Synthetic, but How Much Risk Transfer?*

Alex Osberghaus
University of Zurich, Swiss Finance Institute

Glenn Schepens
European Central Bank

This draft: March 15, 2025
First draft: February 01, 2025

Abstract

Banks use synthetic risk transfers (SRTs) to sell the first loan portfolio losses to non-bank investors while retaining the loans on their balance sheets. This is the first paper to investigate this trillion-euro market, using transaction-level data on synthetically transferred loans in the euro area. We show in a difference-in-difference setting that less capitalized banks with riskier loan portfolios are more likely to do SRTs. A discontinuity in capital risk weights reveals that banks offload capital-expensive loans, which leaves them relatively less capitalized. SRTs are associated with increased and safer lending, higher dividend payments, and reduced monitoring. Although SRT investors have relatively low leverage, bank credit matters. Banks are more likely to sell SRTs to investors to whom they also lend credit, and total bank credit to these investors increases before the SRT investment, consistent with partial debt financing. Finally, thicker first-loss tranches, which are common in U.S. SRTs, are bought by more leveraged investors and have higher expected losses.

*Alex thanks Steven Ongena and Andreas Fuster for invaluable guidance throughout his PhD. Some of this work was completed while Alex visited NYU Stern where he received helpful feedback from Viral Acharya, Kristian Blickle, Yannis Cabossioras, Matteo Cosigniani, Ian D'Souza, Daniel Greenwald, Maximilian Jager, Peter Koudijs, Toomas Laarits, Yiming Ma, Eva Mulder, Guillaume Plantin, Mattew Plosser, Anthony Saunders, Alexi Savov, Philipp Schnabl, Sascha Steffen, and Bruce Tuckman. Additionally, we thank Olimpia Carradori, Thea Kolasa, Felix von Meyerinck, and seminar participants at ECB's Banking Supervision seminar for helpful comments. The views expressed do not necessarily reflect those of the ECB or the Eurosystem.

"If you're unfamiliar with synthetic risk transfers, there's a chance you'll hear all about them when the next financial crisis hits."

Bloomberg's Editorial Board

29 October, 2024

1 Introduction

Synthetic risk transfer (SRT), also called synthetic securitization or credit risk transfer, is the practice of banks to pool loans and sell *tranches* of the credit risk to non-bank investors while retaining ownership of the loans themselves.[1] Thus, SRTs blend features of both hedging through credit default swaps (CDS) and traditional (cash) securitizations. Like CDS, SRTs transfer credit risk to an investor who is compensated with regular fee payments without transferring ownership of the underlying asset.[2] However, unlike CDS, but similar to traditional securitization, SRTs consist of different risk tranches. The junior tranches absorb the first loan losses and are typically sold, while the senior tranches absorb the subsequent loan losses and are typically retained by the bank.[3]

Banks have synthetically transferred more than one trillion euros in assets to the non-bank financial sector worldwide since 2016 according to the International Monetary Fund (IMF, October 2024). The market has so far been predominantly European, accounting for at least two-thirds of synthetically transferred assets (see, e.g., González and Triandafil (2023) or Fitch Ratings (2024)). Figure 1 shows that in the space of firm loans alone, the outstanding amount of SRTs by euro area banks was 300 billion euros at the end of 2024, up from 60 billion in 2018. More than 20 percent of outstanding firm credit was synthetically transferred

[1] In Europe, SRT also stands for significant risk transfer which may include synthetic risk transfer and traditional (cash) securitization. Here, we use the acronym to refer to the synthetic variant.

[2] In SRTs, the credit risk transfer is typically achieved through financial guarantees or credit linked notes (CLNs), where the latter can be either issued by the bank directly or a special purpose vehicle (SPV). CLNs are securities similar to funded CDS in which the CLN issuer (the bank or the SPV in our case) promises to pay back the principal minus the amount of the defaulted loans. For a more detailed explanation on SRT transaction types, we refer to a European Systemic Risk Board report by González and Triandafil (2023) and Section 2.3 of this paper. Also note that the word "synthetic" in the SRT acronym refers to the fact that the ownership of the underlying loans is not transferred. SRTs are different from products such as synthetic CDOs that were popular before the 2008 global financial crisis and that allowed investors to insure securities they did not own.

[3] In our sample, SRTs usually have two or three tranches and the bank retains the senior tranche, see Section 2.

in Portugal in 2024, and more than 5 percent in Italy, Germany, and Spain (Figure 2). 24 euro area banks, half of which have a portfolio size of more than 500 billion euros, had more than 10 percent of their firm-loan portfolio insured through SRTs. The market in the United States is considerably smaller but growing faster with an estimated outstanding SRT volume of 68 billion euros in 2024, compared to around 17 billion in 2023 (Bloomberg via Bank of America estimates as of March 2024).

This is the first paper to systematically investigate SRTs. What banks use them, what loans do they transfer, and what are the consequences of SRTs at the bank, firm, and loan level? To answer these questions, we exploit a regulatory change that increased the propensity to do SRTs, and distortions and a discontinuity in the capital risk weights of loans. In addition, we investigate whether SRTs achieve real risk transfer. Specifically, we study the interconnectedness of the banking sector and the SRT issuing bank with the non-bank SRT investors. The presumption that investors use bank credit to invest in SRTs was labeled "round-tripping" by the popular press but has so far never been tested.[4] Lastly, we show examples of the trade-off between achieving a significant transfer of credit risk and investor returns.

Our research questions require data on SRT issuing banks, the SRT loans, the corresponding loan pools, non-bank SRT investors, and investors' credit structures. These requirements are fulfilled by the euro area's monthly credit registry, AnaCredit, which is administered by the ECB. It registers all loans by euro area banks to firms where the bank has a firm exposure of at least 25,000 euros. Synthetically transferred loans are flagged and the loans' corresponding SRT pools receive an identifier. In addition, SRT issuing banks usually also report the identity of the non-bank SRT investor.[5] Banks' loan exposure to these non-bank SRT investors again comes from AnaCredit which includes loans to financial firms. Finally, AnaCredit is complemented by COREP, another ECB dataset that provides information on the SRT itself, such as the tranching structure or its collateralization. Our main sample period is from September 2018 until July 2024.

[4]See, for example, "IMF warns of 'round-tripping' fears", Financial Times, 22 October, 2024.

[5]SRTs can be done through financial guarantees or credit derivatives. The provided investor is usually the ultimate investor if the SRT is done through financial guarantees. If the SRT is done through derivatives, the investor is the intermediating bank or a special purpose vehicle. Most SRTs in our dataset are done through financial guarantees.

We show that lower-capitalized banks with riskier loan portfolios use SRTs compared to banks that do not use SRTs. For identification, we use a regulatory change implemented in April 2021 that increased the propensity of banks to use SRTs by facilitating capital relief for them[6]. Upon using SRTs, banks tend to synthetically transfer capital-expensive loans. We hold firm and loan characteristics equal by exploiting the so-called SME support factor which make capital risk weights an increasing function of the firm's annual revenue and the bank's exposure to that firm, and discontinuously so for firms with revenues around 50 million euros. Banks seem to use SRTs to offset some of these capital distortions, leaving them less capitalized relative to the riskiness of their loan portfolio.

A higher propensity for a bank to use SRTs is associated with more and safer lending and increased dividend payments after the April 2021 regulatory change. We also find evidence consistent with greater moral hazard: After a bank includes a loan in an SRT, it reduces the frequency with which it adjusts its estimates of the firms' probability of default compared to other firms it lends to and other banks lending to the same firm. We interpret this as banks being less attentive to actual fluctuations in firm risk, which might translate to lower monitoring.

What are the consequences of a surging SRT market on the bank-non-bank nexus? We can identify 65 ultimate SRT investors that invest in 281 SRT issues. We find that the ratio of bank loan liabilities to assets of non-bank SRT investors is generally low[7]. Nevertheless, banks and non-banks are interconnected. Banks are more likely to sell credit risk to non-bank investors they also grant credit to during the sample period compared to SRT investors with no such connection. In addition, the banking sector's loan exposure to the non-bank SRT investor increases around the SRT investment, especially when the investment is more likely to be cash collateralized and when it is large.[8] This suggests that some of the funding

[6] A similar regulatory change can be found in the U.S. where in September 2023, the Federal Reserve provided clarifying statements that were widely interpreted as allowing SRTs to systematically qualify for capital relief.

[7] Non-bank SRT investors' descriptive statistics are sensitive to the level of consolidation we consider and whether we include investments of governmental entities. Our baseline regression results are at the unconsolidated investor level, even though investors are often part of a larger corporation. We run robustness regressions for nongovernment investors.

[8] SRT transactions can be funded or unfunded. In funded transactions, banks receive cash collateral upfront (as is always the case if SRTs are done through CLNs) while in unfunded transactions, banks are reimbursed in case of defaults on the underlying loans. In Europe, transactions can be unfunded and still achieve capital relief if the investor has a high enough rating (such as governmental bodies or large insurance companies).

used for SRT investments comes from banks, consistent with the "round-tripping" assertion in the popular press.

Finally, there is a trade-off between achieving significant risk transfer from banks to non-bank investors by selling a larger fraction of the SRT (a "thicker" first-loss tranche) and the return of non-bank investors. All else equal, thicker tranches imply lower expected returns, since it is less likely for 10 percent of the portfolio to default than 5 percent. However, lower returns can be offset by higher investor leverage or riskier loans in the SRT. Indeed, we find that SRTs that sell thicker tranches tend to have investors with higher ratios of bank loans to assets and contain riskier loans.[9] This has implications for the surging U.S. market where banks have to sell a larger portion of the SRT than their European counterparts to achieve comparable capital relief. Our findings suggest that U.S. SRTs might attract more leveraged investors and contain loans with higher expected losses than European SRTs.

Our work connects to at least two strands of research, one on CDS and traditional securitization, and another emerging literature on the interconnectedness of banks' and non-banks' balance sheets. Parlour and Plantin (2008) model a market in which banks securitize credit for funding or to trade on private information. Investors participate only if the funding motive is likely enough. The model is particularly relevant for SRTs, which often involve loans to corporates or small businesses – assets that are less standardized and more information-sensitive compared to those in traditional securitization. It also rationalizes the growth in SRT volumes after the April 2021 regulatory change that facilitated capital relief for SRTs, and thus strengthened the funding rationale for these transactions. Other papers investigate the consequences of CDS and securitization for bank and firm outcomes (e.g. Bolton and Oehmke (2011), Carbo-Valverde, Degryse, and Rodríguez-Fernández (2015), or Fuster and Vickery (2015)) and monitoring (e.g. Keys et al. (2010) or Degryse et al. (2021)). Our study is the first to explore these dynamics in the context of SRTs – a structure that blends elements of CDS and traditional securitization.

On the link between banks' and non-banks' balance sheets, Acharya, Schnabl, and Suarez (2013) find that before the 2008 global financial crisis, banks oftentimes explicitly guaranteed

[9]The latter result is at least partially by design since banks have to prove the "significance" of the risk transfer to achieve capital relief which is a function of the expected losses. Nevertheless, it exemplifies the interplay between a safer tranching structure for banks and riskier underlying SRT characteristics.

the loans they securitized. Securitization therefore did not achieve actual risk transfer but was used as a tool to bypass capital regulation. We study a less explicit bank-non-bank connection by investigating banks' debt exposure to SRT investors. Acharya, Cetorelli, and Tuckman (2024) show that banks and non-banks finance each other and their abnormal equity returns are correlated. Jacewitz, Unal, and Wu (2022) find evidence that banks provide insurance to the prime institutional money market funds they sponsor. Using institution- and loan-level data, we investigate a market where banks and non-banks are partially interconnected in a circular way, namely, banks invest in loans to non-banks who invest in banks' credit risk.

The paper is structured as follows. In Section 2, we introduce the data, explain the sample construction, and show descriptive statistics of the SRT market, SRT banks, SRT loans, SRT transactions, and non-bank SRT investors. Section 3 shows the results. We start by answering what banks use SRTs, what loans they transfer, and what the consequences are of SRTs at the bank and firm level (Section 3.1). We continue with an analysis of the interconnectedness of banks and non-bank SRT investors, and the trade-off between the thickness of the tranche sold and investor return (Section 3.2). Section 4 concludes.

2 Data and Descriptive Statistics

2.1 Data

The lack of disclosure in most countries makes studying SRTs difficult. We illuminate the black box by employing the euro area-wide credit registry called AnaCredit, administered by the European Central Bank. AnaCredit records all loans by euro area banks to firms (non-financial or financial), to which the banks have an exposure of at least 25,000 euros, on a monthly basis. The data start in September 2018, and the reported variables include loan type (such as term loans or credit lines), loan amount, interest rate, collateral, realized payment delays, realized defaults, and the firm's probability of default (PD) estimates.

A unique feature of the data is that it includes comprehensive information about SRTs. Once a loan gets synthetically transferred it receives an SRT flag, and the originating bank

continues to report the loan monthly. The bank also reports an SRT issue identifier, the amount of risk transferred, and the investor for every synthetically transferred loan. The SRT issue identifier pins down the loan pool and the transaction to which each loan belongs, and the amount of risk transferred reflects the amount of potential losses borne by the non-bank SRT investors. The name of the non-bank SRT investor that is disclosed in AnaCredit is typically that of the ultimate investor that assumes the risk, but could also be a bank that underwrites a derivative or the special purpose vehicle through which the risk is transferred (see the next section). Whenever it is that of the ultimate investor, we can exploit the fact that in AnaCredit banks also report their loans to financial firms to unveil banks' loan exposure to these investors.

In addition to their loan reporting, systemically important euro-area banking groups report SRT transaction details in a database called COREP. It includes variables such as the issuance and maturity date, the number of tranches, the attachment and detachment point of each tranche, the size of the tranches, the amount transferred by the originating bank, the collateral that the investor pledged (if any), the expected and unexpected default estimates, and the expected loss given default.

Balance sheet and P&L information of the SRT issuing banks, the non-bank SRT investors, and the firms whose loans are synthetically transferred comes from AnaCredit and Bureau van Dijk's (BvD) Bankfocus and Orbis.

2.2 Sample Construction

For the bank-level analysis, we rely on the flag in AnaCredit that indicates whether and when a loan was synthetically transferred. We only consider SRTs whose underlying loans go to non-financial corporations. SRT amounts are then aggregated at the bank-year or bank-quarter level, depending on the frequency with which the relevant data are reported. To understand the motivation behind issuing SRTs and to investigate their consequences at the bank level, we compare SRT-issuing banks ("SRT banks") with banks that do not issue SRTs ("non-SRT banks"), but that are comparable in size. As SRT banks tend to be large, we choose non-SRT banks that are at least as large as the 10th percentile of SRT banks in a respective country. This results in 71 SRT banks and 941 non-SRT banks. However, Bank-

focus' coverage of capital ratios, which are featured in every bank-level regression, reduces the number of non-SRT banks to 300. Additionally to our non-SRT bank selection, we control for bank size by interacting 10 bank size dummies with the natural logarithm of banks' balance sheets, similar to specifications in Sufi (2007). This should further alleviate concerns that some of our results are driven by bank size.

The investigation of the interconnectedness between banks and non-bank SRT investors uses a more detailed approach to identify SRTs by using AnaCredit's SRT issue identifier. In rare instances where the identifier differs despite identical dates of receiving an SRT flag across multiple loans for the same originating bank and non-bank SRT investor, we harmonize the SRT issue identifier. We then exclude loan pools with fewer than 15 loans and risk amounts transferred below 1 million euros. Additionally, loan pools with fewer than 5 loans or fewer than 3 debtors are excluded, regardless of their risk amounts transferred. After these adjustments, our sample comprises 171,506 synthetically transferred loans to non-financial companies, with a total value of 260 billion euros across 352 SRT issues.

Among the 91 non-bank SRT investors during our sample period, we identify 65 as the ultimate investors. These 65 ultimate investors invest in 281 of the 352 SRT issues (80 percent) and hold 72 percent of the total SRT volume issued. We identify non-bank investors as the ultimate investors based on their names in AnaCredit, which are either non-bank (ultimate) investors, SPVs, or banks. Although AnaCredit does not specify the financial instrument used for the transactions, it is likely that when the investor is neither an SPV nor a bank, the SRT is executed through a financial guarantee, whereas when the investor is an SPV or a bank, they act as intermediaries in a derivative. This assumption is consistent with public information from ESMA, which publishes data of a subset of SRTs.[10] According to the ESMA data, 85 percent of issues are transferred with guarantees and 15 percent with derivatives. Almost all SRT transactions with financial guarantees in our sample are bilateral between one bank and one non-bank investor.

We merge COREP to the SRT loan pools identified through AnaCredit based on the originating bank, the issuance date, and the transaction amounts. Only around 50 SRT issues

[10]The financial instrument of the SRT is only available for issues that received the STS label for "simple", "transparent", and "standardized", i.e., only since April 2021.

could be matched to AnaCredit this way. The poor match might be due to COREP only covering systemically important institutions, or it might be due to AnaCredit reporting at the unconsolidated level, while COREP reporting at the group level. We are working on a better match between the two data sources. Finally, nearly all AnaCredit counterparties can be merged to Orbis and Bankfocus, respectively.

