default Risk, COVID-19 pandemic.

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I. Introduction

It is generally accepted that the complex securitisation market meaningfully impacted the widespread turmoil that characterised the credit crisis of 2008 (Antoniades, 2016; Dungey, Fry, González-Hermosillo, & Martin, 2011; Gorton, 2009; Mian & Sufi, 2009; Shin, 2009, among others). Even though subprime residential mortgages were central to the losses experienced by investors in the US securitisation, losses in the European asset backed securities (ABS) market were much more contained and mostly unrelated to residential property loans.[1] Still, the whole European ABS sector saw a sharp decline in investors' trust. For instance, over the total amount of securitised product issued in Europe, the fraction of ABS deals not withheld by the issuers and placed with investors dropped from 70% to roughly 12% in 2008, and more than 10 years later, it has yet to recover to the pre-crisis levels.[2] This called for a continuous process of regulatory intervention that was finalised in Europe in 2017, with the announcement of the new 'specific framework for simple, transparent and standardised securitisation' (The European Parliament and the Council, 2017), which came into force in January 2018. Whether the regulatory effort to obviate the difficulties that the securitisation market faced since the credit crises is restoring confidence in the ABS market or, on the contrary, whether the additional regulation is further penalizing the sector, is open to debate. For instance, the relatively small losses hitting the European ABS market during the Great Recession could suggest that European regulators may have over-reacted and introduced unnecessary restrictions.[3] Understanding to what extent the credit market has been affected by the new regulation is particularly relevant if we consider the

[1] See 'Securitisation can be a sturdy ally for investors.' Financial Times. August 15, 2017.

[2] Source: AFME, Finance for Europe. Securitisation Data Report, European Structured Finance. Q4:2019.

[3] See 'Regulating European securitisation, after the crisis.' Financial Times. July 30, 2018.

huge pressure the ongoing COVID-19 pandemic has put on the sector as a whole. On this matter, we will assess whether the new provisions helped the securitisation sector to be more resilient towards the adverse shocks of the pandemic.

In this study, we empirically analyse whether, and to what extent, securitised residential mortgages have been impacted by the new regulatory framework. We expect that, overall, the new regulation may give banks incentives to issue loans of a better quality, i.e., with lower delinquency rates. For instance, as it can be seen in Figure 1, loans originated after 2018 show a significantly lower one-year delinquency probability than those pooled before the regulation entered into force. However, the introduction and preference for a new type of 'high-quality' securitisation, called Simple, Transparent and Standardised (STS) securitisation, may have distorting effects on banks' behaviour. For instance, McGowan and Nguyen (2020) have raised concerns that STS labels may create a false sense of security on investors who may be prepared to fund riskier loans without requiring an adequate rate of return. This would not be extraordinarily surprising: many studies (for instance, Coval, Jurek, & Stafford, 2009), show that the increasing demand for high rated securities, matched with the possibility to transfer the risk to outside investors, led banks active in securitisation to lax their lending standards and generate the widespread of 'bad loans'. These low-quality loans were eventually passed to unaware investors under the guise of highly-rated securitisation. On the other hand, the increasing simplicity, transparency and standardisation may outweigh these possible distorting behaviours and promote the beneficial use of securitisation practices. Covitz, Liang, and Suarez (2013), among others, show that securitisation programs with stronger observable characteristics are less likely to experience runs in periods of crisis. It is therefore crucial to assess how the new STS securitisation behaves during the pandemic,

understanding possible channels through which higher resilience to adverse macro-economic shocks can be obtained.

Consequently, we will first focus on the effects on the new securitisation regulation by analysing the delinquency of residential mortgages securitised between Q3-2012 and Q4-2019. The sample contains 5,552,252 loans, securitised in 233 residential mortgage-backed securities (RMBSs), for a final 31,767,427 total number of observations. This will help us understand the pure effects of the new provisions, before the pandemic first hit the economy. Next, we will assess the impacts of the COVID-19 pandemic on our mortgage population, analysing whether the new type of STS securitisation performs differently under these unusual circumstances. To do so, we will focus on 1,840,158 loans, securitised between Q1-2018 and Q1-2021, differentiated on whether they have been securitised in STS deals or not.[4] Using a conservative approach, a loan is deemed to be delinquent if it has defaulted or is in arrears for at least two consecutive quarters. RMBSs are particularly interesting since they are the most popular ABS asset class in Europe as far as the volumes outstanding are concerned.[5] For instance, at the end of 2018, they represented almost 55% of the outstanding volumes of securitised assets.

Our findings confirm that the general provisions of the new EU ABS regulation had a positive impact on the delinquency of securitised mortgages. Loans securitised in non-STS deals issued after the announcement of the new rules show a 10 basis points (bp) lower probability of being delinquent, after controlling for macro-economics conditions. The decrease in delinquency probability for loans issued after the entrance into force of the regulation in 2018 is greater than

[4]The list of all asset-backed securities meeting the STS criteria is publicly available at the European Securities and Markets Authority (ESMA) register: https://www.esma.europa.eu/policy-activities/securitisation/simple-transparent-and-standardised-sts-securitisation

[5]Source: AFME, Finance for Europe. Securitisation Data Report, European Structured Finance. Q4:2018.

the average decrease, as they show an additional 15.6 bp reduction in delinquency probabilities. The increase in quality is particularly relevant given that the average delinquency rate of the whole sample is 1.60%. Next, we investigate which type of loans has been affected the most by the new regulation. Firstly, we show that the decrease in delinquency probability is more evident for mortgages given to self-employed and unemployed borrowers. However, the fraction of loans granted to these categories has also been falling since 2018. This result is likely to be driven by the impossibility to securitise loans insofar as the information provided to the lender cannot been verified (Article 9 of Regulation (EU) 2017/2402). Secondly, we analyse the eventuality that the ban on 'cherry-picking' (Article 6) and enhanced investor due diligence (Article 5) may have impacted loans with riskier characteristics. Our findings confirm that mortgages with a loan-to-value (LTV) ratio above one and those with a hybrid interest rate, show a lower delinquency rate when issued after 2017. On the other hand, after the new regulation started to apply, our sample shows a decreasing fraction of high-LTV loans (above 90%).

In the second part of the paper, we focus on the consequences of the COVID-19 pandemic on the securitisation market. Overall, we show that European residential mortgages have been negatively affected by the pandemic and that the effects are heterogeneous across countries and borrower categories. For instance, the fraction of defaulted loans in our sample doubles from 0.11% in Q4-2019 to 0.22% in Q1-2020, peaking at 0.25% in Q3-2020. Unemployed and self-employed borrowers suffered the most from the pandemic, showing the largest increase in delinquency rates. However, the newly introduced STS securitisation proves to be effective in tackling the negative effects of these macro-economic shocks. Loans securitised in STS deals generally perform better that their non-STS counterparts, showing a 21 bp lower delinquency probability over the whole COVID-19 sub-period. Moreover, the negative effects of the pandemic

are much more contained for this new type of high-quality securitisation, after controlling for loan and borrower characteristics. For instance, when considering loans issued after 2018, while the average quarterly delinquency rate of non-STS loans peaks at 27 bp in Q3-2020, STS loans' delinquency rate is only around 3 bp in the same period. This is particularly relevant if we consider that the new STS criteria do not imply anything on the quality of the underlying assets securitised, but only that common standards of simplicity, transparency and standardisation are met.

We contribute to the existing literature in four main ways. To the best of our knowledge, this is the first paper that empirically analyses the possible effects of the new ABS regulatory framework on the credit quality in the European market. For this reason, our research contributes to the wider debate on the regulatory response that followed the financial crisis of 2008 (Benetton et al., 2020; Fender & Mitchell, 2009; Akseli, 2013, among others). More precisely, we contribute to the literature that analyses the relationship between macro-prudential regulatory policies and mortgage defaults. While the impact of such policies on credit growth and housing prices has been generally analysed (e.g., Akinci & Olmstead-Rumsey, 2018), very few studies focus on their effects on mortgage defaults. For instance, Stanga, Vlahu, and de Haan (2020) find that restrictive macro-prudential policies are significantly associated with a lower share of mortgage arrears in total residential debt. We show that changes in the ABS regulatory framework are also responsible for a decrease in mortgage delinquencies in Europe and that the effects are heterogeneous among different borrower categories and loan characteristics.

Second, we add to those studies that investigate how changes in banking regulation can substantially alter credit allocation across loan types and affect banks' credit practices. For instance, Keil and Müller (2020) show that bank branching deregulation can affect not only

the amount but also the type of credit in the economy. Acharya, Bergant, Crosignani, Eisert, and McCann (2020), in analysing the effects of newly introduced limits on loan-to-income and loan-to-value 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 are more distant from the lending limits. Further, Klein, Mössinger, and Pfingsten (2020) document that the new transparency regime (introduced in Europe in 2013) gives banks incentives to issue better performing and diversified ABSs. We show that the ABS regulation of 2018 contributes to a shift from high-LTV loans to low-LTV loans and to a decrease in quantity of credit given to self-employed and unemployed borrowers. This is particularly relevant when we consider that the same borrower categories are the most affected by the ongoing COVID-19 pandemic.[6]

Third, we contribute to the literature that studies the importance of the securitisation structure in periods of credit crisis (e.g., Covitz et al. (2013); Benmelech and Dlugosz (2009)). We show that less complex securitisations that meet the new criteria of simplicity, transparency and standardisation, called STS securitisation, perform significantly better than their non-STS counterparts. Moreover, thanks to their superior characteristics, STS deals prove to be more resilient to the adverse shocks of the COVID-19 pandemic.

Finally, we contribute to the growing literature that analyses the impacts of the ongoing COVID-19 pandemic on the credit market. The recent studies tend to focus on the effects on the credit supply (e.g., Horvath, Kay, & Wix, 2021; Colak & Öztekin, 2020), the effectiveness of policy interventions (e.g., Moulton et al., 2020; Sarker, 2020), and often rely on US data (Cherry, Jiang, Matvos, Piskorski, & Seru, 2021). By using a large dataset of European residential mortgages, we show that the COVID-19 pandemic led to an increase in delinquencies in Europe, that started in

[6]See 'UK self-employed feel the pain of missing out on Covid support' Financial Times. December 23, 2020.

the first quarter of 2020 and peaked in the third quarter of the same year. The rise in delinquency ratios is heterogeneous across countries and borrower categories.

