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Uhde, André

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Prof. Dr. André Uhde

University of Paderborn, Department of Taxation, Accounting & Finance, Germany.

E-mail address: andre.uhde@upb.de.

Abstract: Employing a unique sample of 956 credit risk securitization transactions issued by 64 stock-listed European banks across the EU-13 plus Switzerland over the period from 1997 to 2010, we are the first who empirically analyze the relationship between credit (risk) securitization and a change in the issuing banks' effective tax rates. We provide evidence that banks may reduce their tax expenses through securitization via a direct and indirect channel. The results suggest that securitization may be described as an appropriate instrument to pursue tax avoidance, while the tax expense-reducing effect through securitization becomes even stronger under increasing statutory corporate income tax rates. Our baseline findings remain robust under various robustness checks, especially when controlling for a reverse causation between an issuing bank's level of tax burden and the incentive to securitize. Results from further analyses provide additional and important implications for tax policies, banking regulation and the ongoing process of revitalizing the European securitization market.

JEL classification: G21, G28; H25, H71
Keywords: Securitization, credit risk transfer, effective tax rates, European banking

1. Introduction and motivation

Credit (risk) securitization describes the transformation of illiquid loans and their risks into tradable securities. By means of a traditional securitization transaction, the originator (here: a bank) transfers a pool of loans to a Special Purpose Vehicle (SPV), which in turn refinances the purchase of this pool by the issuance of asset-backed securities (ABS). Acting as an intermediary between the bank and external capital market investors, the SPV passes funding from selling these securities through to the bank and forwards interest and principal payments from underlying loan agreements to the investors. By means of a true sale (cash) securitization transaction, the bank typically retains the most risky tranche of the securitization transaction (first loss piece, FLP) and completely transfers the remaining underlying pool of loans out of the bank's balance sheet to the SPV. In contrast, in case of a synthetic securitization transaction, credit risk from underlying loans is transferred entirely or partly through funded (e.g., credit-linked notes, CLN) or unfunded (e.g., credit default swaps, CDS) credit derivatives, whereas the loans remain on the bank's balance sheet.

The broad strand of prior academic research papers provides two well-accepted motives for banks to engage in credit risk securitization (e.g., Farruggio and Uhde, 2015; Michalak and Uhde, 2011; Uhde and Michalak, 2010; Duffie, 2008; Leland, 2007; Merton, 1995; Gorton and Pennacchi, 1995; Carlstrom and Samolyk, 1995). These motives include (a) reducing a bank's economic and regulatory capital burden by means of credit portfolio diversification and specification through credit (risk) securitization, and (b) serving a bank's liquidity and funding management by using credit risk securitizations as an alternative funding source beyond deposits and traditional capital market financing.

In two similar studies, Han et al. (2015) and Gong et al. (2015) suggest tax avoidance as another motive to engage in credit risk securitization. Han et al. (2015) investigate the impact of a change in corporate income tax rates from different national states in the U.S. on the

incentive to securitize for 1,379 U.S. banks, which issued mortgage backed securities (MBS) between 2001 and 2008. Similarly, Gong et al. (2015) analyze the relationship between statutory corporate income tax rates and ABS transactions with different credit underlyings for a sample of 265 issuing banks with headquarters in 19 OECD countries over the period from 1999 to 2006. While controlling for further determinants of a securitization transaction (especially competition levels in respective loan and deposit markets) both papers provide empirical evidence that domestic banks stronger engage in securitization activities under rising statutory corporate income tax rates. The authors explain their findings by the fact that securitizing banks usually pay corporate income taxes, whereas most of their SPVs do not. Accordingly, this tax asymmetry would create an incentive for banks to stronger engage in the securitization business, i.e. they sell loans to the SPV in order to avoid higher corporate income tax payments at the bank level when statutory corporate income tax rates increase.

Inspired by these studies, the paper at hand investigates if European banks pursue tax avoidance strategies through securitization. However, in contrast to the related studies provided by Han et al. (2015) and Gong et al. (2015) we do not investigate if an increase in statutory corporate income tax rates triggers credit risk securitization activities by banks. Rather and contrary, we empirically analyze if credit (risk) securitization has a significant impact on the issuing banks' effective tax rates (ETRs). In our opinion, this is a more direct strategy to investigate if banks indeed may utilize securitization to pursue tax avoidance.

We argue that the impact of credit risk securitization on a bank's ETR is complex since it depends on a direct and indirect effect. As a *direct effect*, selling loans to the SPV immediately reduces a bank's interest income from loans, which – ceteris paribus – reduces a bank's pre-tax profit and hence, its tax expense in a first step.

In a second step, the *indirect effect* hinges on the way a securitizing bank uses the liquidity, which has become available from selling true sale transactions or from regulatory capital

relieves due to synthetic transactions (Greenbaum and Thakor, 1987). (1) Using the liquidity to reinvest into less (more) profitable loans, reduces (increases) the bank's interest income, pre-tax profits and hence, tax liability. Accordingly, the actual effect on a bank's ETR depends on the bank's reinvestment strategy ex post. (2) Using the liquidity to release own liabilities leads to a decrease in a bank's leverage ratio (Cebenoyan and Strahan, 2004), which in turn raises a bank's ETR. An increase in the ETR is due to the fact that the "tax-shield", i.e. the tax-deductibility of interest expense, decreases with a reduced leverage ratio. Accordingly, the actual effect on a bank's ETR depends on the way the bank restructures debt capital after securitization.

The paper at hand aims to shed a brighter light on this nexus. We employ a unique sample of 956 credit risk securitization transactions issued by 64 stock-listed European banks across the EU-13 plus Switzerland over the period from 1997 to 2010 and provide evidence that securitization reduces an issuing bank's tax expense via the direct and indirect effect. In addition, the tax expense-reducing effect becomes even stronger under increasing statutory corporate income tax rates suggesting that European banks pursue tax avoidance strategies through securitization. Our baseline findings remain robust under various robustness checks, especially when controlling for reverse causality between the incentive to securitize and the issuing bank's level of tax burden. Moreover, results from further analyses provide additional and important implications for tax policies, banking regulation and the ongoing process of revitalizing the European securitization market.

Our analysis complements the aforementioned studies provided by Han et al. (2015) and Gong et al. (2015), which are most related to our paper as they analyze tax avoidance as a further motive for banks to engage in the securitization business. Additionally, our analysis contributes to empirical studies, which focus on the determinants of a bank's decision to securitize in general (Farruggio and Uhde, 2015; Cardone-Riportella et al., 2010; Bannier and

Hänsel, 2008; Agostino and Mazzuca, 2008; Martín-Oliver and Saurina, 2007; Uzun and Webb, 2007; Calomiris and Mason, 2004; Minton et al., 2004). Finally, the paper at hand contributes to the broad strand of literature from the field of empirical tax research, which employs ETRs from *non-financial firms* in order to identify determinants of this ratio and to measure tax avoiding strategies by means of this ratio (e.g., Dyreng et al., 2017; Kim et al., 2011; Chen et al., 2010; Desai and Dharmapala, 2006). In this context, and to the best of our knowledge, we are the first who empirically investigate determinants of the ETR (along with tax avoidance) for a sample of *financial* firms (here: banks).

The remainder of the paper is organized as follows. Section 2 describes the data and presents the empirical model. The empirical results are reported and discussed in Section 3. Finally, Section 4 summarizes and includes important policy implications.

2. Empirical methodology

2.1 Data

2.1.1 Securitization data

Our unique data on credit (risk) securitization transactions is hand-collected from offering circulars and presale reports provided by *Moody's*, *Standard & Poor's* and *FitchRatings*. These reports include detailed information on credit risk securitizations, especially on the type and structure of each transaction as well as the underlying reference portfolio. The sample includes 956 credit risk securitization transactions issued by 64 stock-listed[1] European banks across the

[1] Following Altunbas et al. (2009), we employ stock-listed banks only in order to obtain a homogenous sample, which is not „biased" by differences in accounting standards, loan portfolio management techniques and business policies. Moreover, especially in Europe, most non-stock-listed savings banks have own internal credit pools on a group-level to manage their loan portfolios. Thus, instead of selling securitized loans to capital market investors these banks rather use the internal credit pool to diversify loan portfolio risk. In addition, most non-stock-listed credit cooperatives in Europe are not allowed to sell loans to external investors at all.

EU-13 plus Switzerland[2] over the period from 1997 to 2010. While Table 1 reports the geographical distribution of the issuing European banks in our sample, the descriptive statistics of our sample of securitization transactions is presented in Table 2. As shown, the cumulated total volume of securitization transactions in our sample amounts to € 2,104.96 billion and thus, covers nearly 60 percent of the entire cumulated volume of credit risk being transferred through securitization between 1997 and 2010 in the EU-13 plus Switzerland as reported by the *Association for Financial Markets in Europe* (AFME).[3] It is further revealed that true sale transactions account for approximately two thirds and that synthetic transactions account for one third of the entire number and the total volume of securitization transactions. Moreover, our sample of securitizations is mainly represented by Residential Mortgage Backed Securities (€ 1,210.98 billion) and Collateralized Debt Obligations (€ 655.45 billion).

Figures 1a and 1b more precisely illustrate the development of the securitization activity at European banks over the entire period. A notable transfer of credit risks through securitization did not begin until 1997. With the exception of the year 2004 (announcement of the Basel II framework with stronger regulations for securitization transactions) the volume and number of

[2] As shown in Table 1, the EU-13 comprises Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the United Kingdom. We omit securitization transactions from banks located in Finland and Luxembourg since we are not able to clearly assign securitization transactions to respective originating banks in these countries. We additionally include Switzerland for two reasons. First, even though Switzerland is not part of the EU / EMU, the Swiss banking sector is strongly entangled with the European banking market. Second, several large securitization transactions are observed especially at UBS and Credit Suisse. We exclude Switzerland from our baseline regressions as a robustness check. However, as we do not obtain remarkably different results, we do not present them in this paper but provide them on request.

[3] According to the AFME, the cumulated volume of credit risk being transferred through securitization in the EU-13 countries plus Switzerland between 1997 and 2010 amounts to a total of € 3,522.74 billion. Note, however, that the AFME aggregates the volumes of securitization transactions from stock-listed and non-stock-listed banks, other financial intermediaries, industrial companies as well as governmental authorities. Unfortunately, the amount of the isolated cumulated volume of securitization transactions from banks is not available.

securitization transactions continuously increased over the sample period reaching their peaks in 2006 and at the beginning of 2007, followed by a sharp decrease due to the U.S. subprime crisis starting in mid-2007 and the European sovereign debt crisis beginning in 2009. A similar development is shown by Figure 1c, which additionally displays the percentage of sample banks that engaged in the securitization business per year during the entire sample period. Furthermore and as shown by Figures 2a and 2b, some banks issued more than one securitization transaction during the sample period ("frequent issuers"). In this case, we aggregate the volumes of a frequently issuing bank's single transactions and calculate a cumulated volume per year.

