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Do European banks with a covered bond program issue asset-backed securities for funding? ☆

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ABSTRACT

The decline in the issuance of asset-backed securities (ABSs) since the financial crisis and the comparative advantage of covered bonds (CBs) as a funding alternative to ABSs raise the question of whether banks still issue ABSs as a way to receive funding. By applying double-hurdle regression models to a dataset of 134 European banks observed during the period from 2007 to 2013, this study reveals that banks with a covered bond program (CBP) securitize, ceteris paribus, less of their assets. The estimated difference in ABS issuance is driven mainly by banks being more likely to issue ABSs as a funding tool rather than trying to manage their credit risk exposure or to meet regulatory capital requirements. Consistently, a worse liquidity/funding position results in higher levels of securitization only for banks without a CBP.

1. Introduction

The issuance of asset-backed securities (ABSs)[1] in Europe has decreased dramatically in size since the start of the 2007 financial crisis. According to SIFMA/AFME data,[2] the amount of euro-denominated structured finance products (excluding retained securities) issued in 2007 was 418 billion euro; by 2012, the figure had shrunk to 253 billion euro. Clearly, one of the main drivers of this trend was the central role that structured finance products have played in the unfolding of the crisis in the United States (e.g., Coval et al., 2009; Longstaff, 2010; Gorton and Metrick, 2012). European financial institutions were among the main investors in US ABSs before the start of the crisis (Bertaut et al., 2012), creating a direct link for contagion. This has raised investors' skepticism toward this class of complex financial products (e.g., Célérier and Vallée, 2014). Despite the potential conflicts of interest and misaligned incentives that characterize the originate-to-distribute banking scheme, European

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[1] Throughout this paper, we use the term ABS to generally identify structured finance products resulting from the securitization of extant financial assets via a special-purpose vehicle (SPV). The term thus encompasses mortgage-backed securities (MBSs), collateralized debt obligations (CDOs), and collateralized loan obligations (CLOs).

[2] Data accessed at www.sifma.org on November 11, 2015.

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official institutions still consider ABSs to be key instruments that allow banks to raise the necessary capital to provide consumers and small- and medium-sized enterprises (SMEs) with credit (European Commission, 2015). Thus, it is important to understand what currently drives European banks' decisions to securitize their assets.

Whereas ABS issuance has shrunk by approximately half between 2007 and 2012, during the same period, the issuance of euro-denominated covered bonds (CBs) has actually increased, from 332 billion euro to 405 billion euro, according to European Covered Bond Council (ECBC) data.[3] Van Rixtel and Gasperini (2013) report that the share of CBs of total gross bonds issued by European banks has increased from 26% in 2007 to 42% in 2012. Some commentators (e.g., European Central Bank, 2011) have argued that banks have replaced ABSs with CBs since the start of the crisis. To a certain extent, ABSs and CBs can, in fact, be considered substitutes. Both are fixed-income securities backed by a ring-fenced pool of collateral assets. However, ABSs and CBs also exhibit some key differences, as discussed at length in Section 2. Most notably, the transfer of credit risk from originators to investors is less complete with CBs than with ABSs. This has two direct consequences. On the one hand, the lower level of risk for investors entailed by CBs results in lower yields and thus lower costs of funding. On the other hand, CBs are not an effective way for the originator to reduce its credit risk exposure (Packer et al., 2007). This and other material differences between ABSs and CBs can provide the latter with a comparative advantage as a funding tool but not as a method to reduce credit risk exposure and/or risk-weighted assets (RWAs).

However, not every bank can issue CBs because covered bond programs (CBPs) are strictly regulated in most European countries. On the contrary, contract-based ABSs allow greater flexibility and can be issued as one-off transactions. Thus, securitization can still be a viable source of liquidity for banks with no access to the CB market.

In this study, we address how the ability to issue CBs as an alternative to ABSs affects the issuance of structured finance products by European banks. We use a sample of 775 observations of 134 European banks between 2007 and 2013 to investigate how CBPs affect if, how much, and why banks issue ABSs. We do so by employing double-hurdle models, which enable accounting for potential differences in the effect of a bank's characteristics on if and how much it engages in securitization.