The reminder of the article is organised as follows: Section II introduces the new ABS regulation. Section III describes our sample. Section IV presents the methodology used. Section V illustrates the effects of the general provisions of the new ABS regulation. Section VI describes the impact of the COVID-19 pandemic and the effects of STS securitisation. We conclude in Section VII.

II. The new European ABS regulation

Following the announcement in 2017 (Regulation (EU) 2017/2402), the new EU ABS regulation entered into force in 1st January 2018, significantly reforming the EU securitisation market and introducing a framework for 'Simple, Transparent and Standardised' securitisation. The new regulation promotes the harmonisation of the ABS market through numerous provisions which can be grouped in: i) general provisions, Articles 1-17, affecting all types of securitisation, and ii) provisions for Simple, Transparent, and Standardised securitisation, Articles 18-28, including the criteria defining this new class of ABS. Among the first group, the most relevant rules are related to:

- Improvement of investor due diligence. Investors are now asked to monitor, among others, the risk profile of an individual securitisation position and underlying exposures;
- Ban on 'cherry-picking'. Assets cannot be transferred to a Securitisation Special Purpose Entity which incurs higher losses than comparable assets that remain in the balance sheet of the originator;
- Enhancement of transparency requirements;

- Inclusion of the criteria for credit-granting. Loans granted after 2016 cannot be securitised whenever the information involved cannot be verified by originators (e.g, Income for Self-Employed);
- Ban on re-securitisation. It is now prohibited to issue ABS deals which include securitisation positions in their pool of underlying exposures.

We believe that these provisions may affect banks' credit practices and improve the performance of the assets issued after the regulation.

The second part of the regulation identifies the criteria for distinguishing, and privileging, particularly high-quality securitisation, called Simple, Transparent and Standardised, or STS. Unlike other provisions of the Securitisation Regulation, which apply to all securitisations, the STS regime is optional. Effectively, there are now two different classes of EU securitisation: STS and non-STS securitisation, differentiated on the basis of whether or not they meet the STS criteria. The criteria include requirements relating to the underlying assets (such as asset sale, asset homogeneity, origination standard), disclosure and verification (such as documentation contents and clarity, external verification of underlying exposures) and transaction structure (such as risk retention compliance, interest rate and currency risk mitigation). Because the criteria primarily relate to the process by which the transaction is structured rather than the underlying credit quality of the assets involved, there should be no implication that STS securitisation is less risky, but rather than the risk involved will be better assessed by a prudent and diligent investor. Consequently, the effects of this newly introduced securitisation type on the underlying assets are uncertain. On one hand, the improvements in simplicity, transparency and standardisation are likely to positively affect assets performance. For instance, Ertan, Loumioti, and Wittenberg-Moerman (2017) show that higher market comparability and information disclosure are associated

with lower default rates of the loans involved. On the other hand, similarly to what happened during the sub-prime crisis with highly rated ABS tranches (Benmelech & 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 impacts of this newly introduced securitisation type on the European credit market is particularly important.

III. Data Source and Description

We retrieve our data from the European DataWarehouse (ED), the designated platform in Europe for collecting and validating standardised loan-level data for Asset-Backed Securities. From January 2013, loan-by-loan information on residential mortgage-backed securities, eligible to be accepted as collateral in Eurosystem credit operations, have to be quarterly reported on 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, property information and performance indicators. ABSs used in repos with the ECB are particularly interesting as they are subject to tight transparency rules since 2013.[7] This allows us to rule out the concern that our results could just be driven by greater transparency and/or comparability among the loans securitised.

Table 1, reports the final number of deals, loans, unique borrowers and observations by country of origination. As it can be noted in Panel A, the whole sample includes 40,295,781 observations, reported from Q3-2012 to Q1-2021, which correspond to 6,549,131 loans. Countries where having more than one loan is usual, like Spain or Germany, tend to have a lower number

[7]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.

of unique borrowers than the number of loans. On the contrary, countries with a higher fraction of joint mortgages, like Italy, are characterised by a higher number of borrowers. In Netherlands, loans are typically segmented into parts and that is the reason why the number of loans can significantly differ from the number of borrowers. The majority of RMBS deals used in Eurosystem credit operations is issued in Netherlands, France, Spain and Italy. However, one should be careful in using this data to describe the Euro area residential mortgage market. For instance, the country with the fewest number of deals in our sample, i.e. Germany, has one of the most developed residential real estate market. The reason that we have few observations in this case is because in Germany loans are usually re-packaged in a type of covered bonds, 'Pfandbriefe', which is rarely reported to the ED (Gaudêncio, Mazany, & Schwarz, 2019). However, our sample is still a fair representation of the RMBS market: for instance, in 2018, our sample covers 55.7% of the total European RMBS issuance.[8]

In order to not overlap the effects of the ABS regulation of 2018 and the impact of the COVID-19 pandemic, we split the sample in: pre-COVID-19 subsample, which includes 5,552,252 mortgages securitised from Q3-2012 to Q4-2019 (Table 1, Panel B); and COVID subsample, which includes 1,840,158 mortgages securitised from Q1-2018 and Q1-2021 (Panel C). As it can be noted in the table, the two sub-samples are similar in terms of loan and borrower distribution by country of origination. We first use the pre-COVID-19 sample to analyse the effects of the general provisions of the ABS regulation on the quality at origination of securitised residential mortgages. Secondly, the COVID-19 sample is used to assess the effects of the COVID-19 pandemic on the credit market and the possible difference in quality between STS and non-STS securitisation.

[8]Source: AFME, Finance for Europe. Securitisation Data Report, European Structured Finance. Q4:2018.

A. Pre-COVID-19 sample

When analysing the quality at origination of our mortgage population, one of the main problem is that older loans tend to be over-represented in the sample, since they are generally reported over time for a higher number of quarters (until the deal is closed). Consequently, one must take into consideration that older loans are likely to show on average higher default rates simply because they are reported for a longer period. Moreover, the negative effects of the COVID-19 pandemic are likely to have a distorting impact on loan delinquencies, potentially biasing our results. To tackle these issues, we focus on the pre-COVID period (up to Q4-2019) and we only consider the first two years of data available after a loan has been originated.[9] In this way, mortgage delinquency probabilities can be considered as a proxy for quality at issuance. Moreover, this softens the concern that the loan and borrower information at origination we use in the model are no more representative of the loans we analyse. 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 $1,846,394$ loans, reported from Q3-2012 to Q4-2019, for a final $6,304,373$ total number of observations. Each loan enters the final sample only if it has been reported to the ED within the first two years after origination, and then we exclude them from the sample two years after the date of issuance. Mortgages can also exit the sample before reaching two years of life if they are flagged as delinquent, redeemed, foreclosed or if they have matured or been sold.

[9] Appendix C, Panel (C) shows how the main results hold when we relax this constraint by analysing the first three years after origination. We also show in Panel (B) that results are robust to the exclusion of loans originated after 2019, i.e., loans with less than one year of observations.

To measure the effects of the new ABS regulation on the quality of the RMBS underlying assets, we will use an indicator variable, *Delinquent*, that reflects whether a loan has defaulted, foreclosed or entered delinquency in a given period of time. According to the European Banking Authority, a mortgage is considered defaulted when its repayments are more than 90 days past due or when the debtor is deemed to be unlikely to pay its credit obligations. Then, our variable *Delinquent* takes a value of one each time a loan is in arrears for at least two consecutive quarters or it has been flagged as defaulted or foreclosed by the originator. As it can be seen in the summary statistics in Table 2, 1.70% of the total number of loans of our pre-COVID-19 subsample satisfies this delinquency definition. A relatively low number of defaults is not surprising since we are measuring the quality at origination by analysing the first two years of observations after issuance. Our main variable of interest, *Originated from 2018*, is a dummy that takes value 1 for loans originated after the new regulation entered into force, i.e., from 1st January 2018.

In the pre-COVID-19 sample, the majority of the mortgages (43.0%) is characterized by a fixed interest rate. Only 2.1% of the loans have a full floating interest rate, and 33.7% are characterized by a hybrid interest rate (where either fixed rates are updated periodically or part of the mortgage is financed at a fixed rate and part is financed at a variable rate). As far as the payment type and purpose are concerned, 55.7% of the loans' payment type consist in annuities (fixed amount made up of interest and capital, to be paid monthly), while 63.1% have been issued for purchase purposes, as opposed to re-mortgage 12.0%, renovation 7.6% and construction 7.2%. The model also includes the loan current interest rate (Louzis, Vouldis, & Metaxas, 2012), which averages at 2.58%

across the whole subsample, the number of years to maturity (Von Furstenberg, 1970), and the LTV at origination (Campbell & Dietrich, 1983; Deng et al., 2000). This latter variable, which indicates the ratio between the loan balance at origination and the value of the property, has been included as a categorical variable. It is reasonable to believe that the default probability increases with the LTV ratio.

Next, as far as the borrowers' information is concerned, we will use the *Employment Status* (Vandell & 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, i.e. *Second Time Borrower*. In our dataset, 83.3% of the borrowers are employed, while the second most common category, self-employed, covers 9.6% of the sample. Unsurprisingly, only 1.4% of the observations are related to unemployed borrowers. This latter category, as well as the self-employed borrowers, are those naturally more likely to default on their mortgages.

In terms of macro-economic controls, we consider the country specific unemployment rates and the 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; Peterson & Arun, 2018), found that higher unemployment negatively affects borrowers' ability to repay loans.

B. COVID-19 sample

The second sample includes 1,840,158 loans, reported from Q1-2018 to Q1-2021, with a total of 11,605,841 observations. In this case, we are not interested in the quality at origination, but rather in the effects of the ongoing COVID-19 pandemic: for this reason all the available observations are considered. Loans are securitised in 112 RMBS deals, 43 of which satisfy the new STS criteria.