With regard to our empirical analysis, we employ the one-period lagged cumulated volume of securitizations per bank and year (*Securitization* $_{(t-1)}$). Notes on this and all further variables, respective data sources, descriptive statistics and correlation coefficients are reported by Tables 3, 4 and 5. We are aware of the fact that including a ratio, such as securitization to total assets or securitization to net loans, would better account for the banks' different opportunities to securitize credit risk. However, we do not use these ratios for two reasons. *First*, we observe that the measure of (the log of) total assets may cause multicollinearity since it exhibits a high mean variance inflation factor (VIF) and is strongly correlated with two further included bank-specific measures (net interest margin and leverage, see Section 2.1.3), which are necessary to empirically model the direct and indirect impact of credit risk securitization on a bank's ETR. *Second*, as regards a bank's net loans, we do not use this measure to build a ratio since we employ a bank's net loans as an instrument variable for later instrument variable estimations. Thus, instead of building securitization ratios, we employ the cumulated securitization volume per bank *i* and year *t*, but additionally include separate bank-specific control variables, which proxy for a bank's size and its credit exposure (see Section 2.1.3). Moreover, we lag the securitization measure by one year to basically address a probable reverse causality between a

bank's tax burden and its incentive to securitize loans.[4] In addition and as argued in Section 1, next to the direct effect, the impact of securitization on a bank's ETR is also determined by the bank's investment strategies ex post and the way the bank's capital exposure is restructured after securitization (indirect effect). Therefore, lagging the securitization measure by one period appropriately allows time for this indirect effect.

2.1.2 Effective tax rate (ETR)

Related empirical tax literature proposes a firm's *effective tax rate* (ETR) as an appropriate variable to measure tax avoidance (e.g., Dyreng et al., 2017; Hanlon and Heitzman, 2010; Chen et al., 2010; Dyreng et al., 2008). In fact, different types of ETR measures are used in the tax literature.[5] Next to book ETRs, especially cash ETRs are widely accepted since they reflect a broader range of tax avoidance activities than book ETRs.[6] Unfortunately and in contrast to U.S. banks, European banks do hardly disclose cash ETRs. Instead, we have to rely on the European banks' book ETRs, which we retrieve from the *Bankscope* database compiled by *FitchRatings* and provided by *Bureau van Dijk*.

The book ETR is calculated as the annual accounting value of tax expense divided by the annual accounting value of pre-tax profits. Built this way, the book ETR suffers from two limitations when measuring tax avoidance (e.g. Dyreng et al., 2017; Gebhart, 2017). *First*, many tax avoidance strategies aim at reducing current tax expense and increasing deferred tax

[4] We control for probable reverse causality in a more sophisticated way by performing Granger-causality tests and a 2SLS instrumental variable estimation approach in Section 3.3.

[5] See Gebhart (2017) for a detailed overview, discussion and analysis of different measures of corporate tax avoidance.

[6] These tax avoidance activities include income shifting from high-tax to low-tax jurisdictions, investment in tax favored assets, accelerated depreciation deductions and tax credits (e.g., Dyreng et al., 2017). Note, however, that many tax avoidance strategies do not play a major role for banks and hence, can be ignored (e.g., strategic transfer pricing, accelerated depreciation deductions or tax credits for research and experimentation).

expense at the same time. Hence, since total tax expense in the numerator of the book ETR ratio includes both, current and deferred tax expense, the book ETR may not thoroughly reflect tax deferral strategies by banks. *Second*, reductions of the tax expense do not only result from active tax planning strategies by banks, but they may also be due to changes in valuation allowances or due to book accruals. Both effects are included in the numerator of the book ETR and cannot be isolated.

As a consequence of both shortcomings, and triggered by the fact that our sample period includes turbulent periods for banks due to the global financial crisis and European sovereign debt crisis, the annual book ETRs in our sample exhibit a high volatility (with values of even more than 100 per cent) while also negative values (due to a negative pre-tax income or tax expense) are observed. For example, we find the highest ETR at 1,008.46 per cent for the Italian *Banca Monte Dei Paschi di Siena SpA* in 2008. In this year, when the financial crisis spread to Europe, pre-tax profits of this bank collapsed sharply and the tax expense (0.9298 bn. €) clearly exceeded the pre-tax profit (0.0922 bn. €). As another example, we observe the lowest ETR at -265.12 per cent for the German *Commerzbank AG* in 2001. In this year, this bank disclosed a negative tax expense of -0.114 bn. € due to tax deferral strategies while the pre-tax income amounted to 0.043 bn. €. Performing a detailed outlier analysis,[7] we identify eight positive and six negative values as outliers in our time series of ETR data, which accounts for approximately 1.5 per cent of the entire data. Taking this into account, we winsorize the time series of ETR data and replace the outliers by the next values counting inwards from the outliers respectively. We include both the winsorized ETR and the outlier-infected ETR in our baseline regression model and discuss differences in respective regression results in Section 3.1.

[7] In a first step, we investigate a leverage-versus-residual-squared plot and find high leverage and large residuals in 14 cases, which we define as outliers. In a second step, we compute a discrepancy measure (Studentized residuals), a leverage measure and an influence measure (DFBETA) as residual statistics. Results from these statistics confirm the outliers that have been identified in the first step.

2.1.3 Control variables

Next to a bank's cumulated securitization volume per year as our independent variable of main interest, we employ further measures that may have an effect on a bank's ETR. Some of the following control measures are well-accepted determinants of ETRs from non-financial firms as proposed by related empirical studies from the field of empirical tax research (e.g., Dyreng et al., 2017; Kraft, 2014). We expand this set of control variables by several variables that are more specific for banks.

To begin with, we control for the effect of bank size (*Size*) on the ETR. As mentioned in in Section 2.1.2, we do not employ a bank's (log of) total assets as a proxy for bank size since we observe that this variable exhibits a high mean variance inflation factor (VIF) while it is highly correlated with two further included bank-specific measures (net interest margin and leverage), which, however, are necessary to empirically model the direct and indirect impact of credit risk securitization on a bank's ETR by structural equation models (Section 3.2). Thus, in order to avoid biased estimation results due to simultaneity and multicollinearity, we employ the natural log of a bank's total operating expense as an alternative measure of bank size. This measure includes staff expenses but also regulatory expenses, which clearly increase with an increasing bank size. Empirical results concerning the impact of a firm's size on its ETR are ambiguous. While some related tax studies document a negative impact (e.g., Richardson and Lanis, 2007; Porcano, 1983; Siegfried, 1972) others find a positive effect (e.g., Rego, 2003; Zimmerman, 1983), or no relationship at all (e.g., Liu and Cao, 2007; Stickney and McGee, 1997).

We further include the ratio of non-interest income to interest income in order to control for a bank's business model (*Business Model*). The impact of a bank's business model on the ETR is not clear. Given that banks, which engage in the fee-based business (investment banking, venture capital, and trading activities), have additional investment opportunities, diversify their revenues more efficiently and thus, are more profitable (Higgins et al., 2015; Brunnermeier et

al., 2011), one may argue that these banks exhibit higher tax expenses. In contrast, however, it is also suggested that banks, which stronger engage in more risky fee-based activities may exhibit a higher risk exposure (Lepetit et al., 2008). Next to write-downs and value-adjustments, a higher risk exposure increases the regulatory capital basis and hence, decreases profits and the tax burden.

A bank's net interest margin (*Profitability*) is employed to control for the effect of a bank's profitability on the ETR. Among the different measures of bank profitability, we employ the net interest margin since this measure is most meaningful when investigating the direct and indirect effect of a securitization transaction on the issuing bank's ETR (Section 3.2). The net interest margin is built as the difference between the accounting values of a bank's interest income and interest expense. Results from related tax studies focusing on the relationship between profitability and ETRs are mixed. One part of the literature provides empirical evidence that more profitable firms have higher ETRs (e.g., Armstrong et al., 2012; Liu and Cao, 2007; Richardson and Lanis, 2007). In contrast, other studies document a significantly negative relationship between profitability and a firm's ETR (e.g., Dyreng et al., 2017; Kraft, 2014). The negative effect is traced back to the fact that more profitable firms may have a stronger incentive to reduce their tax burden through tax deductions and thus, are more frequently engaged in aggressive tax planning and tax avoidance strategies (e.g., Kraft, 2014; Rego, 2003). Similarly, it is also suggested that more profitable firms may more efficiently use tax exemptions and credits (Manzon and Plesko, 2002).

Furthermore, we include a measure of a bank's leverage ratio, which is built as the accounting values of total debt divided by total equity per year (*Leverage*). Empirical evidence provided by related tax studies reveals that the ETR may decrease with an increasing leverage ratio (e.g., Dyreng et al., 2017; Armstrong et al., 2012; Stickney and McGee, 1982). This negative relationship is due to the fact that European tax regulations treat expenses associated

with a restructuring of the capital structure differently, i.e. interest expenses for debt are usually tax-deductible (known as the "tax-shield"), while dividends are not (Kraft, 2014). Moreover, it is also argued that banks with higher leverage ratios exhibit stronger debt covenants. As a consequence, more risky investments with profits above the market average are less likely due to a stronger disciplining and monitoring by debtholders (Berger and Bouwman, 2013; Rajan and Zingales, 1995; Calomiris and Kahn, 1991), which may finally result in lower tax expenses.

Turning to country-, market- and regulation-based control variables, we initially employ the natural log of a country's GDP as a well-accepted macroeconomic control variable for the state of the economy (*GDP*). We expect a positive impact of this measure on a bank's ETR since banks operating in countries with a higher economic performance may have greater investment opportunities and may pay higher taxes (Adrian et al., 2010; Wheelock and Wohar, 2009; Estrella and Gikas, 1991).

We additionally include statutory corporate income tax rates from the European countries in our sample ($CIT_{(t-1)}$). These tax rates show the basic central government statutory (flat or top marginal) corporate income tax rates, which include a surtax (if any), and which are adjusted (if applicable) to show the net rate when the central government provides a deduction in respect of sub-central income tax. We lag the CIT measure by one period to allow time for the probable impact on a bank's ETR. Suggesting that a large part of the variation in a bank's ETR is determined by the variation of the domestic country's corporate income tax rate, we expect a positive impact of this measure on the ETR.

We proceed and control for differences in European banking market structures by including the Lerner-Index (*Lerner-Index*) (Lerner, 1934). The relationship between the degree of a bank's market power and the ETR is ambiguous. On the one hand, it is argued that larger monopolistic banks have more political power and more resources to manage taxes in their favor (Dyreng et al., 2008; Richardson and Lanis, 2007; Siegfried, 1972). On the other hand,

given that monopolistic banks may charge interest rates and provisions above marginal costs and thus, are more profitable (Boyd et al., 2004; Matutes and Vives, 2000; Freixas and Rochet, 2008), one may argue that banks with greater market power have higher tax liabilities. In addition, the political cost theory proposes that larger and more profitable monopolistic banks have greater public visibility, which encourages governments to charge higher corporate income tax rates from these banks in order to achieve a transfer of wealth (Watts and Zimmerman, 1990; Zimmermann, 1983).

