What drives bank securitisation? The Spanish experience

Clara Cardone-Riportella [a], Reyes Samaniego-Medina [b], Antonio Trujillo-Ponce [b,*]

[a] Department of Business Administration, Carlos III University of Madrid, Calle Madrid 126, 28903 Getafe, Madrid, Spain
[b] Department of Business Administration, Pablo de Olavide University, Carretera de Utrera Km 1, 41013 Seville, Spain

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ABSTRACT

This paper analyses the reasons why Spanish banks securitised in the period 2000–2007 on such a large scale that Spain has become the European country with the second-largest issuance volume after the UK.

The results obtained by applying a logistic regression model to a sample of 408 observations indicate that liquidity and the search for improved performance are the decisive factors in securitisation. We find no evidence to support hypotheses regarding credit risk transfer and regulatory capital arbitrage.

Our study also presents a more detailed analysis that differentiates between asset and liability securitisation programmes.

1. Introduction

Securitisation is a financial technique that allows a batch of illiquid assets to be transformed into a liquid tradable instrument with a known flow of income payments. This transformation is made possible through the use of an instrumental entity (a special purpose vehicle or SPV) that is separate, by law, from the entity with ownership rights to the instrument. Consequently, this technique allows banks to transform heterogeneous assets that, in the great majority of cases, are not negotiable into securities that are liquid, homogeneous and suitable for sale to third parties. The range of assets that can be securitised is very wide and includes mortgage loans, credit card receivables, bonds, auto loans and loans to small and medium-sized enterprises (SMEs), among others.

Asset securitisation has become one of the most visible consequences of financial innovation in recent years. In Europe, the volume of securitised assets grew from 78.2 billion Euros in 2000 to 711.1 billion Euros in 2008, which represents a 10-fold increase in volume in less than a decade.[1] It is true that the current financial crisis, in which securitisation seems to have played a notable role, halted the commissioning of new securitisation programmes during the second half of 2007 and the beginning of 2008. However, the pressing need for liquidity among financial entities provoked a sharp change after the first quarter of 2008, and the volume issued in the latest year increased by almost 60% over that of the previous year.

Over the past decade, Spain has established itself as one of the most prolific European countries in issuing securitised banking assets. It is second only to the United Kingdom, despite this financial technique's being a relatively recent phenomenon in Spain. In fact, although off-balance-sheet securitisation appears to have been subject to regulation for the first time in 1992, it was not until 1998 that the securitisation of all types of assets, with or without a mortgage guarantee, was permitted.[2] Appendix 1 gives an overview of the most common securitisation structures; it also describes the situation of the Spanish market in 2007.[3]

Despite this notable expansion of the market, there have been few empirical studies focusing on the specific characteristics of

* Corresponding author. Tel.: +34 954 349 185; fax: +34 954 348 353.
E-mail addresses: ccardone@emp.uc3m.es (C. Cardone-Riportella), rsammed@upo.es (R. Samaniego-Medina), atrupon@upo.es (A. Trujillo-Ponce).

[1] Data according to the European Securitisation Forum Data Report Q4: 2008, available at http://www.afme.eu/reports.aspx.

[2] Law 19/1992, 7 July on real estate investment companies and funds schemes and on mortgage securitisation funds and Royal Decree 926/1998, 14 May which regulates securitisation funds and securitisation fund management companies.

[3] Data from the Report on Banking Supervision in Spain 2007, Bank of Spain. Available at http://www.bde.es/informes/be/supervi/supervie.htm.

banks that lead to programmes of securitisation.[4] In this context, this paper seeks to extend the scope of the existing body of literature; it analyses the factors that encouraged Spanish banks to securitise between 2000 and 2007. Although these specific characteristics are currently unclear, previous studies seem to agree on three main (but not mutually exclusive) groups of motivations as detailed below.

First, the search for new sources of financing has been often mentioned in the literature. The liquidity effect of securitisation is particularly obvious in cash transactions. Here, the transfer of assets follows a true (“off-balance-sheet”) sale of the underlying portfolio to a special purpose vehicle (SPV). The SPV then issues notes to fund the assets purchased from the originating bank. Obviously, this transaction leads to an inflow of cash (funding); consequently, it leads to a possible restructuring of the bank’s balance sheet contingent on the reallocation of cash by the originator (Gorton and Pennacchi, 1995). The need for liquidity has been stated to be the principal determining factor of securitisation in recent empirical studies such as that of Agostino and Mazzuca (2008).

Second, securitisation allows higher-risk banks to originate and fund risky financial assets (such as mortgages, consumer loans, and business loans) in a way that minimises financial distress costs (Gorton and Souleles, 2006). These institutions can use SPVs to remove loans from their balance sheet. SPVs are structured to remain “bankruptcy-remote” from the originating firm. That is, the creditors of the SPV do not have any claim against the originator’s assets. Moreover, the bonds sold by the SPV are structured to make default or bankruptcy all but impossible (although there can be defaults on the underlying loans). According to this efficient contracting explanation, financial firms facing greater than expected financial distress costs (such as firms with high leverage and risky assets) are more likely to be active securitisers than other firms. Some recent studies emphasise the importance of this factor in the decision of a bank to securitise assets, including those of Minton et al. (2004) and Bannier and Hänsel (2008). The latter authors describe securitisation transactions as being used mainly as a risk transfer and funding tool that increases the efficiency of both risk sharing and liquidity transformation. However, at this point we have to remember that the originating entity usually repurchases the tranche of worst credit quality assets (known as the first losses or the equity tranche) from the SPV to secure a sufficient degree of credit improvement for subsequent tranches. This not only allows placing the securitised bonds at a lower cost in the market, but also limits the effective transfer of credit risk to the final investors.

Finally, another group of studies argue that banks have resorted to asset securitisation to reduce their capital requirements (Ambrose et al., 2005; Calomiris and Mason, 2004; Duffie and Garleanu, 2001; Pennacchi, 1988; Uzun and Webb, 2007, among others). This would involve exploiting the opportunity to arbitrage the regulatory capital required under the Capital Accord of 1988 (Basel I).[5] Nevertheless, the Basel II Agreement, which came into effect in the majority of the countries of the European Union in 2008, remedies some of the weaknesses of the Basel I Agreement. With this new Accord, the possible reduction in the capital requirements is closely associated both with the quality of the underlying portfolio and with the amount of risk exposure retained by the originating entity, which prevents the possible arbitrage of capital.[6] However, while some incentives to use regulatory capital arbitrage are reduced under the new framework of Basel II, which uses risk-sensitive capital ratios, arbitrage may have contributed to the increase in securitisation in the early years (Minton et al., 2004). Meanwhile, Bannier and Hänsel (2008) argue against the hypothesis that banks have been arbitraging their regulatory capital. They even find a significant “reverse” regulatory arbitrage effect; banks with low Tier 1 capital securitise significantly less than banks with high Tier 1 capital.

Apart from the factors indicated, Bannier and Hänsel (2008) report that another possible cause of the increase in bank securitisation is the search for improved measures of performance for the entity. However, in the existing literature, this does not appear to be considered a determinant variable to the same extent as the factors previously indicated. It should not be forgotten that the downside aspects of securitisation include the fixed costs of setting up the SPV and a potential reduction in the flow of tax benefits from keeping the assets on the balance sheet and financing them with debt.[7]

We must also take into consideration a final series of elements that seem to influence the decision of a bank to securitise. These include the type (commercial bank, savings bank, credit cooperative, investment bank, etc.) and size of the bank. With respect to the originator type, Minton et al. (2004) state that “the efficient contracting hypothesis predicts that commercial banks and savings institutions securitise assets to a lesser degree than other institutions because commercial banks and savings institutions do not bear the costs of financial distress (the deposit insurer does). In contrast, the regulatory arbitrage hypothesis predicts the opposite”. Regarding the size, because setting up a securitisation programme leads to significant fixed costs, we should expect only relatively large banks to securitise their loans (Bannier and Hänsel, 2008; Uzun and Webb, 2007).