As it can be seen in the summary statistics in Table 2, 0.95% of the loans in this sample is deemed as delinquent. The COVID-19 sample does not significantly differ from the pre-COVID-19 sample in terms of loan composition. For instance, the fraction of mortgages granted to employed borrowers is equal to 83.3% in the pre-COVID-19 sample and 82.3% in the COVID sample. The most relevant distinction can be noted as far as the interest rate type is concerned. The COVID-19 sample has a much higher fraction of loans with a hybrid interest rate (41.9% vs 33.7% in the first sample), balanced by a lower fraction of loans with a fixed interest rate (28.5% vs 43.0% in the first subsample). Indeed, after a decade of bottom-low interest rates, rising inflation has prompted fears of rising interest rates in the last years.[10] This can eventually give banks incentive to issue loans with a interest rate that can be adjusted as the interest rate goes up. Finally, the change in the house price indexes averages at 1.09 during the COVID-19 period, higher than the 0.15 average of the pre-COVID-19 period, reflecting the increasing trend in house prices observed in the most recent years. For instance in 2020, despite the pandemic, the annual

[10] See 'Bonds rally on both sides of Atlantic ahead of US inflation data' Financial Times. June 9, 2021.

growth rate of the European house price index reached levels that had not been recorded since 2007.[11]

IV. 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 & Capone Jr, 1990; Vandell & Thibodeau, 1985; Jiang, Nelson, & Vytlacil, 2014). Our baseline model, implemented on the pre-COVID-19 sample, is specified as follows:

$$\begin{aligned} \textit{Loan delinquency} = \alpha + \beta_1 \textit{Originated after 2018} + \textit{Loan characteristics FE} \\ + \textit{Borrower's characteristics FE} + \textit{Macro-variables} \\ + \textit{ABS deal FE} + \textit{Quarter FE} \end{aligned} \tag{1}$$

To assess the channels through which the improvement in quality is obtained, we will then interact the origination period with several loan and borrower characteristics. Country specific changes in unemployment rates and house price indexes (HPI) are lagged, as their effect on the defaults rate are not likely to be immediate. For instance, after losing a job, one can usually temporally sustain subsequent mortgage payments through savings. Moreover, as explained by Kau, Keenan, and Kim (1994), by defaulting today

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

one gives up the option to default in the future. As a result, borrowers may prefer to wait to see if house prices recover and not to default even when the equity is negative. For this reason, the change in HPI variable will be lagged up to 1 year (4 quarters), while the change in unemployment rate, which is expected to have a shorter-term impact on default probabilities, will be lagged only two quarters.[12] 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 FE allow us to control for RMBS deal structural features and bank credit practices, while quarter FE will capture biases related to the reporting quarter. A detailed description of all the variables can be found in Appendix A.

We then focus on the effects of the COVID-19 pandemic on mortgage performances. To do so, we use the COVID-19 sample and implement the following model:

$$\begin{aligned} \textit{Loan delinquency} = \alpha + \beta_i \ \textit{Quarter FE} \ &+ \textit{Loan characteristics FE} \\ &+ \textit{Borrower's characteristics FE} + \textit{Macro-variables} \\ &+ \textit{ABS deal FE} \end{aligned} \tag{2}$$

By analysing the coefficients of the quarter fixed effects, we are able to determine whether an increase in default probabilities has followed the advent of the COVID-19

[12] Our results are consistent when different lags of the macro-variables (from 1 to 4 quarters) are used (untabulated).

pandemic, after controlling for loan characteristics, borrower information and macro-economic conditions of the residential market.

Finally, we assess whether Simple, Transparent and Standardised securitisation differ in quality from non-STS securitisation. After identifying all loans securitised in STS deals with a categorical variable, *STS Securitisation*, we use the COVID-19 sample and implement the following model:

$$\begin{aligned} \textit{Loan delinquency} = \alpha + \beta_1 \ \textit{STS Securitisation} + \textit{Loan characteristics FE} \\ + \textit{Borrower's characteristics FE} + \textit{Macro-variables} \\ + \textit{Country FE} + \textit{Quarter FE} \end{aligned} \tag{3}$$

By interacting the STS securitisation variable and the quarter fixed effects we will then analyse the performance of STS securitisation during the COVID-19 pandemic. It must be noted that, to avoid collinearity problems, country fixed effects are used instead of the usual deal fixed effects. All models are characterized by clustered standard errors at deal level.

V. The effects of the general provisions

Firstly, by excluding from our analysis all deals that meet the STS requirements, we analyse the impact of the general provisions of the new regulation on loan delinquencies. These provisions are likely to affect all new ABS deals issued after 2018. However, whether the effects are translated into higher quality at origination of the underlying assets is not

certain. For instance, banks could simply securitise relatively good-quality older loans to fulfil the new requirements without actually improving their lending standards. That is the reason why we focus on the quality at origination, distinguishing between loans issued after and before 1st January 2018. The full output of the baseline model, Equation (1), is reported in Table 3, Panel A. Results obtained by gradually adding the variables to the model can be seen in Panel B. In line with our expectations, mortgages issued after 2018 tend to have, on average, a 6.6 bp lower probability of being delinquent than those issued before the regulation.[13] The increase in quality is substantial when we consider that it refers to delinquencies within the first two years of life of a loan. Moreover, our sample includes loans securitised into RMBSs that are eligible for repurchase agreements with the ECB and, as a consequence, cannot have a rating below A3. To understand the magnitude of this quality improvement, one can note that the decrease in default rates is even higher than the 5 bp average default rate of a A3 rated bond.[14] The remaining coefficients of the model give us insight on 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 (above 0.9), as well as those with higher interest rates, show on average larger delinquency rates. Interestingly, loans given to second-time borrowers tend to default less than their first-time counterparts. This could signal that wider information available on a given borrower can improve banks' credit risk assessment and eventually reduce the resulting probability of default. As far as the interest rate type is concerned, our results

[13] As a robustness check, we run the same model without considering loans originated before 2013. This allows us to account for the possible effect of the increasing transparency introduced at the beginning of that year. Results remain similar and are reported in Appendix B, Panel A.

[14] Source: Moody's investors service: 2021.

highlight that when interest rate uncertainty is higher, borrowers tend to default more. This is the reason why, on average, loans with a floating or hybrid interest rate show higher default probabilities than those with a fixed interest rate (baseline for this variable). On the contrary, the payment type (whose baseline is annuity) does not significantly drive default rates in our sample. The amortisation schedule of principal and interest rates does not seem to be relevant when compared to other loan characteristics. Finally, when borrowers' employment status is considered, results show that loans given to self-employed workers and pensioners tend to default more than those granted to regular employed borrowers of about 7.6 bp and 2.76 bp respectively.

We further expand our results by analysing the quality at origination of mortgages issued from 2017. This allow us to investigate whether banks started to change their behaviour after the announcement of the new regulation. As it can be seen in Table 4, Specification 1, loans issued in 2017 show a 9.9 bp lower delinquency probability than those issued before 1st January 2017. Similarly, loans issued from 1st January 2018 have a 15.6 bp lower probability of being delinquent than loans issued before 2017. More generally, as it can be seen in Specification 2, banks seem to improve their credit practices since 2017, the year in which the regulation is first announced, with loans originated from 2017 showing a 10.5 bp lower delinquency probability than those issued before 2017. On this matter, one possible concern is related to the possibility that banks could improve their lending standards independently from the new ABS regulation. To alleviate this concern, we show in Appendix C that loans originated in 2015 and 2016 (before we observe the increase in quality) do not show lower delinquency rates than those issued before 1st January 2015.

Next, we investigate possible channels that might have driven the improvement in mortgage quality. One of the provisions of the new regulatory framework prevents residential mortgages to be securitised if the lender has not been able to verify the information provided by the loan applicant. For this reason, our first hypothesis is that the increase in quality following the introduction of the new rules, should be particularly evident for certain types of borrowers, such as the self-employed, due to their possible lack of proof of income. To examine this issue, we plot the distribution of loans per employment status and year of origination in our sample (Figure 2). As it can be seen, after the entrance into force of the new ABS regulation, the fraction of loans granted to self-employed applicants (in brown) is constantly decreasing. This is associated with a slight increase in other employment categories whose information can be more easily verified (such as loans given to pensioners). Moreover, although less evident, the fraction of loans granted to unemployed borrowers starts to decrease in the same period. Further evidence on this matter is provided in Table 5, in which we employ our model to study the impact of this provision on default probabilities by interacting the employment status and the loan origination period. The estimated coefficients confirm that loans given to self-employed show 8.28 bp lower default probabilities than their counterparts only when issued after 2017. This is the year when, after the announcement of the new ABS rules, we first observe an improvement in banks' credit practices. Further, also residential mortgages granted to unemployed applicants, which have been issued after the new regulation, prove to have a 10.96 bp lower delinquency probability than loans given to unemployed borrowers originated before 1st January 2017. Overall, it appears that banks, in order to comply with the new rules, substantially reduced

the credit granted to certain types of borrower. On the other hand, through the tightening of banks' credit practices, the quality at origination of these loans is higher.

We then investigate the possibility that the ban on cherry-picking and the higher investor due diligence may influence banks' issuance of loans with 'risky' characteristics. The impossibility to transfer to external entities loans which incur higher losses than those kept in the balance sheet may give banks incentives to improve the quality of loans which are naturally more likely to default. At the same time, higher investor awareness of the riskiness of the underlying assets may incentivise banks to shift the composition of their securitisation portfolios towards safer assets. To shed a light on these issues, we analyse loan characteristics that, over the whole sample, are associated with higher delinquency probabilities. In Table 6, Panel (A), we show that loans with a LTV above 0.9, issued before the regulation, are more likely to be delinquent. However, that is not the case for loans originated after 1st January 2017 with a LTV above 1, which show a 6.44 bp lower delinquency rate than high-LTV loans issued before that date. Similarly, as it is shown in Panel (B), loans with a hybrid interest rate type are of a better quality only when issued in the most recent years, showing a 8.67 bp lower probability of being delinquent. Moreover, when we analyse the distribution of loans by loan-to-value bucket and year of origination (Figure 3), we can notice that the change in banks' behaviour is also reflected on the quantities of credit supplied. From 2017, the fraction of mortgages with a LTV ratio between 0.6 and 0.8 (in yellow in the Figure) significantly increases; on the contrary, the fraction of mortgages with a LTV ratio above 0.8 (in green in the Figure) sharply decreases. Overall, these results appear to confirm our hypothesis of the impact of the ban

on cherry picking and higher investor due diligence on banks' credit practices and highlight the direct effects of the new regulation on the credit market.