2.3 Descriptive Statistics

For the first time, these novel data allow for a detailed characterization of SRTs beyond aggregate statistics. We first present descriptive statistics of the European SRT market for firm loans, such as the market size and its country distribution. In the sections thereafter, we follow the credit risk from the loan originators to the investors. Specifically, we first characterize the SRT banks, then the SRT loans, followed by the SRT transaction, and the non-bank SRT investors.

2.3.1 SRT market

The outstanding amount of synthetically transferred loans to non-financial corporations in the Euro Area has quintupled from around 60 billion euros at the end of 2018 to 300 billion euros in the third quarter of 2024 (Figure 1)[11]. The median and mean SRT amount are 27 million and 725 million euros, respectively, but range from 2.4 million (10^{th} percentile) to 2.9 billion euros (90^{th} percentile). The median and mean SRT contain 63 and 484 loans, respectively, and the 10^{th} and 90^{th} percentiles are 10 and 1,196.

Figure 3 depicts the sum of all synthetically transferred loans by major euro area countries in September 2024. It shows that in absolute terms, the SRT market was largest in Germany (120 billion euros outstanding) and Italy (75 billion euros), and considerably smaller in Portugal (30 billion euros), Spain (25 billion euros), France (15 billion euros), the Netherlands (6 billion euros), and Austria (4 billion euros), and negligible in Belgium and Ireland. As a share of all loans to non-financial corporations, the SRT market was largest in Portugal and Italy (21 and 7 percent), followed by Germany (5 percent), Spain (3 percent), Austria,

[11] In the space of loans to non-financial corporations in the Euro Area, SRT is thereby larger than traditional securitization.

The Netherlands, France, Ireland, and Belgium (all 1 percent or less) (Figure 2)[12].

The distribution of SRT issues over the year is only mildly skewed in our sample. 22 percent are issued in the first quarter of the year, 26 percent in the second, 23 percent in the third, and 28 percent in the last quarter. Lower issuance in the first and higher issuance in the last quarter is consistent with banks being especially concerned with balance sheet cosmetics towards the end of the year.

2.3.2 SRT banks

Before comparing SRT banks with non-SRT banks, we show the market concentration at the bank level and the importance of SRTs for banks. Figure 4 shows the number of SRT banks and the market concentration, measured with the Herfindahl-Hirschman Index (HHI) of outstanding SRT amounts, over time. The number of banks with outstanding SRTs increased strongly during our sample, from only 20 at the end of 2018 to over 60 in 2024. The HHI is extremely volatile and exhibits a general upward trend due to a large jump at the end of 2023. However, during most of our sample period, the HHI is well below 0.4. At the end of 2018, 9 banks issued 90 percent of outstanding SRTs, and in July 2024, it was 11.

SRTs have become an important tool for euro area banks. In July 2024, 7 banks had more than 25 percent of their firm loan portfolio synthetically transferred and another 17 banks had more than 10 percent transferred. The average SRT share transferred among SRT banks was 11, and the median was 7 percent. Among the 24 banks that transferred at least 10 percent of their firm loans, 12 had a balance sheet size of more 500 billion euros.

How do SRT banks differ from non-SRT banks? As implied in the previous paragraph, the first striking difference is that SRT banks are much larger than non-SRT banks; the balance sheet size of the median and mean SRT bank was 237 and 414 billion euros in 2020, respectively, compared to 2 and 42 billion euros of the non-SRT bank. We therefore select non-SRT banks to be at least as large as the 10th percentile of SRT banks in a given country. In our regressions, we additionally control for bank size by interacting bank size bins with the natural logarithm of banks' balance sheets.

Table 1 shows that the median capital ratio and Tier 1 capital ratio of SRT banks are 17.8

[12] *All loan amounts* include traditionally securitized loans.

and 15.3 percent, respectively, and thereby significantly lower than those of non-SRT banks at 19.6 and 18.5. In Figure 5, we show a binned scatter plot with the natural logarithm of the SRT amount on the y-axis and the Tier 1 capital ratio on the x-axis. It shows a strongly negative relationship between the two variables. These findings will hold in cross-sectional regressions and our difference-in-difference specifications in Section 3.1.

In Table 1, we also find that the firm loan portfolio of SRT banks is riskier than that of non-SRT banks. Portfolio riskiness is measured as the average PD that banks assign to firms they lend to, weighted by the loan amounts. If they do not assign a PD estimate to a firm, we take the weighted average PD of the industry in which the firm operates. The average PD is 2.0 percent for the median SRT bank and only 0.9 percent for the median non-SRT bank. This is also reflected in the share of loan payments that are overdue and delinquent, that is, more than 90 days overdue. Analogously to Figure 5, Figure 6 shows a binned scatter plot with the natural logarithm of the bank's SRT amount on the y-axis and its portfolio riskiness on the x-axis. It reveals a strongly negative relationship between the two variables, a finding that we will again reinforce in our regression setting of Section 3.1.

Table 1 also reveals that the median SRT bank has a much higher ratio of liquid assets to deposits than the median non-SRT bank (34.4 compared to 28.9 percent). This might explain why SRT banks choose SRTs over traditional securitization through which they would get liquidity. Finally, the median SRT bank has a much lower return on equity (2.8 percent) than the median non-SRT bank (4.7 percent).

2.3.3 SRT loans

What loans are synthetically transferred? Table 2 compares SRT loans with all loans to non-financial corporations in the euro area in June 2024.[13] For illustrative purposes, values are winsorized at the one percent level. The table shows that the median SRT loan amount is 200,000 and thereby twice as large as the median loan in banks' portfolios at 100,000. Similarly, the revenue of the borrowers whose loans are transferred is greater than that of the median borrower (4 million euros compared to 1.6 million euros). The median SRT

[13] For computational reasons, we take a snapshot of all loans in banks' portfolios in June 2024. Synthetically transferred loans are analyzed on the first date of transfer but across the entire sample.

loan rate is lower (0.023) than the median bank loan (0.040), while the median probability of default of the firms is similar for both groups (0.008 compared to 0.009). The share of overdue and delinquent loan payments is much lower for SRT loans compared to all bank loans (0.014 compared to 0.045 and 0.009 compared to 0.028). Finally, while 60 percent of loans to non-financial corporations carry a fixed rate, only 40 percent of SRT loans do.

Next, we investigate the differences between SRT loans and all loans along the dimensions of loan type (Figure 7), loan purpose (Figure 8), borrower size (Figure 9), and borrowers' economic sector (Figure 10). Figure 7 shows that banks' loan portfolios consist to equal parts of term loans, credit lines, and trade receivables, while revolving credits comprise a smaller part. In contrast, SRT loans consist almost entirely of term loans, credit lines, and revolving credit, all to similar amounts.[14] In line with an overrepresentation of revolving credit, 8 shows that roughly half the synthetically transferred loans serve as working capital, while working capital makes up only around 10 percent of banks' loan portfolios. Figure 9 reveals that loans to firms classified as *large* and *small* make up around 70 percent of banks' loan portfolios, the rest go is to *micro* and *medium* sized firms. In contrast, almost 70 percent of SRTs consist of loans to *large* firms, followed by loans *medium* sized firms.[15] Finally, Figure 10 shows an overrepresentation of loans to the manufacturing sector among SRT loans and an underrepresentation of the real estate sector.

2.3.4 SRT transaction

As comprehensive as it is, AnaCredit does not contain details on the transaction through which SRT loans are synthetically transferred. To shed light on the tranching and other transaction-specific characteristics, we use the ECB's COREP data set.

The median SRT has two tranches, a first loss tranche and a senior tranche.[16] The attachment point of the risk sold, that is, the point after which the non-bank investor takes on

[14]The overrepresentation of loans with flexible amounts drawn is also an indication of why these loans are not sold (individually or through traditional cash securitization): owners need a liquidity facility to provide the draw-downs.

[15]Size classifications are according to the Annex to Commission Recommendation 2003/361/EC, i.e. micro firms have fewer than 10 employees, small firms 10-49, medium-sized firms 50-249, and large 250 or more.

[16]This assumes a zero value whenever the value for the number of mezzanine tranches in COREP is missing. If we do not make that assumption, the median SRT has three tranches, i.e. a first loss, a mezzanine, and a senior tranche.

losses, is 0 percent for the median SRT and 3 percent for the SRT in the 90^{th} percentile. The attachment point of the senior tranche is equal to the detachment point of the risk sold at 15 percent for the median SRT. In other words, for the median SRT, the thickness of the first loss tranche is 15 percent and that of the senior tranche is 85 percent and entirely kept by the originating bank. However, there is considerable variation in the share of the risk sold. The SRT at the 10^{th} percentile sells off 7 percent of the credit risk while 30 percent of SRTs sell the risk of the entire loan portfolio.

98 percent of SRTs are placed in private transactions and only 2 percent are placed publicly. Finally, while typically missing, information on collateralization reveals that when SRTs qualify for capital relief, 60 percent of deals are cash-funded, 25 are funded with other zero-percent risk-weight collateral, and in 15 percent of SRTs the investor is of high enough solvency that it does not have to pledge collateral.

2.3.5 Non-bank SRT investors

Who invests in SRTs? Figure 14 shows the types of non-bank SRT investors and the corresponding SRT amounts. The largest investor types, whose SRTs are above 60 billion euros, are SPVs[17]. In that case, we cannot yet identify the ultimate investor, but we are working on identifying the ultimate *investor type* through the ECB's security holdings database. The largest ultimate investors, with SRT amounts of 60 billion euros, are European governments and the European Investment Fund (EIF). Among that group, the majority of the investment is made by the EIF, which became a large player during and after the Covid-19 pandemic. Insurance companies are also invested in SRTs that amount to almost 60 billion euros. These are followed by private investment funds, which invest in SRTs with amounts above 20 billion euros, while pension funds, financial firms classified as other financial corporations, captive financial companies, and financial auxiliaries all invest in SRTs that sum up to less than 20 billion euros. Investors in around one third of SRTs amounts are domiciled outside of the EU, and most of the non-EU investors are U.S.-based.

Figure 15 shows the SRT holdings by investor type over time. Before 2022, insurance companies and the European governments and EIF were the main investor types (we again

[17]Numbers in this section sum up all SRT amounts, not just the amounts synthetically transferred.

depict SPVs even though we have not yet identified their ultimate investor types). From 2022 and especially towards the end of our sample in 2024, more and more investor types enter the market, such as private investment funds, companies classified as "other finance corporations", pension funds, and captive finance companies. The increase in non-bank investor types is also reflected in the number of investors: Figure 16 shows that in 2024, 30 non-bank investors held SRTs (around 45 if we include governments / EIF and SPVs),[18] up from 20 (or 30 if we include governments / EIF and SPVs) at the end of 2018. The concentration of SRT holdings, as measured by the Herfindahl-Hirschman Index (HHI), remained stable or slightly decreased during our sample period and is mostly well below 0.4.

Table 3 shows descriptive statistics of these investors at the SRT investment level. The table is divided into statistics of all SRT investments and nongovernmental or EIF investments as well as at the investor group level and the unconsolidated investor level. Unconsolidated statistics are more meaningful if subsidiaries raise their own funds and if parent companies do not bail them out in case of default. In contrast, group-level statistics are more meaningful if we want to allow for the possibility of one subsidiary raising debt on behalf of another, or if parent companies bail out subsidiaries in case of default. Either way, our current numbers for total assets at the group level are unreliable as suggested by around one-fourth of bank debt-to-asset ratios being larger than one. All values greater than one are dropped and statistics including group-level asset values are reported in Table 3 only for completeness. Due to these irregularities, most regressions are at the unconsolidated investor level. We are working to get more reliable statistics at the investor-group level. Another caveat of the data is that some variables are sparsely populated. Table 3 includes a column with the number of observations for each variable. We are working on a more representative sample.

The non-bank investor (unconsolidated) of the median SRT has total assets of 2,500 million euros and 37 if we exclude governments and the EIF. It has a ratio of bank debt to assets of 0.07 (all SRTs) and 0 (excluding government and EIF investments) and the ratio of SRT investment (potential losses, not the entire SRT amount) to total assets is 0.02 (all SRTs) and 0.05 (excluding government and EIF investments). The median non-bank SRT investor

[18] This probably underestimates the true number of non-bank investors as oftentimes SPVs are held by more than one investor.

group has 7 (all SRTs) or one (excluding government and EIF investments) bank relationships at the time of the SRT investment and 10 (all SRTs) or 3 (excluding government and EIF investments) during our sample from September 2018 until July 2024. The share of SRTs whose investors receive credit from the bank they buy the SRT from during our sample is 0.50 (all SRT investments) or 0.22 (excluding government and EIF investments).

3 Results

The previous section characterized the SRT market and provided descriptive statistics from the loan-originating bank to the SRT investor. Here, we ask what banks use SRTs, what loans are synthetically transferred, and what the consequences of SRTs are. We answer these questions in the first subsection of our results. In the second subsection, we investigate the interconnectedness of banks and non-bank SRT investors and show suggestive evidence of the implications of a trade-off between the significance of risk transfer and investor return.

3.1 SRTs: Banks, loans, and their consequences

We start by showing that banks with lower capital ratios and riskier loan portfolios are more likely to use SRTs. For identification, we use a regulatory change implemented in April 2021 that increased the propensity of banks to do SRTs by facilitating capital relief for them. Exploiting distortions and discontinuities in the capital risk weights, we then show that, holding loan characteristics constant, these (relatively riskier) banks are more likely to synthetically transfer capital-expensive loans. This leaves them less capitalized, relative to the riskiness of their non-SRT loan portfolio. We proceed by showing that banks with an ex-ante higher propensity to use SRTs increase their lending and dividend payments after the April 2021 regulatory change that increased their ex-post propensity to use SRTs. Finally, we show evidence consistent with lower monitoring of firms whose loans were synthetically transferred.

3.1.1 What banks use SRTs?

First, we reinforce our descriptive analysis by showing that SRT banks are lower capitalized and have riskier loan portfolios than non-SRT banks. We first show this in the cross-section, and then take advantage of the April 2021 regulatory change in a difference-in-differences setting. The cross-sectional regression is

$$SRT_{b,t} = \beta_1 Bank\ characteristics_{b,t-1} + \beta_2 X_{b,t-1} + \epsilon_{b,t}. \quad (1)$$

$Bank\ characteristics_{b,t-1}$ takes on values of banks' Tier 1 capital ratio and the riskiness of banks' loan portfolios in the previous period. In the former case, we aggregate data at the yearly level, since this is the frequency at which Bankfocus provides Tier 1 capital ratios, and in the latter case, we aggregate data at the quarterly level. $SRT_{b,t}$ takes on the value of a dummy that identifies if a bank issues SRTs of at least 50 million euros in a given year or 12.5 million euros in a given quarter, and the natural logarithm of the SRT amount.

We use linear probability and logistic regressions in specifications with the SRT-dummy, and linear and exponential-mean regressions in the SRT-amount specifications. SRT-amounts contain many zeros and are therefore more closely mapped by an exponential distribution compared to a linear regression. We use country $\times$ year or country $\times$ quarter fixed effects, and wild-bootstrap standard errors at the country level.[19] In addition to our sample selection based on bank size, we tightly control for it by creating 10 bank-size bins based on banks' balance sheets and interacting them with the natural logarithm of banks' balance sheets. Additionally, we always control for banks' liquidity using the ratio of liquid assets to deposits.

Table 4 shows the results. In columns (1) – (4), the explanatory variable is banks' Tier 1 capital ratio, and in columns (5) – (8) the explanatory variable is banks' portfolio riskiness. It is easiest to interpret our results in columns (1) and (5), where we use linear probability regressions and the SRT dummy as the dependent variable. Column (1) shows that having

[19] An exception is column (6) of Table 4 where we use country and quarter fixed effects. Our logistic regression algorithm does not converge otherwise.

an 8.8 percentage point lower Tier 1 capital ratio (corresponding to one standard deviation) is associated with a 35 percent higher likelihood of doing an SRT in a given year. Similarly, an increase in banks' portfolio riskiness of 2.2 percent (corresponding to one standard deviation) is associated with a doubling in their likelihood of doing an SRT in a given quarter. These estimates are confirmed in the different specifications of Table 4.

To tighten these results, we take advantage of a regulatory change that facilitated capital relief for SRTs. Effective on 9 April, 2021, the existing EU framework for simple, transparent, and standardized (STS) (cash) securitizations was extended to SRTs. Following the regulatory change, banks that structure their SRTs according to the STS framework could benefit from lower risk weights on the senior tranche they typically retain.[20] Figure 17 shows that the share of SRTs that received capital relief under the STS label in a quarter rose sharply after the April 2021 regulatory change. Similarly, Figure 18 shows that the amounts of new SRTs were relatively stable at around 50 billion euros per quarter in the year leading up to the regulatory change and started to increase significantly thereafter to above 80 billion euros in Q2 of 2024.

We run a difference-in-difference (DiD) estimation with the SRT-dummy and the natural logarithm of SRT-amounts as the dependent variables, bank characteristics as the continuous treatment variables, and post-April 2021 as the "post"-period:

$$SRT_{b,t} = \beta_1 Post\ April\ 2021_t * Bank\ characteristics_{b,t-1} + \beta_2 X_{b,t-1} + \epsilon_{b,t}. \quad (2)$$

$Bank\ characteristics_{b,t-1}$ are again banks' Tier 1 capital ratios and the riskiness of their firm loan portfolio. In the former case, data are yearly and $Post\ April\ 2021_t$ in specification (2) constitutes the years 2022, 2023, and 2024. In the latter case, data are quarterly and the quarters from Q2 2021 onward constitute the $Post\ April\ 2021_t$ period.