Finally, we control for differences in banking regulations between the European countries in our sample by employing the Capital Regulatory Index as proposed by Barth et al. (2013, 2008, 2004, 2001) (*Capital Regulation*). This yearly index reflects the intensity of regulatory capital requirements in each country while a higher index level indicates greater capital regulatory requirements for banks. The impact of the strength of regulatory capital requirements on a bank's ETR is not clear. On the one hand, stronger requirements may force banks to manage their credit risk exposures more efficiently (Beltratti and Stulz, 2012), which leads to decreasing credit costs and ceteris paribus, higher profits and tax payments. On the other hand, stronger regulatory requirements may also limit a bank's financial leeway and investment opportunities (Laeven and Levine, 2009), which may result in decreasing profits and tax expenses.

2.2 Empirical model

We employ a random effects model on panel data in order to empirically investigate if securitizing credit (risk) has an impact on a bank's ETR:

$$y_{it} = \beta_1 c_{it-1} + \sum \beta_k x_{it,k} + \mu_{it}, \qquad (1)$$

with $\mu_{it} = \alpha_i + \varepsilon_{it}$. The ETR of bank *i* in a respective year *t* is represented by y_{it} while c_{it-1} is the one-period lagged cumulated volume of securitizations from bank *i* in a respective year *t*. The vector $x_{it,k}$ includes control variables as described in Section 2.1.3. ε_{it} is an error term and α_i as well as β_1 and β_k denote the parameters to be estimated.

Performing detailed model diagnostics, we initially control for multicollinearity between our independent variables. Since the mean variance inflation factor (VIF) of all right-hand side variables from our baseline regression is low at 1.27, we rule out that our estimation results are biased by multicollinearity. We further investigate if regressing our model by random effects is appropriate. Due to the fact that the standard Hausman test (1978) is not reliable under heteroscedasticity, we employ a generalization of the Hausman approach by Arellano (1993). Adopting this approach, the null hypothesis that the individual specific effect is uncorrelated with the independent variables cannot be rejected at $\rho < 0.619$ suggesting that employing a random effects model is suitable. In addition, taking into account that we observe both a strong between- and within-variation of our independent variables, which is especially true for the securitization measure, a generalized-least-squares (GLS) estimation within a random effects model is reasonable, since the GLS estimator considers both types of variation as a weighted average. We also employ time dummies to control for time-specific effects (e.g., trends in banking regulation; common shocks to the European banking market). A joint F-test rejects the null hypothesis that time dummies for all years are equal to zero at $\rho < 0.000$ suggesting that controlling for time-specific effects is appropriate. Furthermore, while several banks in our sample continuously securitize over the entire sample period and others do not, we address heterogeneous securitization frequencies by clustering standard errors at the bank-level. Following Greene (2000), we utilize a modified Wald statistic for groupwise heteroscedasticity in the residuals while allowing for unbalanced panels in order to verify whether the use of clustered-robust standard errors enhances our model fit. The Wald test statistic rejects the null-

hypothesis of homoscedasticity at $\rho < 0.000$ suggesting that clustering at the bank-level is necessary to address a possible downward bias and misspecification in the estimated standard errors (Moulton, 1990).

3. Empirical results

3.1 Baseline regressions

We start the empirical analysis with regression (1) in Table 6, which includes the winsorized ETR measure as presented in Section 2.1.2. As shown, the *securitization* measure enters this regression significantly negative at the five-percent level suggesting that European banks may reduce their effective tax rates through securitization. Accordingly, we provide first evidence that European banks pursue tax avoidance through securitization, which would describe a further motive to engage in the securitization business. As discussed in Section 1, the negative impact of securitization on the issuing bank's ETR can be disentangled into a direct and indirect effect. We empirically investigate both effects in further detail by regressing structural equation models in Section 3.2.

Among the bank-specific control variables, bank *size* turns out to be a significant negative determinant of the ETR, which corresponds to findings from previous tax studies (e.g., Dyreng et al., 2008; Richardson and Lanis, 2007). Our result suggests that larger banks have a greater potential to exploit tax avoidance opportunities. In particular, it is argued that larger banks usually become experts at tax planning and hire tax experts with more expertise in order to optimize the bank's activities to achieve the highest possible tax savings (Porcano, 1983; Siegfried, 1972).

As further shown, *profitability* has a significantly positive impact on a bank's ETR. Our result confirms results from previous tax research papers, which empirically document that more profitable firms have higher ETRs (e.g., Armstrong et al., 2012; Liu and Cao, 2007;

Richardson and Lanis, 2007). In contrast, we do not find that more profitable banks have stronger incentives to reduce their tax burden through tax deductions and thus, are more frequently engaged in aggressive tax planning and tax avoidance strategies (e.g., Kraft, 2014; Rego, 2003; Manzon and Plesko, 2002).

Turning to country-, market- and regulation-based control variables, we initially find a significantly positive relationship between the *GDP* measure and the banks' ETRs. This result indicates that banks operating in countries with a higher economic performance have greater investment opportunities, which should result in higher pre-tax profits and a higher tax liability (Adrian et al., 2010; Wheelock and Wohar, 2009; Estrella and Gikas, 1991).

It is further shown that the *Lerner-Index* enters the regression significantly positive at the five-percent level indicating that banks with greater market power exhibit higher ETRs. Our finding is in line with theoretical arguments suggesting that monopolistic banks charge interest rates and provisions above marginal costs and thus, are more profitable and have a higher tax expense (Boyd et al., 2004; Matutes and Vives, 2000; Freixas and Rochet, 2008). In addition, our result confirms arguments from the political cost theory that larger and more profitable monopolistic banks have greater public visibility, which encourages governments to charge higher corporate income tax rates from these banks to achieve a transfer of wealth (Watts and Zimmerman, 1990; Zimmermann, 1983).

Finally, *capital regulation* enters regression specification (1) significantly negative at the one-percent level documenting that stronger regulatory capital requirements may limit a bank's financial leeway and investment opportunities, which results in decreasing pre-tax profits and tax expense (Laeven and Levine, 2009). In contrast, we do not find that stronger regulatory capital requirements force banks to more efficiently manage their credit risk exposures (Beltratti and Stulz, 2012), which results in decreasing credit costs and – ceteris paribus – higher profits from lending and hence, a higher tax expense.

Regression specification (2) in Table 6 reports results from regressing our baseline model when including the outlier-infected ETR instead of the winsorized measure. As shown, the baseline results from specification (1) are qualitatively reiterated. However, coefficients of all significant variables are upward biased while the model fit (as measured by the adjusted R-squared) decreases. Taking this into account, we choose to pursue our analysis with the more conservative winsorized ETR measure.

Reconsidering empirical studies provided by Han et al. (2015) and Gong et al. (2015), who provide evidence that rising statutory corporate income tax rates (CITs) may trigger a domestic bank's decision to securitize, we build an interaction variable which is built by multiplying the securitization measure with the *CIT* measure. As shown by regression specification (3), this interaction variable enters the regression significantly negative at the one-percent level while the coefficient value remarkably increases as compared to the coefficients of the single securitization measure as included in specifications (1) and (2). Taking this into account, our finding suggests that tax avoidance effects through securitization increase with increasing statutory corporate income tax rates. If this is true, a stronger engagement in the securitization business by European banks may be due to the fact, that banks perform tax avoidance through securitization in order to compensate an increase in their tax liabilities due to rising statutory corporate income tax rates.

3.2 Direct and indirect effect

As argued in detail in Section 1, the negative impact of securitization on a bank's ETR may be explained by a direct and an indirect effect. As a *direct effect,* selling loans to the SPV immediately reduces a bank's interest income from lending, which – ceteris paribus – may reduce a bank's pre-tax profits and hence, its tax expense and ETR. The *indirect effect* depends on the way a bank uses the liquidity ex post, which has become available from selling a

securitization transaction. (1) Using cash from securitization to reinvest into less (more) profitable interest-bearing assets (esp. loans), reduces (increases) the bank's interest income, pre-tax profits and hence, tax liability. (2) Using cash from securitization to release own liabilities results in a decrease in a bank's leverage ratio and hence, in a smaller "tax-shield" (Cebenoyan and Strahan, 2004), which in turn should raise the bank's ETR.

We empirically analyze the direct and indirect effect by employing a structural equation modeling (SEM) approach based on a simple path analysis without latent variables (Kline, 2005; Wright, 1921). Using this technique allows for the inclusion of relationships among variables that serve as predictors in one single model. As shown by Figure 3, we employ two simple mediation models. These models assume that the effect of securitization on a bank's ETR is explained through the fact that securitization affects a bank's profitability and leverage ratio while in turn, these mediator variables have an impact on the ETR.

Results from SEM regressions are reported in Table 7 and commonly used fit statistics of both structural equation models (model chi-square, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and the Standardized Root Mean Square Residual (SRMR)) are displayed at the bottom of the table. We use the unlagged securitization measure to investigate the direct effect, whereas we employ the one-period lagged securitization measure to analyze the indirect effect, which is observed after securitization. As shown by regression specifications (1) and (2), we find that the unlagged and one-period-lagged securitization measure have a significantly negative impact on bank profitability while profitability still affects the ETR significantly positive, but to a much smaller extent as compared to our baseline regressions. Our finding initially confirms the direct effect of securitization on a bank's ETR. Thus, the negative direct impact of securitization on a bank's ETR may be explained by the fact that loans are sold to the SPV during a securitization transaction, which provokes an immediate decrease in bank profitability (as measured by the

net interest margin), and which in turn reduces the bank's pre-tax profits and hence, tax burden. Furthermore, we also provide evidence for the indirect effect since the significantly negative impact of the one-period lagged securitization measure on bank profitability suggests that issuing banks in our sample pursue a less profitable reinvestment strategy after securitization. As a consequence, the bank's pre-tax profits, tax expenses and ETR continue to decrease. Finally, Table 7 reveals that we do not provide any empirical evidence for a significant mediating relationship between securitization, an issuing bank's leverage ratio ("tax-shield") and its ETR. Therefore, both the direct and indirect effect of securitization on an issuing bank's ETR may solely be explained by a decrease of the net interest margin due to securitization.

3.3 Reverse causality

A priori, the direction of causality between securitization and effective tax rates is not clear. Against the background of our baseline findings, reverse causality may arise if it is assumed that banks exhibiting higher tax liabilities have a stronger incentive to utilize securitization as an instrument to pursue tax avoidance. Although we employ a one-period lagged securitization measure in our baseline regression model to basically address this possible endogeneity problem, we control for reverse causality in a more sophisticated way by performing *Granger-causality tests* and a *2SLS instrument variable estimation approach*.