Martín-Oliver and Saurina (2007) are the only authors to date who have analysed the factors determining bank securitisation in Spain. To this end, they employ the financial statements provided by banks to the Bank of Spain during the period 1999–2006. After an analysis of the three principal motivations to which we have previously made reference—improvement of liquidity, transfer of credit risk and regulatory capital arbitrage—they conclude that the only factor driving bank securitisation in Spain during that period is the need for liquidity.

Our study extends the limited previous literature on this topic by analysing the 2000–2007 period from the Bankscope database.[8] It also considers as an additional possible cause of securitisation by banks in Spain the search for improvement in the measurement of efficiency of the entity (in line with the work of Bannier and Hänsel (2008) for the European market). And finally, our work includes liability securitisation programmes in the analysis for the first time. This is a phenomenon that originated in Spain but is currently also found in other countries. The securitisation of liabilities could be considered an inappropriate form of securitisation, although its structure is of the traditional type and it functions in a very similar way to the securitisation of assets. The only notable feature is that

[4] One portion of the existing literature offers analyses of aspects such as the effect of securitisation on the risks incurred by the banks making use of this technique (Dionne and Harchaoui, 2008; Hänsel and Krahnen, 2007; Vermilyea et al., 2008), the quoted prices of the shares of the entities issuing securitisation programs (Lockwood et al., 1996; Thomas, 1999, 2001) and the supply of bank loans (Hirtle, 2007; Loutskina and Strahan, 2009), among others.

[5] In Jones (2000), there is an analysis of the principal techniques used to perform capital arbitrage under this Accord (Basel I). Prior to Basel II, the treatment of securitisation from the point of view of the regulation of capital was unsatisfactory. Regulation differed in the different jurisdictions because treatment specifically for securitisation had not been foreseen in Basel I and, in general, the regulations were less sensitive to risk. Because the capital required was the same, the cost of holding low-risk assets was greater because the incremental capital was not economically justifiable. To save on regulatory capital, banks may therefore try to remove low-risk assets from their balance sheets and retain high-risk assets.

[6] For a more detailed analysis of the treatment of securitisation in Basel II, see Basel Committee on Banking Supervision (2004) and Catarineu and Pérez (2008). Furthermore, Blum (2008), Bongaerts and Charlier (2009) and Johnston (2009) provide a detailed discussion of the capital requirements under the Basel II Capital Framework.

[7] Calmès and Théoret (2010) revisit the impact of off-balance-sheet activities on banks risk-return trade-off.

[8] The Bankscope database is compiled by Bureau van Dijk Electronic Publishing.

Table 1
Composition of the sample.

Bank type	Year								Total
	2000	2001	2002	2003	2004	2005	2006	2007	
Commercial banks	16	13	15	12	14	18	16	13	117
Savings banks	37	36	31	32	31	36	33	24	260
Credit cooperatives	2	4	4	3	5	6	6	1	31
Total	55	53	50	47	50	60	55	38	408

these liabilities cannot be sold to a fund; a third entity (an investment company or similar) is required to intervene, purchasing the liabilities issued by a credit entity and selling them immediately to the SPV.

The paper is structured as follows. Section 2 describes the data and methodology employed in the empirical research and also defines the explanatory variables. Section 3 presents and discusses the results obtained. Section 4 summarises and concludes.

2. Methodological aspects

2.1. Sample

Our sample comprises all of the Spanish commercial banks, savings banks and credit cooperatives in the Bankscope database during the period 2000–2007 with information available for every one of the variables analysed. However, those entities that presented abnormal ratios or extreme values were eliminated from the sample as outliers. Once this filtering was complete, the final sample consists of 408 observations, of which 117 correspond to commercial banks, 260 to savings banks and 31 to credit cooperatives. Table 1 shows the number of banks that comprise the sample for each of the years included in the investigated time span.

To research a more homogenous sample, the analysis focuses exclusively on those entities authorised by the Bank of Spain to capture funds from the public. As stated in the preceding section, these banks account for almost all issues in the Spanish securitisation market. Furthermore, the time frame considered is sufficiently long for a longitudinal analysis, but it is not long enough for significant structural changes to have taken place. This period also coincides with a substantial expansion of the securitisation activity in Spain, encouraged by a change in the regulations that did not allow the securitisation of all types of assets almost until the end of the 1990s. For this reason, this study focuses on the period of 2000–2007.

Finally, we obtain the data on the securitisation activity from the documents that the banks are compelled by law to deposit with the Spanish National Securities Market Commission (CNMV).[9] Table 2 shows that the percentage of Spanish banks that securitise has grown considerably during this decade, increasing from 29.1% in 2000 to more than 90% in 2007. Sorting by type of entity demonstrates that the savings banks securitise the most; seven of every 10 have securitised during these eight years, whereas only half of the commercial banks and credit cooperatives have made use of this financial technique.

2.2. Definition of variables

The primary objective of this study is to determine which factors are decisive in the development of bank securitisation. Consequently, the dependent variable takes the value 1 if the bank has acted as originator in at least one securitisation transaction and 0 otherwise. Next, we identify a series of specific characteristics of the banks (explanatory variables). Three motivations have regularly been put forward in the literature as being responsible for the securitisation activity of banks: the search for new sources of financing or liquidity, the transfer of credit risk and the regulatory capital arbitrage. We add a fourth factor to this list: improvement to the performance measures for the entity as well as a set of control variables. Therefore, whether an entity securitises or not is a function of liquidity, credit risk, regulatory capital, performance and the control variables. All of these explanatory variables are in accordance with those put forward in similar studies (see Table 3).

2.2.1. Liquidity (or funding)

Following the line established in earlier studies, this study considers three variables as proxies of the liquidity factor:

- (1) Interbank Ratio: This is defined as the percentage ratio of money lent to other banks divided by money borrowed from other banks. If this ratio is greater than 100, it indicates that the bank is a net placer rather than a borrower of funds in the market and therefore is more liquid.
- (2) Net Loans/Deposits & S.T. Funding: This liquidity ratio indicates the relationship between loans and deposits as a percentage. A higher ratio corresponds to a less liquid bank.
- (3) Liquid Assets/Deposits & S.T. Funding: This is a deposit run-off ratio that expresses the percentage of sudden customer and short-term fund withdrawals that could be met. A higher ratio corresponds to the entity's being more liquid and less vulnerable to a classic run on the bank.

In theory, one would expect bank to be more predisposed to securitise part of its portfolio when the assets of the entity are less liquid. It is precisely this lack of liquidity that would motivate banks to seek new sources of financing in the securitisation market.

2.2.2. Credit risk

The second group of variables is intended to measure the risk profile of the bank. This will help to determine whether the Spanish banks have employed securitisation as a way of transferring part of their credit risk. If this is the case, the banks with assets of lower quality should show greater securitisation activity.

For this purpose, we choose two variables:

- (4) Loan Loss Reserve/Gross Loans: This ratio indicates how much of the total loan portfolio is covered by the entity's current reserves. It is a reserve for losses expressed as a percentage of total loans. Given a similar charge-off policy, a higher ratio corresponds to a lower-quality loan portfolio.
- (5) Non-Performing Loans/Gross Loans: This is a measure of the amount of total doubtful loans (as a percentage). Lower ratios correspond to better asset quality.