Table 5 shows the results for the banks Tier 1 capital ratios as the continuous treatment

[20]The STS framework requires the following SRT structure. "Simplicity": underlying assets meet eligibility criteria such as being part of the core business; homogeneity of underlying asset types; no re-securitization; among others. "Transparency": disclosure of performance to investors; documentation requirements, etc. "Standardization": refers to the tranching structure, risk retention, the hedging of interest rate and currency risk, among others.

variable. As in the cross-sectional regressions, we control for bank size by interacting 10 bank-size dummies with the logarithm of banks' balance sheets. When we use bank fixed effects, we cluster at the bank level, and when we use country fixed effects, we wild-bootstrap standard errors at the country level. Columns (1) - (3) use an SRT dummy as the dependent variable, and columns (4) - (6) use the natural logarithm of the SRT amount.

In column (1), we estimate a linear probability model and use bank and year fixed effects to show that low capital ratios are especially negatively associated with SRT issuance after the 2021 regulatory change. In columns (2) and (3), we use logistic regressions for a better model fit. However, in non-linear regressions, in contrast to linear ones, the regression coefficients of interacted variables do not have the desirable interpretation of a cross-partial derivative. Therefore, we split the sample into the period up to 2021 (column (2)) and the period after 2021 (column (3)).[21] As in the linear difference-in-difference regression of column (1), our results show that post-2021, low Tier 1 capital ratios are more negatively associated with SRT issuance compared to the period up to 2021.

In column (4), we again use a linear regression and bank fixed effects to show that low Tier 1 capital ratios are more negatively associated with SRT-amounts after the 2021 regulatory change. Columns (5) and (6) confirm this result using better-fitting exponential-mean models and a sample split similar to columns (2) and (3). Taken together, Table 5 suggests that SRT banks are much lower capitalized than non-SRT banks, and especially after capital relief for SRTs was facilitated in April 2021.

Next, we run regression (2) with portfolio riskiness as the continuous treatment variable and Q2 2021 onward as the post-period. Table 6 shows the results. The table is set up analogous to Table 5, that is, columns (1) – (3) use an SRT dummy as the dependent variable, and columns (4) – (6) use the natural logarithm of the SRT amount. In columns (1) and (4), we use bank fixed effects in linear regressions. Columns (2), (3), (5), and (6) feature sample splits, and logistic (columns (2) and (3)) and exponential mean regressions (columns (5) and (6)).

Our most stringently controlled regressions with bank fixed effects in columns (1) and (4)

[21] Due to the small time series in these two subsamples, we only use country and year fixed effects instead of bank and year fixed effects.

show a positive, albeit insignificant, coefficient on the interaction terms between bank portfolio risk and the post-Q2 2021 dummy variable. Besides the possibility of a null-effect, the insignificance of the interaction terms might come from model misspecification (using a linear probability model) or insufficient time-variation of portfolio risk within banks. Indeed, the non-linear regressions with country $\times$ quarter fixed effects of columns (2), (3), (5), and (6) show that coefficients on portfolio riskiness were 22.96 and 17.26 before the regulatory change and much larger at 52.56 and 34.90 thereafter. Taken together, our results suggest that risky banks are potentially more likely to engage in SRTs after capital relief for SRTs was facilitated.

3.1.2 What loans are synthetically transferred?

What loans do these (relatively riskier) SRT banks synthetically transfer and what are the implications for their capitalization? According to Basel regulation, each bank loan is assigned a risk weight which is used to calculate the bank's regulatory capital ratio. To assign these risk weights, banks in our sample typically use the Internal Ratings Based Approach (IRBA), which, in principle, makes risk weights an accurate function of a loan's risk[22]. However, the functional form of the IRBA risk weights, nevertheless, introduces discontinuities and distortions. That is, two loans with the same loan characteristics and underlying risk might receive different risk weights. In that case, we hypothesize that the SRT bank will synthetically transfer the capital-expensive loan. It would thereby trade away inefficiencies and inaccuracies in capital regulation. However, the implication would be that its (remaining non-SRT) loan portfolio is less capitalized relative to the underlying loan risk after the SRT compared to before.

To test this, we exploit the following distortions and discontinuities in capital regulation. For corporate exposures where the firm has annual revenues above 50 million euros, the loan's risk weight is a function of the firm's probability of default (PD), the loan's maturity (M) and its loss given default (LGD). For exposures to SMEs whose annual revenue is less than 50 million euros, the risk weight formula is additionally an increasing function of the

[22] 96.5 percent of synthetically transferred loans in our sample are granted by banks that use the Internal Ratings Based Approach (IRBA)

firm's revenue and the bank's total exposure to the firm. This is due to the SME support factor, whose purpose is to incentivize lending to small firms. Since June, 2020, the function of the risk weights has the following arguments, where the arrows indicate the directional influence

$$\begin{aligned} RW =& \mathcal{F}(PD \uparrow, M \uparrow, LGD \uparrow, \frac{\min\{\max\{5, S\}, 50\} - 5}{45} \uparrow) \\ & \times \frac{\min\{E; €2,500,000\} \cdot 0.7619 + \max\{E - €2,500,000; 0\} \cdot 0.85}{E}. \end{aligned} \tag{3}$$

S stands for the firm's annual revenue and E stands for the bank's total exposure to the firm. Before June, 2020, the threshold for bank-firm exposures below which the SME support factor applied was 1.5 million euros and the functional form of the risk weights was slightly different.

In Figure 11, we plot the risk weights on the y-axis as a function of banks' firm-exposure on the x-axis, for a hypothetical firm with annual revenues of 10, 20, 30, 40, and 50 million euros. In this example, we choose a PD of one percent, a maturity of 5 years, and a LGD of 20 percent. The Figure shows that the risk weights increase linearly in the firm's annual revenue for values between 5 and 49 million euros, and discontinuously so between 49 and 50 million euros. For firms with annual revenues below 50 million euros, risk weights are constant in banks' firm exposures up to 2.5 million euros (after June 2020) and increase at a diminishing rate thereafter. Therefore, the discontinuity in the risk weights as firms' annual revenue increases from 49 to 50 million euros is more pronounced for smaller values of bank-firm exposure.

We start by showing that, conditional on a host of control variables and fixed effects and for loans to firms with revenues below 50 million euros, the likelihood of synthetically transferring a loan increases in the firm's revenue and the bank's exposure to the firm. We estimate the linear probability model

$$\textit{SRT-loan}_{i,t} = \beta_1 \textit{Revenue}_{i,t} + \beta_2 \textit{Log bank firm exposure}_{i,t} + \delta X_{i,t} + \epsilon_{i,t}. \tag{4}$$

SRT-loan equals 100 if a loan is synthetically transferred in a given year and 0 otherwise.

Revenue features as is and the bank's firm exposure is log-linearized to capture the functional form of the risk weights formula (3). We estimate regression (4) on two sub-samples, one with loans to firms with annual revenues below 50 million euros and another one with loans to firms with annual revenues between 50 and 100 million euros. Because the SME support factor is only applied to firms with annual revenues below 50 million euros, we expect a positive relationship between the likelihood to synthetically transfer a loan and the firm's annual revenue and the bank's exposure for the first sub-sample, but not for the second. In regression (4), we control for the firms' probability of default, the loan rate, and loan size bins interacted with the natural logarithm of the loan size. In addition, we feature bank $\times$ year $\times$ loan type $\times$ interest rate type $\times$ loan purpose $\times$ borrower industry $\times$ residual maturity fixed effects.

Table 7 shows the results. Columns (1) and (2) feature the sub-sample of firms with annual revenues below 50 million euros, and columns (3) and (4) feature the 50-100 million euro sub-sample. While in the remainder of this section, we bootstrap standard errors at the bank-level, we cannot do this here for computational reasons (our first subsample has 31 million observations). Instead, in columns (1) and (3), we do not cluster standard errors and in columns (2) and (4), we simply cluster but do not bootstrap at the bank level. Our results confirm that the likelihood of transferring loans is positively associated with the firm's annual revenue and the bank's firm exposures for firms with annual revenues below 50 million euros. For firms with annual revenues between 50 and 100 million euros, there is no such relationship. We interpret this as consistent with the notion that banks transfer capital-expensive loans.

Next, we tighten the statistical identification by exploiting the discontinuity in the risk weights as firms' annual revenue increases above 50 million euros[23]. We estimate

$$\textit{SRT-loan}_{i,t} = \beta \textit{Borrower revenue bins}_{i,t} + \delta X_{i,t} + \epsilon_{i,t}, \tag{5}$$

where *Borrower revenue bins* are dummy variables that are one if a firm's annual rev-

[23]Featuring our tight fixed effects in a regression discontinuity design (RDD) has proven difficult. We are working on adding an RDD specification.

enue (in million euros) is within the following intervals, and zero otherwise: [25,30), [30,35), [35,40), [40,45), [45,50), [50,55), [55,60), [60,65), [65,70). The β of the [25,30) interval constitutes the base-coefficient against which the coefficients of the other intervals are compared. We feature the same fixed effects and controls as in regression (4), but here we are able to bootstrap standard errors at the bank level. We run regression (5) separately for loans where the bank has a firm exposure below 7.5 million euros and those where the bank has a firm exposure above 7.5 million euros. As evident from the example of Figure 11, the discontinuity in the risk weights is larger below 7.5 million euros than above.[24] We therefore expect an increase in β around the 50 million euro threshold for loans to firms with annual revenues below 7.5 million euros but not those above.

Figures 12 and 13 plot the β coefficients of regression (5) and their 95 percent confidence interval. In Figure 13, banks have firm exposures below, and in Figure 12 above, 7.5 million euros. Figure 13 shows that the discontinuous increase in capital costs, as firms' annual revenues increase to 50 million euros, translates into a sharp increase in the likelihood of synthetically transferring a loan. The likelihood of transferring a loan is 30 percent higher for loans that are granted to firms with annual revenues between 50 and 55 million euros, compared to those to firms with annual revenues between 40 and 45 million euros. In contrast, Figure 13 shows that when banks have firm exposures of more than 7.5 million euros, the likelihood of transferring a loan does not increase as the annual revenue increases above 50 million euros. This is consistent with the absence of a jump in capital costs.

We reinforce this finding in the following specification:

$$\textit{SRT-loan}_{i,t} = \beta_1 \mathbb{1}(\textit{revenue} \geq €50\ \textit{million})_{i,t} \times \textit{Log bank firm exposure}_{i,t} + \delta X_{i,t} + \epsilon_{i,t}. \qquad (6)$$

That is, *SRT-loan* (100 or 0) is regressed on a dummy variable that is 1 if a firm has an annual revenue above 50 million euros and 0 otherwise. We expect the coefficient of this dummy variable to be positive in accordance with a discontinuous jump in the capital costs around the threshold. However, the size of the jump decreases in the bank's exposure to

[24]The precise number of 7.5 million is chosen arbitrarily, but fundamentally in line the size of the discontinuity in Figure 11.

the firm. We capture this by interacting the dummy variable with the natural logarithm of the bank's firm exposure. We use two different samples, one includes firms with annual revenues between 45 and 55 million euros (5 million euros around the threshold), and the other one includes firms with revenues between 40 and 60 million euros (10 million euros around the threshold). We run placebo tests with thresholds of 40 and 60 million euros and revenue bins of 35 – 45, 30 – 50, 55 – 65, and 50 – 70.

Table 8 shows the results. In columns (1) – (4), we use 5 million euro revenue bins, and in columns (5) – (8), we use 10 million euro revenue bins on each side of the threshold. Columns (1), (2), (5), and (6) use the 50 million euro revenue threshold, while columns (3) and (7) use the 40 million euro threshold, and columns (4) and (8) use the 60 million euro threshold as a placebo. Columns (1) and (5) show the coefficient of the uninteracted dummy variable while all other specifications additionally show the coefficients of the interaction with the logarithm of the bank's firm exposure. In all specifications, we control for the same variables and fixed effects as in regression (4). Standard errors are wild bootstrapped at the bank level.

Columns (1) and (5) show that on average banks are 10 percent more likely to transfer loans to firms with revenues that are just above 50 million euros compared to firms with revenues just below 50 million euros. Columns (2) and (6) show that the effect is stronger for loans where the bank's exposure is small compared to large exposures. For a hypothetical firm exposure of one million euros, banks are on average 60 percent more likely to transfer loans to firms that have revenues of at least 50 million euros. Our placebo tests in columns (3), (4), (7), and (8) show that the likelihood of synthetically transferring a loan does not discontinuously increase around revenues of 40 or 60 billion euros, independently of the bank's firm exposure.

In summary, we consistently show that banks tend to synthetically transfer capital-expensive loans. This leaves banks relatively less capitalized. By smoothing out the distortions and edges of capital regulation, capital is allocated more efficiently. However, this also implies that banks can no longer cross-substitute capital from loans that are (too) expensive to loans that are (too) cheap in terms of capital. Future analysis will reveal the quantitative effect of SRTs on banks' total capitalization.

Our results predict that the larger the explicit or implicit distortions in capital risk weights, the more likely banks will choose strategically capital-expensive loans for SRTs, and the larger the negative effect on post-SRT bank capitalization. An explicit distortion currently introduced as part of "Basel IV" or "Basel III endgame" is the "output floor", which is a limit on how much lower IRBA banks can set the risk weights compared to banks that use the standardized approach (SA)[25]. An unintended consequence might be that banks partially undo this lower bound by synthetically transferring loans whose risk weights are increased by this regulation. Beyond such explicit distortions of capital risk weights, there might be implicit ones that incline banks to set different risk weights for similar loans.

3.1.3 Bank and loan level consequences of SRTs

The previous subsections showed that SRT banks are lower capitalized and maintain riskier loan portfolios than non-SRT banks. When using SRTs, banks tend to synthetically transfer capital-expensive loans, which leaves them relatively less capitalized. In this subsection, we show that banks with an ex-ante higher propensity to issue SRTs increase dividend payments and lending to safer firms after the April 2021 regulatory change. In addition, we use a novel measure of moral hazard – the frequency with which banks change their probability of default estimates – and find evidence of decreased monitoring.

To show the effects of SRTs on lending, risk taking, and dividend payments, we run the following DiD estimation at the year-level:

$$\textit{Bank outcomes}_{b,t} = \beta_1 \textit{Propensity to do SRT}_{b,t-1} * \textit{Post April 2021}_t + \beta_2 X_{b,t-1} + \epsilon_{b,t}. \quad (7)$$

$\textit{Post April 2021}_t$ again specifies the post-2021 period while the $\textit{Propensity to do SRT}_{b,t-1}$ identifies the treatment group. We use two ways to calculate the propensity to do SRT. First, we estimate it using propensity score matching based on 2020-values (that is, before the April 2021 regulatory change) of bank size, capital ratios, and countries for around 300

[25] In the euro area, the output floor is progressively increased, such that the capital risk weights under the IRBA cannot be lower than 50 percent of the risk weights under the SA in 2025 and 72.5 percent at finalization in 2032.

banks. Together, these variables explain 56 percent of issuing an SRT during our sample. Second, we use an indicator variable that identifies banks that issued an SRT before April 2021. We assume that having issued SRTs before the regulatory change decreases the hurdles of issuing them afterward.

Table 9 shows the results. We have three dependent variables, the amount of new lending, the riskiness of new loans, and banks' dividend ratios. The table shows three columns per dependent variable, where the first two columns use the measured propensity to do SRTs, and the third column uses the dummy variable that indicates SRT issues before April 2021. All regressions are linear, and the first of the three columns uses country $\times$ year fixed effects while the second and third use bank and year fixed effects. In all specifications, we tightly control for bank size by interacting 10 bank size bins with the natural logarithm of banks' balance sheets.

In columns (1) - (3), the dependent variable is the natural logarithm of new loan amounts granted in a year. We control for the natural logarithm of maturing loans and that of new loans granted in a respective country as a measure of loan demand. All columns consistently show that an increased propensity to do SRTs is associated with higher lending after the 2021 regulatory change. We interpret this as banks using some of the freed-up capital to expand their balance sheets.

Columns (4) - (6) show the results for the riskiness of new lending as the dependent variable. The riskiness of new lending is measured as the average PD of firms to which the bank lends in a given year, weighted by the loan amounts. We control for the riskiness of banks' loan portfolios and the riskiness of their maturing loans, using the same PD measures. All columns consistently show that a higher propensity to do SRTs is associated with safer lending. These results reinforce the finding that banks with riskier loan portfolios tend to do SRTs and suggest that these banks use SRTs to shift their portfolio to safer assets.

Finally, columns (7) - (9) use the dividend ratio from BvD's Bankfocus as the dependent variable. Columns (7) and (8) show that a higher propensity to do SRTs is associated with higher dividend payments after the SRT regulatory change, while the coefficient in column (9) is positive but insignificant. In sum, our results suggest that banks use the SRT-induced capital relief for further lending and a shift towards safer firms, but also for higher dividend

payments.