To begin with, in our case the Granger test (Granger, 1969) is used as a standard econometric procedure to explore the causal directions between securitization and effective tax rates. In a first step, testing for Granger causality requires that the time series of the ETR and securitization measures are covariance stationary. We perform a Fisher-type test for unit roots that is suitable for finite panel datasets (Choi, 2001). Based on an Augmented-Dickey-Fuller (ADF; Dickey and Fuller, 1981; 1979) and Phillips-Perron test (Phillips and Perron, 1988), unit-root tests are conducted for each panel individually. Subsequently, p-values from these

tests are combined to produce an overall test. As shown in Table 8, the null hypothesis that the panels contain a unit root is rejected for both time series.

In a second step, both the Akaike Information Criterion (AIC) (Akaike, 1974) and the Schwarz Information Criterion (SIC) (Schwarz, 1978) are used to find an appropriate number of lags for the ETR and securitization measure to be included in the autoregressive analysis. Both criteria suggest an optimal lag order of 1 for each of the series. However, since the Granger-causality test is very sensitive to the number of lags included in the regression, we additionally perform the analyses with three lags, then drop the third and then the second if they are not significant and if the significance level of the F-test does not decline. This procedure again suggests an optimal lag order of 1 for both time series.

In a final third step, the Granger-causality tests are performed. The Granger test involves two separate autoregressive analyses. In a first regression, the securitization measure is regressed on the first lag of itself and on the ETR measure. In turn, the ETR measure is regressed on the first lag of itself and on the lagged securitization measure in the second regression. As reported by Table 8, while control variables exhibit expected signs in both regressions, the ETR measure enters regression (1) insignificantly negative, whereas the coefficient of the one-period lagged securitization measure is observed to be significantly negative at the ten-percent level in regression (2). Additionally taking respective F-tests into account, results from Granger tests reveal that a bank's ETR does not Granger-cause securitization, whereas securitization Granger-causes a change in a bank's ETR as reported by our baseline findings from Table 6. Accordingly, results from Granger-causality tests provide first evidence that our baseline results may not be biased by reverse causality.

We proceed and employ a 2SLS instrument variable estimation approach next to the Granger-causality tests. We use the one-period lag of an issuing bank's amount of net loans as an instrument for securitization since the number and volume of securitization transactions

clearly depend on the size of a bank's loan portfolio. Corresponding to our baseline model we employ a two-stage least squares (2SLS) IV estimator with random effects, time dummies and a robust-clustering on the bank-level. Table 9a reports that the instrument variable enters the first stage regression significantly positive at the one-percent level suggesting a positive impact of the loan portfolio size on a bank's securitization activity. Furthermore, Table 9b shows that results from the IV regressions on the second stage reiterate our main finding of a negative relationship between securitization and an issuing bank's ETR while most of the control variables remain robust.

Concerning the "quality and strength" of our instrument variable employed, the correlation matrix in Table 5 reports that the instrument variable is nearly uncorrelated with the ETR but sufficiently high correlated with the securitization measure. Furthermore, results from tests of underidentification and weak identification reveal that the IV regression results are robust to issues of instrument validity. We use the rank statistic proposed by Kleibergen-Paap (KP, 2006) which is robust under heteroscedasticity and robust-clustering in the case of a single endogenous regressor and a single instrument. As Table 9a reports, the KP rank LM statistic (underidentification test) is at 7.13 with $\rho = 0.008$ rejecting the null hypothesis that the equation is underidentified. The KP rank Wald F statistic (weak identification test) is at 19.47 and hence very close to the Stock and Yogo (2005) ten-percent critical value of 16.38. In addition, since the KP rk Wald F statistic satisfies the Staiger and Stock (1997) "rule of thumb" that the F-statistic should be at least at 10, we reject the null hypothesis of a weak correlation between our instrument and the endogenous regressor.

3.4 Further analyses

In the following, we analyze the negative relationship between securitization and an issuing bank's ETR in greater detail by controlling for (i) the issuance frequency, (ii) the type of a

securitization transaction, (iii) the degree of standardization, (iv) the respective underlyings of a securitization transaction and (v) different stages of securitization activities in Europe.

To begin with, reconsidering Figures 2a and 2b it is revealed that some banks in our sample securitize more than once during the sample period. Taking this into account, we control if the negative impact of securitization on ETRs differs for frequently issuing banks. Accordingly, we build a dummy variable that takes on the value of 1 if a bank belongs to the group of frequent issuers, and 0 otherwise (*Freq. Issuer*). Subsequently, we interact the dummy variable with the securitization measure. As shown by regression specification (1) in Table 10, the interaction variable enters the regression significantly negative at the five-percent level. However, as the coefficient value of the interaction variable is only marginally higher as compared to the coefficient of the single securitization measure from our baseline regression (1) in Table 6, we do not find that the negative impact of securitization on ETRs remarkably increases for frequently issuing banks.

In a next step, we include true sale and synthetic transactions and control, if the effect of credit risk securitization on a bank's ETR may depend on the type of transaction. As shown by regression specifications (2a) and (2b), a significantly negative impact on a bank's ETR is observed in the case of true sale transactions only. This result was expected since only in the case of true sale transactions loans are completely transferred out of the bank's balance sheet, which results in an immediate decrease in net interest income and hence, tax burden.

As a further sensitivity analysis, we control for the degree of standardization and differentiate between opaque and non-opaque securitization transactions. Opaque transactions are issued on complex loan arrangements including securitizations of collateralized debt obligations (CDOs) and other less transparent unspecified underlyings (Others). In contrast, non-opaque transactions are characterized by higher levels of standardization, transparency, collateralization and granularity. This group of transactions comprises securitizations of

residential mortgage backed securities (RMBSs), commercial mortgage backed securities (CMBSs), credit cards receivables (CCs) and consumer loans (CLs). As shown by regression specifications (3a) and (3b), we provide evidence of a significantly negative relationship between non-opaque securitization transactions and ETRs, whereas we do not find any statistical effect for opaque transactions. Further increasing the granularity, we additionally investigate the impact of single underlyings of a securitization transaction on an issuing bank's ETR. As reported by Table 11, we find a negative relationship between the ETR and the securitization of residential mortgage backed securities (RMBS) and credit card receivables (CC) respectively, whereas we do not find a statistical effect for all remaining underlyings.

Finally, as discussed in Section 2.1.1, our time series of securitization transactions comprises the beginning and the boom phase of securitization activities in Europe, the global financial crisis and European sovereign debt crisis period as well as the drying up of the securitization market until the end of 2010. Taking this into account, it is imperative to control if the negative impact of securitization on the banks' ETRs differs during these time periods. Accordingly, we split the entire sample period into three sub-periods ranging from 1997 to 2001 (*onset stage*), from 2002 to 2007 (*boom stage*) and from 2008 to 2010 (*crises stage*). As shown by regression specifications (1) - (3) in Table 12, we provide evidence for a negative relationship between securitization and the banks' ETRs for the boom stage only while this negative impact is noticeably stronger as compared to our baseline result. In contrast, we do not provide any evidence for a negative relationship between securitization and ETRs during the onset and crisis stage. Latter results, however, have to be taken with caution since especially the empirical analysis of the onset and crisis stage may suffer from a (too) small number of observations.

4. Summary and implications

Employing a unique sample of 956 credit risk securitization transactions issued by 64 stock-listed European banks across the EU-13 plus Switzerland over the period from 1997 to 2010 we are the first who investigate the impact of credit (risk) securitization on an issuing bank's effective tax rate. Our analysis reveals that banks may reduce their tax expenses through securitization via a direct and indirect channel. The results suggest that securitization may be described as an appropriate instrument to pursue tax avoidance, while the tax expense-reducing effect through securitization becomes even stronger under increasing statutory corporate income tax rates. Our baseline findings remain robust under various robustness checks, especially when controlling for a probable reverse causation between an issuing bank's level of tax burden and the incentive to securitize.

The analysis at hand provides important implications for tax policies, the banking regulation and the ongoing process of revitalizing the European securitization market. Recent regulatory and industry initiatives mainly focus on an increase in transparency and an implementation of standardization levels to revitalize the European securitization market under much sounder conditions (European Parliament and the Council, 2017; European Parliament, 2016; EBA, 2014; BCBS, 2012; ECB, 2011). Obviously, these initiatives are important, keeping in mind that securitization is commonly accepted as one of the main triggers of the global financial turmoil. However, against the background of our empirical results, one should also pay attention to the relationship between taxation and securitization when revitalizing the European securitization market. Thus, as we find that securitization enables banks to reduce their pre-tax profits and tax burden, tax legislators and banking regulators should be aware of this fact when designing tax laws and banking regulations.

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Empirical Appendix

Table 1
Geographical distribution of the securitizing European banks in the sample

Country	Bank	
Austria	Erste Group Bank AG	
Belgium	Dexia SA	KBC Groupe NV
Denmark	Danske Bank A/S	Sydbank
France	BNP Paribas Natixis SA	Crédit Agricole SA Société Générale SA
Germany	Bayerische Hypo- und Vereinsbank (UniCredit Bank AG) Deutsche Bank AG Dresdner Bank AG IKB Deutsche Industriebank AG	Commerzbank AG Deutsche Postbank AG Hypo Real Estate Holding AG
Greece	EFG Eurobank Ergasias	Piraeus Bank SA
Ireland	Allied Irish Banks Plc DePfa Bank Plc	Bank of Ireland
Italy	Banca Antonvenata Banca Lombarda e Piemontese Banca Nazionale del Lavoro SpA Banca Popolare Italiana/di Lodi Intesa Sanpaolo/Banca Intesa Sanpaolo IMI	Banca Carige SpA Banca Monte Dei Paschi di Siena SpA Banca Popolare di Milano SCaRL Capitalia Group/Banca di Roma Mediobanca SpA UniCredit SpA
Netherlands	ABN Amro (RBS Holding NV) ING Groep NV	Fortis Bank SNS Reaal NV (SRH NV)
Portugal	Banco BPI SA Banco Comercial Português, SA	Banco Espirito Santo SA
Spain	Banco Bilbao Vizcaya Argentaria SA Banco de Valencia SA Banco Pastor SA Banco Santander SA Caja de Ahorros del Mediterraneo	Banco de Sabadell SA Banco Espanol de Crédito SA Banco Popular Espanol SA Bankinter SA
Sweden	Nordea Bank AB Swedbank AB	Skandinaviska Enskilda Banken AB
Switzerland	Credit Suisse Group AG	UBS AG
United Kingdom	Abbey National (Santander UK Plc) Barclays Plc HBOS Plc Lloyds TSB Group Plc (Lloyds Banking Group Plc) Royal Bank of Scotland Group Plc	Alliance & Leicester Plc Bradford & Bingley Plc HSBC Holdings Plc Northern Rock Standard Chartered Plc

Table 2
Descriptive statistics of the securitization transactions (in billion €) in the sample (1997 - 2010)

	N	Total Volume	Mean	Standard Deviation	Min	Max
Type of transaction						
True sale Transactions	673	1,390.6620	2.0664	2.8036	0.0016	27.4886
Synthetic Transactions	283	714.2992	2.5240	2.8662	0.0580	22.0000
Underlying asset pool						
Collateralized Debt Obligations	295	655.4450	2.2218	2.5696	0.0580	16.8630
Residential Mortgage Backed Securities	420	1,210.9831	2.8833	3.4079	0.0016	27.4886
Commercial Mortgage Backed Securities	93	95.1984	1.0236	1.1382	0.1990	7.0920
Credit Cards Receivables	24	28.8900	1.2037	1.9085	0.0560	9.9359
Consumer Loans	59	49.5661	0.8410	0.8392	0.0250	5.2751
Others	65	64.8785	0.9981	0.7645	0.0280	3.1000
Total Transactions	956	2,104.9612	2.2018	2.8285	0.0016	27.4886

Note that the total volumes are cumulated over the entire sample of 64 banks and the entire sample length of 14 years, whereas the mean, standard deviation, minimum and maximum refer to single securitization transactions.