[9] Information obtained from the CNMV webpage (http://www.cnmv.es). Data on synthetic securitisation are not collected; please see Iscoe and Kreinin (2007) for information on synthetic CDOs.

Table 2
Number (and percentage) of entities comprising the sample that have securitised.

Bank type	Year								Total
	2000	2001	2002	2003	2004	2005	2006	2007	
Commercial banks	7 (43.8%)	6 (46.2%)	7 (46.7%)	5 (41.7%)	8 (57.1%)	8 (44.4%)	12 (75.0%)	11 (84.6%)	64 (54.7%)
Savings banks	8 (21.6%)	16 (44.4%)	20 (64.5%)	26 (81.3%)	27 (87.1%)	32 (88.9%)	30 (90.9%)	23 (95.8%)	182 (70.0%)
Credit cooperatives	1 (50.0%)	1 (25.0%)	0 (0.0%)	2 (66.7%)	3 (60.0%)	4 (66.7%)	5 (83.3%)	1 (100.0%)	17 (54.8%)
Total	16 (29.1%)	23 (43.4%)	27 (54.0%)	33 (70.2%)	38 (76.0%)	44 (73.3%)	47 (85.5%)	35 (92.1%)	263 (64.5%)

2.2.3. Regulatory capital arbitrage

If the regulatory capital arbitrage hypothesis holds true, then a financial entity that holds less regulatory capital will have a greater incentive to securitise its assets. The variables employed to measure the relationship between securitisation and this hypothesis include the following:

- (6) Capital Adequacy Ratio: This ratio is the total capital adequacy ratio under the Basel rules. It measures Tier 1 + Tier 2 capital, which includes subordinated debt, hybrid capital, loan loss reserves and valuation reserves as a percentage of risk-weighted assets and off-balance-sheet risks. This ratio should be at least 8%.
- (7) Equity/Total Assets: Because equity is a cushion against asset malfunction, this ratio measures the amount of protection afforded to the bank by the equity invested in it. A higher ratio corresponds to the entity's being better protected.

2.2.4. Performance

We identify a series of ratios for monitoring the effect of efficiency improvement as a motivator of the bank in its propensity to securitise:

- (8) Return On Assets (ROA): This is perhaps the single most important ratio for comparing the efficiency and operational performance of banks. The ratio considers the returns generated from the assets financed by the bank.
- (9) Return On Equity (ROE): The return on equity is a measure of the return on shareholder funds. Obviously, a higher value is better. Still, care should be taken when weighting this ratio too heavily in an analysis, as it may be high at the expense of an over-leveraged balance sheet.
- (10) Cost-to-Income Ratio (CIR): This ratio is currently one of the most widely considered. It measures the overheads or cost of running the bank (the greatest proportion of which is normally salaries) as a percentage of income generated before provisions.

Previously published studies have not found any conclusive results based on these variables. Bannier and Hänsel (2008) find that the need to improve the bank's overall financial efficiency or performance drives bank securitisation (i.e., lower ROA and/or ROE values or a higher CIR ratio indicates a higher probability of the entity's deciding to securitise loans). However, based on the risk-appetite argument, banks with relatively superior performance should be particularly active in loan securitisation.

2.2.5. Control variables

For control purposes, we include some general characteristics of the originating entity in the analysis as additional regressors. First, we analyse the impact of bank size; we measure it as the log of the entity's total assets ((11) bank size). This variable is expected to be positive because scaling economics follow from the fixed costs of setting up a securitisation programme. Second, we add two dummy variables to identify commercial banks and savings banks respectively ((12) bank type). This enables an evaluation of whether the character of the entity influences the decision to securitise assets. Last, we control for year difference effects by including a dummy variable for each year considered in the analysis ((13) year).

Table 4 summarises the explanatory variables and their expected signs as considered in the present study.

2.3. Methodology

As a first approximation, we perform a univariate analysis of the sample. This yields the principal descriptive statistics regarding the explanatory variables and serves to indicate the main differences between the two groups studied. We follow this preliminary study by a multivariate analysis that explores the possible causal relationship between the probability of securitising and the explanatory variables to be isolated. For this analysis we choose a logistic regression model.

Logistic regression (also known as the logistic model) is a form of regression used when the dependent variable is dichotomous (in this case, to securitise or not) and the independent variables are of any type.[10] It is normally employed when trying to obtain a function to predict whether an observation belongs to a particular group or when trying to analyse the influence of a series of independent variables on the dependent variable (in our case, those of the bank's characteristics that may influence its decision to securitise or not). The logistic equation is as follows:

$$\begin{aligned} Z_{i,t} = {} & b_0 + b_1 \cdot \text{Interbank Ratio}_{i,t-1} + b_2 \cdot \text{Loans/D\&ST}_{i,t-1} \\ & + b_3 \cdot \text{Liquid A/D\&ST}_{i,t-1} + b_4 \cdot \text{LL Reserve/Gross L}_{i,t-1} \\ & + b_5 \cdot \text{Non-perf. L/Gross L}_{i,t-1} + b_6 \cdot \text{Capital Ratio}_{i,t-1} \\ & + b_7 \cdot \text{Equity/TA}_{i,t-1} + b_8 \cdot \text{ROA}_{i,t-1} + b_9 \cdot \text{ROE}_{i,t-1} \\ & + b_{10} \cdot \text{CIR}_{i,t-1} + b_{11} \cdot \text{Size}_{i,t-1} + b_{12} \cdot \text{Bank Type}_{i,t} \\ & + b_{13} \cdot \text{Year}_{i,t} + \varepsilon_{i,t}. \end{aligned} \quad (1)$$

Here, $Z_{i,t}$ is the log odds of the dependent variable for the ith case in the tth period, b_0 is a constant and the "b" terms are the logistic regression coefficients, also called parameter estimates. All bank-specific variables enter into the regression equation staggered by one period to avoid potential problems of endogeneity.

To describe the relationship between Z_i and the probability of securitising (π_i) for the ith case we have to use the following link function:

[10] An alternative to logistic regression analysis is probit analysis. These two types of analysis are very similar to one another. While logistic analysis is based on log odds, probit uses the cumulative normal probability distribution. Both produce similar results in this case. The probit analysis is available upon request.

Table 3
Bank-specific variables used in previous studies (in chronological order).

	Sample	Database	Model used	Bank-specifics variables				
				Liquidity or funding	Credit risk	Equity or regulatory capital	Others characteristics (performance, cost, ...)	Control variables
Calomiris and Mason (2004)	US banks (1996)	Faulkner and Gray's Card Industry Directory/Nilson Report	Univariate/ OLS regression/ Probit/ Tobit	– Cash and government securities/on-balance-sheet assets	– Total loans greater than 90 days past due or with non-accrual status/total assets – Standard deviation of total loans greater than 90 days past due or with non-accrual status/total assets – Insured deposits/total deposits	– Tiers 1 and 2 capital/managed assets – Tiers 1 and 2 capital/on-balance-sheet assets – Growth of Tiers 1 and 2 capital over past year (log difference)	No	No
Minton et al. (2004)	US financial companies with publicly traded stock (1993–2002)	Compustat/Securities Data Corporation	Univariate/ Probit/ Tobit	No	– Asset Risk (firm's stock return volatility) – Firm's debt rating (dummy) – Leverage (Capital-Asset Ratio)	No	– Return on Equity (ROE) – Issuer's tax payments	– Size (market capitalisation) – Originator Type (dummy)
Martín-Oliver and Saurina (2007)	Spanish banks (1999–2006)	Bank of Spain/Spanish National Securities Market Commission	Probit/ Tobit	– Credit growth (high, medium and low) (dummy) – Loan/deposits – Interbank (relative weight of interbank liabilities)	– Non-Performing Loan Ratio – Non-Performing Mortgage Ratio – Concentration of the Loan Portfolio (Herfindahl-Hirshman Index)	– Solvency Ratio (quotient between capital and risk-weighted assets)	– Average cost of liabilities	– Size (log of its total assets) – Weight of the mortgage portfolio – Bank type (dummy) – Year (dummy)
Uzun and Webb (2007)	US banks (2001–2005)	Call reports	Univariate/ Logistic Regression	No	No	– Total equity capital – Tier 1 capital – Total risk-based capital ratio – Tier 1 leverage ratio	No	– Size – Leverage (Loan Ratio) – Grow
Agostino and Mazzuca (2008)	Italian banks (1999–2006)	Bankscope/Talete Creative Finance	Probit	– Interbank Ratio – Net Loans/Total Assets – Liquid Assets/ Dep. & ST Funding – Historical Cost – Leverage (Total Assets/Total Equity) – Market Instruments Funding Ratio – Listing in Financial Markets (dummy)	No	– Tier 1 ratio – Total capital ratio	– Return on Equity (ROE) – Return on Assets (ROA) – Net fees and Commissions Ratio – Interest-bearing assets Ratio	– Size – Number of securitisations in previous years – Year (dummy)