Does the risk transfer to the non-bank financial sector affect banks' monitoring behavior? This would be more important for SRTs, whose underlying loans are often non-standardized, than for traditional securitization for which banks often use assets that are standardized and whose performance is arguably less sensitive to monitoring. We test banks' monitoring intensity of firms whose loans are synthetically transferred with the following regression:

$$Monitoring_{f,b,t} = SRT\ loan_{f,b,t-1} * Post\ SRT_{f,b,t-1} + \gamma_f + \delta_b + \omega_t + \epsilon_{f,b,t}. \quad (8)$$

$Monitoring_{f,b,t}$, the dependent variable in regression (8), is estimated as the fluctuations in banks' estimates of firms' probability of default in a given quarter. Our original data are monthly, so banks can adjust their estimates at most twice. We assume that high levels of monitoring, for example, frequent visits to firms' factories, allow banks' probability of default estimates to precisely capture actual fluctuations in firm risk. In contrast, banks that stop monitoring would decrease the frequency with which they adjust their probability of default estimates regardless of actual fluctuations in firm risk. We use two measures that capture the fluctuations of PD estimates, the first one is the standard deviation of PD estimates in a quarter, and the second one indicates if the standard deviation is greater than zero. $SRT\ loan_{f,b,t-1}$ is a dummy variable that is 1 if a loan gets synthetically transferred during its lifetime and 0 otherwise, while $Post\ SRT_{i,b,t-1}$ is 1 after the transfer and 0 before.[26]

Columns (1) and (2) of Table 10 show the results for the standard deviation of PD estimates and columns (3) and (4) show the results for the dummy variable that indicates above-zero standard deviation. Columns (1) and (3) use firm, bank, and quarter fixed effects (f, b, and t in regression (8)), and columns (2) and (4) use borrower $\times$ quarter and bank fixed effects. Standard errors are clustered at the bank level. Our fixed effects are of the Kwaja & Mian-type and allow for an evaluation of monitoring against other banks of the same firm and the other firms of the same bank. Column (2), which features the most stringent fixed effects, shows that upon synthetically transferring the loan, the standard deviation of PD es-

[26]Note that the probability of default estimates in AnaCredit concern the firm and not the loan. Our current approach does not account for additional firm exposure of the SRT bank through non-SRT loans.

timates decreases by one-third. Qualitatively, our results are the same in column (4) for the dummy variable that indicates above-zero standard deviation of PD estimates, although of lower economic magnitude. We interpret these results as indicative of a significant decrease in firm monitoring by the bank after including a loan in an SRT issue.

3.2 Risk transfer

The previous section shows that lower-capitalized banks with riskier loan portfolios engage in SRTs. How are these banks, and the banking sector as a whole, interconnected with the non-bank investors that take on the credit risk? Although the descriptive statistics above show that the ratio of bank loans to assets of non-bank investors in European SRTs is relatively low, subsection 3.2.1 of this section shows that interconnectedness and leverage still matter. Banks are more likely to sell an SRT to a non-bank investor they also grant credit to compared to a non-bank investor with which they have no credit relationship. We also show evidence that the outstanding amounts of bank loan liabilities of SRT investors increase around the SRT investment. This is consistent with banks partially financing non-banks' investments in their own or other banks' credit risk.

In 3.2.2, the second subsection, we show that thicker first-loss SRT tranches, as they are common in U.S. SRTs, are associated with investments by non-banks with higher bank debt-to-asset ratios and have higher expected losses. All else equal, thicker first-loss tranches imply a greater transfer of credit risk, but also a lower return for the non-bank SRT investor. Investors in thicker first-loss tranches might therefore increase their return by greater investor leverage and higher expected losses[27]. Our results are purely correlational, and some specifications suffer from a low number of observations. They nevertheless illustrate a trade-off between SRT safety (thicker tranches) and investor return (as affected by their leverage and the SRT's expected losses).

[27] Importantly, the relationship between first-loss thickness and expected loss is partially by regulatory design, see below.

3.2.1 Bank-non-bank nexus

AnaCredit records not only data on SRT loans, their associated transaction, and non-bank SRT investors, but also loans to non-bank financial institutions, including the non-bank SRT investors. This allows us to give a detailed picture of banks' and non-banks' interconnectedness through the loan market. We are working on including debt sources of non-banks that are not captured in AnaCredit, such as commercial paper.

We start by showing a natural connection between the SRT issuing bank and the non-bank SRT investor. Banks are more likely to sell credit risk to potential investors with which they have a substantial credit relationship during our sample compared to potential investors with which they are unconnected. To show this, we estimate the following:

$$\textit{SRT investment dummy}_{b,t,j} = \beta_0 + \beta_1 \textit{Credit relationship dummy}_{b,t,j} + \delta_b + \omega_t + \eta_j + \epsilon_{b,t,j}. \quad (9)$$

$\textit{SRT investment dummy}_{b,t,j}$ equals 1 if a non-bank (with subscript j) invests in the given SRT and 0 otherwise, while $\textit{Credit relationship dummy}_{b,t,j}$ equals 1 if the non-bank SRT investor receives credit of at least 1 million euros from the SRT bank during our sample. We consider as potential investors all non-banks that actually invest in an SRT in a given country and during the respective year.

Table 11 features linear probability regressions with different fixed effects. In columns (1) and (4), we use year fixed effects, while the other columns use bank, investor, and year fixed effects. In the latter case, standard errors are clustered at the bank level. Columns (1), (2), (4), and (5) consider credit relationships at the unconsolidated investor level while columns (3) and (6) consider the entire investor group. Columns (4) – (6) restrict the sample to exclude governmental and EIF investments. All columns show that having a credit relationship is positively associated with selling the SRT to that investor. Our results suggest a natural interconnectedness between these financial entities.

Next, we test the dynamics of bank loan liabilities of non-bank SRT investors. Do they increase in the months before the SRT investment? This would suggest that SRTs are partially debt-financed and provide evidence in line with the "round-tripping" presumption. We test

this by running the following regression:

$$\textit{Log debt amount outstanding}_{s,\tau,t} = \beta_0 + \beta_1 \textit{Months to SRT investment}_{s,\tau,t} + \theta_s + \omega_t + \epsilon_{s,\tau,t} \tag{10}$$

Log debt amount outstanding$_{s,j,\tau}$ is the natural logarithm of the sum of loan amounts the investor owes to banks in a given month. *Months to SRT investment*$_{s,j,\tau}$ captures time to SRT investment fixed effects (with subscript τ since it is different from the calendar time t). The unit of observation is the investment s, that is, if an investor invests twice during our sample, it also appears twice in this regression. We control for SRT investment fixed effects (θ_s) and calendar time fixed effects (ω_t). Standard errors are clustered at the SRT investment level.

If there is a relationship between bank loans and the SRT investment, we expect it to exist in funded deals, that is, when the investor has to cash-collateralize the SRT investment upfront. Since AnaCredit does not provide information on collateralization and our AnaCredit – COREP merge is of poor quality, we assume that investments of governmental bodies are unfunded (not collateralized) while investments by private firms are more likely funded. In addition, we expect debt to matter most for large unfunded investments. To capture these differences, we run regression (10) separately for all SRT investments, for SRT investments of nongovernmental investors (likely funded), and for SRT investments of nongovernmental investors whose transferred tranche is at least 50 million euros (funded and large investments).

Figure 19 plots the β_1 fixed effects and the corresponding 95 percent confidence intervals for all investments in blue, funded investments in red, and funded and large investments in green. 6 months before the SRT investment serves as the baseline[28]. We find that for all investments, there is a small increase in the loan liabilities of investors in the 6 months before the SRT investment. In line with the presumption that the connection should be stronger for funded transactions, the increase is a lot more pronounced and strongly statistically significant for funded investments. Although the increase becomes insignificant after the SRT

[28]We have no information on how many months before the synthetic transfer of loans, the cash collateral has to be provided.

investment, debt levels remain elevated relative to before the investment. The strongest uptake of debt is observed for funded and large investments above 50 million euros. We interpret these results as consistent with some of the financing for SRTs coming from banks.

3.2.2 Significance of risk transfer and investor return

There exists a trade-off between the significance of the credit risk transfer and investor returns. The significance of the credit risk transfer increases in the thickness of the first-loss tranche that is sold to a non-bank SRT investor. However, all else equal, the return of the investor decreases in the thickness of the first-loss tranche. This decrease can be undone by higher leverage of the investor or higher expected SRT losses. Indeed, we show that both are positively correlated with the thickness of the tranche sold off by the banks. This has implications for the growing U.S. SRT market, where banks need to sell a thicker tranche (typically 12.5 percent) than their European counterparts (typically 8.5 percent) to achieve similar capital relief. This is due to the Collins Amendment to the Dodd-Frank Act, which is effectively a lower bound to the risk weights on assets.

To test the implications of different sizes of the sold-off tranches, we run the following estimation:

$$Y_{s,b,j} = \beta_0 + \beta_1 * \textit{Thickness tranche sold}_{s,b,j} + \epsilon_{s,b,j}. \tag{11}$$

$Y_{s,b,j}$ takes two values, the non-bank investors' loan liabilities over assets, as our current proxy for leverage, and the expected losses of the SRT. The latter is from the ECB's COREP data set. We have two variables for the $\textit{Thickness tranche sold}_{s,b,j}$, the first one is calculated from AnaCredit as the ratio of the risk amount transferred to the total SRT-amount, and the second one is given in COREP. Due to the poor match between AnaCredit and COREP, we use both data sets separately.

Table 12 reports the results for non-bank SRT investors' loan liabilities over assets as the dependent variable.[29] For these specifications, data are entirely from AnaCredit. Column

[29] We only consider loans that are not made for construction and real estate purposes.

(1) uses no controls and no fixed effects, column (2) features investor type and country fixed effects, and column (3) additionally controls for the SRT size and the average probability of default of the underlying loans. Columns (4) and (5) are similar to column (3) but exclude government and EIF investments (column (4)) and to investors with positive amounts of debt from European banks (column (5)). Investor-type fixed effects are used to account for differences in risk-taking and expected yields.

Our preferred specification in column (3) shows that a 28 percentage point thicker sold-off tranche (1 SD) is associated with investors having 3 percentage points higher values of loan liabilities over assets (or 30 percent of their standard deviation). Column (4) without government and EIF investments shows a much greater magnitude but loses significance due to a lower number of observations. At face value and assuming a similar expected yield of non-bank SRT investors, these results predict higher leverage values in the U.S. SRT market compared to the European one.

For American non-bank investors to achieve similar yields as their European counterparts, banks could also sell the credit risk of riskier loans. Indeed, we show that thicker tranches tend to include riskier loans. However, in Europe, this is at least partially by design: to obtain capital relief, banks need to prove the *significance* of the risk transfer, which makes the thickness of the sold tranche a function of the underlying loan risk. Nevertheless, the strong correlation between tranche thickness and underlying risks reveals a conflict between the significance of the risk transferred and the investors' search for yield as reflected in the riskiness of the underlying assets.

Table 13 displays the results of regression (11) with the expected loss as the dependent variable. In COREP, banks report the expected loss and the detachment point of the risk sold reflects the thickness of the tranche. In column (1), we use no controls, while in column (2), we control for the natural logarithm of the SRT amount and bank and year fixed effects (not that COREP does not have investor data). In column (3), we limit our data to SRTs with a tranche thickness of at least 8.5 percent. All columns show a positive relationship between the thickness of the sold tranche and the expected losses. Again and importantly, some of the connection between tranche thickness and SRT riskiness is by regulatory design. Future analysis will reveal to what extent it is also reflective of investors' search for yield.

4 Conclusion

This paper is the first to investigate the rapidly growing synthetic risk transfer market, where banks sell the first losses on a loan portfolio while retaining the loans on their balance sheets. We use detailed loan-level data and identify SRT-issues and non-bank SRT investors. In addition, we know banks' loan exposure to these non-bank SRT investors.

Our analysis takes advantage of a regulatory change that increased the propensity of banks to use SRTs, and distortions and a discontinuity in the capital risk weights. With that, we show that less capitalized banks with riskier loan portfolios use SRTs. When using SRTs, banks tend to transfer capital-expensive loans, which leaves them less capitalized relative to the riskiness of their loan portfolio. SRTs are associated with increased lending to safer firms, higher dividend payments, and lower monitoring.

In addition, we find that while investors are not greatly leveraged, they are nevertheless connected to banks through the loan market. Banks are more likely to sell the SRT to non-bank investors with whom they have a credit relationship. Investors' debt levels go up before the SRT investment, consistent with some SRT funding coming from the banking sector. Finally, thicker tranches are sold to investors with higher levels of bank debt to assets and they have higher expected losses. This has implications for the US SRT market, where first-loss tranches are typically thicker than in Europe.

Ongoing work explores whether SRTs are a productive tool for banks to expand lending and restructure their balance sheet or if the risks outweigh.

References

Acharya, Viral, Nicola Cetorelli, and Bruce Tuckman (2024). "Where Do Banks End and NBFIs Begin?" In: *National Bureau of Economic Research* 32316.

Acharya, Viral, Philipp Schnabl, and Gustavo Suarez (2013). "Securitization without risk transfer". In: *Journal of Financial Economics* 107.3, pp. 515–536.

Bolton, Patrick and Martin Oehmke (2011). "Credit default swaps and the empty creditor problem". In: *The Review of Financial Studies* 24.8, pp. 2617–2655.

Carbo-Valverde, Santiago, Hans Degryse, and Francisco Rodríguez-Fernández (2015). "The impact of securitization on credit rationing: Empirical evidence". In: *Journal of Financial Stability* 20, pp. 36–50.

Degryse, Hans, Yalin Gündüz, Kuchulain O'Flynn, and Steven Ongena (2021). "Identifying empty creditors with a shock and micro-data". In: *CEPR Discussion Paper No. DP16773*.

Fuster, Andreas and James Vickery (2015). "Securitization and the fixed-rate mortgage". In: *The Review of Financial Studies* 28.1, pp. 176–211.

González, Fernando and Cristina Morar Triandafil (2023). "The European significant risk transfer securitisation market". In: *ESRB: Occasional Paper Series* 23.

Jacewitz, Stefan, Haluk Unal, and Chengjun Wu (2022). "Shadow insurance? Money market fund investors and bank sponsorship". In: *The Review of Corporate Finance Studies* 11.2, pp. 414–456.

Keys, Benjamin J, Tanmoy Mukherjee, Amit Seru, and Vikrant Vig (2010). "Did securitization lead to lax screening? Evidence from subprime loans". In: *The Quarterly Journal of Economics* 125.1, pp. 307–362.

Parlour, Christine A and Guillaume Plantin (2008). "Loan sales and relationship banking". In: *The Journal of Finance* 63.3, pp. 1291–1314.

Sufi, Amir (2007). "Information asymmetry and financing arrangements: Evidence from syndicated loans". In: *The Journal of Finance* 62.2, pp. 629–668.

5 Figures

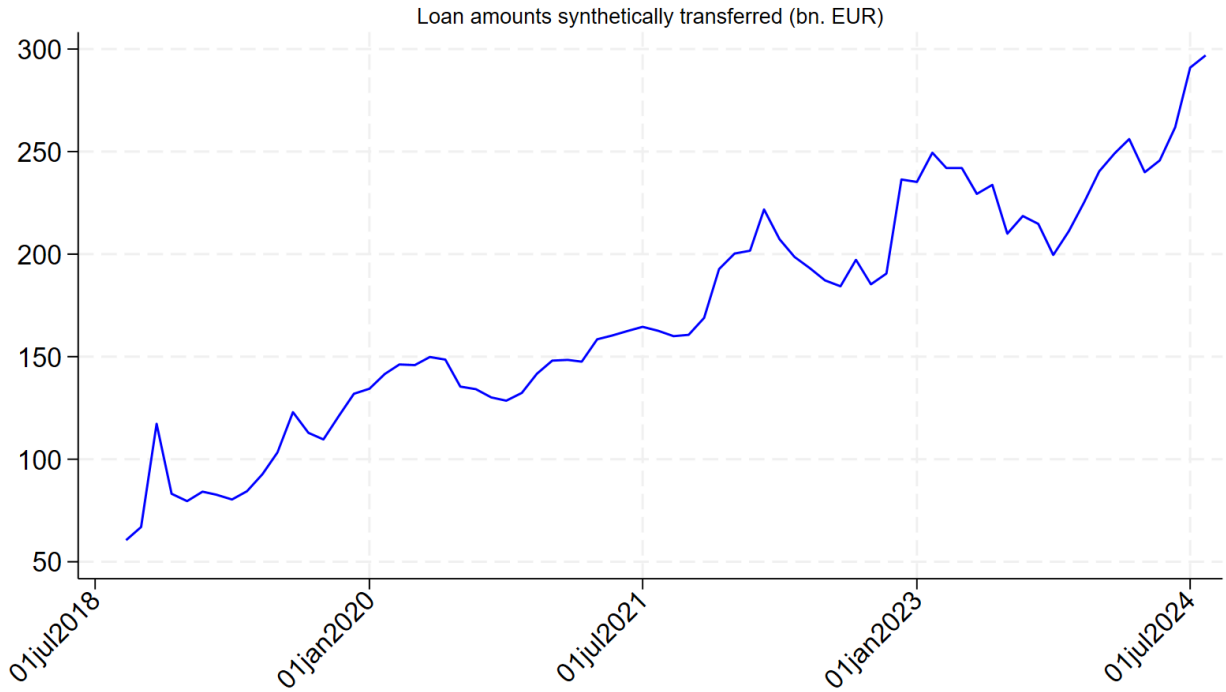


Figure 1: This figure shows the stock of SRT amounts in billion euros over time, that is, the sum of synthetically transferred loan amounts. The primary data are at the loan level and from the ECB's credit registry AnaCredit.