Figure 1a
Development of the number of securitization transactions in the sample per year

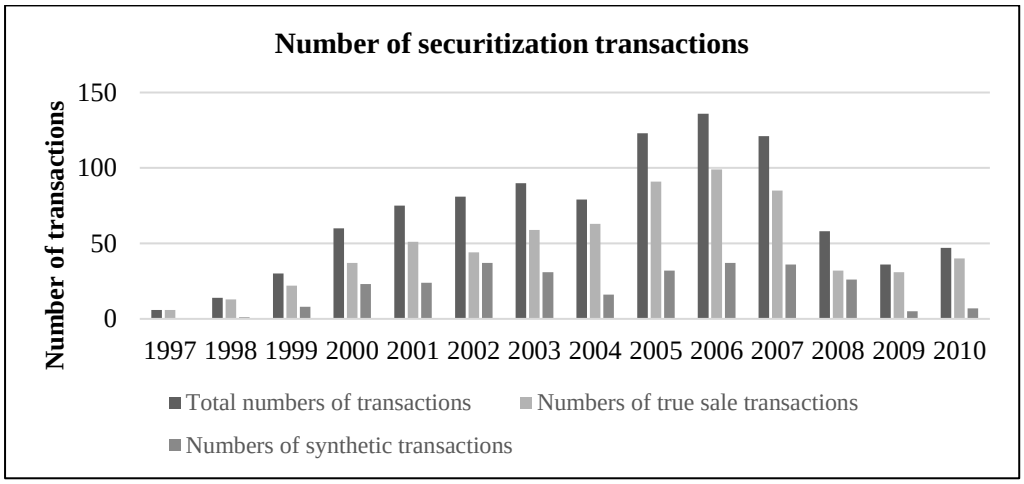


Figure 1b
Development of the volume of securitization transactions in the sample per year

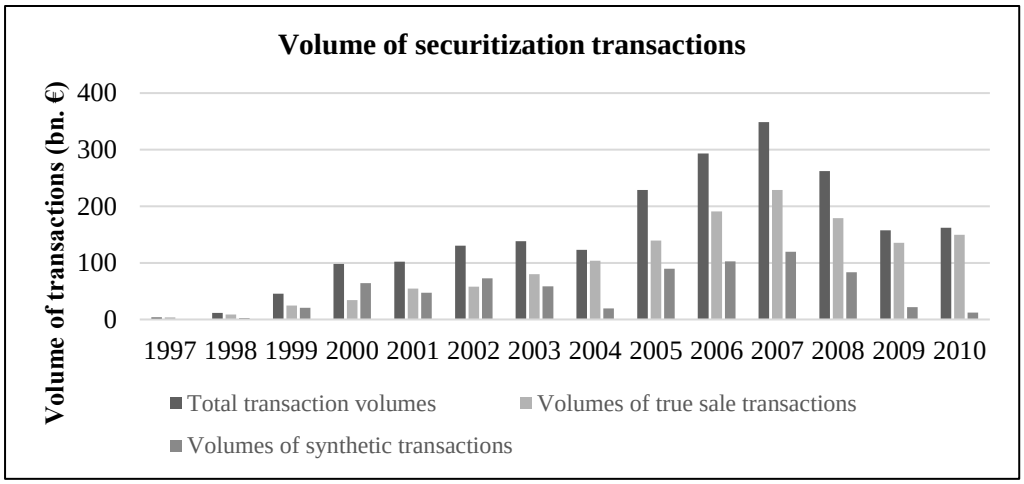


Figure 1c
Percentage of sample banks that engaged in the securitization business per year

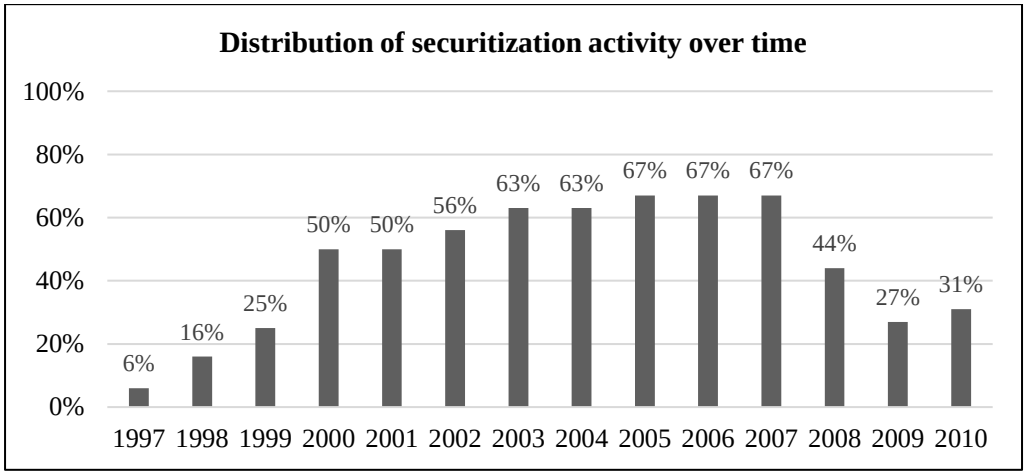


Figure 2a
Frequent issuers in the sample – by the number of securitization transactions

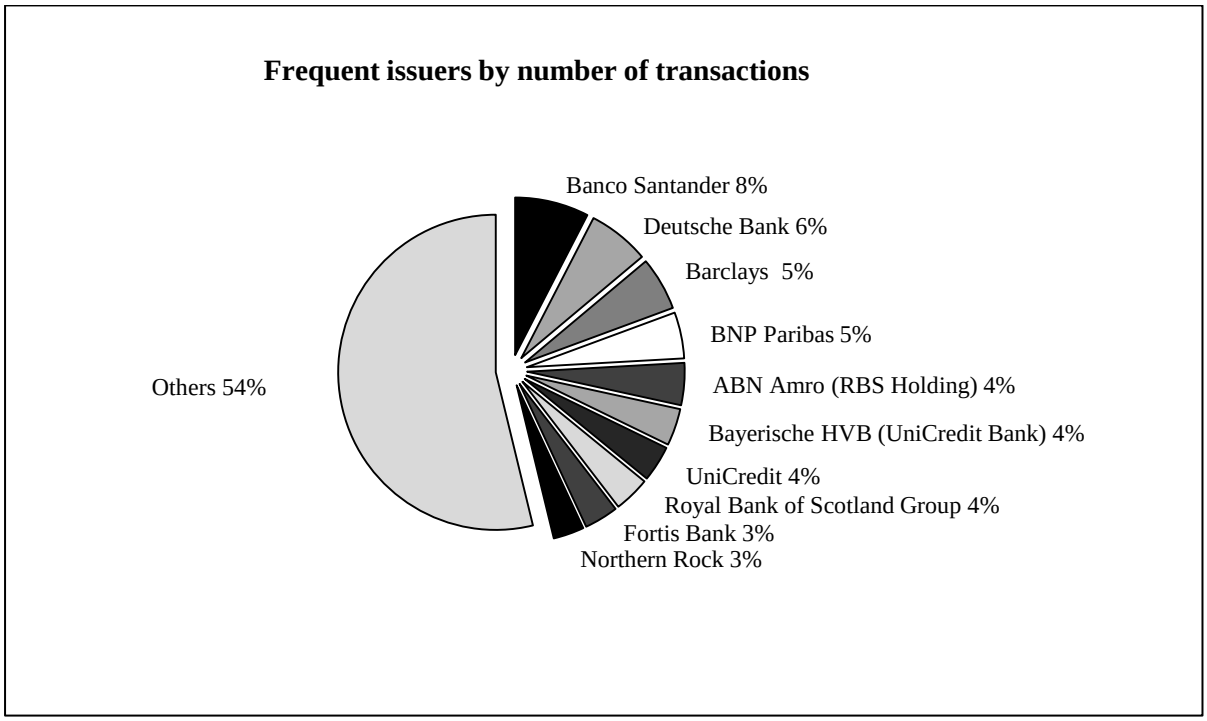


Figure 2b
Frequent issuers in the sample – by the volume of securitization transactions