(*continued on next page*)

Table 3 (*continued*)

	Sample	Database	Model used	Bank-specifics variables			Others characteristics (performance, cost, ...)	Control variables
				Liquidity or funding	Credit risk	Equity or regulatory capital		
Bannier and Hänsel (2008)	European banks (1997–2004)	Bankscope/Quarterly CDO Deal List by Standard and Poor's/European Securitisation Deal List by Computershare Fixed Income Services Limited	Univariate/ Logit	– Liquidity (money lent to other banks/ money borrowed from other banks) – Low Liquidity (decile of banks with lowest liquidity) (dummy) – Low liquidity * liquidity	– Risk (Credit Risk Provision/Net Interest Income) – High Risk (decile of banks with highest risk) (dummy) – High Risk * Risk – High Risk * Low Tier 1 (dummy, stock-listed firms only) – Quality (gross interest income/gross outstanding accounts)	– Tier 1 Ratio – Low Tier 1 (decile of banks with lowest Tier 1 capital) (dummy) – Low Tier 1 * Tier 1 – Equity share (equity/total assets)	– Return on Equity (ROE) – Cost-Income Ratio (CIR) – Low Performance (decile of banks with highest CIR) (dummy) – Low Performance * CIR – Tax	– Size (log of total assets) – Business Variable Year (dummy) – Country(dummy) – Bank Type (dummy)

Table 4
Explanatory variables employed in the analysis.

Explanatory variables	Expected sign
(A) Liquidity (or funding)	
(1) Interbank Ratio	(−)
(2) Net Loans/Deposits & S.T. funding	(+)
(3) Liquid Assets/Deposits & S.T. funding	(−)
(B) Credit Risk	
(4) Loan Loss Reserve/Gross Loans	(+)
(5) Non-Performing Loans/Gross Loans	(+)
(C) Capital Regulatory	
(6) Capital Adequacy Ratio	(−)
(7) Equity/Total Assets	(−)
(D) Performance	
(8) Return On Assets (ROA)	(±)
(9) Return On Equity (ROE)	(±)
(10) Cost-to-Income Ratio (CIR)	(±)
(E) Others	
(11) Bank Size	(+)
(12) Bank Type (dummy)	
(13) Year (dummy)	

$$\pi_i = \frac{1}{1 + e^{-Z_i}}. \tag{2}$$

3. Results

3.1. Univariate analysis

Table 5 shows a first-order descriptive analysis of the sample, which is divided into two groups: banks that securitised during the time period considered and banks that did not (263 versus 145). The variables we select as indicators of liquidity, namely the (1) Interbank Ratio, (2) Net Loans/Deposits & Short-Term Funding, and (3) Liquid Assets/Deposits & Short-Term Funding, evolve in the expected direction. Banks that securitise have a lower Interbank Ratio (133.05% versus 136.18%); this would indicate that the entity resorting to securitisation is a net borrower of funds in the interbank market and is therefore seeking to improve its financial position. Also, the mean percentage of loans relative to deposits and other short-term financing is 97.67% for banks that securitise, compared with 75.96% for those that do not. Similarly, liquid assets make up 14.87% of short-term bank financing for entities that securitise as opposed to 23.84% for entities that do not. All of these variables seem to indicate that, on average, the banks that engage in securitisation present lower liquidity than those that do not.

The ratios employed to measure the bank's credit risk, namely, (4) Loan Loss Reserve/Gross Loans and (5) Non-Performing Loans/Gross Loans, yield different results. While the former is slightly higher for banks that securitise (2.00% versus 1.95%), the Non-Performing Loans/Gross Loans ratio does not yield the expected results (0.95% for banks that securitise compared to 1.04% for those that do not). We would expect this latter ratio to be higher for banks that develop securitisation programmes, which would imply that securitisation is used as a way to transfer credit risk. The subsequent analyses will confirm whether this variable has statistical significance.

The univariate analysis also shows that banks using securitisation present lower capital ratios on average than those that do not (11.64% versus 12.82%). However, both figures are significantly higher than the minimum 8% required by the Basel capital agreements. Also, equity constitutes a smaller percentage of the total assets of the entities that have chosen to securitise assets.

All three variables measuring banking efficiency or performance (ROA, ROE and CIR) show worse mean results for the group of banks that securitise. This may indicate that some banks have

Table 5
Descriptive statistics for the variables.

	N	Range	5% percentile	95% percentile	Median	Mean		Std. deviation
						Statistic	Std. error	
Not securitised								
(1) Interbank Ratio	145	983.89	3.74	532.05	76.26	136.18	14.64	176.27
(2) Loans/D&ST	145	160.20	3.25	114.96	81.19	75.96	2.66	32.00
(3) Liquid A./D&ST	145	94.12	1.65	63.64	21.80	23.84	1.49	17.95
(4) LL Reserve/Gross L.	145	3.89	0.45	3.50	1.89	1.95	0.06	0.78
(5) Non-Perf. L./Gross L.	145	2.73	0.24	2.24	0.89	1.04	0.05	0.58
(6) Capital Adequacy Ratio	145	28.70	8.23	21.34	12.10	12.82	0.37	4.40
(7) Equity/T.A.	145	22.58	2.44	11.83	7.45	7.68	0.29	3.54
(8) ROA	145	4.80	0.23	1.86	0.88	0.92	0.05	0.64
(9) ROE	145	29.32	4.44	20.47	12.82	12.92	0.40	4.78
(10) CIR	145	83.36	23.38	75.47	57.39	55.82	1.20	14.43
(11) Size (LN Assets)	145	11.09	13.70	18.29	15.61	15.71	0.13	1.56
Securitised								
(1) Interbank Ratio	263	815.03	8.14	525.03	86.98	133.05	9.24	149.89
(2) Loans/D&ST	263	161.35	64.77	135.59	96.27	97.67	1.40	22.69
(3) Liquid A./D&ST	263	58.83	2.05	36.39	12.74	14.87	0.71	11.48
(4) LL Reserve/Gross L.	263	3.63	1.48	2.84	1.94	2.00	0.03	0.41
(5) Non-Perf. L./Gross L.	263	3.38	0.37	1.99	0.83	0.95	0.03	0.52
(6) Capital Adequacy Ratio	263	13.90	9.10	14.20	11.60	11.64	0.10	1.67
(7) Equity/T.A.	263	20.55	4.93	10.54	7.15	7.57	0.13	2.10
(8) ROA	263	3.40	0.52	1.55	0.84	0.86	0.02	0.37
(9) ROE	263	28.57	6.86	18.67	11.48	12.22	0.25	3.98
(10) CIR	263	64.59	42.22	69.92	58.69	57.94	0.51	8.26
(11) Size (LN Assets)	263	12.84	9.51	18.61	15.98	15.58	0.15	2.42

decided to engage in securitisation as a way to improve their performance ratios.