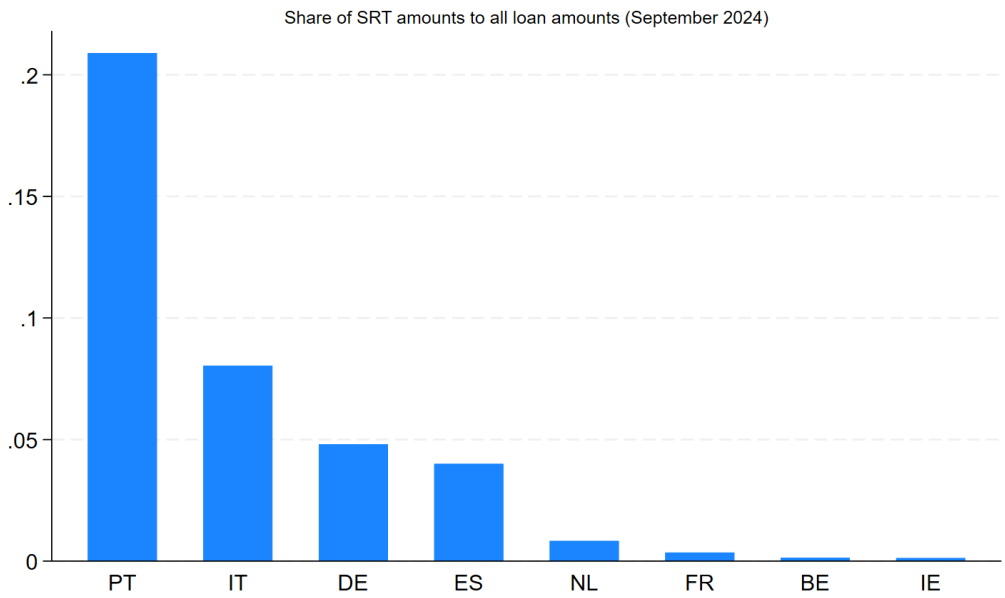


Figure 2: This figure shows the share of SRT amounts to total loans to non-financial corporations by country in June 2024. The data include all loans above 25,000 euros, including loans that are traditionally securitized.

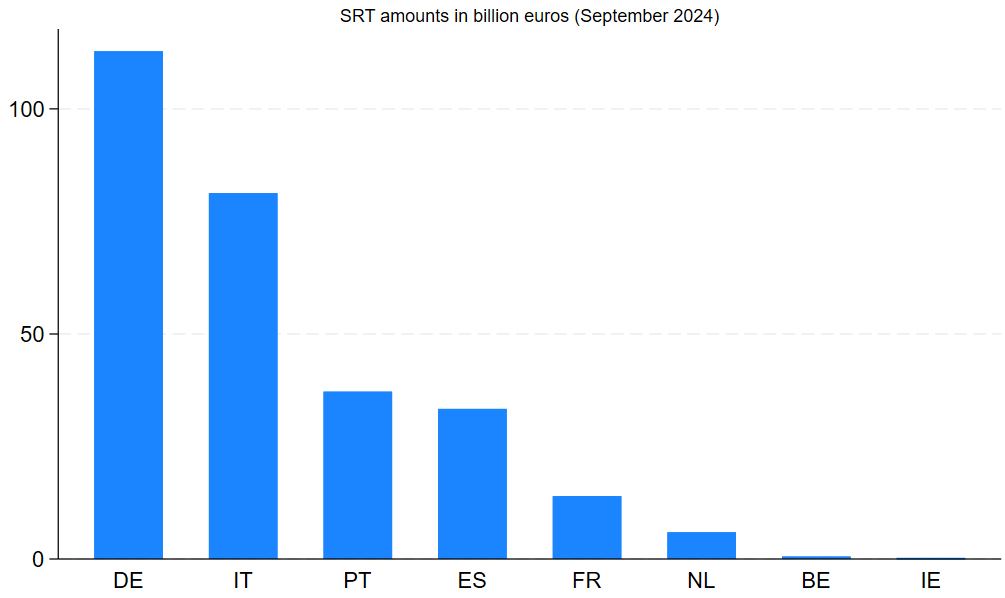


Figure 3: This figure shows the SRT amounts in billion euros by country in June 2024. Data include all synthetically transferred loans to non-financial corporations.

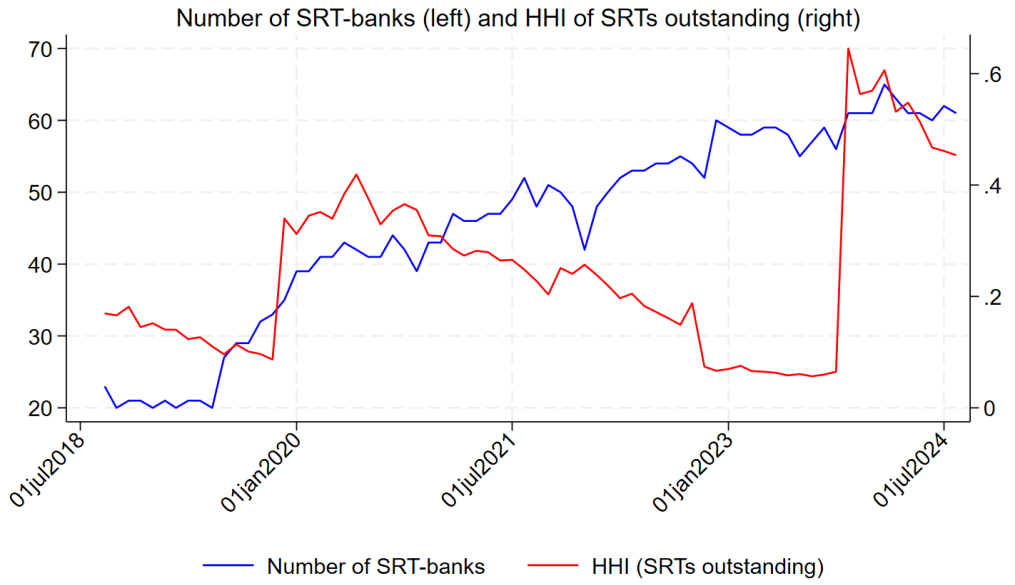


Figure 4: This figure shows the number of SRT-issuing banks in blue and the left y-axis and the concentration of SRT amounts in red on the right y-axis. Concentration is measured with the Herfindahl-Hirschman Index (HHI). SRT banks are selected according to total outstanding SRTs amounts above 50 million euros.

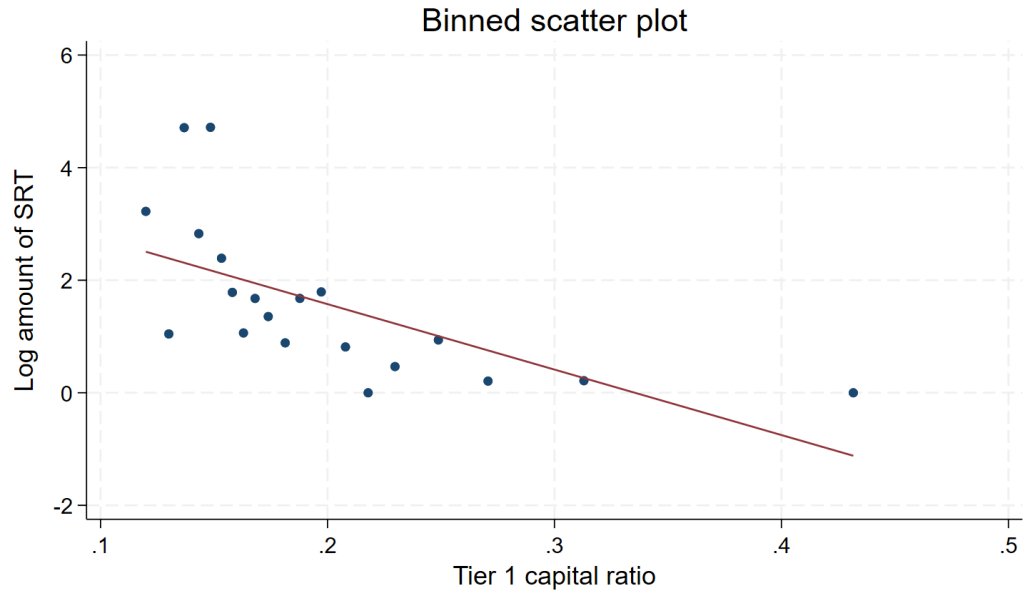


Figure 5: This figure shows a binned scatter plot with the natural logarithm of SRT amounts in a given year on the y-axis and the bank's Tier 1 capital ratio on the x-axis. Non-SRT banks are selected to be at least as large as the 10th percentile of SRT banks in a given country.

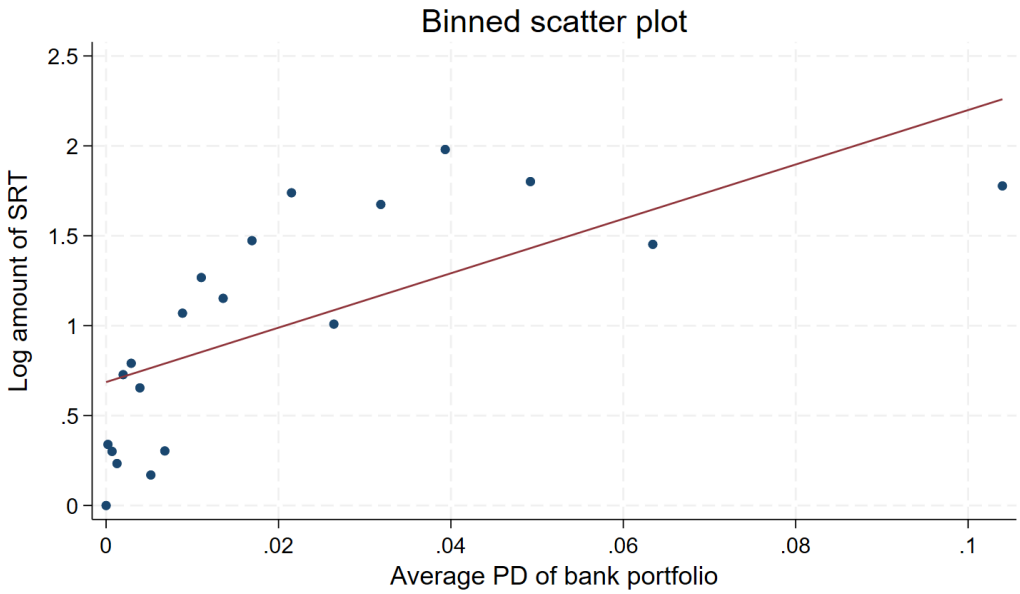


Figure 6: This figure shows a binned scatter plot with the natural logarithm of SRT amounts in a given year on the y-axis and the bank's average probability of default of their firm-loan portfolio on the x-axis. Non-SRT banks are selected to be at least as large as the 10th percentile of SRT banks in a given country.

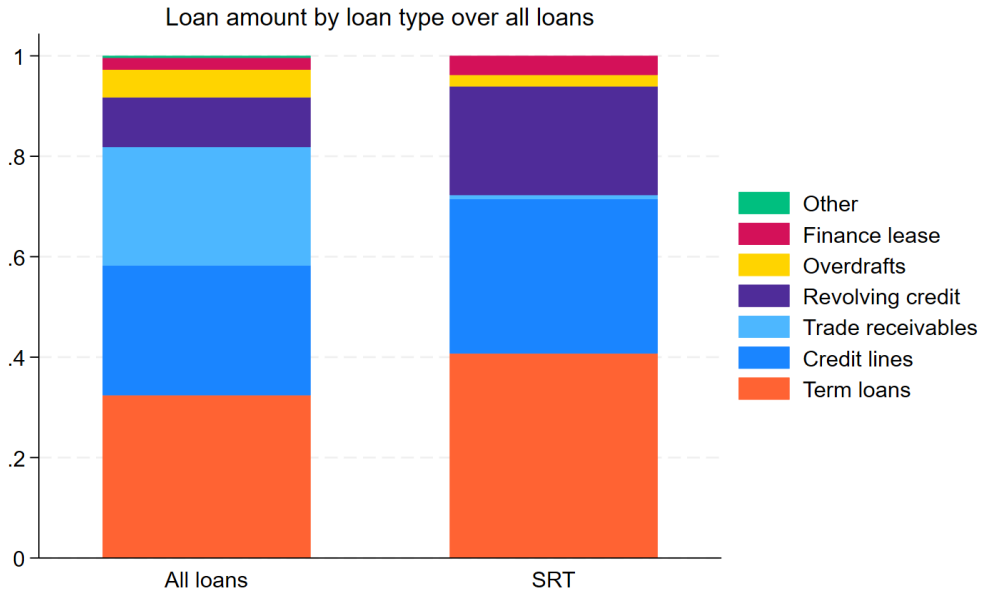


Figure 7: The figure shows the loan amounts of a certain loan type. On the left, we consider all loans to non-financial corporations in AnaCredit in June 2024, and on the right, we consider non-financial corporations whose loans get synthetically transferred.

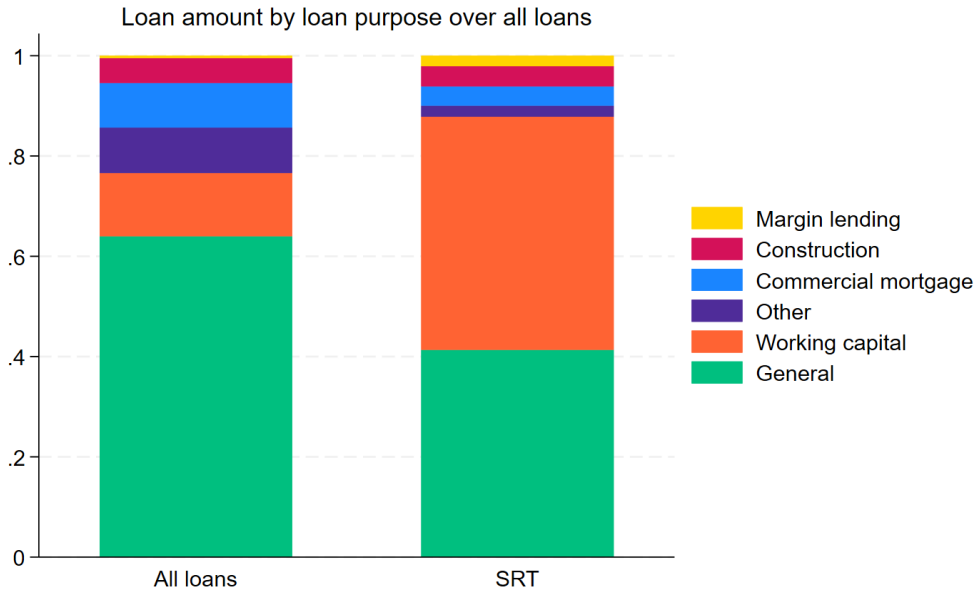


Figure 8: The figure shows the loan amounts of a certain purpose. On the left, we consider all loans to non-financial corporations in AnaCredit in June 2024, and on the right, we consider non-financial corporations whose loans get synthetically transferred.

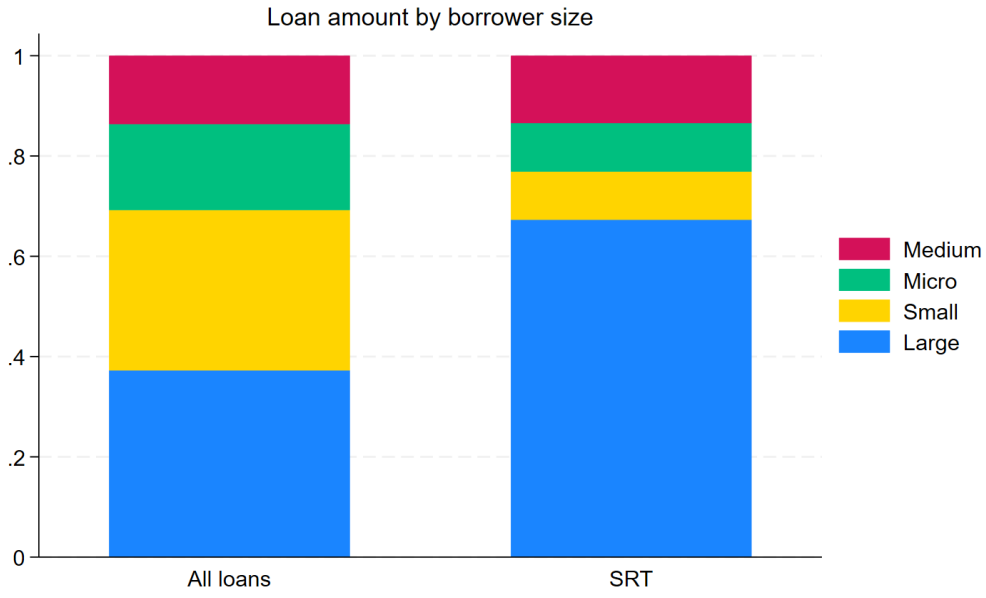


Figure 9: The figure shows the loan amounts that go to non-financial corporations of a certain size classification. On the left, we consider all non-financial firms that borrow bank loans according to AnaCredit in June 2024, and on the right, we consider firms whose loans get synthetically transferred. Size classifications are according to the Annex to Commission Recommendation 2003/361/EC, i.e. micro firms have fewer than 10 employees, small firms 10-49, medium-sized firms 50-249, and large 250 or more.