VI. COVID-19 and Loan Delinquencies

Despite the higher credit quality of securitised residential mortgages due to the recent ABS regulation, the ongoing COVID-19 pandemic is likely to have a significant impact on credit exposures. As the economic outlook remains unstable, banks are experiencing an increasing pressure on their credit portfolios and, consequently, on their stability. Governments around the world attempted to curb the detrimental effects of the pandemic by introducing country lockdowns and stimulus packages. While all the government policies seem to have a general positive impact on stock returns (Narayan, Phan, & Liu, 2021), the same is not true for the credit sector. As underlined by Colak and Öztekin (2020), lockdown measures unintentionally pushed borrowers into solvency crises, which eventually led to a spike in credit risk around the world. This is confirmed by our mortgage population which experiences a sharp rise in delinquency rates even for loans originated after the new regulation. As shown in Figure 4, panel A, the quarterly delinquency rate of loans issued in 2018 doubles from 3.4 bp in Q4-2019 to 7.9 bp in Q1-2020; it then peaks at 14.7 bp in Q3-2020. Similar patterns are observed for loans issued in 2019 and 2020. Borrowers have not been all equally hit by the pandemic: as it is evidenced in Panel B, unemployed and self-employed borrowers show the largest increase in delinquency rates. For instance, the delinquency rate of unemployed borrowers goes from 16 bp in Q4-2019 to 123 bp in Q1-2020. Similarly, the delinquency rate of self-employed borrowers rises from 12 bp at

the end of 2019 to 58 bp in 2020. On the contrary, employed borrowers only show a 6 bp increase in delinquency rates. Moreover, it is clear from the Figure that while unemployed borrowers show the highest increase in delinquency rates in the first quarter of 2021, the remaining borrower categories seem to be slightly more resilient, with their delinquency ratios peaking only in the third quarter of 2021. Indeed, employed borrowers are those who benefited the most by the introduction of furlough job support schemes, generally used across Europe during the COVID-19 pandemic to tackle the rise in unemployment rates.[15] Moreover, the severity of the impact of the pandemic on loan delinquencies seems to be also influenced by country-specific factors. As shown in the literature (Colak & Öztekin, 2020), the contraction in bank lending seems to be less pronounced in relation to i) lower country's pandemic intensity, ii) more developed financial intermediaries, iii) stricter bank supervision and iv) a sounder health system. While this is not the main focus of this paper, we supplement these findings by showing that similar patterns can be found as far as borrowers' delinquencies are concerned. As shown in Figure 4, panel C, mortgage delinquency ratios during the pandemic strongly differ among countries in our sample. For instance, if we consider loans originated in France, only 0.30% of the active loans in 2019 entered delinquency by the end of 2020. The same is not true for countries like Spain or United Kingdom, whose default ratios are above 2.1% in the same period. Interestingly, there seems to be a strong relationship between countries' pandemic severity and loan delinquencies. When we consider countries' excess mortality rates with respect to the pre-pandemic average mortality rates, we can note that all countries that saw an increase

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

in excess mortality rates below the European average (+11.7%), like Ireland, France and Netherlands, are those characterised by lower delinquency rates. On the opposite, countries whose increase in excess mortality rates is far above the European average, like Spain and Italy, show higher loan delinquency ratios during the pandemic.[16]

It must be underlined that loan delinquencies do not necessarily turn into defaults, especially during these extraordinary circumstances. Indeed, payment holiday schemes have been widely used in the attempt to soften the distress caused by the pandemic. However, as it has been warned by John O'Donnell in his article on Reuters[17], long periods of payment holidays could result in a potential problem for banks as debts stack up, undermining all their efforts to put the Coronavirus crisis behind them. It is therefore important to assess the magnitude of the impact of the COVID-19 pandemic on loan delinquencies after controlling for loan characteristics, borrower information and country-specific factors. To do so, we implement Equation (2) on the COVID-19 sample, plotting the marginal coefficients of the quarter fixed effects in Figure 5. Our model confirms that the probability of being delinquent starts to increase in Q1-2020 and peaks in Q3-2020, with all the coefficients of 2020 being significant at (at least) 5% confidence level. More precisely, the delinquency probability increases by 18 bp from Q4-2019 to Q3-2020. It then quickly reaches the pre-pandemic levels in the first quarter of 2021. A fall in payment delinquencies is generally expected in Europe, as countries gradually end their payment holiday schemes. However,

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

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

whether this will turn into actual defaults is too early to say, as more data will be needed to shed a light on this important issue.

A. Simple, Transparent and Standardised Securitisation

Finally, we explore whether the newly introduced STS securitisation standards have an impact on mortgage quality. Indeed, the COVID-19 pandemic can play an important role when studying the effectiveness of these provisions in improving the soundness and stability of the securitisation market. STS labels identify all ABSs which are 'simple' in terms of their underlying assets, 'transparent' with respect to the information available to investors, and 'standardised' as they are easily comparable to other securitised structures. However, STS labels do not imply anything about the quality of the underlying assets. This raises the possibility that STS deals, despite their improved simplicity, transparency and standardisation, may in fact contain loans of bad quality. Their conformity to a regulatory standard may be misconstrued by investors as a signal of higher credit quality, eventually making them more easily tradable. To investigate this concern, we restrict our analysis to RMBS deals subject to the new regulation (COVID-19 subsample), i.e., issued from 1st January 2018. The subsample includes 1,840,158 loans, 47.7% of which are included in STS deals. As it can be seen in Table 7, STS deals do not show substantial differences from their non-STS counterparts in terms of loan composition. For instance, the distribution of mortgages by borrower employment status is almost the same across the two categories. However, some notable distinctions can be noted as regard the interest rate type and loan-to-value ratios. While 31.6% of non-STS loans have a floating interest rate, only 8.6%

of STS loans have a similar adjustable interest rate. On the contrary, the fraction of loans with a fixed interest rate is much higher in STS deals (54.5% vs 10.4% in non-STS deals). However, STS loans tend to have, on average, higher loan-to-value ratios. For instance, the fraction of loans with a LTV ratio above one is 34.8% in STS deals while it is only 24.3% in non-STS ones. Moreover, in compliance with the new simplicity and standardisation criteria, STS deals show significantly lower fractions of atypical loans, denominated 'Other' in the table, with regard to all loan characteristics.

Besides these structural differences, STS deals seem to be also characterised by better-performing underlying assets. In our COVID-19 subsample, only 0.20% of STS loans enter delinquency, while 1.62% of their non-STS counterparts is delinquent in the same period. By implementing Equation (3) on the second subsample, we complement these findings and show that loans in STS deals show lower delinquency probabilities after controlling for loan characteristics, borrower information and macro-economic conditions of the residential market. As it can be seen in Table 8, loans securitised in STS deals from Q1-2018 to Q1-2021 show a 21.6 bp lower probability of default than their non-STS counterparts. Our finding seems to dispute the hypothesis that STS securitisation may give banks incentive to issue and securitise loans of a worse quality. On the contrary, banks tend to issue and securitise higher quality loans when the ABS structure allows for a better and easier assessment of the risks involved. Moreover, the table highlights the factors that are linked with an increase in delinquency probabilities during the COVID-19 pandemic. As it can be noted, delinquencies during the crisis are mostly driven by high-LTV loans, and by loans given to legal entities, unemployed and self-employed borrowers. For instance, loans with

a LTV ratio above 1 show a 12.3 bp higher delinquency probability than low-LTV loans during the pandemic (against the 4.44 bp of the pre-COVID period). Similarly, unemployed borrowers have a 17.7 bp higher delinquency probability than employed borrowers during the COVID-period, which significantly differs from the 2.2 bp higher delinquency probability they had before the pandemic.

Finally, we show that STS deals, thanks to the higher quality of their underlying assets, are also more resilient to the adverse shocks of the COVID-19 pandemic. As it can be seen in Figure 6, loans securitised in STS deals default significantly less than their non-STS counterparts during the whole pandemic period. For instance, if we focus on loans originated in 2018 (Panel A), while the non-STS quarterly delinquency rate peaks at 35 bp in Q3-2020, the STS delinquency rate only peaks at 4 bp in the same period. More generally, the delinquency rate of non-STS loans increases on average by 24 bp from Q3-2019 to Q3-2020; on the contrary, the delinquency rate of STS loans only increases on average by 3 bp in the same period. We confirm these findings by interacting in our model the variable 'STS Securitisation' with the quarter fixed effects. As it can be noted in Table 9, loans securitised in STS deals show a lower increase in delinquency probabilities than their non-STS counterparts during the whole pandemic period, after taking into consideration all the usual controls of the model. It is therefore clear that the new STS provisions contribute to increasing the quality of the securitisation market as a whole, making it more resilient to adverse macro-economic shocks. These results are even more remarkable when we consider that the increasing performance has been obtained by enhancing the simplicity,

transparency and standardisation of asset-backed securities, without actually constraining the quality of the loans securitised.

VII. Conclusions

In this study, we explore whether the reduction in ABS complexity introduced by the new securitisation regulation in 2018, had an impact on securitised residential mortgages. To do so, we analyse loan-level data obtained from the European DataWarehouse, the designated platform in Europe for the collection of information related to Asset-Backed Securities used in repurchase agreements. We find out that loans securitised in RMBS deals issued after the announcement of the regulation show a 10 bp lower probability of default within the first two years after their origination. The increase in quality is substantial when we consider that the loans in our sample are of high quality in order to be eligible for repo transactions with the ECB. We then investigate possible channels through which banks are able to improve the mortgages' quality at origination. Our findings demonstrate that, after the enforcement of the new regulatory regime, banks actively reduced the quantity of loans issued with a high LTV ratio. The fraction of loans granted to unemployed and self-employed borrowers also went down. On the other hand, through the tightening of banks' credit practices, the quality at origination of these type of loans results to be higher. The impossibility to transfer riskier loans to external entities, the higher investors due diligence and the requirement to verify all loan information seem to be directly linked with these results.