Our main findings are readily summarized. We show that all else being equal, banks with a CBP are expected to securitize a lower share of their assets. The difference is approximately 0.11–0.13 percentage points, depending on the model. As a term of comparison, banks in our sample securitize on average 0.18% of their assets. Consistent with the comparative advantage of CBs as a funding tool, the difference between the level of ABS issuance for banks with and without a CBP is mainly driven by banks with a low level of asset liquidity. Proxies for the level of a bank's credit risk exposure or need to meet regulatory capital requirements do not appear to play an equally relevant role. Coherently, we find a negative marginal effect of asset liquidity on securitization levels for banks without a CBP but not for banks able to issue CBs. The difference between the two marginal effects is statistically significant and increases with the level of asset illiquidity. These results are robust to the use of alternative proxies for a bank's liquidity/funding needs. No significant difference in the marginal effect of proxies for a bank's assets' credit risk and regulatory capital position is found for both banks with and without a CBP.

This paper contributes to a growing literature addressing banks' securitization activities (Maddaloni and Peydró, 2011; Pagano and Volpin, 2012; Jiang et al., 2013; Wang and Xia, 2014, among others) and in particular to the literature focusing on how individual characteristics of European banks can explain their ABS issuance levels (Affinito and Tagliaferri, 2010; Cardone-Riportella et al., 2010; Farruggio and Uhde, 2015). These studies have generally identified a bank's need for liquidity as one of the main determinants of securitization. However, they typically do not consider the role played by the availability of alternative sources of funding/liquidity. To the best of our knowledge, this is the first study to demonstrate how the ability to issue CBs influences a bank's securitization activity–and particularly so during the recent crisis period. In a related study, Carbó-Valverde et al. (2011) examine the determinants of both CB and mortgage-backed security (MBS) issuance as independent from each other. They find that banks issue CBs, but not MBSs, to meet their liquidity needs. By considering a bank's *ability* to issue CBs, we complement their results by demonstrating that European banks still issue structured finance products for funding/liquidity reasons, but only when they cannot resort to CBs. This result is consistent with the idea that–when available–CBs currently constitute a preferred funding tool compared with ABSs.

The rest of this paper is organized as follows. Section 2 reviews the rationales for securitization in light of the existing literature and discusses the material differences between ABSs and CBs. Section 3 presents the data and methodology used in this study. The empirical results are presented and discussed in Section 4. Section 5 concludes with some final remarks.

2. Background and empirical predictions

In this section, we review the extant literature regarding banks' rationales for securitization (Section 2.1) and discuss the main differences between ABSs and CBs, culminating in our empirical predictions (Section 2.2).

2.1. Rationales for securitization

The extant literature identifies three main rationales for securitization linked to the individual characteristics of the issuer.

[3] Data accessed at http://ecbc.hypo.org on November 24, 2015.

The first reason for banks to issue structured finance products is to satisfy their funding/liquidity needs. Securitization allows efficiently selling illiquid assets such as mortgages and corporate loans, transforming them into new liquidity to be retained or invested. Securitization as a form of raising funds can often be preferable to raising new retail deposits. The latter are redeemable at any point in time, leaving the bank exposed to bank runs. ABS issuance can instead be seen as a form of medium- to long-term financing. Several previous studies (e.g., Affinito and Tagliaferri, 2010; Cardone-Riportella et al., 2010; Farruggio and Uhde, 2015) have identified the level of liquidity of a bank's assets as one of the main drivers of securitization.

The second reason for securitization is related to the transfer of credit risk to investors. By selling the underlying assets to a Special-Purpose Vehicle (SPV), the bank removes risky assets from its balance sheet and passes the credit risk to the investors. The credit risk of a bank's assets is thus expected to play a relevant role in the determination of its securitization activity. However, the direction of such an effect is not trivial. On the one hand, banks with more risky assets can have a greater incentive toward securitization. On the other hand, given the existing information asymmetries, only banks with a high asset quality and a good reputation might be able to securitize their assets without incurring a considerable discount on their face value (e.g., Albertazzi et al., 2015; Ambrose et al., 2005; An et al., 2011; Calomiris and Mason, 2004). Moreover, banks usually retain the equity (i.e., the first loss) tranche of the ABSs on their balance sheet (DeMarzo, 2005). As a result of these contrasting effects, previous empirical studies have found support for both positive (Affinito and Tagliaferri, 2010; Bannier and Hänsel, 2006) and negative (Calem and LaCour-Little, 2004; Farruggio and Uhde, 2015) relationships between assets' credit risk and the level of securitization.