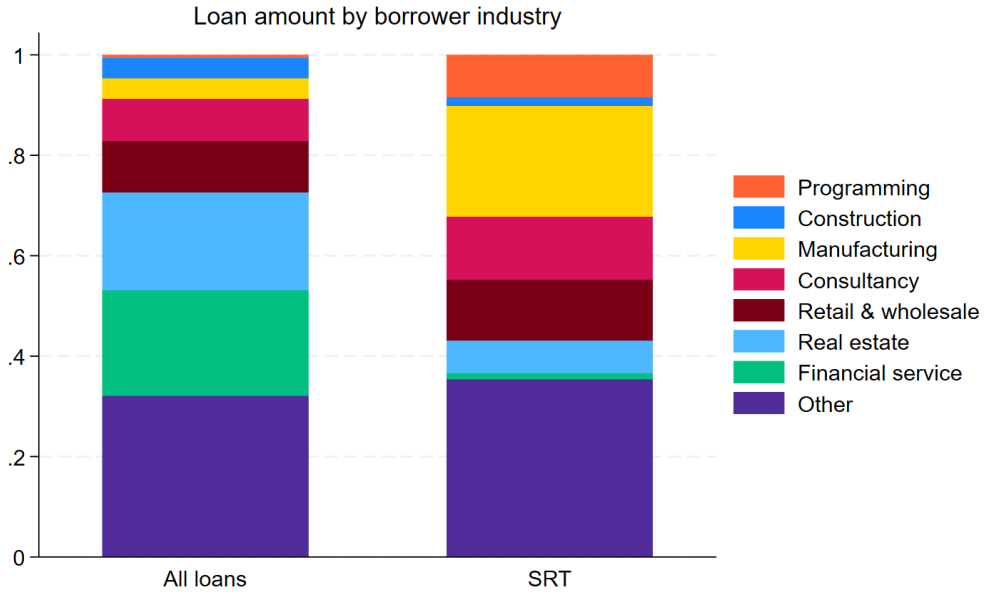


Figure 10: The figure shows the loan amounts that go to non-financial corporations of respective economic sectors as classified by their NACE codes. On the left, we consider all borrowers that borrow bank loans according to AnaCredit in June 2024, and on the right, we consider firms whose loans get synthetically transferred. Firms that active in the financial service industry according to their NACE codes are nevertheless classified as non-financial corporations according to the ESA 2010 accounting framework.

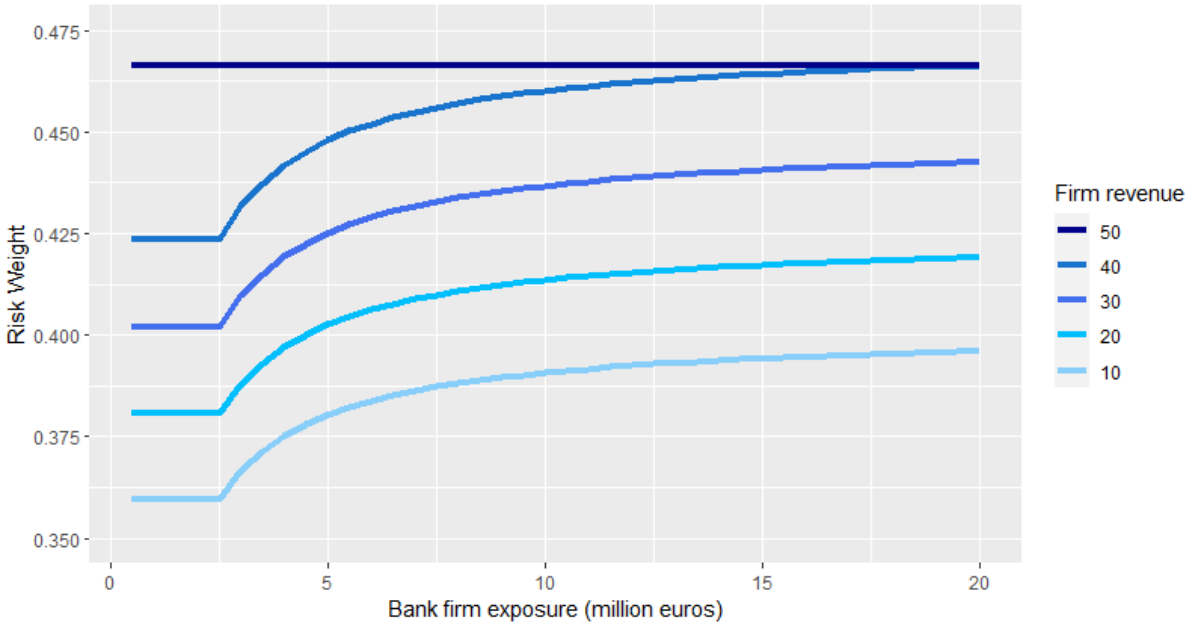


Figure 11: This figure shows the risk weights on the y-axis as a function of the bank's firm exposure in million euros on the x-axis and firms with annual revenues of 10, 20, 30, 40, and 50 million euros. For firms with annual revenues above 50 million euros, the risk weight is not a function of the revenue or the bank's firm exposure. For the additional variables that enter the risk weight formula, we chose the following values: Firm probability of default is one percent, loan maturity is 5 years, and the loss given default is 20 percent.

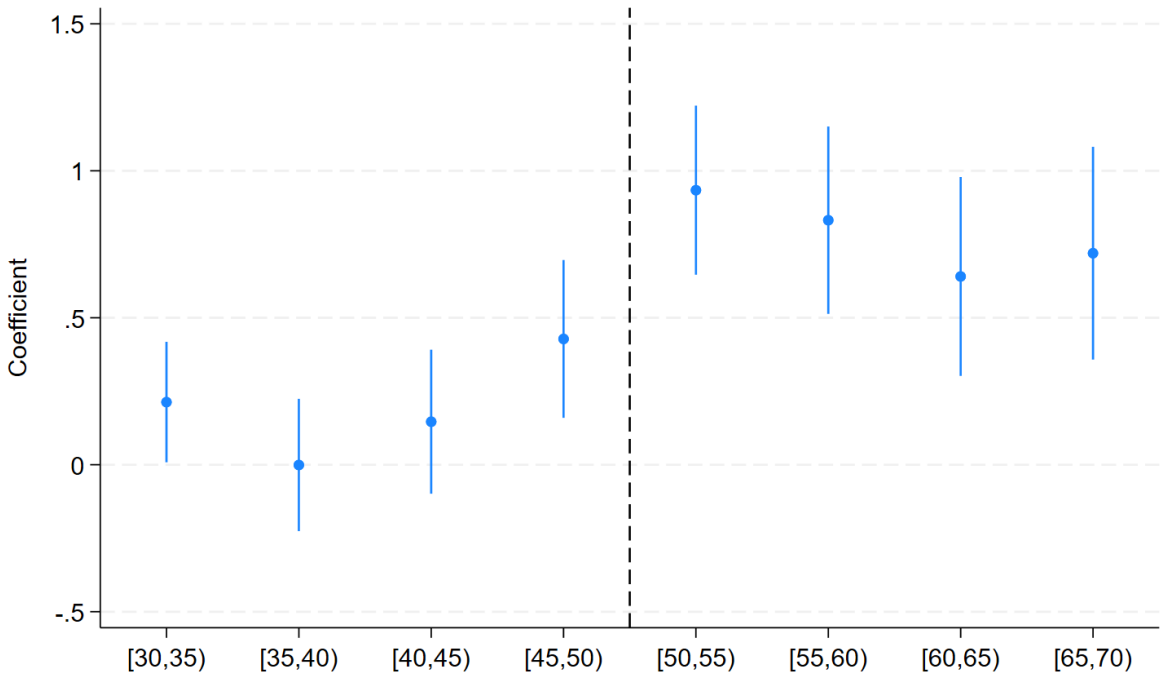


Figure 12: This figure plots the β coefficients and their 95 percent confidence interval of the following regression, for the sample of loans that are granted by banks with firm exposures below 7.5 million euros: $\textit{SRT-loan}_{i,t} = \beta_1 \textit{Borrower revenue bins}_{i,t} + \delta X_{i,t} + \epsilon_{i,t}$. $\textit{SRT-loan}_{i,t}$ is equal to 100 if a loan is synthetically transferred in a given year and 0 otherwise. The $[25, 30)$ bin serves as the benchmark. We control for the firm's probability of default, the loan rate and loan size bins interacted with the natural logarithm of the loan amount. In addition, we use the following fixed effects: Bank $\times$ year $\times$ loan type $\times$ interest rate type $\times$ loan purpose $\times$ borrower industry $\times$ residual maturity above 1 year. Standard errors are wild-bootstrapped at the bank level.

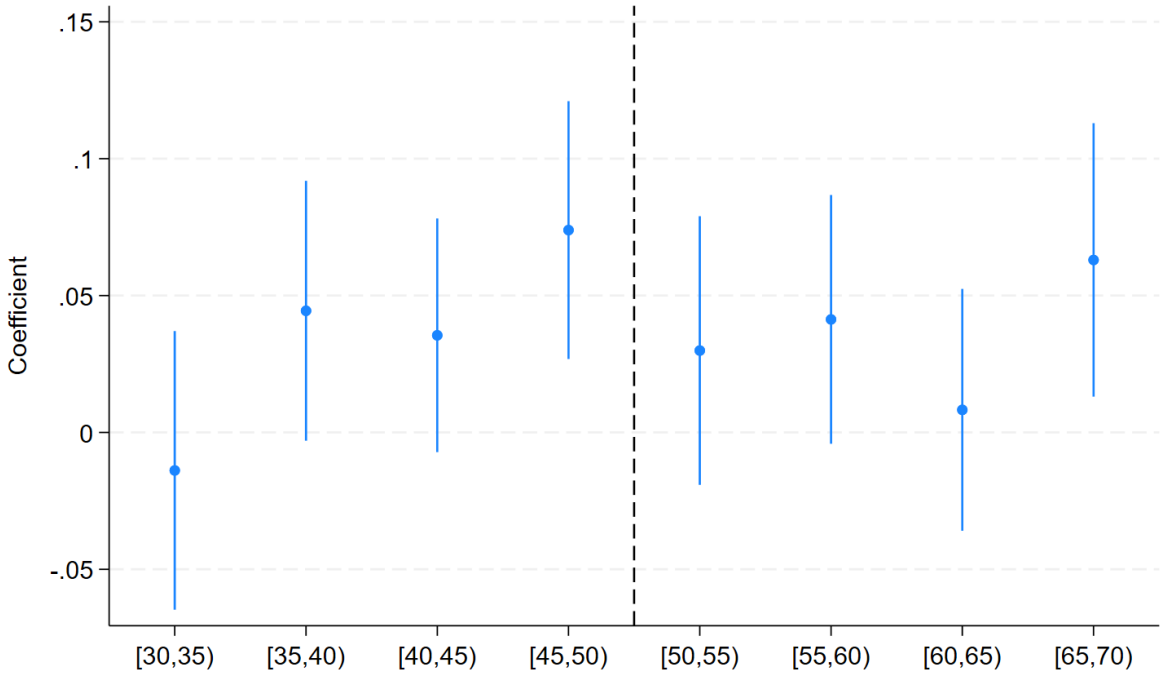


Figure 13: This figure plots the β coefficients and their 95 percent confidence interval of the following regression, for the sample of loans that are granted by banks with firm exposures above 7.5 million euros: $\textit{SRT-loan}_{i,t} = \beta_1 \textit{Borrower revenue bins}_{i,t} + \delta X_{i,t} + \epsilon_{i,t}$. $\textit{SRT-loan}_{i,t}$ is equal to 100 if a loan is synthetically transferred in a given year and 0 otherwise. The $[25, 30)$ bin serves as the benchmark. We control for the firm's probability of default, the loan rate, and the natural logarithm of the loan amount. In addition, we use the following fixed effects: Bank $\times$ year $\times$ loan type $\times$ interest rate type $\times$ loan purpose $\times$ borrower industry $\times$ residual maturity above 1 year. Standard errors are wild-bootstrapped at the bank level.

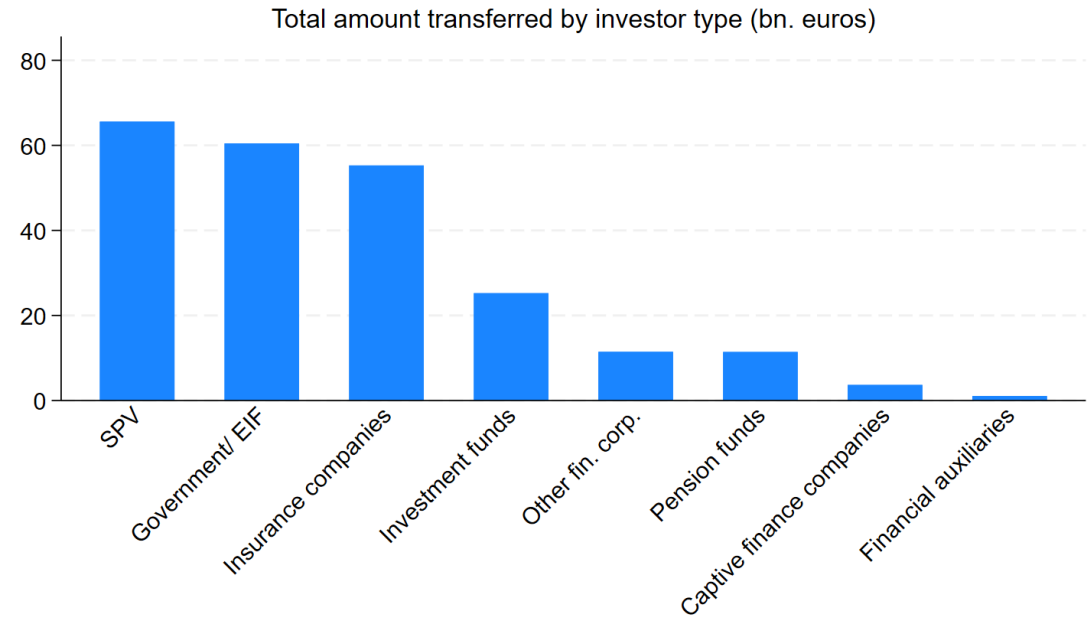


Figure 14: This figure shows the SRT amounts and their corresponding investor types. In case the investor is an SPV, we do not know the ultimate investor. EIF stands for European Investment Fund.

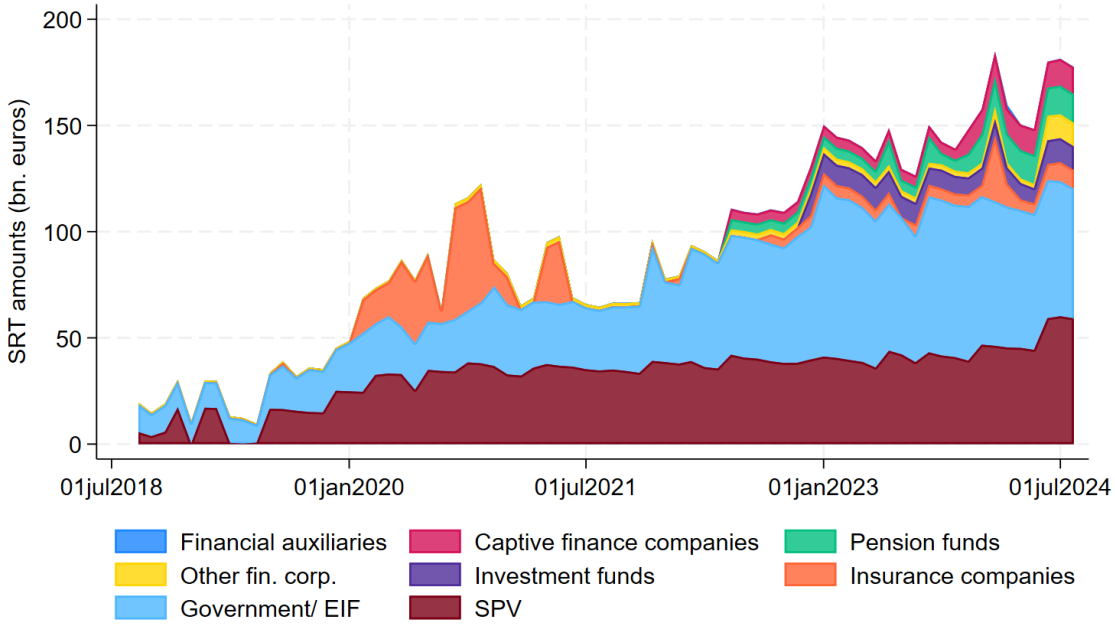


Figure 15: This figure shows the SRT amounts and their corresponding investor types. In case the investor is an SPV, we do not know the ultimate investor. EIF stands for European Investment Fund.