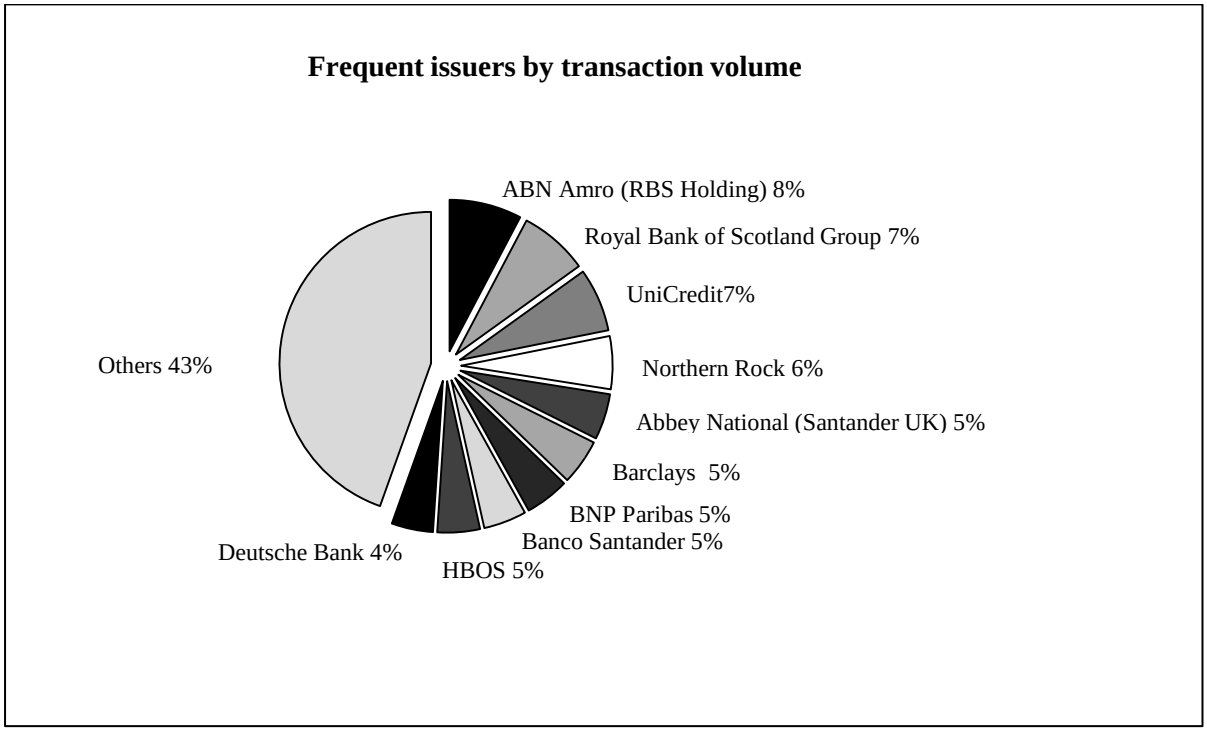


Table 3
Notes on variables and data sources

Variable	Description	Data Sources
ETR (not winsorized)	A bank's effective tax rate per year. The ratio is calculated as the accounting value of a bank's tax expense divided by the accounting value of a bank's pre-tax profit.	Bankscope, authors' calc.
ETR	Winsorized ETR. Eight positive and six negative ETR values are classified as outliers. They are replaced by the next values counting inwards from the outliers respectively.	
Securitization (t-1)	A bank's cumulated volume of securitization transactions per year in billion €. Lagged by one period.	Moody's, Standard & Poor's, FitchRatings
Securitization (t-1) * CIT (t-1)	Interaction variable. *Securitization (t-1)* is multiplied with the countries' one-period lagged statutory corporate income tax rates (*CIT (t-1)*).	
Freq. Issuer	Dummy variable that takes on the value of 1 if a bank issues more than one securitization transaction per year, and 0 otherwise. Lagged by one period.	
Securitization (t-1) * Freq. Issuer	Interaction variable. *Securitization (t-1)* is multiplied with the dummy variable (*Freq. Issuer*), which identifies frequently issuing banks.	
Securitization (true sale) (t-1)	A bank's cumulated volume of true sale securitizations per year in billion €. Lagged by one period.	
Securitization (synthetic) (t-1)	A bank's cumulated volume of synthetic securitizations per year in billion €. Lagged by one period.	
Securitization (opaque) (t-1)	A bank's cumulated volume of securitizations per year in billion € while the underlying securitization portfolio is based on collateral debt obligations (CDOs) and other unspecified assets (Other). Lagged by one period.	
Securitization (non-opaque) (t-1)	A bank's cumulated volume of securitizations per year in billion € while the underlying securitization portfolio is based on residential mortgage backed securities (RMBSs), commercial mortgage backed securities (CMBSs), credit cards receivables (CCs) and consumer loans (CLs). Lagged by one period.	
Securitization (CDO) (t-1)	A bank's cumulated volume of securitizations per year in billion € while the underlying securitization portfolio is based on collateralized debt obligations (CDOs). Lagged by one period.	
Securitization (RMBS) (t-1)	A bank's cumulated volume of securitizations per year in billion € while the underlying securitization portfolio is based on residential mortgage backed securities (RMBSs). Lagged by one period.	
Securitization (CMBS) (t-1)	A bank's cumulated volume of securitizations per year in billion € while the underlying securitization portfolio is based on commercial mortgage backed securities (CMBSs). Lagged by one period.	
Securitization (CC) (t-1)	A bank's cumulated volume of securitizations per year in billion € while the underlying securitization portfolio is based on credit cards receivables (CCs). Lagged by one period.	

Table 3 (continued)
Notes on variables and data sources

Variable	Description	Data Sources
Securitization (CL) (t-1)	A bank's cumulated volume of securitizations per year in billion € while the underlying securitization portfolio is based on consumer loans (CLs). Lagged by one period.	Moody's, Standard & Poor's, FitchRatings
Securitization (Other) (t-1)	A bank's cumulated volume of securitizations per year in billion € while the underlying securitization portfolio is based on other unspecified assets (Other). Lagged by one period.	
Size	Natural log of a bank's accounting value of total operating expenses (esp. staff and regulatory expenses) per year.	Bankscope
Business Model	Ratio of the accounting values of a bank's non-interest income to interest income per year.	
Profitability	A bank's net interest margin per year. The margin is built as the difference between the accounting values of a bank's interest income and interest expense.	
Leverage	Ratio of the accounting values of a bank's total debt to total equity per year.	
Net Loans (t-1)	Accounting value of a bank's net loans (gross loans minus loan loss reserves) in billion € per year. Lagged by one period.	
GDP	Natural log of a country's gross domestic product (GDP) per year.	World Bank's WDI
CIT (t-1)	One-period lagged statutory corporate income tax rate per country and year. The rate includes a surtax (if any), and is adjusted if the central government provides a deduction in respect of sub-central income tax.	OECD Tax Database
Lerner-Index	The Lerner-Index per country and year. This index measures a bank's level of market power by relating price to marginal cost. Essentially, the index measures the percentage markup that a bank is able to charge over its marginal cost. Index values range between 0 and 1 while higher values indicate greater market power.	Lerner (1934), authors' calc.
Capital Regulation	Capital regulatory index proposed by Barth et al. (2013, 200, 2004, 2001). This yearly index captures information on (i) whether the capital requirements for banks in a country appropriately reflect risk elements, (ii) whether market value losses are deducted prior to the calculation of the capital adequacy ratio, and (iii) which types of funds are employed to establish a bank. Index values range from zero to ten. A higher level of the capital regulatory index indicates greater regulatory requirements and higher capital stringency.	Barth et al. (2013, 2008, 2004, 2001)

Table 4
Descriptive statistics (absolute values in billion €; percent in decimal values)

Variable	N	Mean	Std. dev.	Min	Max
ETR (not winsorized)	851	0.2725	0.4477	–2.6511	10.0846
ETR	851	0.2620	0.2164	–0.9672	0.9779
Securitization (t-1)	809	2.4014	6.2291	0	59.6736
Securitization (t-1) * CIT (t-1)	809	0.7212	1.8312	0	25.3792
Freq. Issuer	896	0.1875	0.3905	0	1
Securitization (t-1) * Freq. Issuer	809	1.5608	5.9216	0	59.6736
Securitization (true sale) (t-1)	809	1.5338	4.2784	0	59.6736
Securitization (synthetic) (t-1)	809	0.8676	0.3655	0	59.4510
Securitization (opaque) (t-1)	809	0.8601	3.2985	0	62.4940
Securitization (non-opaque) (t-1)	809	1.5413	4.3817	0	59.6736
Securitization (CDO) (t-1)	809	0.7836	3.1626	0	57.4080
Securitization (RMBS) (t-1)	809	1.3444	4.2055	0	59.6736
Securitization (CMBS) (t-1)	809	0.1177	0.7143	0	9.7750
Securitization (CC) (t-1)	809	0.0208	0.2610	0	6.1303
Securitization (CL) (t-1)	809	0.0586	0.4145	0	7.1890
Securitization (Other) (t-1)	809	0.0765	0.4093	0	5.0860
Size	843	7.6348	1.3451	4.0518	10.2438
Business Model	824	0.2906	0.2850	–1.2890	3.9316
Profitability	851	0.1902	0.0096	–0.0002	0.0740
Leverage	851	0.2289	0.1460	0.0522	1.6329
Net Loans (t-1)	794	12.9521	14.5120	0.0422	112.8651
GDP	896	13.6109	0.9500	11.1472	15.0740
CIT (t-1)	832	0.3105	0.0759	0.0850	0.5320
Lerner-Index	896	0.1493	0.0601	–0.1250	0.3880
Capital Regulation	896	6.2545	1.9347	2	9

Table 5
Correlation matrix

	ETR (not winsorized)	ETR	Securitization (t-1)	Securitization (t-1) * CIT (t-1)	Freq. Issuer	Securitization (t-1) * Freq. Issuer	Securitization (true sale) (t-1)	Securitization (synthetic) (t-1)	Securitization (opaque) (t-1)	Securitization (non-opaque) (t-1)	Securitization (CDO) (t-1)	Securitization (RMBS) (t-1)	Securitization (CMBS) (t-1)	Securitization (CC) (t-1)	Securitization (CL) (t-1)	Securitization (Other) (t-1)	Size	Business Model	Profitability	Leverage	Net Loans (t-1)	GDP	CIT (t-1)	Lerner-Index	Capital Regulation
ETR (not winsorized)	1.00																								
ETR	0.95*	1.00																							
Securitization (t-1)	-0.07*	-0.12*	1.00																						
Securitization (t-1) * CIT (t-1)	-0.08*	-0.12*	0.99*	1.00																					
Freq. Issuer	-0.04	-0.05	0.45*	0.48*	1.00																				
Securitization (t-1) * Freq. Issuer	-0.06*	-0.11*	0.92*	0.92*	0.55*	1.00																			
Securitization (true sale) (t-1)	-0.06*	-0.10*	0.82*	0.81*	0.42*	0.76*	1.00																		
Securitization (synthetic) (t-1)	-0.05	-0.08*	0.74*	0.74*	0.28*	0.67*	0.23*	1.00																	
Securitization (opaque) (t-1)	-0.03	-0.05	0.74*	0.75*	0.30*	0.72*	0.33*	0.88*	1.00																
Securitization (non-opaque) (t-1)	-0.08*	-0.13*	0.86*	0.84*	0.42*	0.76*	0.92*	0.39*	0.30*	1.00															
Securitization (CDO) (t-1)	-0.03	-0.05	0.73*	0.74*	0.29*	0.71*	0.30*	0.89*	0.99*	0.29*	1.00														
Securitization (RMBS) (t-1)	-0.07*	-0.11*	0.83*	0.81*	0.38*	0.73*	0.90*	0.37*	0.28*	0.98*	0.26*	1.00													
Securitization (CMBS) (t-1)	-0.06*	-0.09*	0.26*	0.23*	0.20*	0.25*	0.23*	0.18*	0.16*	0.26*	0.17*	0.08*	1.00												
Securitization (CC) (t-1)	-0.00	-0.01	0.08*	0.08*	0.14*	0.09*	0.08*	0.05	0.05	0.08*	0.05	0.01	0.09*	1.00											
Securitization (CL) (t-1)	-0.07*	-0.10*	0.15*	0.17*	0.17*	0.16*	0.17*	0.05	0.07*	0.16*	0.07*	0.05	0.12*	-0.01	1.00										
Securitization (Other) (t-1)	-0.01	-0.03	0.33*	0.34*	0.16*	0.32*	0.27*	0.25*	0.39*	0.18*	0.27*	0.19*	-0.02	0.01	0.01	1.00									
Size	-0.08*	-0.11*	0.10*	0.09*	0.16*	0.10*	0.12*	0.03	0.04	0.11*	0.03	0.10*	0.07*	0.08*	-0.03	0.11*	1.00								
Business Model	-0.06	-0.06*	-0.04	-0.03	-0.01	-0.03	-0.04	-0.02	-0.00	-0.06	-0.00	-0.06*	0.01	0.06	0.01	0.00	0.07*	1.00							
Profitability	0.12*	0.19*	-0.21*	-0.20*	-0.22*	-0.19*	-0.17*	-0.17*	-0.13*	-0.21*	-0.14*	-0.19*	-0.17*	-0.02	0.02	0.03	-0.20*	-0.02	1.00						
Leverage	-0.09*	-0.15*	0.13*	0.12*	0.16*	0.12*	0.12*	0.08*	0.03	0.16*	0.04	0.15*	0.12*	0.02	-0.05	-0.07*	0.25*	-0.14*	-0.27*	1.00					
Net Loans (t-1)	-0.09*	-0.07*	0.50*	0.50*	0.49*	0.47*	0.46*	0.32*	0.33*	0.46*	0.32*	0.41*	0.24*	0.11*	0.23*	0.15*	0.13*	0.12*	-0.36*	0.16*	1.00				
GDP	0.06*	0.12*	0.15*	0.17*	0.26*	0.16*	0.16*	0.07*	0.09*	0.15*	0.08*	0.13*	0.11*	0.07*	0.05	0.09*	0.15*	-0.07*	-0.19*	0.03	0.28*	1.00			
CIT (t-1)	0.09*	0.20*	-0.05	-0.00	0.04	-0.02	-0.05	-0.03	0.01	-0.08*	-0.00	-0.06*	-0.13*	-0.01	0.03	0.05	-0.11*	-0.01	0.32*	-0.29*	-0.13*	0.23*	1.00		
Lerner-Index	0.03	0.08*	-0.02	-0.01	0.06*	0.01	0.05	-0.10*	-0.06	0.01	-0.07*	0.02	-0.09*	0.06*	0.05	0.10*	-0.01	0.10*	0.16*	-0.25*	-0.04	0.17*	0.14*	1.00	
Capital Regulation	-0.09*	-0.12*	0.04	0.05	0.13*	0.03	0.10*	-0.05	-0.03	0.08*	-0.02	0.06*	0.04	0.04	0.09*	-0.07*	-0.06*	0.01	0.09*	-0.07*	0.04	0.00	0.05	0.12*	1.00