The third rationale for securitization is linked to a bank's need to meet regulatory capital requirements. By transferring credit risk out of its balance sheet, a bank can reduce its risk-weighted assets (RWAs) and, thus, its need for Tier I and II capital, as required by Basel rules. Securitization can even allow a bank to engage in regulatory capital arbitrage, i.e., reducing its capital requirements while not effectively reducing its credit risk exposure. This possibility was particularly evident under the Basel I rules, as illustrated by Jones (2000). Basel II tries to significantly mitigate the scope for regulatory capital arbitrage (Blum, 2008; Fabozzi and Davis, 2007); however, such opportunities can still occur within the current regulatory framework (e.g., Calem and LaCour-Little, 2004). Empirical studies have found some evidence of regulatory capital requirements as a significant driver of securitization, especially during the Basel I regime (Acharya et al., 2013; Affinito and Tagliaferri, 2010; Ambrose et al., 2005; Calomiris and Mason, 2004; Cebenoyan and Strahan, 2004).

2.2. Asset-backed securities versus covered bonds

As already stated in Section 1, both ABSs and CBs are fixed-income securities backed by a determined pool of collateral that is ring-fenced from other liabilities of the issuer. There are, however, several material differences between ABSs and CBs, from the points of view of both issuers and investors.

2.2.1. Asset-backed securities

ABSs are technically issued by an SPV created ad hoc. The SPV buys the collateral from the depositor (the entity collecting the underlying assets and creating the SPV) and issues structured finance products backed by such collateral. The proceeds of the sale of ABSs to investors are ultimately used to pay the depositor. The latter is typically also the originator of the assets (e.g., the bank granting a firm with the loan that is subsequently securitized), although assets can also be originated by third parties. Securitization is mostly based on contractual mechanisms, thus allowing for a high degree of flexibility (European Banking Authority, 2014a). ABSs are usually structured in different tranches; each tranche is characterized by a different level of exposure to credit, prepayment, and interest rate risks, and it is thus tailored to different investors' needs. Further credit enhancement (e.g., third-party insurance) can also be embedded in the deal.

One of the main consequence of the manner in which ABSs are issued is that the SPV provides bankruptcy remoteness (Ayotte and Gaon, 2011) to the depositor, i.e., investors in ABSs only have a claim on the assets effectively owned by the SPV. Even if Basel II requires originators to retain a significant net economic interest in the underlying assets (Basurto et al., 2015), by design, the structured finance market is thus exposed to agency problems (see for example Ashcraft and Schuermann, 2006). Originators have superior knowledge about the true quality of assets. This can lead to adverse selection, as already discussed in Section 2.1. At the same time, bankruptcy remoteness implies that by issuing ABSs, banks can effectively remove risky assets from their balance sheet and reduce their RWAs computed for regulatory purposes.

2.2.2. Covered bonds

The main difference between ABSs and CBs is that the latter are issued directly by the bank, which remains ultimately liable for the payments due to investors. The issuer designates a pool of assets to be pledged as collateral but retains those assets on its balance sheet. In case the assets used as collateral no longer meet the quality criteria mandated by national laws–or if prepayments occur–the issuer has to increase/replace the assets in the pool. When a bank issuing CBs faces financial distress, the ring-fenced assets are shielded from claims of other creditors of the bank. In the extreme case in which the collateral is insufficient to cover the claims of CB investors, CBs have the same seniority over the remaining assets of the bank as senior unsecured bonds. The collateral pool for a CB is thus more a form of credit enhancement rather than an effective source of cash flows paid to investors. CBs are additionally argued to benefit from an implicit state guarantee that does not apply to ABSs. Volk and Will (2012) and the European Banking Authority (2014b), among others, have observed how

government support for the issuing bank has often translated into an implicit guarantee also for its CBs. As a result of their superior credit enhancement and implicit government guarantee, CBs are typically characterized by significantly lower yields than other debt securities (including ABSs) issued by the same bank (Packer et al., 2007). The spreads between CBs and government bonds are often considered to merely reflect a liquidity premium (e.g., Kempf et al., 2012).