Finally, the mean size of the banks that securitise, measured as the log of their total assets, is only slightly lower than that of those banks that do not (15.58 versus 15.71). The statistical range is, however, very high in both cases.

Next, we perform an analysis of variance (ANOVA) to determine whether the differences found in the mean values of the variables studied are statistically significant.[11] At the univariate level, four of the considered variables show significantly different behaviour for those banks that securitise versus those that do not (see Table 6). These four variables are as follows:

- (2) Net Loans/Deposits & Short-Term Funding.
- (3) Liquid Assets/Deposits & Short-Term Funding.
- (6) Capital Adequacy Ratio.
- (10) Cost-to-Income Ratio (CIR).

In summary, at the univariate level, significant differences seem to exist in terms of mean levels of liquidity (variables (2) and (3)), regulatory capital (variable (6)), and banking efficiency (variable (10)) between the banks that securitise and those that do not. On average, those banks that securitise present lower liquidity, lower capital ratios, and lower performance.

3.2. Multivariate analysis

After univariate analysis, we conduct a logistic regression analysis. First, however, we perform an analysis of multicollinearity for the independent variables previously selected. A study of the matrix of correlations indicates that the coefficients of bivariate correlation are all close to zero, except for those between ratio (8) ROA and the variables (7) Equity/Total Assets and (9) ROE. We subsequently confirm this dependence via an analysis of multicollinearity. The Variance Inflation Factor (VIF) for all of these variables is close to 10, and in the case of the ROA ratio, it reaches a value of 14.462.[12] As a result, we eliminate this ratio from the analysis, leading to substantial improvement in all the VIFs of the independent variables, whose values are now all below 2 (in the majority of cases, they are close to 1).[13]

Once the multicollinearity issue has been dealt with, we can then determine the logistic model. Table 7 reflects the results achieved by applying the logistic regression to the sample of banks (model 1). Of the set of variables considered in the study, five (two ratios of bank liquidity and ratios of performance, size, and bank type) present statistical significance[14]:

- (1) Interbank Ratio.
- (2) Net Loans/Deposits & Short-Term Funding.
- (10) Cost-to-Income Ratio (CIR).
- (11) Size.
- (12) Bank Type.

The signs of the coefficients confirm our expectations.[15] Therefore, one expects a greater likelihood of securitisation by a bank when either the Interbank Ratio is lower or the proportion of the

[11] The basis of ANOVA is the partitioning of sums of squares into between-group and within-group portions. These calculations are used via the Fisher statistic (F) to analyse the null hypothesis. The null hypothesis states that there is no difference between means of the different groups, suggesting that the variance of the within-group samples should be identical to that of the between-group samples (resulting in no between-group discrimination capability).

[12] The Variance Inflation Factor (VIF) measures the impact of collinearity among the variables in a regression model. The VIF shows us the degree to which the variance of the coefficient estimate is inflated by multicollinearity. The square root of the VIF tells us how much larger the standard error is compared with what it would be if that variable were uncorrelated with the other X variables in the equation. A common rule of thumb is that VIFs of 10 or higher (or equivalently, those with a tolerance of 0.10 or less) can be regarded as indicating multicollinearity. In weaker models, even values above 2.5 may be a cause for concern.

[13] This absence of multicollinearity was corroborated by analysing the Index of Condition.

[14] To test the significance of individual logistic regression coefficients for each independent variable (that is, to test the null hypothesis in logistic regression that a particular logit (effect) coefficient is zero), we use the Wald statistic. We also find statistical significance for the years included in the analysis as dummy variables.

[15] Parameter estimates (b coefficients) associated with explanatory variables are estimators of the change in the logit caused by a unit change in the independent variable. The b coefficients vary between plus and minus infinity, with 0 indicating that the given explanatory variable does not affect the logit (that is, it does not affect the probability of securitising). Positive or negative b coefficients indicate that the explanatory variable increases or decreases the logit of the dependent variable, respectively.

entity's loans that are financed with deposits and other short-term debt (less liquidity) is higher. Still, a high Cost-to-Income Ratio could motivate the bank to securitise part of its portfolio of assets with the aim of improving its profitability.

Since we use logistic regression, it will be the marginal effects that give us a more reliable idea of how much the probability of securitising increases given a specific variation in the explanatory variables.[16] Therefore, because the marginal effect (in percentage terms) of the (10) CIR variable is equal to 2.265, we can state that when this ratio increases by one unit, the probability that a bank will opt to securitise will increase by 2.265% when other variables are controlled for. This leads to a new conclusion; of the three ratios with statistical significance, it is the CIR ratio that appears to exert the most influence on the probability that a bank will securitise.

Moreover, the likelihood of securitisation is increased by 19% if the bank in question is a savings bank. This is an expected result, given that 70% of the Spanish savings banks securitised in the period studied, compared with only 50% of commercial banks and credit cooperatives. Also, the logistic model seems to indicate that large banks are more disposed to securitise than smaller ones.

Using securitisation as a mechanism for transferring credit risk is not a relevant factor over the period considered. This could be because the Spanish banks have retained an increasingly large share of the risks associated with securitisation (the "originate-to-hold" as opposed to the "originate-to-distribute" model of securitisation).

Finally, the regulatory capital arbitrage hypothesis is not confirmed by the logistic model. None of the variables used to test this hypothesis (ratios (6) Capital Adequacy Ratio and (7) Equity/Total Assets) reach statistical significance in the regression analysis.

3.3. Results according to the characteristics of the underlying portfolio

As can be seen in Appendix 1, most of the securitisation programmes in Spain have mortgage loans as their underlying assets. In these programmes, the securitisation of other assets, such as commercial loans or consumer credits, accounts for a much smaller fraction. In any case, the securitised portfolios consist of large numbers of assets of relatively low individual value with similar risk profiles (ABS-transactions). However, a significant percentage of securitisation in Spain (approximately 20%) is backed by liabilities issued by banks, mainly mortgage-covered bonds (the so-called *cédulas hipotecarias*).[17] In a high percentage of cases, these programmes are structured as CDOs. By definition, the securitisation of liabilities cannot be used to transfer the rights and risks associated with the assets. Consequently, one would expect the transfer of credit risk not to be a motivating factor in this type of transaction; in contrast, it could be expected to motivate ABS transactions.

To check the validity of this starting hypothesis, we break down the original sample into two non-exclusive subgroups to identify differences in the behaviour of the banks depending on the type of underlying being securitised (assets versus liabilities). We present the results from this logistic regression model for the two types of securitisation indicated in Table 8 (models 2 and 3).

In this analysis, factors driving banks to securitise assets continue to be the objective of greater liquidity (ratio (2) Loans/Deposits & Short-Term Debt) and improved performance (ratio (10) CIR) as we confirm. However, the principal—and sole—motivation appears to be the search for improved liquidity in the case of the securitisation of liabilities (ratios (1) Interbank Ratio and (2) Loans/Deposits & Short-Term Debt). In reality, the securitisation of liabilities constitutes an alternative way of placing these liabilities on the market. The reason is that securitisation, by means of the subordination of the securities issued (the tranche structure), can obtain the maximum credit rating (AAA) for almost the entire issue. In many cases, it even improves the credit rating of the originating credit entity.