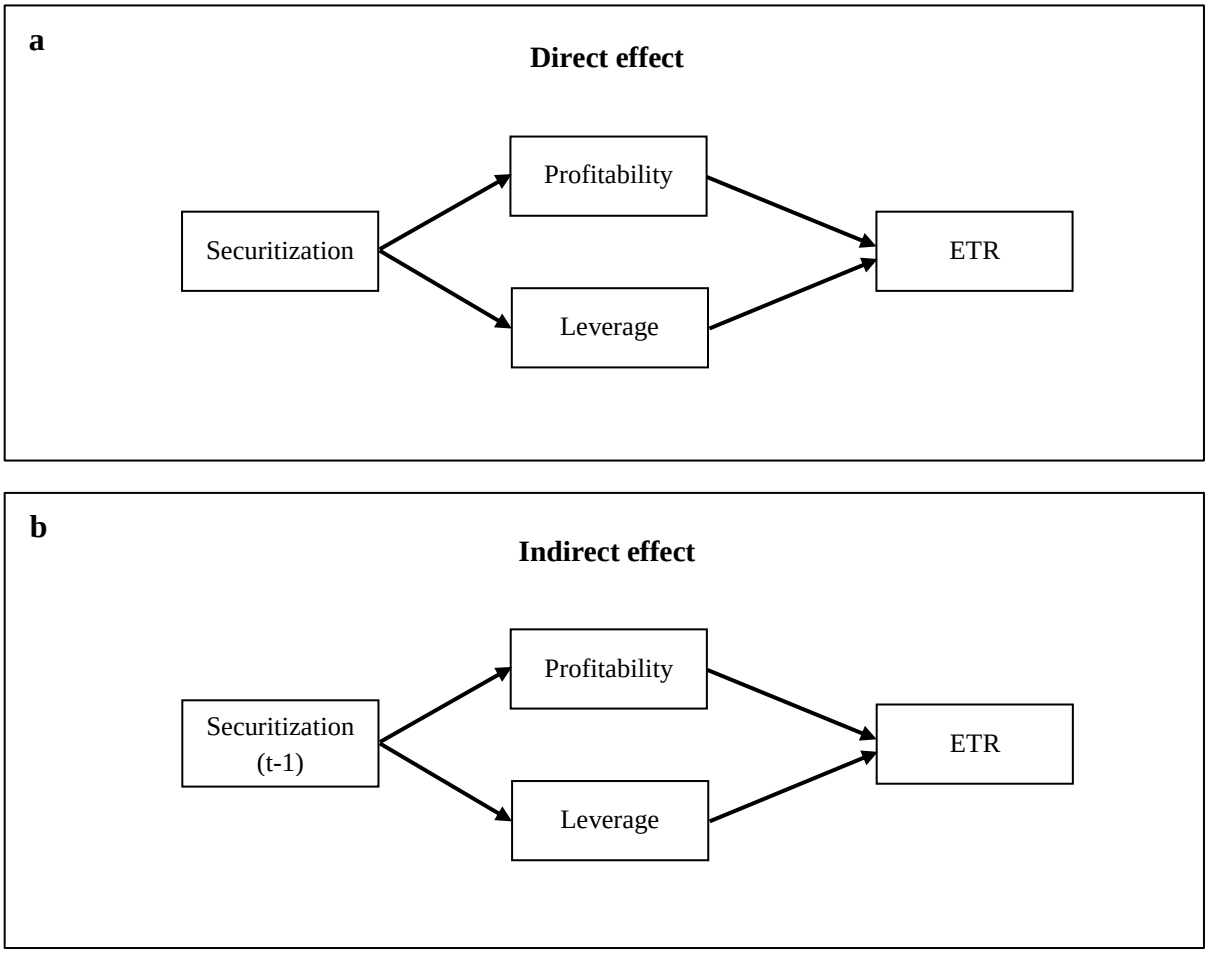
Note: * indicates statistical significance at the 10% level or better.

Table 6
Baseline regressions

	ETR (1)	ETR (not winsorized) (2)	ETR (3)
Securitization $_{(t-1)}$	–0.0305**	–0.0496*	–0.0258***
	(0.035)	(0.055)	(0.003)
Securitization $_{(t-1)}$ * CIT $_{(t-1)}$			–0.0996***
			(0.001)
Size	–0.0122*	–0.0208*	–0.0134**
	(0.078)	(0.051)	(0.049)
Business Model	–0.0451	–0.0382	–0.0390
	(0.107)	(0.280)	(0.168)
Profitability	2.4910**	4.4225**	2.3790**
	(0.015)	(0.026)	(0.019)
Leverage	–0.0700	–0.1111	–0.0587
	(0.257)	(0.272)	(0.320)
GDP	0.0278**	0.0381**	0.0280**
	(0.025)	(0.041)	(0.022)
CIT $_{(t-1)}$	0.1761	0.1584	0.3273**
	(0.203)	(0.400)	(0.019)
Lerner-Index	0.3150**	0.4756**	0.3128**
	(0.046)	(0.036)	(0.044)
Capital Regulation	–0.0141***	–0.0234*	–0.0138***
	(0.001)	(0.053)	(0.001)
Cluster at bank-level	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
No. of obs.	735	735	735
No. of groups	64	64	64
Adj. R^2	0.12	0.06	0.13

Notes: The random-effects panel model estimated is ETR $_{(i = \text{bank}, t = \text{time})} = \alpha_i + \beta_1$ Securitization$_{i,t-1} + \beta_2$ Size$_{i,t} + \beta_3$ Business Model$_{i,t} + \beta_4$ Profitability$_{i,t} + \beta_5$ Leverage$_{i,t} + \beta_6$ GDP$_{i,t} + \beta_7$ CIT$_{i,t-1} + \beta_8$ Lerner-Index$_{i,t} + \beta_9$ Capital Regulation$_{i,t} + \varepsilon_{i,t}$. The regression period spans from 1997 to 2010. The dependent variable is the effective tax rate (ETR) of a bank *i* and year *t*. Securitization, as our variable of main interest, is the cumulated securitization volume of a bank *i* in year *t* in billion €. All further variables are included on a yearly basis, and they are described in detail in Tables 3 and 4. Specification (1) reports results from a regression including the winsorized ETR as discussed in Section 2.1.2. Specification (2) presents regression results when employing the outlier-infected ETR. In specification (3) the securitization measure is interacted with the sample countries' one-period lagged statutory corporate income tax rates (CIT $_{(t-1)}$). Constant term included but not reported. Heteroscedasticity consistent p-values are in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level.

Figure 3
Structural equation models



Notes: These figures illustrate the mediation models, which are estimated following a structural equation modeling approach. It is assumed that the effect of securitization on a bank's ETR is explained through the fact that securitization affects a bank's profitability and leverage ratio while in turn, these variables affect the ETR. Figure 3a illustrates the *direct* effect of securitization on ETRs, which requires to include the unlagged securitization measure. Figure 3b displays the *indirect* effect of securitization on ETRs, which requires to employ the one-period lagged securitization measure.

Table 7
Baseline regressions (structural equation models)

		(1) direct effect	(2) indirect effect
Securitization	→ Profitability	–0.2059***	
		(0.000)	
Securitization	→ Leverage	–0.0123	
		(0.720)	
Securitization $_{(t-1)}$	→ Profitability		–0.2135***
			(0.000)
Securitization $_{(t-1)}$	→ Leverage		–0.0010
			(0.788)
		ETR	ETR
Profitability		0.1889***	0.1957***
		(0.000)	(0.000)
Leverage		–0.0546	–0.0547
		(0.104)	(0.117)
Cluster at bank-level		Yes	Yes
Time dummies		Yes	Yes
No. of obs.		851	792
No. of groups		64	64
χ^2 (p-val.)		6.852 (0.033)	9.140 (0.010)
RMSEA		0.053	0.067
CFI		0.933	0.904
SRMR		0.028	0.033

Notes: This table presents results from estimating structural equation models. The mediation models are illustrated in Figure 3. We include the unlagged securitization measure in regression specification (1) to investigate the direct effect of securitization on the ETR, whereas we employ the one-period lagged securitization measure to analyze the indirect effect, which is observed after securitization. The model chi-square, the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI) and the Standardized Root Mean Square Residual (SRMR) are reported as commonly-accepted fit statistics of structural equation models. Constant term included but not reported. Heteroscedasticity consistent p-values are in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level.