Next, we show that the European credit market has been widely impacted by the COVID-19 pandemic. Residential mortgages show a rise in delinquency rates that starts in Q1-2020 and peaks in Q3-2020. However, the effects are heterogeneous across borrower characteristics and countries. We show that self-employed and unemployed borrowers are those who suffered the most these unusual circumstances. Moreover, countries which have been more severely hit by the pandemic are also those where the increase in delinquency rates is higher. Despite this credit deterioration, we demonstrate that the new STS standards introduced by the ABS regulation of 2018 helped to curb the detrimental effects of the pandemic. We show that loans pooled in STS deals exhibit a lower probability of being delinquent by roughly 22 bp, alleviating the concern that STS labels, which do not discriminate on the basis of the underlying assets' quality, may give banks incentives to issue riskier loans. Moreover, we show that STS loans are much more resilient to the adverse shocks of the COVID-19 crisis. While non-STS loans show a 24 bp average increase in their delinquency ratio, STS loans' delinquency ratio only increases by 3 bp in the same period. It appears that the new regulation was a step in the right direction to improve the stability and soundness of the European securitisation market. We believe that the improved quality of the securitised loans could increase investors' confidence in the ABS market and attract greater capital inflow into it. However, caution is needed as the evidence suggests that the new regulatory requirements are also responsible for a decrease in credit supply for some borrower categories. This is particularly relevant when we consider that the same type of borrowers have been strongly affected by the ongoing COVID-19 pandemic. More research

is therefore needed to understand whether the benefits of the new regulation outweigh the possible negative impact of these credit constraints.

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Figure 1. Cumulative delinquency of residential mortgages, pre-COVID-19 sample. The Figure shows the average cumulative delinquency rates of mortgages originated before and after the introduction of the 2018 European ABS regulation. The rates are cumulated up to 4 quarters since the mortgage securitisation is reported to the European DataWarehouse. A mortgage is considered delinquent if it has defaulted or is in arrears for at least two consecutive quarters.

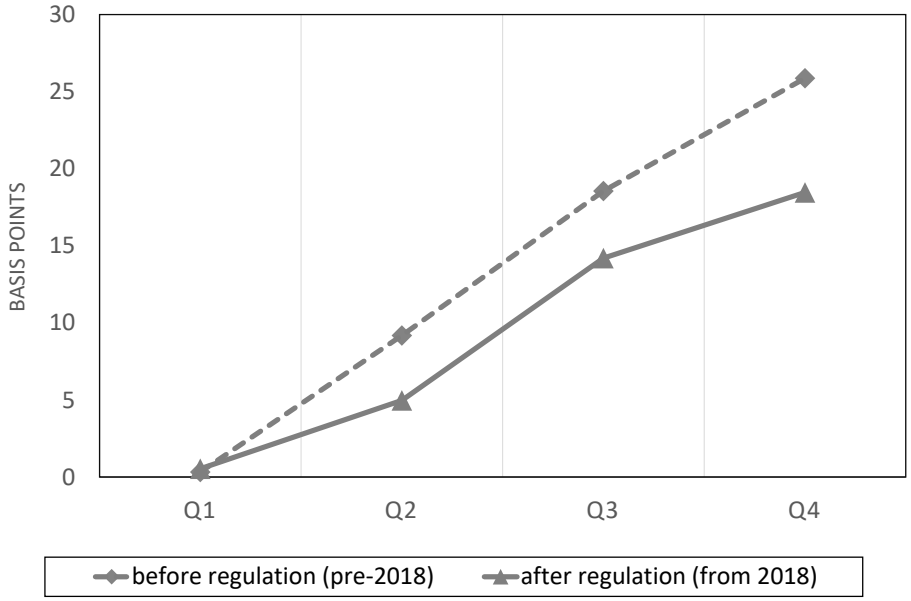

Figure 2. Distribution of residential mortgages by employment status and year of origination, pre-COVID-19 sample. Figure A shows the distribution of unemployed, self-employed, student and pensioner borrowers by year of origination; Figure B shows the distribution of employed borrowers by year of origination.

FIGURE A

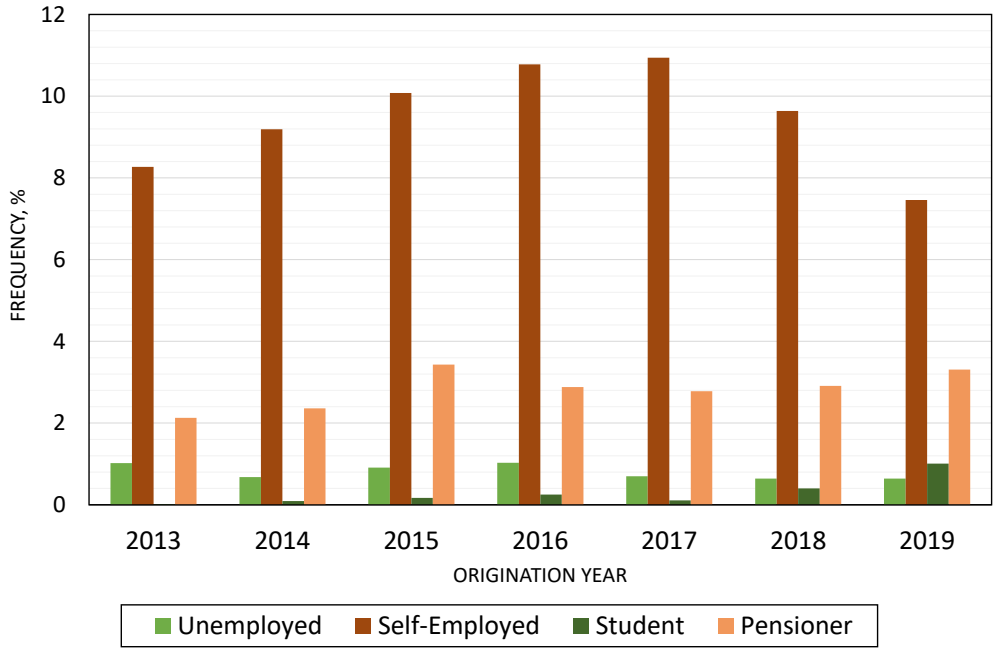

FIGURE B

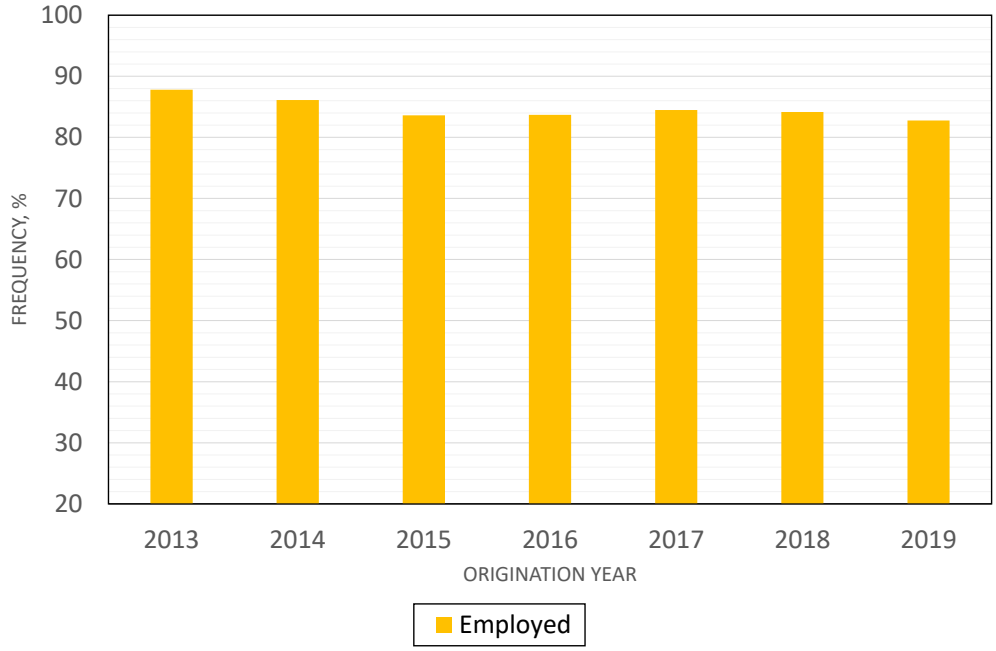

Figure 3. Distribution of residential mortgages per loan-to-value bucket and year of origination, pre-COVID-19 sample.

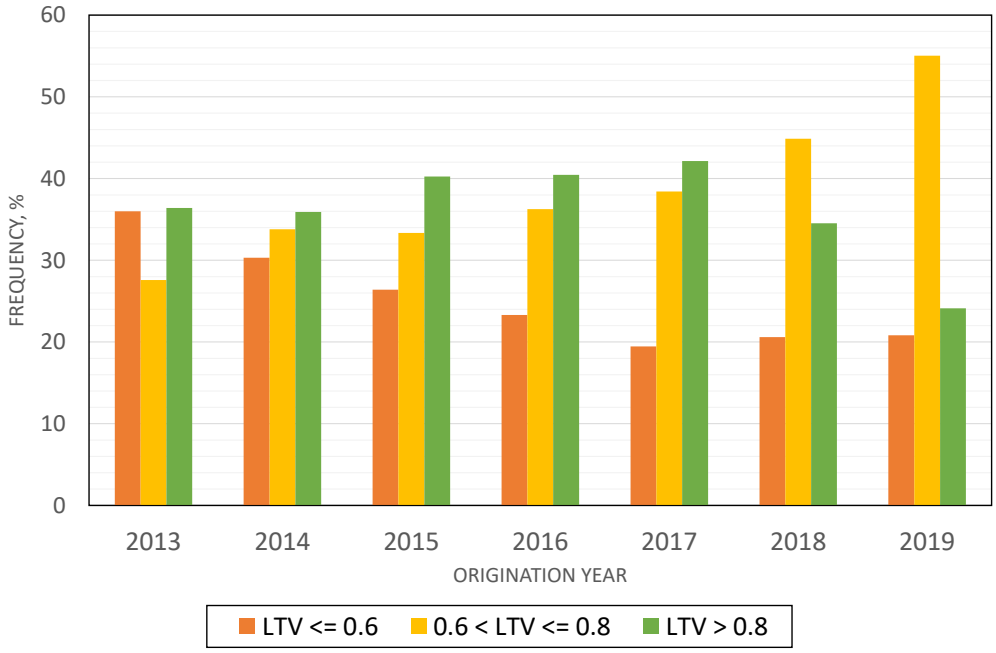

Figure 4. The effects of the COVID-19 pandemic on loan delinquencies. The Figures show the quarterly delinquency rate by year of origination (Figure A) and by employment status (Figure B) and the cumulative delinquency rate by country of origination during the pandemic relative to the total number of active loans in Q4-2019 (Figure C).