Another key difference between ABSs and CBs is that covered bonds are subjected to strict national legislation that (a) establish which assets are eligible as collateral, (b) mandate national supervisors to address and keep monitoring the quality of such collateral, and (c) specify which institutions are allowed to issue CBs. The last point is of particular interest because it implies that not every bank is authorized to have a covered bond program (CBP)–and thus to issue CBs. For example, the German *Pfandbriefgesetz* requires banks to prove their intention to engage in CB issuance on a regular basis; a license to issue CBs can be revoked if a bank does not issue CBs for two years (European Banking Authority, 2014b). At the European level, the Capital Requirement Directive (CRD) only recognizes as covered bonds those securities that are issued under such national legislation (for a brief review of CBP legislative frameworks, see, for example, Packer et al., 2007).

In summary, whereas European regulatory frameworks allow for considerable flexibility to issue ABSs, they are more stringent about the key characteristics of both the CB issuer and the underlying asset pool.

2.2.3. Empirical predictions

From the above discussion regarding the different characteristics of ABSs and CBs, which is summarized in Table 1, it follows that CBs have a comparative advantage over ABSs in that they are less affected by agency problems. This is all the more relevant during a crisis period, when investor confidence is eroded. We thus expect that all else being equal, during the crisis period investigated in this study, banks allowed to issue CBs securitize less than banks without a CBP.

In this context, CBs can be regarded as a cheaper funding tool than ABSs. Indeed, Carbó-Valverde et al. (2011) show that banks are more likely to issue CBs (but not ABSs) for liquidity reasons. Consistently, we expect the securitization activity of a bank with a CBP to be independent of its funding needs. However, for banks that are not able to resort to CBs, ABSs can still constitute a relevant funding tool. Overall, the role of liquidity in explaining the intensity of ABS issuance is predicted to differ significantly between banks with and without a CBP.

Whereas CBs may constitute a preferable substitute for ABSs as a funding tool, this is not the case for the other two main rationales for securitization illustrated in Section 2.1, i.e., transferring credit risk exposure and meeting regulatory capital requirements. This is because the cover pool is retained on a bank's balance sheet, and the credit risk is not transferred to the investors. Covered bonds thus do not allow the issuer to pursue these goals the same manner that ABSs do. Consequently, the ability to issue CBs should not influence the role played by these two rationales in explaining the observed levels of securitization.

3. Data and methodology

This section presents the dataset (Section 3.1) and the methodology (Section 3.2) used in our analyses.

3.1. Data

The starting point in building our sample is a dataset retrieved from Bankscope. We consider both securitizing and non-securitizing banks across the EU-13 countries in the European Monetary Union (EMU).[4] The sample covers the period from 2007 to 2013. We focus on this period for two reasons. First, we are particularly interested in the securitization activity of banks since the 2007 crisis eroded investors' confidence in ABSs. Second, the implementation of the Basel II capital requirements started in the considered countries on January 1, 2007 (European Central Bank, 2007). Securitization activities before and after the transition from Basel I to Basel II might not be comparable because the two regulations differ significantly in terms of the manner in which securitization is accounted for (Fabozzi and Davis, 2007). The Bankscope dataset initially includes 179 banks from the considered countries. After excluding non-independent banks (i.e., banks whose ultimate owner is another bank) and bank-year observations for which the necessary bank-level variables–described below–are missing, we are left with 775 observations for 134 banks. We henceforth refer to this subset of the data as the dataset used in this study. Table 2 presents the distribution of the dataset by country and year.

3.1.1. Asset-backed security issuance

Our dependent variables aim at capturing if and how much European banks resort to securitization. Data about the issuance of structured finance products are provided by J.P. Morgan and retrieved from their "International ABS & CB Research" database, which includes structured finance products issued worldwide. For each security, the database reports information such as the involved counterparties, the tranche size and currency, and the characteristics of the collateral. The database initially includes 7174 euro-denominated tranches issued between 2007 and 2013, for a total value of 2.25 trillion euro. As a

[4] The countries initially considered are thus Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, and Portugal. We later exclude Luxembourg because of no usable observations. From the EU-13 countries, we exclude the UK for two reasons. First, we want to focus on banks within the EMU area. Second, several financial institutions in the UK issue unregulated, "structured" Covered Bonds without possessing a CBP. This is generally not the case in the countries considered. See www.ecbc.eu/framework/list.