The transfer of credit risk remains an irrelevant factor in explaining the securitisation by Spanish banks. None of the variables used to measure the bank's credit risk shows statistical significance for both types of programmes. While we might expect this in the securitisation of liabilities by means of CDO-type structures, we might not necessarily expect this in the case of the securitisation of assets (ABS transactions). This, again, suggests that Spanish banks have opted for an "originate-to-hold" model of securitisation as opposed to the "originate-to-distribute" model.

Besides, neither model confirms the regulatory capital arbitrage hypothesis, which seems to definitively discount the notion that

Table 6
Analysis of variance (ANOVA).

Variables	Sum of squares	df	Mean squares	*F*	Sig.
(1) Interbank Ratio					
Between groups	913.839	1	913.839	0.036	0.850
Within groups	1.036E+07	406	25517.957		
Total	1.036E+07	407			
(2) Loans/D&ST					
Between groups	44034.845	1	44034.845	63.322	0.000***
Within groups	282335.483	406	695.408		
Total	326370.328	407			
(3) Liquid A./D&ST					
Between groups	7513.045	1	7513.045	37.668	0.000***
Within groups	80978.505	406	199.454		
Total	88491.550	407			
(4) LL Reserve/Gross L.					
Between groups	0.288	1	0.288	0.884	0.348
Within groups	132.498	406	0.326		
Total	132.786	407			
(5) Non-Perf. L./Gross L.					
Between groups	0.766	1	0.766	2.615	0.107
Within groups	118.872	406	0.293		
Total	119.638	407			
(6) Capital Adequacy Ratio					
Between groups	130.839	1	130.839	15.102	0.000***
Within groups	3517.553	406	8.664		
Total	3648.393	407			
(7) Equity/T.A.					
Between groups	1.072	1	1.072	0.147	0.702
Within groups	2961.978	406	7.296		
Total	2963.050	407			
(8) ROA					
Between groups	0.398	1	0.398	1.690	0.194
Within groups	95.478	406	0.235		
Total	95.876	407			
(9) ROE					
Between groups	45.667	1	45.667	2.493	0.115
Within groups	7438.296	406	18.321		
Total	7483.963	407			
(10) CIR					
Between groups	421.492	1	421.492	3.576	0.059*
Within groups	47850.961	406	117.860		
Total	48272.453	407			
(11) SIZE (LN Assets)					
Between groups	1.586	1	1.586	0.343	0.559
Within groups	1879.959	406	4.630		
Total	1881.545	407			

* Statistical significance level at the 10%.
*** Statistical significance level at the 1%.

[16] The marginal effect is simply the gradient of the logistic cumulative distribution function at this mean value. For a continuous variable, it can be represented as follows:

$$\frac{\partial \text{Prob}(y_i = 1)}{\partial x_k} = \frac{\partial F}{\partial x_k} = \frac{1}{1+\exp -(x_i' b)} \times \frac{1}{1+\exp(x_i' b)} \times b_k.$$

For a dummy variable (D_i), it makes no sense to compute a derivative. In this case, the marginal effect is equal to $\text{Prob}[y_i = 1 | x_i, D_i = 1] - \text{Prob}[y_i = 1 | x_i, D_i = 0]$.

[17] The *cédulas hipotecarias* are covered bonds issued by Spanish banks and backed by mortgage loans.

Table 7
Determinants of bank securitisation.

Variables	*b*	Std. error	Marginal effect (×100)
Model 1			
(1) Interbank Ratio	−0.002**	0.001	−0.046
(2) Loans/D&ST	0.049***	0.011	0.983
(3) Liquid A./D&ST	0.014	0.015	0.289
(4) LL Reserve/Gross L.	0.264	0.354	5.323
(5) Non-Perf. L./Gross L.	−0.520	0.374	−10.499
(6) Capital Adequacy Ratio	−0.002	0.055	−0.045
(7) Equity/T.A.	−0.052	0.052	−1.056
(9) ROE	0.113	0.050	2.280
(10) CIR	0.112***	0.021	2.265
(11) Size (LN Assets)	0.329***	0.144	6.644
(12a) Commercial bank	−0.057	0.973	−1.154
(12b) Savings bANK	0.905*	0.853	19.030
Constant	−12.671***	2.579	–
Year dummy	Yes		
N securitised (*N* not securitised)	263 (145)		
Log pseudo-likelihood	−178.526		
Wald statistic	145.34***		
Pseudo-R^2	0.477		

Notes: The dependent variable equals 1 if a bank completes a securitisation transaction and 0 otherwise. Standard errors are clustered by banks. For the dummy variables, the marginal effects are for a discrete change from 0 to 1.
* Statistical significance level at the 10%.
** Statistical significance level at the 5%.
*** Statistical significance level at the 1%.

Spanish banks may have employed securitisation as a way of reducing regulatory capital.

Finally, we show the type of bank to be relevant when a securitisation programme is established. The likelihood of issuing an ABS is reduced by 28% if the bank considered is a savings bank. By contrast, in the case of a liability securitisation programme, the likelihood of it being developed increases by 72% when the bank in question is a savings bank. In other words, savings banks have a greater propensity than commercial banks to opt for the securitisation of liabilities. We also observe that when we distinguish between types of securitisation programmes (ABS versus Liabilities CDO), there is a change in the effect of entity size on the probability of securitising. Thus, it is the smaller savings banks that are more inclined to implement liability securitisation programmes, whereas, in the case of ABS programmes, it is the larger banks that are more predisposed to securitise.

3.4. Robustness checks

In order to further confirm the aforementioned findings, we conduct a number of robustness checks and report all of these results in Table 9. First, with respect to the variables employed as regressors, we re-estimate the previous models (models 2 and 3) in order to retest those hypotheses with no statistical significance. To this end, we replace the Non-Performing Loans/Gross Loans ratio with the Loan Loss Provisions/Net Interest Income ratio as a proxy for the measurement of the credit risk of the banks (models

Table 8
Determinants of bank securitisation according to the characteristics of the underlying portfolio.

Variables	Model 2 (ABS)		Model 3 (Liabilities CDO)	
	b	Marginal effect (×100)	*b*	Marginal effect (×100)
(1) Interbank Ratio	−0.001	−0.027	−0.003***	−0.061
	(0.001)		(0.001)	
(2) Loans/D&ST	0.037***	0.927	0.036***	0.757
	(0.009)		(0.012)	
(3) Liquid A./D&ST	0.003	0.081	0.015	0.311
	(0.015)		(0.017)	
(4) LL Reserve/Gross L.	0.211	5.223	0.178	3.753
	(0.386)		(0.442)	
(5) Non-Perf. L./Gross L.	−0.462	−11.474	−0.128	−2.696
	(0.367)		(0.447)	
(6) Capital Adequacy Ratio	0.015	0.361	−0.053	−1.128
	(0.052)		(0.070)	
(7) Equity/T.A.	−0.073	−1.824	0.033	0.702
	(0.056)		(0.087)	
(9) ROE	0.062	1.543	0.131	2.765
	(0.047)		(0.041)	
(10) CIR	0.076***	1.881	0.040	0.843
	(0.021)		(0.021)	
(11) Size (LN Assets)	0.458***	11.373	−0.544***	−11.484
	(0.131)		(0.195)	
(12a) Commercial bank	−0.449	−11.002	1.321	29.805
	(0.794)		(1.230)	
(12b) Savings bank	−1.157*	−28.146	5.118***	72.451
	(0.699)		(1.173)	
Constant	9.163***		−6.358*	
	(2.497)		(3.595)	
Year dummy	Yes		Yes	
N securitised (*N* not securitised)	185 (223)		150 (258)	
Log pseudo-likelihood	−216.841		−143.047	
Wald statistic	99.06***		112.67***	
Pseudo-R^2	0.361		0.628	

Notes: In Model 2 the dependent variable equals 1 if a bank completes an ABS-transaction and 0 otherwise. In Model 3 the dependent variable equals 1 if a bank completes a Liabilities CDO transaction (most likely a CDO of *cédulas hipotecarias*) and 0 otherwise. Standard errors, which are reported in parentheses, are clustered by banks. For the dummy variables, the marginal effects are for discrete change from 0 to 1.
* Statistical significance level at the 10%.
*** Statistical significance level at the 1%.