Figure A

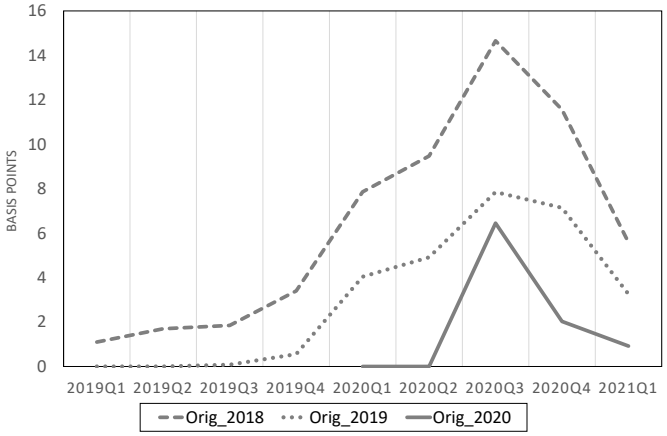

Figure B

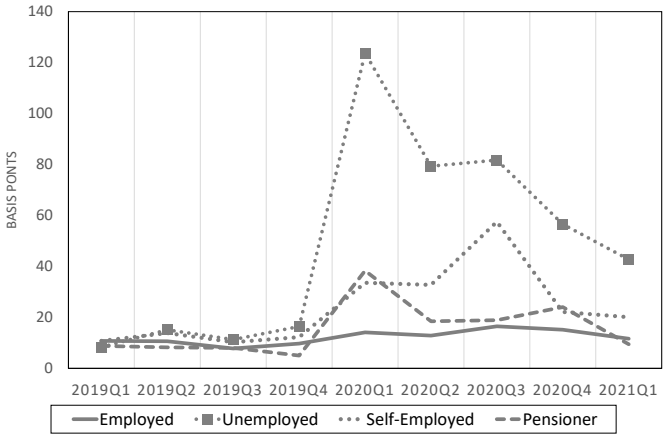

Figure C

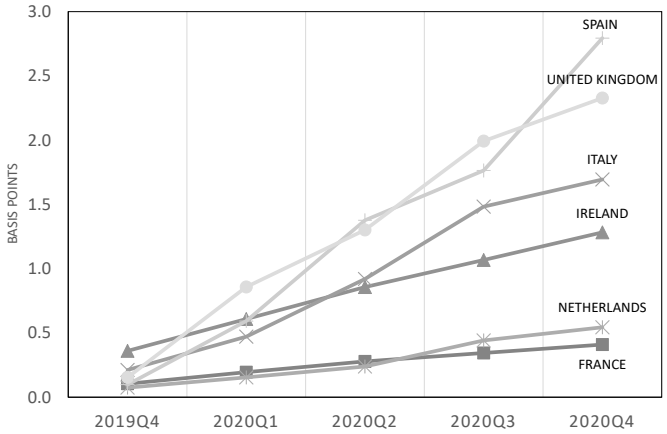

Figure 5. COVID-19 and quarter fixed effects, COVID sample. The Figure shows the quarter fixed effect marginal coefficients of the probit regression model defined in Equation 2 and their 95% confidence intervals computed with the delta method.

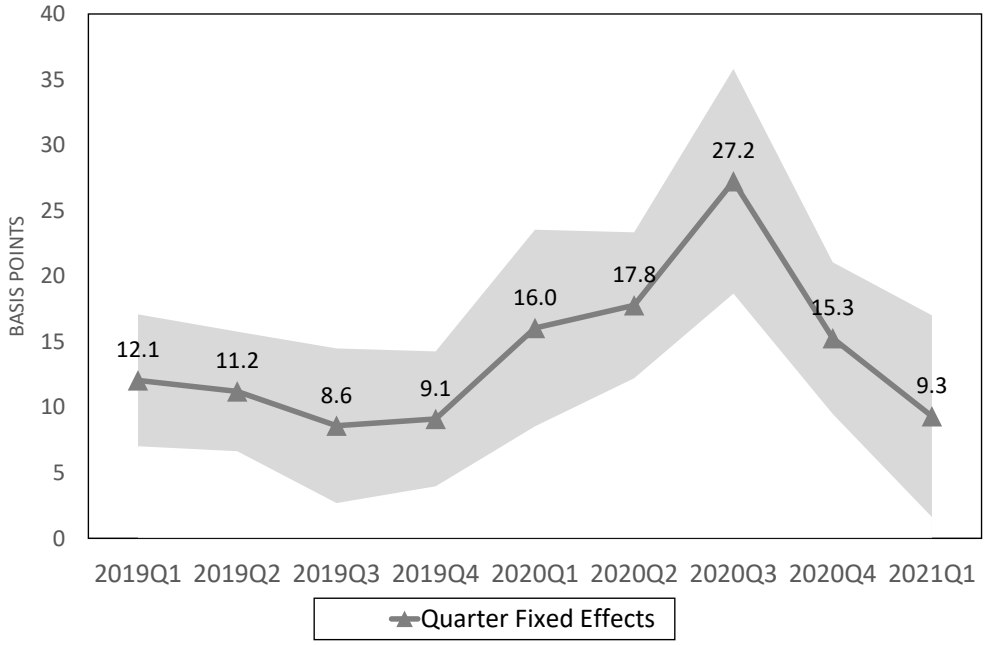

Figure 6. COVID-19 pandemic and loan delinquencies: STS vs non-STS securitisations. The Figure show quarterly delinquency rates of STS and non-STS securitisations for mortgages originated in 2018 (Figure A), 2019 (Figure B) and 2020 (Figure C).

Figure A

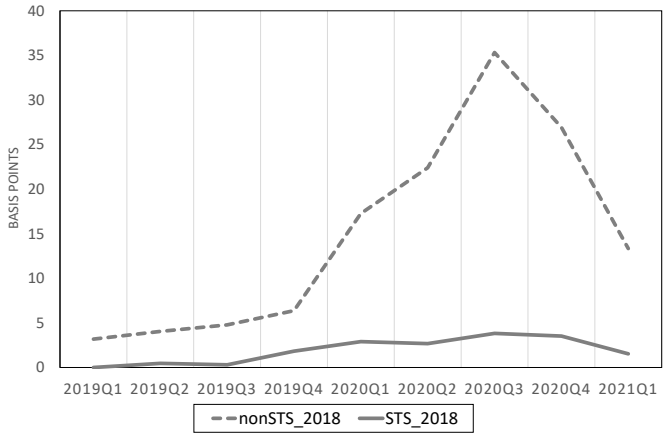

Figure B

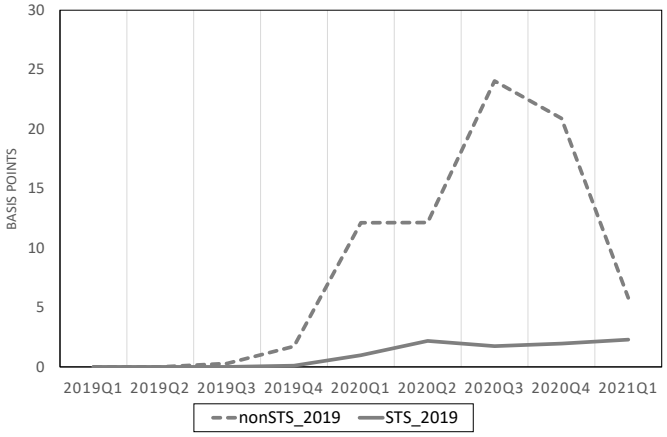

Figure C

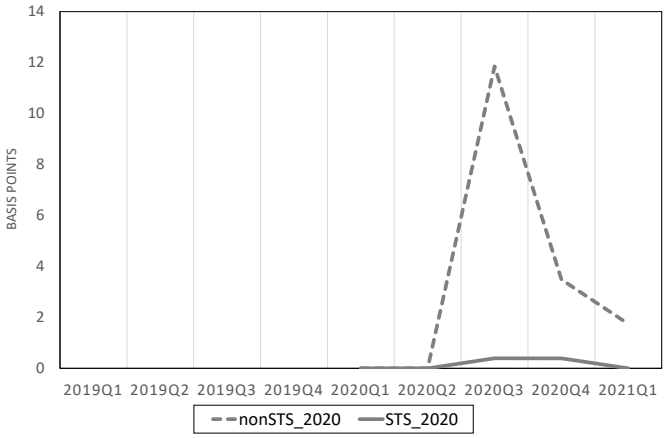

Table 1. Distribution of mortgages by country of origination. The table reports country distributions of securitisation deals, mortgage loans, borrowers and quarterly observations at the loan level across the whole sample (Panel A), the pre-COVID-19 subsample (Panel B) and the COVID-19 subsample (Panel C). The two subsamples overlap from Q1-2018 to Q4-2019.