Table 1
Main differences between asset-backed securities and covered bonds. This table summarizes the main differences between asset-backed securities and covered bonds, as discussed in Section 2.2.

	Asset-backed securities	Covered bonds
Issuer	Special Purpose Vehicle (SPV)	Bank originating the assets
Investors claim	Over assets owned by the SPV and the associated cash flows	Over collateral and the issuer
Eligible assets	No or little restriction on eligible assets	Defined by national laws
Structure	Customized	Standardized. Face value typically repaid at maturity
Balace Sheet treatment	Assets are sold to SPV. Credit Risk is transferred	Pledged cover assets remain in the balance sheet of the issuer
Availability	No or little restriction	Covered bond programs subjected to national regulators approval
Collateral pool	Typically static/revolving	Dynamic. Quality of the collateral has to be preserved
Government guarantee	None	Implicit in support for the issuer

Table 2
Sample distribution by year and country. This table presents the distribution of bank-year observations in the dataset by country (rows) and year (columns).

Country\Year	2007	2008	2009	2010	2011	2012	2013
Austria	10	13	15	15	16	16	16
Belgium	6	6	8	8	8	7	5
Germany	11	14	18	19	20	22	20
Spain	21	22	25	25	24	23	15
Finland	2	2	2	1	4	4	4
France	10	10	8	5	5	7	7
Greece	5	6	7	7	6	7	6
Ireland	6	6	6	6	6	6	6
Italy	9	13	13	13	13	12	13
Netherlands	8	8	8	9	10	10	8
Portugal	7	6	6	6	6	6	6

term of comparison, the total amount of European ABSs, CDOs and MBSs issued over the same period amounted to 2.64 trillion euro, according to SIFMA/AFME data.[5] We carefully hand-match the structured finance dataset with the 775 bank-year observations in our sample to ensure that we identify all securities originated by the 134 banks considered in this study. Of the 7174 securities in the J.P. Morgan dataset, 2,037 are originated by one of the banks in our sample. As is customary in the literature (e.g., Affinito and Tagliaferri, 2010; Farruggio and Uhde, 2015), for each bank i in year t, we measure the level of securitization as the total value of structured finance products issued by bank i in year t scaled by the bank's consolidated total assets as reported in Bankscope ($SEC\ ratio_{i,t}$). $SEC_{i,t}$ is an indicator equal to 1 if $SEC\ ratio_{i,t}$ is strictly positive (i.e., if bank i issued at least one security in year t) and 0 otherwise. Following Affinito and Tagliaferri (2010), we exclude from the computation of *SEC ratio* and *SEC* those securities originated to be retained. Of the 134 banks in the sample, 36 issued (and did not retain) at least one structured finance product in the period considered (74 bank-year observations). Table 3 reports some descriptive statistics about the securitization activity of these banks.

On average, securitizing banks create approximately 7 deals (17 tranches) per year, for a total yearly amount of 2.4 billion euro. MBSs are by far the most common structured finance product, representing approximately half of the total amount; securities backed by loans to SMEs follow, at approximately 14%.

3.1.2. Covered bond program

Our main explanatory variable of interest is an indicator (*CBP*) that captures whether a bank has a covered bond program. To build *CBP*, we start from the technical reports of the Norddeutsche Landesbank (2013), which include a list of banks issuing CBs. If a bank is in the list of CB issuers, then *CBP* is set equal to 1 for that bank; if not, then the indicator is set equal to 0. We further check whether the 134 banks are included in the list of banks with a CBP compiled by the European Covered Bond Council (ECBC).[6] Finally, we search on Bloomberg for each of the 134 banks considered to ensure that no bank for which $CBP = 0$ has actually issued CBs, and vice versa.[7] By construction, *CBP* is a time-invariant characteristic of each bank. Differently from Carbó-Valverde et al. (2011), who focus on the different rationales for banks to issue CBs and ABSs, in this study, we are interested in how the *ability* of a bank to issue CBs affects its securitization activity, which is why we focus on *CBP* rather than on the CB issuance activity in each year. Of the 134 banks in the dataset, 70 appear to be able to issue CBs, corresponding to 424 observations (55% of the sample).

[5] Data accessed at www.sifma.org on October 19, 2015.
[6] Data available at http://www.ecbc.eu/issuers.
[7] For no bank did the value of *CBP* change as a result of these further checks.