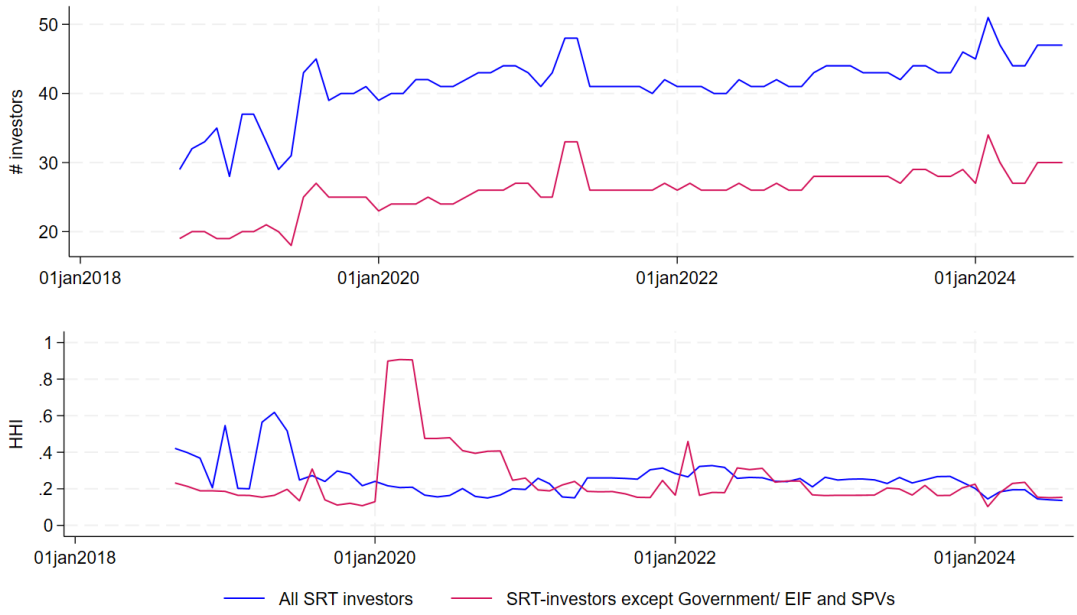


Figure 16: This figure shows the number of non-bank investors that hold SRTs of non-financial corporations over time (top) and the concentration of SRT holdings as measured by the Hirschman-Herfindahl-Index (HHI) (bottom). We show all investors, including governments/ EIF and SPVs, in blue and exclude them for the red line. The blue line probably underestimates the true number of investors as it assumes a single ultimate investor per SPV.

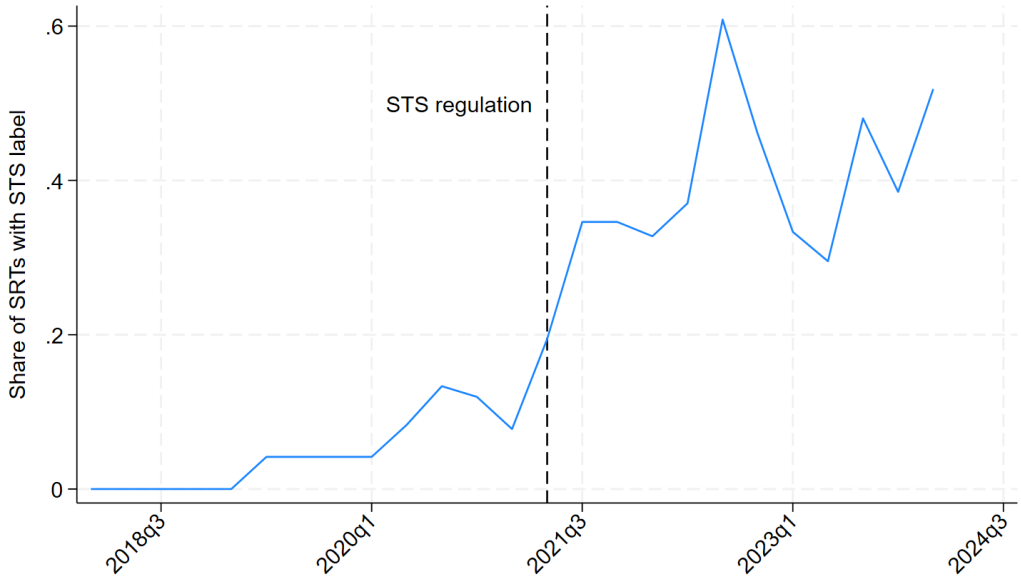


Figure 17: This figure shows the three-months moving average of the fraction of SRTs for which the banks receive capital relief under the STS label in a given quarter. The vertical line depicts the April 2021 regulatory change after which SRTs could get facilitated capital relief under the STS label. Data are from ECB's COREP.

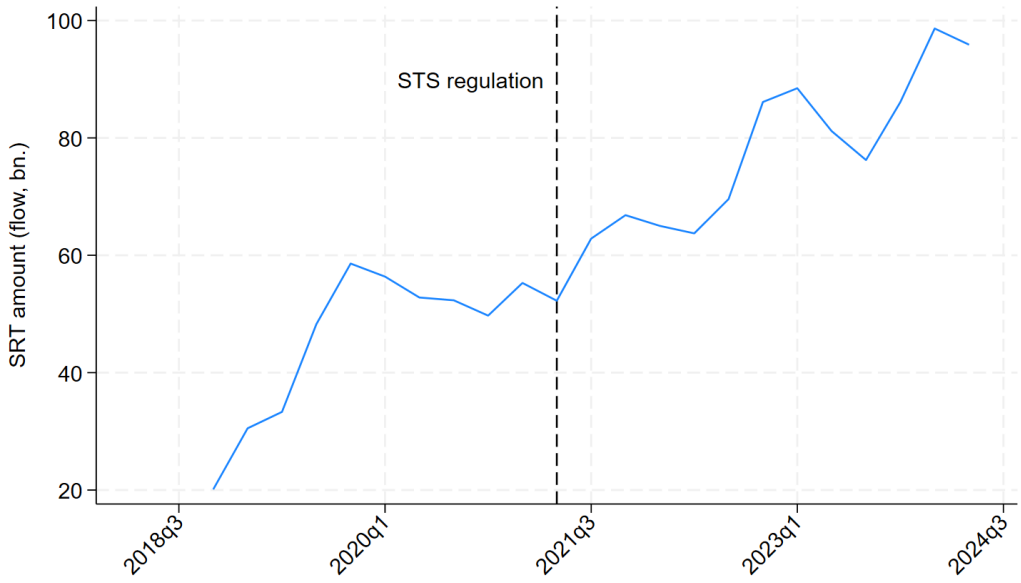


Figure 18: This figure depicts a three-months moving average of the SRT amounts over time. Data are from ECB's AnaCredit.

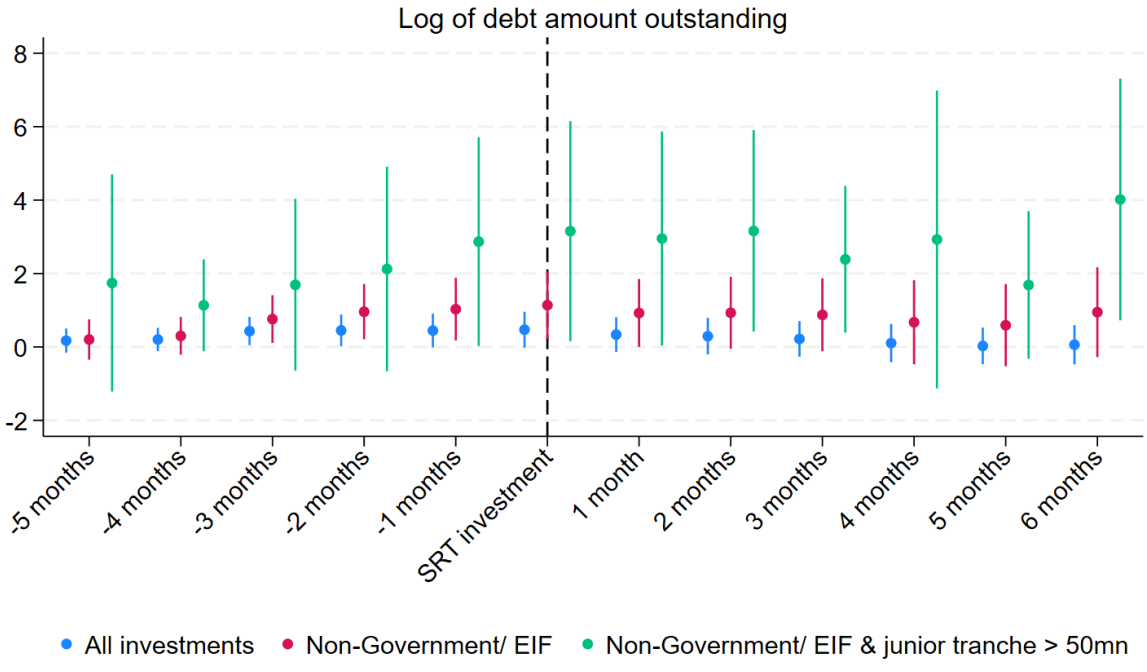


Figure 19: This figure shows the months until SRT investment fixed effects as estimated in regression 10, with 6 months before the SRT investment as the baseline. The dependent variable is the natural logarithm of debt outstanding of non-bank SRT investors. We control for SRT investment and calendar time fixed effects. Standard errors are clustered at the SRT investment level. nongovernmental/ EIF investments are more likely to be funded and therefore more likely to have an association with debt levels.

6 Tables

Table 1: This table shows the characteristics of SRT banks in 2020, before the 2021 regulatory change that facilitated capital relief. Non-SRT banks are selected to be at least as large as the 10th percentile of SRT banks in a given country. Our regressions effectively feature a lot fewer non-SRT banks due to missing variables. Financial information is at the unconsolidated bank level. Capital ratios, liquidity, and ROE are from BvD's Bankfocus, the rest is from AnaCredit. In this table, values are winsorized at the 1 percent level.

	SRT banks *71*					Selected non-SRT banks *941*				
	mean	SD	10^{th}	median	90^{th}	mean	SD	10^{th}	median	90^{th}
Balance sheet size (mn.)	414,000	472,000	13,200	237,000	1,510,000	107,000	297,000	791	17,000	248,000
Capital ratio	18.5	3.7	14.2	17.8	23.3	22.0	8.4	14.8	19.6	32.0
Tier 1 capital ratio	16.4	3.5	13.2	15.3	21.9	20.7	7.7	14.0	18.5	30.6
Liquid assets to deposits (%)	38.5	21.2	15.8	34.4	62.0	36.4	24.6	10.5	28.9	75.4
ROE (%)	3.0	8.4	-4.7	2.8	14.9	5.7	7.2	0.1	4.7	14.6
PD loan portfolio (%)	3.3	3.3	0.2	2.0	8.9	2.2	2.9	0	0.9	6.2
Loan payments are overdue (%)	2.9	3.5	0	1.4	7.7	2.0	3.2	0	0.5	6.2
Loans are delinquent (%)	2.3	3.1	0	0.9	6.7	1.3	2.4	0	0.1	4.1

Table 2: This table compares synthetically transferred loans with all loans to non-financial corporations ("S11" in ESA 2010 accounting classification). All variables are winsorized at the one percent level.

	Synthetically transferred loans *171,506*					All loans *June 2024: 13,600,000*				
	mean	SD	10^{th}	median	90^{th}	mean	SD	10^{th}	median	90^{th}
Loan amount	943,665	2,860,711	38,772	200,000	2,000,000	364,597	937,721	30,000	100,000	750,000
Loan maturity (years)	5.6	3.6	2.0	5.0	10.0	8.2	6.5	1.0	6.0	18.0
Loan rate	0.028	0.019	0.008	0.023	0.059	0.039	0.028	0.007	0.040	0.074
Borrower revenue (mn.)	45	209	0.2	4	74	27	105	0.04	1.6	53
Borrower PD	0.014	0.020	0.002	0.008	0.032	0.080	0.230	0.001	0.009	0.115
Loan payments are overdue	0.014					0.045				
Loan is delinquent	0.009					0.028				
Share fixed rate	0.61					0.40				

Table 3: This table shows characteristics of non-bank SRT investors at the time of the SRT investment (or during the entire sample if specified). Values that include total assets (indicated by $*$) are currently unreliable at the group level as suggested by one fourth of bank debt to asset ratios being larger than one. We nevertheless show our estimates here for completeness but work at the unconsolidated level in the regressions. All observations with ratios above one are dropped. To account for irregular reporting in AnaCredit, we take the maximum debt value and number of banks in a three months window around the SRT issue.

	All SRT investments *282*						SRT investments excl. Government / EIF *142*					
	mean	SD	10^{th}	median	90^{th}	N	mean	SD	10^{th}	median	90^{th}	N
Group level												
Total assets (mn. euros)*	168,000	309,000	32	3,040	5,690	133	134,000	393,000	9	23	220,000	34
Bank loans outstanding (mn.)	6,130	30,200	0	386	5,090	282	5,500	45,100	0	0.1	56	142
Bank loans committed (mn.)	6,550	30,200	0	1,250	6,070	282	5,190	40,500	0	0.5	146	142
Bank debt outstanding to assets*	0.25	0.32	0	0.06	0.79	282	0.04	0.07	0	0.02	0.17	142
SRT investment (first losses) to assets*	0.03	0.04	0	0	0.07	105	0.04	0.07	0	0.01	0.07	28
Number of bank relationships	18.2	33.6	1	7	28	282	7.3	31.0	1	1	3	142
Number of bank relationships during sample	35.4	60.3	2	10	55	282	12.8	52.6	2	3	7	142
Share of investors that receive credit from SRT-bank during sample	0.50					282	0.22					142
Unconsolidated level												
Total assets (mn. euros)	36,000	199,000	9	2,490	2,490	112	92,900	342,000	5	37	781,000	33
Bank loans outstanding (mn.)	505	1,690	0	0.6	381	282	21	135	0	0.1	8	142
Bank loans committed (mn.)	678	2,910	0	2	394	282	23	126	0	0.2	22	142
Loans & securities (mn.)	20,300	211,000	0	5	381	282	49	193	0	0.2	61	142
Liabilities to assets	0.08	0.12	0	0.05	0.15	102	0.04	0.10	0	0	0.12	30
SRT investment (first losses) to assets	0.06	0.11	0	0.02	0.13	103	0.10	0.15	0	0.05	0.36	29
Number of bank relationships	4.6	7.6	1	1	8	282	1.4	0.9	1	1	2	142
Number of bank relationships during sample	8.2	11.2	2	3	12	282	3.0	2.0	1	3	4	142
Share of investors that receive credit from SRT-bank during sample	0.18					282	0.15					142

Table 4: This table shows the results of regressions of an SRT dummy (columns (1), (2), (5), (6)) and the natural logarithm of the SRT amount (columns (3), (4), (7), (8)) on banks' Tier 1 capital ratios (columns (1) – (4)) and the riskiness of their loan portfolio. The latter is measured by the probability of default of firms to which banks lend, weighted by the loan amount. If that is missing, we take the weighted industry average. The data are aggregated at the year-level in columns (1) – (4) as our Tier 1 capital ratios are yearly from Bankfocus by BvD, or at the quarter-level in columns (5) – (8). That is, SRT amounts are summed up within years or quarters. The SRT dummy equals 1 if the yearly SRT amount is at least 50 million euros or the quarterly is at least 12.5 million euros. Fixed effects are at the country × year or country × quarter level, except in column (6) where it is at the country and quarter level (we would not achieve convergence otherwise). Standard errors are wild-bootstrapped at the country cluster. Our sample of non-SRT banks is selected to be at least as large as the 10^{th} percentile of SRT banks in a given country. We additionally control for bank size by interacting the logarithm of its balance sheet with 10 bank size dummies in all specifications.

	(1) SRT	(2) SRT	(3) Log SRT amount	(4) Log SRT amount	(5) SRT	(6) SRT	(7) Log SRT amount	(8) Log SRT amount
Tier 1 capital ratio	-0.266***	-25.24***	-7.031***	-16.76***	✓	✓	✓	✓
	(0.0862)	(1.668)	(1.961)	(0.256)				
PD loan portfolio					1.695***	45.85***	37.29***	26.82***
					(0.152)	(4.063)	(3.379)	(0.706)
Liquid assets to deposits	0.0279	1.379***	0.120	0.681***	0.0628***	2.425***	1.196***	0.846***
	(0.0277)	(0.483)	(0.630)	(0.0736)	(0.0100)	(0.450)	(0.219)	(0.0802)
Mean	0.0670	0.0927	1.707	1.899	0.0380	0.0551	0.924	1.258
Estimation	OLS	Logit	OLS	Exponential mean	OLS	Logit	OLS	Exponential mean
Fixed effects	Country × year	Country × year	Country × year	Country × year	Country × quarter	Country, quarter	Country × quarter	Country × quarter
Controls	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size
SE cluster	WCR: Country	WCR: Country	WCR: Country	WCR: Country	WCR: Country	WCR: Country	WCR: Country	WCR: Country
Pseudo R-squared		0.460		0.473		0.475		0.550
R-squared	0.291		0.304		0.281		0.274	
N	1,924	1,337	1,924	1,730	7,741	5,336	7,826	5,749
Frequency	Yearly	Yearly	Yearly	Yearly	Quarterly	Quarterly	Quarterly	Quarterly

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: This table shows the results of regressions of an SRT dummy (columns (1) – (3)) and the natural logarithm of the SRT amount (columns (4) – (6)) on banks' Tier 1 capital ratios and its interaction with a post-2021 dummy (the regulatory change happened in April 2021). Data are aggregated at the year-level as our Tier 1 capital ratios are yearly from Bankfocus by BvD, that is, SRT amounts are summed up within years. The SRT dummy equals 1 if the yearly SRT amount is at least 50 million euros. When fixed effects are at the country × year level, our standard errors are wild bootstrapped at the country cluster. When fixed effects are at the bank level, we also cluster standard errors at that level. Our sample of non-SRT banks have larger balance sheets than the 10^{th} percentile of SRT banks in a given country. We additionally control for bank size by interacting the logarithm of its balance sheet with 10 bank size dummies in all specifications. Because interaction coefficients of non-linear models do not have the interpretation of a cross-partial derivative, we split the sample in columns (2), (3), (5), and (6), to show that Tier 1 capital ratios are more negatively associated with SRT issues after the April 2021 regulatory change.