Table 9
Robustness checks.

Variables	ABS					Liabilities CDO				
	Model 4	Model 6	Model 8	Model 10	Model 12	Model 5	Model 7	Model 9	Model 11	Model 13
(1) Interbank Ratio	0.000	0.000	0.000		−0.001	−0.003***	−0.003***	−0.000**	−0.002***	−0.003**
	(0.001)	(0.001)	(0.000)		(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
(2) Loans/D&ST	0.030***	0.034***	0.006***	0.039***	0.037***	0.040***	0.036***	0.005***	0.024***	0.042***
	(0.008)	(0.009)	(0.001)	(0.006)	(0.012)	(0.010)	(0.010)	(0.001)	(0.006)	(0.013)
(3) Liquid A./D&ST	0.003	0.013	0.000		−0.007	0.012	0.013	0.003	–	−0.014
	(0.015)	(0.016)	(0.003)		(0.021)	(0.022)	(0.022)	(0.002)		(0.025)
(4) LL Reserve/Gross L.	−0.300	0.089	0.050		0.058	0.332	0.196	−0.001	–	0.167
	(0.264)	(0.297)	(0.056)		(0.412)	(0.361)	(0.419)	(0.046)		(0.498)
(5) Non-Perf. L./Gross L.		−0.512	−0.085		−0.378	–	−0.109	0.011	–	−0.188
		(0.295)	(0.058)		(0.397)		(0.406)	(0.048)		(0.484)
(5) Loan L. Prov./Net Int. Inc.	0.062				–	−0.060	–	–	–	–
	(0.022)					(0.029)				
(6) Capital Adequacy Ratio	0.037		0.003		0.005	−0.073	–	0.000	–	−0.036
	(0.055)		(0.011)		(0.079)	(0.089)		(0.009)		(0.104)
(6) Tier 1		−0.107			–	–	−0.019	–	–	–
		(0.065)					(0.081)			
(7) Equity/T.A.	−0.056	0.007	−0.016	−0.091**	−0.097	0.034	0.024	0.004	–	0.045
	(0.060)	(0.067)	(0.011)	(0.045)	(0.091)	(0.080)	(0.091)	(0.009)		(0.098)
(9) ROE	0.087	0.057	0.007		0.062	0.125	0.133	0.007	–	0.135
	(0.044)	(0.043)	(0.008)		(0.057)	(0.051)	(0.050)	(0.006)		(0.060)
(10) CIR	0.076***	0.069***	0.013***	0.049***	0.075***	0.045	0.040	0.007	–	0.047
	(0.017)	(0.017)	(0.003)	(0.012)	(0.025)	(0.021)	(0.022)	(0.003)		(0.027)
(11) Size (LN Assets)	0.412***	0.395***	0.090***		0.666***	−0.467**	−0.543***	−0.054***	–	−0.523**
	(0.111)	(0.115)	(0.022)		(0.194)	(0.161)	(0.167)	(0.018)		(0.208)
(12a) Commercial bank	−0.575	−0.582	−0.084	0.967***	−0.844	1.367	1.346	0.179	–	1.329
	(0.543)	(0.547)	(0.111)	(0.269)	(0.952)	(1.178)	(1.183)	(0.093)		(1.321)
(12b) Savings bank	−1.229***	−1.247***	−0.244**		−1.566*	5.211***	5.086***	0.614***	3.569***	5.574***
	(0.465)	(0.463)	(0.096)		(0.827)	(1.113)	(1.130)	(0.080)	(0.399)	(1.263)
Constant	−8.914***	−7.118***	−1.212***	−6.100***	−9.544***	−6.776**	−6.830**	−0.468	−4.391***	−8.246**
	(2.262)	(2.343)	(0.407)	(1.114)	(3.390)	(3.248)	(3.360)	(0.338)	(0.773)	(4.200)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N securitised (*N* not securitised)	185 (223)	185 (223)	185 (223)	185 (223)	185 (223)	150 (258)	150 (258)	150 (258)	150 (258)	150 (258)
Log (pseudo) likelihood	−205.730	−210.529	−221.023	−245.132	−202.920	−163.732	−151.031	−155.001	−180.002	−140.154
Wald statistic	89.90***	91.50***	90.01***	76.63***	52.83***	109.75***	113.59***	111.10***	106.11***	64.69***
Pseudo-R^2	0.374	0.368	0.323	0.215		0.636	0.627	0.601	0.574	

Notes: In Models 4, 6, 8, 10 and 12 the dependent variable equals 1 if a bank completes an ABS-transaction and 0 otherwise. In Models 5, 7, 9, 11 and 13 the dependent variable equals 1 if a bank completes a Liabilities CDO transaction (most likely a CDO of *cédulas hipotecarias*) and 0 otherwise. Models 4 and 5 include the Loan Loss Provisions/Net Interest Income ratio in place of the Non-Performing Loans/Gross Loans ratio. The rest of the variables remain the same. Models 6 and 7 consider the Tier 1 Ratio in place of the Capital Ratio. The rest of the variables remain the same. Models 8 and 9 are estimated via robust regression. Models 10 and 11 employ a forward conditional stepwise method for the selection of variables. Models 12 and 13 are estimated using a random effects logistic regression model. Standard errors, which are clustered by banks, are reported in parentheses.

* Statistical significance level at the 10%.

** Statistical significance level at the 5%.

*** Statistical significance level at the 1%.

4 and 5). This latter ratio was employed previously by authors such as Bannier and Hänsel (2008), and it measures the relationship between the provisions in the profit and loss account and the interest income over the same period. Ideally, this ratio should be as low as possible, and in the case of a well-run bank, if the lending book presents higher risk, this should be reflected by higher interest margins. In the same way, we employ the Tier 1 ratio in place of the capital ratio as a proxy variable to analyse the possible use of securitisation as a mechanism for arbitraging regulatory capital (models 6 and 7). It has frequently been employed in previously published studies to measure the relationship between securitisation and the regulatory capital arbitrage hypothesis (for example, in studies by Agostino and Mazzuca, 2008; Bannier and Hänsel, 2008; Calomiris and Mason, 2004). This ratio is shareholder funds plus perpetual non-cumulative preference shares as a percentage of risk-weighted assets and off-balance-sheet risks measured under the Basel rules, and it should be at least 4%. In both cases, the results do not differ from those obtained previously, which again confirms the irrelevance of the hypotheses that the transfer of credit risk and the regulatory capital arbitrage are driving factors in the securitisation activity of Spanish banks.