Panel (A) : Full sample, from Q3-2012 to Q1-2021

Country of Origination	Deals	Loans	Borrowers	Observations
Netherlands	98	1,606,018	775,584	11,245,343
France	27	2,318,880	2,180,649	9,823,654
Spain	41	819,205	678,530	6,269,993
Italy	42	561,179	716,181	4,524,551
Belgium	5	142,248	132,603	1,729,809
United Kingdom	37	312,301	483,503	2,139,554
Germany	3	503,955	281,250	2,351,795
Portugal	5	72,565	70,914	765,027
Ireland	23	212,780	210,103	1,446,055
Total	281	6,549,131	5,529,317	40,295,781

Panel (B): pre-COVID-19 subsample, from Q3-2012 to Q4-2019

Country of Origination	Deals	Loans	Borrowers	Observations
Netherlands	80	1,320,094	695,252	7,119,031
France	22	2,053,516	2,014,525	8,055,314
Spain	36	626,456	465,940	5,802,704
Italy	39	515,423	686,774	3,518,889
Belgium	5	140,225	113,582	1,684,707
United Kingdom	30	246,673	436,272	1,526,781
Germany	3	503,955	281,250	2,351,795
Portugal	3	41,011	49,742	627,944
Ireland	15	104,899	112,720	1,080,262
Total	233	5,552,252	4,856,057	31,767,427

Panel (C): COVID-19 subsample, from Q1-2018 to Q1-2021

Country of Origination	Deals	Loans	Borrowers	Observations
Netherlands	43	656,914	262,713	5,233,694
France	11	403,230	363,909	2,101,577
Spain	9	212,311	219,592	500,996
Italy	12	220,331	218,512	1,706,835
Belgium	1	39,719	49,499	239,386
United Kingdom	17	101,607	95,080	732,499
Portugal	3	50,911	43,388	446,479
Ireland	16	155,135	154,856	644,375
Total	112	1,840,158	1,407,549	11,605,841

Table 2. Mortgage distribution by loan characteristics. The table reports the distribution of residential mortgages across loan and borrower characteristics. Time-dependent variables (* in the table), are described by their average value. A description of all the variables can be found in Appendix A.

		Full sample	**Pre-COVID-19 subsample**	**COVID-19 subsample**
	Sample period	2012q3 - 2021q1	2012q3 - 2019q4	2018q1 - 2021q1
	No. of loans	6,549,131	5,552,252	1,840,158
	Variables	**Mean**	**Mean**	**Mean**
	Delinquent	0.016	0.017	0.009
	Originated from 2018	0.068	0.034	0.207
	STS securitisation	\	\	0.477
Loan characteristics				
	Loan to Value*	0.845	0.837	0.879
	Years to Maturity*	2.811	2.686	3.246
	Interest Rate*	2.541	2.586	2.288
Interest Type	Floating	0.232	0.214	0.276
	Fixed	0.407	0.430	0.285
	Hybrid	0.340	0.337	0.419
	Other	0.021	0.020	0.021
Payment Type	Annuity	0.578	0.557	0.682
	Linear	0.168	0.185	0.061
	Increasing	0.013	0.013	0.009
	Fixed Instalments	0.043	0.047	0.014
	Other	0.198	0.197	0.234
Purpose	Purchase	0.644	0.631	0.703
	Remortgage	0.119	0.120	0.117
	Renovation	0.075	0.076	0.072
	Construction	0.070	0.072	0.058
	Other	0.092	0.102	0.049
Borrower Characteristics				
	Second Time Borrower	0.248	0.253	0.242
Employment	Employed	0.829	0.833	0.823
	Unemployed	0.013	0.014	0.007
	Self Employed	0.095	0.096	0.095
	Legal Entity	0.002	0.002	0.002
	Student	0.001	0.001	0.001
	Pensioner	0.029	0.030	0.028
	Other	0.024	0.025	0.018
Macro-variables				
	ΔUnemployment*	-0.038	-0.070	0.001
	ΔHouse Price Index*	0.435	0.154	1.095

Table 3. The effect of general provisions on loan delinquency rates, pre-COVID-19 sample. Panel A reports panel probit regression results for the baseline model in Equation 1. Panel B reports results from Equation 1 when variables are gradually added to the model. The sample includes non-STS deals only. The variable *Originated from 2018*, is equal to one if the loan has been issued after 1st January 2018, zero otherwise. The definition of the remaining variables can be found in Appendix A. Robust standard errors are clustered at deal level. ***, **, and * denote significance at the 1%, 5% and 10% level respectively.

Panel (A)				
Dependent Variable: Loan delinquency				
	Variable	**Coefficient**	**St. Error**	**Marginal effects (basis points)**
	Originated from 2018	-0.199***	(0.034)	-6.64
	Years to Maturity	-0.010	(0.021)	-0.34
	Interest Rate	0.169***	(0.017)	5.63
Loan-to.value				
	[0.6; 0.7) LTV	-0.006	(0.016)	-0.17
	[0.7; 0.8) LTV	0.044**	(0.021)	1.42
	[0.8; 0.9) LTV	0.022	(0.026)	0.69
	[0.9; 1) LTV	0.084***	(0.031)	2.84
	(above 1) LTV	0.124***	(0.030)	4.44
Int. Rate Type				
	Floating	0.302***	(0.041)	10.41
	Hybrid	0.207***	(0.057)	6.19
	Other	0.160***	(0.050)	4.45
Payment Type				
	Linear	0.057	(0.062)	2.00
	Increasing	0.069	(0.065)	2.46
	Fixed Instal.	-0.042	(0.064)	-1.29
	Other	-0.081**	(0.036)	-2.38
	Purpose			
	Remortgage	-0.060**	(0.030)	-1.83
	Renovation	-0.034	(0.043)	-1.07
	Construction	-0.004	(0.027)	-0.15
	Other	0.076	(0.047)	2.75
Borrower Information				
	Unemployed	0.066	(0.087)	2.21
	Self-employed	0.192***	(0.026)	7.60
	Legal Entity	0.167	(0.140)	6.37
	Student	-0.122	(0.132)	-3.15
	Pensioner	0.081*	(0.042)	2.76
	Other employment	0.014	(0.059)	0.43
	Second Time Borrower	-0.037*	(0.022)	-1.23
Macro-Variables				
	Δ*Unemployment*	0.089	(0.088)	2.95
	Δ*Hourse Price Index*	-0.027	(0.042)	-0.91
	Deal and Quarter FE	Yes		
	Obs.	5,899,735		
	Pseudo-R^2	0.1888		

Panel (B)				
Dependent Variable: Loan delinquency	**Marginal Effect (basis points)**			
Variables	**(I)**	**(II)**	**(III)**	**(IV)**
Originated from 2018	-6.51***	-6.50***	-6.61***	-6.64***
Loan Characteristics		Yes	Yes	Yes
Borrower Characteristics			Yes	Yes
Macro-Variables				Yes
Deal and Quarter FE	Yes	Yes	Yes	Yes
Obs.	5,899,735	5,899,735	5,899,735	5,899,735
Pseudo-R^2	0.171	0.1857	0.1885	0.1888

Table 4. The announcement effect, pre-COVID-19 sample. The table reports panel probit regression results for the baseline model in Equation 1. The sample includes non-STS deals only. The first specification distinguishes between loans originated from 1st January 2018 and those originated in 2017; the second specification identifies loans originated from 1st January 2017. Robust standard errors are clustered at deal level. ***, **, and * denote significance at the 1%, 5% and 10% levels respectively.

Dependent Variable: Loan Delinquency		**Marginal Effect (basis points)**	
	Variables	**(1)**	**(2)**
Origination	*after 2018*	-15.60***	
		(0.030)	
	in 2017	-9.95***	
		(0.027)	
Origination	*from 2017*		-10.49***
			(0.027)
	Loan Characteristics	Yes	Yes
	Borrower Characteristics	Yes	Yes
	Macro-Variables	Yes	Yes
	Deal and Quarter FE	Yes	Yes
	Obs.	5,899,735	5,899,735
	Pseudo-R^2	0.1907	0.1902

Table 5. The effect of unverified information, pre-COVID-19 sample. The table reports panel probit regression results for the baseline model in Equation 1. The sample includes non-STS deals only. The verified information requirement is captured by the interaction of *Origination Period* with the *Employment Status*. Robust standard errors are clustered at a deal level. ***, **, and * denote significance at the 1%, 5% and 10% levels respectively.

Dependent Variable: Loan Delinquency				
	Variable	**Coefficient**	**St. Error**	**Marginal Effect (basis points)**
Origination	*from 2017*	-0.298***	(0.086)	-9.39
Employment	***Unemployed***	**0.174****	**(0.076)**	**8.65**
	Self-Employed	**0.209*****	**(0.026)**	**10.99**
	Legal Entity	0.219*	(0.120)	12.26
	Student	-0.096	(0.139)	-3.36
	Pensioner	0.076	(0.053)	3.41
	Other	0.015	(0.050)	0.63
Origination from 2017	***Unemployed***	**-0.339****	**(0.146)**	**-2.31**
*Employment	***Self-Employed***	**-0.081****	**(0.040)**	**2.71**
	Legal Entity	-0.076	(0.219)	3.11
	Student	-0.064	(0.252)	-2.42
	Pensioner	0.013	(0.074)	1.82
	Other	0.009	(0.127)	0.44
	Loan Characteristics	Yes		
	Borrower Characteristics	Yes		
	Macro-variables	Yes		
	Deal and Quarter FE	Yes		
	Obs.	5,899,735		
	Pseudo-R^2	0.1881		

Table 6. The effect of the general provisions on banks' credit practices, pre-COVID-19 sample. The table reports panel probit regression results for the baseline model in Equation 1. The sample includes non-STS deals only. Banks' credit practices are captured by the interaction of *Origination* with the *Loan to Value ratio* in Panel (A) and *Origination* with *Interest Rate Type* in Panel (B). Robust standard errors are clustered at a deal level. ***, **, and * denote significance at the 1%, 5% and 10% levels respectively.