Table 8
Granger-causality tests

	ETR Granger-causes Securitization (1)	Securitization Granger-causes ETR (2)
Securitization $_{(t-1)}$	0.4254***	–0.0274*
	(0.000)	(0.057)
ETR	–0.0706	
	(0.531)	
ETR $_{(t-1)}$		0.0790
		(0.223)
Size	0.0177	–0.0109*
	(0.371)	(0.093)
Business Model	–0.0010	–0.0360
	(0.988)	(0.191)
Profitability	–8.0308***	2.6641***
	(0.006)	(0.007)
Leverage	–0.1772	–0.0473
	(0.340)	(0.464)
GDP	0.0200	0.0257**
	(0.414)	(0.028)
CIT $_{(t-1)}$	0.5429*	0.1712
	(0.089)	(0.156)
Lerner-Index	0.2506	0.2776*
	(0.407)	(0.094)
Capital Regulation	0.0058	–0.0134***
	(0.600)	(0.001)
Cluster at bank-level	Yes	Yes
Time dummies	Yes	Yes
No. of obs.	735	735
No. of groups	64	64
Adj. R^2	0.26	0.12
Fisher-type unit root test (ETR)		
ADF (inverse χ^2, p-value)	254.91 (0.000)	
Phillips-Perron (inverse χ^2, p-value)	419.48 (0.000)	
Fisher-type unit root test (Securitization)		
ADF (inverse χ^2, p-value)	208.02 (0.000)	
Phillips-Perron (inverse χ^2, p-value)	386.74 (0.000)	
Granger-causality (lag order of 1, based on AIC and SIC)		
H0: ETR does not GC Securitization (F-test, p-value)	0.39 (0.532)	
H0: Securitization does not GC ETR (F-test, p-value)		3.63 (0.006)

Notes: This table presents results from Granger-causality tests and regressions. In regression (1) securitization (dependent variable) is regressed on the one-period lag of itself and on the ETR measure. In regression (2) the ETR (dependent variable) is regressed on the one-period lag of itself and on the one-period lagged securitization measure. Constant term included but not reported. Heteroscedasticity consistent p-values are in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level.

Table 9a
IV estimation (first stage regression)

	Securitization
Net loans $_{(t-1)}$	0.2243***
	(0.000)
Size	0.0188
	(0.473)
Business Model	−0.1654***
	(0.006)
Profitability	−2.6051
	(0.491)
Leverage	0.0119
	(0.964)
GDP	0.0280
	(0.391)
CIT $_{(t-1)}$	0.4695
	(0.239)
Lerner-Index	0.0057
	(0.989)
Capital Regulation	0.0001
	(0.950)
Cluster at bank-level	Yes
Time dummies	Yes
No. of obs.	735
No. of groups	64
Centered R^2	0.07
F-test	16.58***
KP rK LM Statistic	7.13***
KP rK Wald F Statistic	19.47***
Stock-Yogo crit. value (10 %)	16.38

Notes: This table presents the results from the first stage regression of a 2SLS instrumental variable estimator. The securitization measure is instrumented by the banks' one-period lagged accounting value of *net loans*. Constant term included but not reported. Heteroscedasticity consistent p-values are in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level.

Table 9b
IV estimation (second stage regression)

	ETR
Securitization	−0.0870**
	(0.019)
Size	−0.1115
	(0.127)
Business Model	−0.0493*
	(0.075)
Profitability	1.8052
	(0.122)
Leverage	−0.0729
	(0.270)
GDP	0.0303**
	(0.021)
CIT $_{(t-1)}$	0.2098
	(0.124)
Lerner-Index	0.3248**
	(0.049)
Capital Regulation	−0.0137***
	(0.005)
Cluster at bank-level	Yes
Time dummies	Yes
No. of obs.	735
No. of groups	64
Adj. R^2	0.10

Notes: This table presents the results from the second stage regression of a 2SLS instrumental variable estimator. The securitization measure is instrumented by the banks' one-period lagged accounting value of *net loans*. Constant term included but not reported. Heteroscedasticity consistent p-values are in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level.

Table 10
Further analyses

	ETR (1)	ETR (2a)	ETR (2b)	ETR (3a)	ETR (3b)
Securitization $_{(t-1)}$	–0.0119				
	(0.390)				
Securitization $_{(t-1)}$ * Freq. Issuer	–0.0326**				
	(0.041)				
Freq. Issuer	0.0142				
	(0.647)				
Securitization $_{(true\ sale)\ (t-1)}$		–0.0362**			
		(0.028)			
Securitization $_{(synthetic)\ (t-1)}$			–0.0375		
			(0.231)		
Securitization $_{(opaque)\ (t-1)}$				–0.0205	
				(0.246)	
Securitization $_{(non-opaque)\ (t-1)}$					–0.0502**
					(0.012)
Size	–0.0122*	–0.0122*	–0.0128*	–0.0127*	–0.0122*
	(0.075)	(0.075)	(0.067)	(0.066)	(0.080)
Business Model	–0.0456	–0.0445	–0.0451	–0.0443	–0.0455
	(0.105)	(0.115)	(0.108)	(0.116)	(0.106)
Profitability	2.3773**	2.6697**	2.5493**	2.6832***	2.5569**
	(0.024)	(0.010)	(0.012)	(0.009)	(0.012)
Leverage	–0.0756	–0.0645	–0.0769	–0.0751	–0.0602
	(0.215)	(0.296)	(0.205)	(0.209)	(0.344)
GDP	0.0272**	0.0276**	0.0268**	0.0266**	0.0280**
	(0.031)	(0.026)	(0.030)	(0.032)	(0.024)
CIT $_{(t-1)}$	0.1839	0.1764	0.1592	0.1616	0.1747
	(0.185)	(0.210)	(0.260)	(0.258)	(0.206)
Lerner-Index	0.3216**	0.3337**	0.2935*	0.3085**	0.3270**
	(0.040)	(0.031)	(0.051)	(0.047)	(0.038)
Capital Regulation	–0.0143***	–0.0138***	–0.0146***	–0.0144***	–0.0137***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Cluster at bank-level	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes
No. of obs.	735	735	735	735	735
No. of groups	64	64	64	64	64
Adj. R^2	0.12	0.12	0.12	0.11	0.12

Notes: The empirical model and estimation parameters are defined in Table 6. In regression specification (1) the securitization measure is interacted with a dummy (*Freq. Issuer*), which identifies frequently issuing banks in our sample. Regression specifications (2a) and (2b) include the banks' cumulated volume of *true sale* and *synthetic* securitizations per year while specifications (3a) and (3b) report results from employing the banks' cumulated volume of *opaque* and *non-opaque* securitization transactions per year. Constant term included but not reported. Heteroscedasticity consistent p-values are in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level.

Table 11
Further analyses

	ETR (1)	ETR (2)	ETR (3)	ETR (4)	ETR (5)	ETR (6)
Securitization $_{(CDO)\ (t-1)}$	–0.0222					
	(0.215)					
Securitization $_{(RMBS)\ (t-1)}$		–0.0437**				
		(0.033)				
Securitization $_{(CMBS)\ (t-1)}$			–0.1590			
			(0.375)			
Securitization $_{(CC)\ (t-1)}$				–0.1294**		
				(0.047)		
Securitization $_{(CL)\ (t-1)}$					–0.0486	
					(0.294)	
Securitization $_{(Other)\ (t-1)}$						–0.0025
						(0.990)
Size	–0.0127*	–0.0123*	–0.0127*	–0.0130*	–0.0135**	–0.0128*
	(0.065)	(0.078)	(0.063)	(0.060)	(0.049)	(0.061)
Business Model	–0.0443	–0.0455	–0.0437	–0.0449	–0.0427	–0.0444
	(0.116)	(0.109)	(0.125)	(0.115)	(0.131)	(0.118)
Profitability	2.6732***	2.6235**	2.7105***	2.7776***	2.8363***	2.7838***
	(0.010)	(0.011)	(0.009)	(0.008)	(0.007)	(0.008)
Leverage	–0.0749	–0.0616	–0.0685	–0.0723	–0.0727	–0.0717
	(0.211)	(0.324)	(0.291)	(0.232)	(0.224)	(0.236)
GDP	0.0266**	0.0273**	0.0279**	0.0261**	0.0270**	0.0263**
	(0.032)	(0.027)	(0.023)	(0.035)	(0.029)	(0.033)
CIT $_{(t-1)}$	0.1613	0.1763	0.1386	0.1567	0.1762	0.1558
	(0.259)	(0.199)	(0.343)	(0.279)	(0.235)	(0.280)
Lerner-Index	0.3071**	0.3286**	0.2907*	0.3109**	0.3222**	0.3123**
	(0.049)	(0.037)	(0.051)	(0.044)	(0.038)	(0.049)
Capital Regulation	–0.0143***	–0.0140***	–0.0138***	–0.0143***	–0.0138***	–0.0142***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Cluster at bank-level	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	735	735	735	735	735	735
No. of groups	64	64	64	64	64	64
Adj. R^2	0.11	0.12	0.11	0.11	0.12	0.11

Notes: The empirical model and estimation parameters are defined in Table 6. Specifications (1) - (6) report results from regressions including the single securitization underlyings, i.e. (1) collateralized debt obligations (CDOs), (2) residential mortgage backed securities (RMBSs), (3) commercial mortgage backed securities (CMBSs), (4) credit cards receivables (CCs), (5) consumer loans (CLs) and (6) other unspecified assets (Other). Constant term included but not reported. Heteroscedasticity consistent p-values are in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level.

Table 12
Further analyses

	ETR Onset Stage (1)	ETR Boom Stage (2)	ETR Crises Stage (3)
Securitization $_{(t-1)}$	–0.1030		
	(0.116)		
Securitization $_{(t-1)}$		–0.0633**	
		(0.031)	
Securitization $_{(t-1)}$			–0.0109
			(0.500)
Size	–0.0027	–0.0158**	–0.0234
	(0.790)	(0.037)	(0.163)
Business Model	–0.0246	0.0229	–0.1412
	(0.162)	(0.676)	(0.174)
Profitability	3.7410*	4.0905**	0.0621
	(0.065)	(0.019)	(0.984)
Leverage	–0.0157	0.0454	–0.1406
	(0.972)	(0.676)	(0.162)
GDP	0.0396***	0.0345**	0.0129
	(0.002)	(0.017)	(0.652)
CIT $_{(t-1)}$	0.4326**	0.1622	–0.4438
	(0.021)	(0.239)	(0.318)
Lerner-Index	0.1672	0.2786	0.8662*
	(0.392)	(0.223)	(0.074)
Capital Regulation	–0.0230***	–0.0035	–0.0193*
	(0.000)	(0.520)	(0.087)
Cluster at bank-level	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
No. of obs.	216	359	160
No. of groups	64	64	64
Adj. R^2	0.21	0.13	0.07

Notes: The empirical model and estimation parameters are defined in Table 6. The regression specifications show results from splitting the entire sample into three sub-periods, i.e. (1) the onset stage (1997-2001), (2) the boom stage (2002-2007) and (3) the crises stage (2008-2010) of securitization activities in Europe. Constant term included but not reported. Heteroscedasticity consistent p-values are in parentheses. ***, **, * indicate statistical significance at the 1%, 5% and 10% level.