Second, we use robust regression (models 8 and 9). This is an important tool for analysing data that could be disproportionately affected by outliers. The main purpose of robust regression is to provide reliable and stable results when outliers are present by limiting their influence. This robust regression algorithm uses iteratively reweighted least squares to estimate both the regression coefficients and the standard errors, assigning lower weights to those observations with high leverage or influence. As we confirm (see Table 9), most of the explanatory variables maintain either their sign or their statistical significance. Nevertheless, we do see a certain loss of statistical significance in the case of the liability securitisation programmes for ratio (1), the Interbank Ratio, where significance drops from the 1% to the 5% level.[18]

Third, we modify the method used to select variables utilising a forward conditional stepwise method (models 10 and 11). The forward stepwise logistic regression method automatically determines which variables to add from the model. It begins with the constant-only model and adds variables one at a time until it reaches the step at which all variables not in the model have a significance level that, in this case, is higher than 0.05. The most striking difference between this model and previous ones emerges in the variables that determine the ABS-type securitisation, where the (7) Equity/Total Assets ratio demonstrates statistical significance, although with a different sign than would be expected (see model 10). On this basis, the most solvent banks should be more inclined to securitise their assets. Bannier and Hänsel (2008) also observe this "reverse" regulatory arbitrage effect exists in the European market.

Finally, we perform a fourth robustness check to evaluate the method of estimation used in the analysis. Since panel data are used, we can re-estimate the model with fixed or random effects. The random effects estimator is more attractive when the "unobserved heterogeneity" is uncorrelated with all of the explanatory variables. If we have good controls in our equation, we might believe that any leftover neglected heterogeneity only induces serial correlation in the composite error term and does not cause correlation between the composite errors and the explanatory variables. Also, random effects models allow for explanatory variables that are constant over time; this is one advantage they have over fixed effects models. Again, the results we attain using the random effects logistic regression models (models 12 and 13) do not differ from those obtained previously using the base models.[19] They coincide both in terms of the explanatory variables and in their sign, although we do note some loss of statistical significance.

4. Conclusions

Securitisation is a financial operation by which a bank transforms a non-negotiable asset or right to payment/income flow into a fixed-income instrument that is homogeneous, standardised and, consequently, tradable on organised securities markets. Recently, securitisation programmes in Europe have grown exponentially in volume, expanding from 78.2 billion Euros in 2000 to 711.1 billion Euros in 2008. Spain is the second-largest securitisation market in Europe in terms of volume issued.

In this paper, we investigate what drives bank securitisation in Spain. In addition, we explore differences between the banks that securitise assets and those that securitise liabilities, which is an aspect that has scarcely been touched upon in the previous literature. Our study confirm the hypotheses that liquidity and the search for improvements in efficiency are the driving factor that have led Spanish banks to securitise in the period 2000–2007. The logistic regression model does not confirm the hypotheses regarding the transfer of credit risk and regulatory capital arbitrage.

A more detailed analysis, differentiating between asset and liability securitisation programmes, reveals that the objective of seeking new sources of financing is a key factor in both types of programmes. In fact, Spanish banks have employed the securitisation of liabilities in the period analysed for funding purposes only; none of the other variables analysed has played any role in this case. The securitisation of liabilities by means of CDO-type structures is generally utilised by medium-sized savings banks that are able to indirectly group their credits into a common fund. In this way, they can reach the minimum volume necessary to participate in these markets.

The use of securitisation, both as a mechanism in the search for liquidity and, therefore, as a source of additional financing, has increased since the beginning of the current financial crisis in August 2007. However, its use has changed since that time; an increasing number of banks have underwritten their own securitisation programmes to use them as a guarantee for obtaining resources in the auctions of the European Central Bank (ECB). Similarly, some banks are using securitised bonds to obtain liquidity through the Financial Assets Acquisition Fund (FAAF), which was created in 2008 by the Spanish government to generate the liquidity necessary to allow banks to continue lending to the private residential property sector. Both practices have partially replaced the issue of debt, or the interbank market itself, as sources of finance to enable banks to grant loans.

The transfer of credit risk is not a relevant factor in the ABS programmes for the period of time considered. Unlike in other financial systems, particularly in the United States, Spanish banks have retained an increasingly large share of the risks associated with securitisation (the "originate-to-hold" model of securitisation as opposed to the "originate-to-distribute" model). Therefore, since the *Circular* 4/2004 of the Bank of Spain came into effect in 2005, the volume of operations in which the assets have been taken off the balance sheet has been relatively small.[20]

[18] Moreover, given that the liquidity measures seem to have larger outliers (based on the descriptive statistics in Table 5), we replicate the estimations by dropping the observations lying in the 2.5th and 97.5th percentiles of the distribution of each variable. This brings about a reduction in the number of observations from the sample, but the results confirm the pattern's having emerged so far.

[19] The Hausman Tests both have insignificant *p*-values—that is, Prob > chi^2 larger than 0.05; in such a case, it is safe to use random effects. This technique tests the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as those estimated by the consistent fixed effects estimator.

[20] This regulation tightened the criteria for permitting securitised assets to be eliminated from the balance sheets of banks. To do this, there should be a substantial transfer of all the risks and profits associated with the securitised assets.

Related to the regulatory capital arbitrage hypothesis, this paper finds that this variable has not been a key factor in the past. Although the normative development of Basel II in Spain, culminating with *Circular* 3/2008 of the Bank of Spain (which came into effect in June 2008), imposes many more restrictions on banks attempting to reduce their capital requirements using securitisation programmes, it does not seem likely that this will affect the future development of the market.

Finally, the results of this study suggest that the performance-improvement variables cannot be ignored as motivating factors of asset securitisation. The Spanish banks have sought to use asset securitisation to improve their efficiency ratios.

Our findings generally coincide with those reported by previous studies. Bannier and Hänsel (2008) find that a European bank with greater credit risk exposure, lower liquidity and worse performance measures is more likely to securitise. However, according to Agostino and Mazzuca (2008) and Martin-Oliver and Saurina (2007), the only determining factor in securitisation is the search for new sources of bank financing in the Italian and Spanish markets, respectively.

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Appendix 1. Types of securitisation and the Spanish market

According to the term of the securities issued:	According to the characteristics of the underlying portfolio:	Based on the underlying asset:
Long term	Asset-Backed Securities (ABS) (backed by portfolios of homogeneous assets comprising exposure to a large number of obligors)	– Residential Mortgage-Backed Securities (RMBS) – Commercial Mortgage-Backed Securities (CMBS) – Other ABS (auto, credit cards, leases, SMEs, etc.)
	Collateralised Debt Obligations (CDOs) (backed by heterogeneous exposure to a limited number of names)	– Collateralised Loan Obligations (CLOs) – Collateralised Bond Obligations (CBOs) – Structured Finance CDOs (such as CDOs of ABS) According to the aim of the transaction: – Balance-Sheet CDOs – Arbitrage CDOs
Short term	Asset-Backed Commercial Paper (ABCP)	

The Spanish Market in 2007

- The total volume securitised by Spanish banks in 2007 reached 136.8 billion Euros (46% more than the previous year) in contrast to barely 8 billion Euros securitised in the first years of the decade.
- The securitisation of bank assets accounted for around 80% of the securitisation activity in Spain. The largest issuing sector was RMBS transactions, which accounted for 46% of total issuance in 2007; the securitisation of commercial loans (14.0%) and the securitisation of credit to SMEs (7.5%) ranked second and third, respectively. As an emerging trend, 13 billion Euros of interbank loans were securitised in 2007. The other types of underlying assets, together with the programmes of short-term debt securitisation (ABCP), comprised only a small minority of the total assets.
- On the other hand, the securitisation of liabilities in 2007 was backed exclusively by mortgage-covered bonds (*cédulas hipotecarias*). These represented close to 20% of the total securitised volume, although they grew at a slower rate than in the preceding years. Such securitisation programmes are usually classified in the international market as CDOs.
- The great majority of securitisations are of the traditional type; the synthetic type of securitisation, in which the credit risk of the portfolio being securitised is transferred by the contracting of credit derivatives, only represents a small minority in Spain.
- Finally, commercial banks, savings banks and credit cooperatives, accounting for 99%, continue to be almost the only securitisation actors in Spain.

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