Panel (A). Delinquency and Loan to Value				
	Variable	**Coefficient**	**St. Error**	**Marginal Effect (basis points)**
Origination	*from 2017*	-0.289***		-9.14
Loan to Value	*[0.6; 0.7)*	-0.002	(0.018)	-0.05
	[0.7; 0.8)	0.039	(0.025)	1.63
	[0.8; 0.9)	0.026	(0.029)	1.09
	[0.9; 1)	0.078**	(0.037)	3.45
	above 1	**0.151*** **	**(0.036)**	**7.25**
Origination from 2017	*[0.6; 0.7)*	-0.019	(0.043)	-0.37
*Loan-to-value	*[0.7; 0.8)*	0.015	(0.044)	1.06
	[0.8; 0.9)	-0.033	(0.055)	-0.11
	[0.9; 1)	-0.005	(0.068)	1.46
	above 1	**-0.107***	**(0.064)**	**0.81**
	Loan Characteristics	Yes		
	Borrower Characteristics	Yes		
	Macro-variables	Yes		
	Deal and Quarter FE	Yes		
	Obs.	5,899,735		
	Pseudo-R^2	0.1904		
Panel (B). Delinquency and Interest Rate Type				
	Variable	**Coefficient**	**St. Error**	**Marginal Effect (basis points)**
Origination	*from 2017*	-0.242**	(0.102)	-9.21
Int. Rate Type	*Floating*	0.315***	(0.053)	13.56
	Hybrid	**0.268*** **	**(0.060)**	**10.69**
	Other	0.177***	(0.059)	6.25
Origination from 2017	*Floating*	-0.044	(0.065)	5.65
*Int. Rate Type	***Hybrid***	**-0.145****	**(0.074)**	**2.02**
	Other	-0.085	(0.169)	1.45
	Loan Characteristics	Yes		
	Borrower Characteristics	Yes		
	Macro-variables	Yes		
	Deal and Quarter FE	Yes		
	Obs.	5,899,735		
	Pseudo-R^2	0.1905		

Table 7. Mortgage distribution by loan characteristic, COVID-19 sample. The table shows the distribution of residential mortgages for STS and non-STS securitisation across loan and borrower characteristics.

General		**No. of Loans**	**Observations (%)**			
	non-STS	962,633	52.3			
	STS	877,525	47.7			
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. (%)**	**Fixed (%)**	**Other (%)**
	non-STS	55.65	9.06	0.01	0.96	34.32
	STS	76.69	1.69	2.42	0.8	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		**(0.0; 0.7) (%)**	**[0.7; 0.8) (%)**	**[0.8; 0.9) (%)**	**[0.9; 1) (%)**	**above 1 (%)**
	non-STS	29.43	14.43	18.09	13.76	24.28
	STS	22.23	10.86	13.47	18.66	34.78

Table 8. The effect of STS Securitisation on loan quality, COVID-19 sample. The table reports panel probit regression results for the baseline model in equation 3. Our main variable of interest, *STS Securitisation*, is an indicator variable that takes the value of one if the loan belongs to STS deal, and zero otherwise. Robust standard errors are clustered at a deal level and reported in round brackets. ***, **, and * denote significance at the 1%, 5% and 10% levels respectively.

Dependent Variable: Loan Delinquency			
Variables	**Coefficient**	**St. Error**	**Marginal effect (basis points)**
STS Securitisation	-0.493***	(0.070)	-21.59
Years to Maturity	0.085***	(0.032)	3.73
Interest Rate	0.107***	(0.019)	4.69
Loan-to.value			
[0.6; 0.7) LTV	-0.050	(0.039)	-1.77
[0.7; 0.8) LTV	-0.057	(0.046)	-2.01
[0.8; 0.9) LTV	0.019	(0.060)	0.75
[0.9; 1) LTV	0.090	(0.057)	3.91
(above 1) LTV	0.231***	(0.061)	12.29
Int. Rate Type			
Floating	0.239***	(0.048)	12.27
Hybrid	-0.042	(0.054)	-1.42
Other	0.179**	(0.070)	8.44
Payment Type			
Linear	-0.151*	(0.086)	-5.55
Increasing	0.069	(0.062)	3.40
Fixed Instal.	0.108*	(0.059)	5.64
Other	-0.005	(0.033)	-0.23
Purpose			
Remortgage	-0.020	(0.036)	-0.849
Renovation	0.028	(0.039)	1.265
Construction	0.083	(0.064)	4.042
Other	0.031	(0.039)	1.386
Borrower Information			
Unemployed	0.301***	(0.065)	17.73
Self-employed	0.168***	(0.023)	8.08
Legal Entity	0.501***	(0.122)	40.09
Student	0.080	(0.137)	3.41
Pensioner	0.097	(0.082)	4.21
Other employment	0.313***	(0.065)	18.78
Second Time Borrower	0.056	(0.044)	2.44
Macro-Variables			
Δ*Unemployment*	0.207	(6.526)	9.10
Δ*House Price Index*	-0.025	(0.019)	-1.08
Country and Quarter FE	Yes		
Obs.	11,115,625		
Pseudo-R^2	0.0891		

Table 9. STS Securitisation effects quarter by quarter, COVID-19 sample. The table reports panel probit regressions results for the baseline model in Equation 3. Quarterly effects are captured through the interaction of Quarter FEs with the dummy variable *STS securitisation*, which equals one if the mortgage belongs to a STS deal, and zero otherwise. Q4-2019 is the baseline variable for the quarter fixed effects. Quarters before Q4-2019 are included but not tabulated. Robust standard errors are clustered at a deal level. ***, **, and * denote significance at the 1%, 5% and 10% levels respectively.

Dependent Variable: Loan Delinquency		
Variables	**Marginal Effect (basis points)**	
STS Securitisation	-18.41***	
	(0.035)	
	Quarter FE	*Quarter FE * STS*
2020q1	17.21*	-3.71***
	(0.100)	(0.100)
2020q2	16.93***	-3.67**
	(0.052)	(0.015)
2020q3	28.22***	-3.77*
	(0.070)	(0.019)
2020q4	15.01***	-5.28***
	(0.036)	(0.018)
Loan Characteristics	Yes	
Borrower Characteristics	Yes	
Macro-variables	Yes	
Country FE	Yes	
Obs.	11,028,008	
Pseudo-R^2	0.0904	

Appendix A.

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 (in) 2018 (2017)	An indicator variable equal to one if the loan has been originated from (in) 1st January 2018 (2017), and zero otherwise.
STS Securitisation	An indicator variable equal to one if the deal is defined as STS according to the ESMA STS register, and zero otherwise.
Loan's characteristics	
Loan to Value	A categorical variable indicatingg 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 the loan matures.
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 (baseline), or whether its amortisation schedule is linear, increasing, characterised by fixed instalments or other less frequent payment type specifications.
Purpose	A categorical variable indicating whether the loan has been issued for purchase purposes (baseline), remortgage, 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, a student, a pensioner or other less frequent employment specifications.
Macro variables	
Δ*Unemployment*	Two-quarters lagged country-specific change of the unemployment rate.
Δ*House Price Index*	Four-quarters lagged country-specific change of the house price index.

Appendix B.

The effects of the ABS regulation on loan delinquencies, pre-COVID-19 sample. This table reports panel probit regression results for the baseline model in equation 1. The sample includes non-STS deals only. It excludes loans issued before 2013 (Panel A), and loans issued from 2019 (Panel B). In Panel (C), loans up to three years after the loan origination are considered (instead of two). The definition of all variables can be found in Appendix A. Robust standard errors are clustered at deal level. ***, **, and * denote significance at the 1%, 5% and 10% levels respectively.

Panel (A). Loan delinquency and origination period. No loans originated before 2013				
Dependent Variable: Loan delinquency	**Marginal Effect (basis points)**			
Variables	**(I)**	**(II)**	**(III)**	**(IV)**
Originated from 2018	-6.1***	-6.0***	-6.1***	-6.1***
Loan Characteristics		Yes	Yes	Yes
Borrower Characteristics			Yes	Yes
Macro-variables				Yes
Deal and Quarter FE	Yes	Yes	Yes	Yes
Obs.	5,783,050	5,783,050	5,783,050	5,783,050
Pseudo-R^2	0.1718	0.1868	0.1895	0.1897
Panel (B). Loan delinquency and origination period. No loans originated from 2019				
Dependent Variable: Loan delinquency	**Marginal Effect (basis points)**			
Variables	**(I)**	**(II)**	**(III)**	**(IV)**
Originated from 2018	-5.5***	-5.6***	-5.6***	-5.6***
Loan Characteristics		Yes	Yes	Yes
Borrower Characteristics			Yes	Yes
Macro-variables				Yes
Deal and Quarter FE	Yes	Yes	Yes	Yes
Obs.	5,918,240	5,918,240	5,918,240	5,918,240
Pseudo-R^2	0.172	0.1867	0.1894	0.1897
Panel (C). Loan delinquency and origination period, up to three years after loan origination.				
Dependent Variable: Loan Delinquency	**Marginal Effect (basis points)**			
Variables	**(I)**	**(II)**	**(III)**	**(IV)**
Originated from 2018	-6.5***	-6.7***	-6.7***	-6.5***
Loan Characteristics		Yes	Yes	Yes
Borrower Characteristics			Yes	Yes
Macro-variables				Yes
Deal and Quarter FE	Yes	Yes	Yes	Yes
Obs.	11,836,179	11,836,179	11,836,179	11,836,179
Pseudo-R^2	0.1852	0.189	0.1919	0.1937

Appendix C.

The effect of the loan origination on loan delinquency rates, excluding loans securitised after 2017, pre-COVID-19 sample. The table reports panel probit regression results for the baseline model in Equation 1. The sample includes non-STS deals only. The variable *Origination in 2015-2016* is a categorical variable equal to one if the loan has been originated from 1st January 2015 to 31st December 2016, and zero otherwise. Robust standard errors are clustered at a deal level. ***, **, and * denote significance at the 1%, 5% and 10% levels respectively.

Dependent Variable: Loan Delinquency			
	Variables	**Coefficient**	**Margins (%)**
Origination	*in 2015-2016*	0.028	0.009
		(0.024)	
	Loan Characteristics	Yes	
	Borrower Characteristics	Yes	
	Macro-variables	Yes	
	Deal and Quarter FE	Yes	
	Obs.	3,819,223	
	Pseudo-R^2	0.1881	