	(1) SRT	(2) SRT	(3) SRT	(4) Log SRT amount	(5) Log SRT amount	(6) Log SRT amount
Post 2021=1 × Tier 1 capital ratio	-0.210*			-5.698**		
	(0.107)			(2.294)		
Tier 1 capital ratio (≤ 2021)		-21.58***			-11.19***	
		(2.671)			(0.449)	
Tier 1 capital ratio (> 2021)			-28.37***			-20.33***
			(2.045)			(0.343)
Tier 1 capital ratio	-0.0636			-1.164		
	(0.0921)			(1.954)		
Liquid assets to deposits	0.0678	-0.350	3.855***	0.419	-0.599***	1.581***
	(0.0516)	(0.740)	(0.612)	(1.037)	(0.121)	(0.100)
Mean	0.0675	0.110	0.108	1.718	1.775	2.625
Estimation	OLS	Logit	Logit	OLS	Exponential mean	Exponential mean
Fixed effects	Bank, year	Country, year	Country, year	Bank, year	Country, year	Country, year
SE cluster	Bank	WCR: Country	WCR: Country	Bank	WCR: Country	WCR: Country
Additional controls	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size
Adj. R-squared	0.752			0.815		
N	1,912	462	641	1,912	694	714
Frequency	Yearly	Yearly	Yearly	Yearly	Yearly	Yearly

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: This table shows the results of regressions of an SRT dummy (columns (1) – (3)) and the natural logarithm of the SRT amount (columns (4) – (6)) on the riskiness of banks' loan portfolio and its interaction with a post-Q1-2021 dummy (the regulatory change happened in April 2021). Data are aggregated at the quarter level, that is, SRT amounts are summed up within quarters. The SRT dummy equals 1 if the quarterly SRT amount is at least 12.5 million euros. When fixed effects are at the country × quarter level, our standard errors are wild bootstrapped at the country cluster. When fixed effects are at the bank level, we also cluster standard errors at that level. Our sample of non-SRT banks have larger balance sheets than the 10^{th} percentile of SRT banks in a given country. We additionally control for bank size by interacting the logarithm of its balance sheet with 10 bank size dummies in all specifications. Because interaction coefficients of non-linear models do not have the interpretation of a cross-partial derivative, we split the sample in columns (2), (3), (5), and (6), to show that banks' riskiness is more positively associated with SRT issues after the April 2021 regulatory change.

	(1) SRT	(2) SRT	(3) SRT	(4) Log SRT amount	(5) Log SRT amount	(6) Log SRT amount
Post Q1 2021=1 × PD loan portfolio	0.537			12.49		
	(0.461)			(10.03)		
PD loan portfolio (≤ Q1-2021)		22.96***			17.26***	
		(8.152)			(1.419)	
PD loan portfolio (> Q1-2021)			52.56***			34.90***
			(4.659)			(0.791)
PD loan portfolio	-0.177			-5.157		
	(0.402)			(8.544)		
Tier 1 capital ratio	-0.0125	-18.74***	-43.23***	-0.574	-15.74***	-29.93***
	(0.0534)	(2.537)	(0.953)	(1.254)	(0.495)	(0.193)
Mean	0.0354	0.0579	0.0626	0.862	0.819	1.618
Estimation	OLS	Logit	Logit	OLS	Exponential mean	Exponential mean
Fixed effects	Bank, quarter	Country × quarter	Country × quarter	Bank, quarter	Country × quarter	Country × quarter
SE cluster	Bank	WCR: Country	WCR: Country	Bank	WCR: Country	WCR: Country
Controls	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size	Size bins × bank size
Pseudo R-squared		0.463	0.505		0.568	0.551
Adj. R-squared	0.700			0.721		
N	8,482	1,089	3,513	8,568	1,853	3,387
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: This table shows the results of a regression of whether a loan was synthetically transferred in a given year (= 100) or not (= 0) on firms' revenue and the natural logarithm of the bank's firm exposure. We control for the firms' PD, loan rate, and natural logarithm of the loan size × loan size bins. Our fixed effects are bank × year × loan type × interest rate type × loan purpose × borrower industry × residual maturity above 1 year.

	(1)	(2)	(3)	(4)
	SRT loan (= 100)	SRT loan (= 100)	SRT loan (= 100)	SRT loan (= 100)
Revenue (million euros)	0.00608***	0.00608***	-0.000392	-0.000392
	(0.000131)	(0.00205)	(0.000267)	(0.000723)
Log bank firm exposure	0.0210***	0.0210**	-0.00391	-0.00391
	(0.000662)	(0.00965)	(0.00277)	(0.00507)
PD	-1.136***	-1.136**	-2.534***	-2.534**
	(0.0407)	(0.504)	(0.261)	(1.238)
Loan rate	-1.108***	-1.108	0.545*	0.545
	(0.0545)	(1.293)	(0.287)	(0.960)
Mean	0.359	0.359	0.344	0.344
Estimation	OLS	OLS	OLS	OLS
Revenue (million)	[0,50]	[0,50]	[50,100]	[50,100]
Fixed effects	FE	FE	FE	FE
SE cluster		Bank		Bank
Controls	Loan size bins × log loan amount	Loan size bins × log loan amount	Loan size bins × log loan amount	Loan size bins × log loan amount
Adj. R-squared	0.173	0.173	0.365	0.365
N	31,282,991	31,282,991	1,993,606	1,993,606
Frequency	Yearly	Yearly	Yearly	Yearly

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: This table shows the results of a regression of whether a loan was synthetically transferred in a given year (= 100) or not (= 0) on a dummy variable that is one if a firm's annual revenue is at least 50 (40 or 60) million euros and zero otherwise. In some specifications, the dummy variable is interacted with the natural logarithm of the firm exposure of banks. We control for the firm's probability of default, the loan rate, and loan size bins interacted with the natural logarithm of the loan amounts. Our fixed effects are bank × year × loan type × interest rate type × loan purpose × borrower industry × residual maturity above 1 year. Standard errors are wild bootstrapped at the bank level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	SRT loan (=100)	SRT loan (=100)	SRT loan (=100)	SRT loan (=100)	SRT loan (=100)	SRT loan (=100)	SRT loan (=100)	SRT loan (=100)
Revenue > 50 mn=1	0.0389**	0.231**			0.0346***	0.245***		
	(0.0156)	(0.101)			(0.0102)	(0.0642)		
Revenue > 50 mn=1 × Log bank firm exposure		-0.0116*				-0.0127***		
		(0.00600)				(0.00381)		
Revenue > 40 mn=1			-0.135				0.0116	
			(0.0853)				(0.0640)	
Revenue > 40 mn=1 × Log bank firm exposure			0.00782				0.000564	
			(0.00521)				(0.00398)	
Revenue > 60 mn=1				-0.00266				-0.146**
				(0.0962)				(0.0710)
Revenue > 60 mn=1 × Log bank firm exposure				-0.000427				0.00720*
				(0.00547)				(0.00413)
Mean	0.387	0.387	0.00389	0.301	0.364	0.364	0.431	0.330
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Revenue (million)	[45,55]	[45,55]	[35,45]	[55,65]	[40,60]	[40,60]	[30,50]	[50,70]
Fixed effects	FE	FE	FE	FE	FE	FE	FE	FE
SE cluster	WCR: Bank	WCR: Bank	WCR: Bank	WCR: Bank	WCR: Bank	WCR: Bank	WCR: Bank	WCR: Bank
Controls	Loan size bins × log loan amount	Loan size bins × log loan amount	Loan size bins × log loan amount	Loan size bins × log loan amount	Loan size bins × log loan amount	Loan size bins × log loan amount	Loan size bins × log loan amount	Loan size bins × log loan amount
Adj. R-squared	0.450	0.450	0.400	0.448	0.393	0.393	0.366	0.406
N	615,408	615,408	794,296	530,886	1,295,035	1,295,035	1,618,225	1,021,100
Frequency	Yearly	Yearly	Yearly	Yearly	Yearly	Yearly	Yearly	Yearly

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: This table displays the results of regressions of bank outcomes on the interaction of a post-2021 dummy variable with the propensity to do SRTs. The propensity to do SRTs is estimated through propensity score matching with 240 non-SRT banks (row 1) and a dummy variable that indicates if the bank had issued an SRT before the April 2021 regulatory change. We assume that this reduces the fixed costs of issuing SRTs after April 2021. Data are aggregated at the year level, that is, SRT amounts are summed up within years. When fixed effects are at the country × year level, our standard errors are wild bootstrapped at the country cluster. When fixed effects are at the bank level, we also cluster standard errors at that level. We control for bank size by interacting the logarithm of its balance sheet with 10 bank size dummies in all specifications. Data are only from AnaCredit for columns (1) – (6) and AnaCredit and BvD for columns (7) – (9).

	(1) Log amount new loans	(2) Log amount new loans	(3) Log amount new loans	(4) PD new loans	(5) PD new loans	(6) PD new loans	(7) Dividend ratio	(8) Dividend ratio	(9) Dividend ratio
Post 2021=1 × Propensity to do SRT	0.393*	0.327*		-0.643***	-0.694**		14.75**	18.28*	
	(0.234)	(0.169)		(0.246)	(0.275)		(7.292)	(10.07)	
Post 2021=1 × SRT before policy change=1			0.189*			-0.383**			0.589
			(0.108)			(0.148)			(5.444)
Log maturing loans	0.551***	0.279***	0.277***						
	(0.0191)	(0.0705)	(0.0701)						
Log new loans in country	1.955***	0.178	0.181						
	(0.195)	(0.124)	(0.124)						
PD loan portfolio				0.332***	0.200***	0.159***			
				(0.0252)	(0.0511)	(0.0392)			
PD maturing loans				0.0721***	0.0557**	0.0742***			
				(0.0143)	(0.0259)	(0.0236)			
Log net income							-0.303	0.990	1.096
							(1.042)	(0.929)	(0.936)
Mean	24.58	24.58	24.58	1.025	1.019	1.301	7.115	7.115	7.115
Fixed effects	Country × year	Bank, year	Bank, year	Country × year	Bank, year	Bank, year	Country × year	Bank, year	Bank, year
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Frequency	Yearly	Yearly	Yearly	Yearly	Yearly	Yearly	Yearly	Yearly	Yearly
Controls	Capital ratio, size bins × bank size	Capital ratio, size bins × bank size	Capital ratio, size bins × bank size	Capital ratio, size bins × bank size	Capital ratio, size bins × bank size	Capital ratio, size bins × bank size	Capital ratio, size bins × bank size	Capital ratio, size bins × bank size	Capital ratio, size bins × bank size
SE cluster	WCR: Country	Bank	Bank	WCR: Country	Bank	Bank	WCR: Country	Bank	Bank
Adj. R-squared	0.861	0.922	0.922	0.401	0.653	0.664	0.238	0.665	0.654
N	1,432	1,430	1,430	1,189	1,180	1,374	579	579	579

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: This table shows the regression results of our moral hazard measures on the interaction of synthetically transferring a given loan (*SRT bank*) and the post-transfer period (*Post SRT*). Our moral hazard measures capture the frequency with which banks change firms' probability of default estimates in a given quarter (our original data are monthly). *SD(PD)* measures the quarterly standard deviation of PD estimates and *SD(PD) > 0* indicates changes. Columns (1) and (3) feature firm, quarter, and bank fixed effects while columns (2) and (4) feature firm × quarter and bank fixed effects. The interpretation, e.g. of column (2), is as follows: synthetically transferring a loan is associated with a 30% decline in the standard deviation of PD estimates.

	(1) SD(PD)	(2) SD(PD)	(3) SD(PD) > 0	(4) SD(PD) > 0
SRT bank=1 × Post SRT=1	-0.0356**	-0.0323**	-0.0495**	-0.0458**
	(0.0162)	(0.0157)	(0.0209)	(0.0231)
Average PD	0.0571***	0.0488***	0.00782*	0.00153
	(0.0187)	(0.0118)	(0.00470)	(0.00377)
Mean	0.116	0.108	0.332	0.315
Estimation	OLS	OLS	OLS	OLS
Fixed effects	Firm, quarter, bank	Firm × quarter, bank	Firm, quarter, bank	Firm × quarter, bank
SE cluster	Bank	Bank	Bank	Bank
Controls	Firm revenue	Firm revenue	Firm revenue	Firm revenue
Adj. R-squared	0.209	0.433	0.356	0.510
N	4,007,636	3,321,116	4,086,342	3,396,856

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: This table shows the results of a regression of *SRT investment* on *Credit rel.* and *Credit rel. (group)*. SRT investment takes the value one if a given non-bank invests in an SRT issue and zero otherwise. *Credit rel.* and *Credit rel. (group)* take values one if a potential non-bank SRT investor or non-bank SRT investor group receives credit of at least one million euros from the SRT-issuing bank during our sample and zero otherwise. Potential non-bank SRT investors are all firms that actually invest in an SRT in a given country and year. All data are from AnaCredit. All columns show linear probability regressions.

	(1) SRT transaction	(2) SRT transaction	(3) SRT transaction	(4) SRT transaction	(5) SRT transaction	(6) SRT transaction
Credit rel.	0.0409	0.176*		0.0853**	0.0743**	
	(0.0265)	(0.0886)		(0.0372)	(0.0291)	
Credit rel. (group)			0.229***			0.0855**
			(0.0700)			(0.0384)
Mean	0.171	0.165	0.165	0.135	0.130	0.130
Estimation	OLS	OLS	OLS	OLS	OLS	OLS
Fixed effects	Year	Bank, investor, year	Bank, investor, year	Year	Bank, investor, year	Bank, investor, year
Restriction				No Government/ EIF	No Government/ EIF	No Government/ EIF
SE cluster		Bank	Bank		Bank	Bank
Adj. R-squared	0.0242	0.153	0.163	0.0248	0.153	0.154
N	1,691	1,677	1,677	1,055	1,050	1,050

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12: This table shows the results of a regression of *Bank debt to assets* of the SRT investors on the *Thickness of tranche sold*. Bank debt comes from AnaCredit and assets from Orbis by BvD. Bank debt and assets are at the unconsolidated non-bank investor level as our values for assets are currently more reliable at that level. The thickness of the tranche sold is calculated as the credit risk transferred over the sum of all loans in an SRT issue, both from AnaCredit. Control variables are the natural logarithm of the SRT amount and the average probability of default of the underlying loans. In column (5), we restrict the sample to investors with a positive bank debt-to-asset ratio.

	(1) Bank debt to assets	(2) Bank debt to assets	(3) Bank debt to assets	(4) Bank debt to assets	(5) Bank debt to assets
Thickness of tranche sold	0.0847**	0.0851***	0.0969***	0.127	0.108***
	(0.0407)	(0.0234)	(0.0290)	(0.0847)	(0.0353)
Mean	0.0634	0.0640	0.0643	0.0295	0.0790
Estimation	OLS	OLS	OLS	OLS	OLS
Fixed effects		Investor type, country	Investor type, country	Investor type, country	Investor type, country
Restriction				No Gvrnmt/ EIF	Bank debt to assets > 0
SE cluster	Bank	Bank	Bank	Bank	Bank
Controls			SRT size, Avg PD	SRT size, Avg PD	SRT size, Avg PD
Adj. R-squared	0.0850	0.424	0.437	0.850	0.363
N	106	105	102	37	83

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 13: This table shows the results of a regression of the expected loss of an SRT on the thickness of the SRT share sold. Data come from COREP and variables are reported at the SRT level.

	(1) Expected losses	(2) Expected losses	(3) Expected losses
Thickness of tranche sold	0.114***	0.119***	0.0918***
	(0.0297)	(0.0200)	(0.0276)
Log SRT amount		-0.00154	-0.00360
		(0.00266)	(0.00369)
Mean	0.0141	0.0151	0.0193
Estimation	OLS	OLS	OLS
Fixed effects		Bank, year	Bank, year
Restriction			Tranche sold $> 8.5\%$
SE cluster	Bank	Bank	Bank
Adj. R-squared	0.405	0.761	0.419
N	103	92	67

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$