Table 3
Characteristics of securitization activity for banks in the sample. This table presents descriptive statistics regarding securitization activities for bank-year observations in the sample. Bank-year observations for which no issuance of structured finance products (either to be retained or distributed) is observed are excluded. The underlying asset pool refers to the value-weighted share of securities backed by different types of assets for each bank-year, expressed in percentage points. Total- amount (in billions of euro) statistics are presented for all ABSs, excluding securities created to be retained.

	N	Mean	Std. Dev.	5% perc.	Median	95% perc.
No. Deals	74	6.74	18.69	1	2	20
No. Tranches	74	17.15	26.66	3	10	57
Total amount (bln. Euro)	74	2.39	3.98	0.06	1.10	13.00
Underlying asset pool (%)						
Auto	74	15.37	33.06	0.00	0.00	100.00
Collateralized Debt Obligations	74	11.46	28.68	0.00	0.00	100.00
Commercial Mortgage-Backed Securities	74	0.96	5.64	0.00	0.00	0.00
Credit Cards receivables	74	0.00	0.00	0.00	0.00	0.00
Consumer Loans	74	6.19	18.15	0.00	0.00	63.64
Leases	74	0.88	4.75	0.00	0.00	0.60
Residential Mortgage-Backed Securities	74	49.95	44.85	0.00	52.68	100.00
SMEs Collateralized Loan Obligations	74	13.97	29.13	0.00	0.00	100.00
Other	74	1.23	4.7	0.00	0.00	9.02

3.1.3. Bank characteristics and other controls

To proxy for rationales for securitization and to control for extra dimensions likely to influence the phenomena under study, we consider a number of relevant bank characteristics. All of the bank variables described below are computed based on Bankscope data and are lagged 1 year, as is customary, to reduce endogeneity. Whenever possible, we closely follow the definitions proposed by Farruggio and Uhde (2015), who also investigate the rationales for the securitization activity of European banks using Bankscope data.

We use two alternative proxies for bank liquidity/funding needs: *Liquidity ratio*, which is defined as one minus the ratio of net loans to total assets; and *Liquidity alt*, which is defined as the ratio of liquid assets (trading assets, loans and advances with a maturity of less than 3 months) to deposits and short-term funding. Observations characterized by lower values of *Liquidity ratio* or *Liquidity alt* identify banks more likely to securitize for liquidity/funding needs. The ratio of loan loss reserves to gross loans (*Loss to loans*) proxies for a bank's exposure to credit risk. As discussed in Section 2.1, the credit risk of a bank's assets can exhibit either a positive or a negative correlation with the intensity of that bank's securitization activity. To proxy for a bank's need to improve its regulatory capital position, we use the ratio of a bank's Tier 1 capital to its risk-weighted assets (*Tier 1 ratio*). We control for a bank's operative performance using the ratio of operating profit to equity (*ROE*). *Liquidity ratio, Liquidity alt, Loss to loans, Tier 1 ratio*, and *ROE* are all expressed in percentage points. We proxy for a bank's size using the natural logarithm of its total assets, expressed in millions of euro (*LNTA*). Cardone-Riportella et al. (2010) show that bigger banks and banks with better operating performances tend to securitize more. Finally, we control for a bank's typology using an indicator equal to 1 if it is a commercial bank and 0 otherwise (*Commercial*).

We also include in our analysis two country-level control variables (source: Datastream): the difference between the 10-year and 3-year yields on government bonds (*Slope*) and the annual GDP growth (*GDP*). These variables are typically included in studies about securitization to control for the current status and future prospects of an economy. Banks in growing economies have been found to ceteris paribus engage more heavily in securitization activities (e.g., Maddaloni and Peydró, 2011). Table 4 reports descriptive statistics for all of the variables included in this study.

On average, banks in our sample securitize (excluding retained securities) 0.18% of their assets. This number is slightly lower than reported by Farruggio and Uhde (2015) –consistent with the inclusion of three more crisis years in our sample– but comparable in magnitude. The share is 1.84% when only observations for which $SEC = 1$ are considered.

3.2. Methodology

Since by definition the issuance of structured finance product cannot be negative, previous studies have often investigated the determinants of securitization using a Tobit model. However, such a model ignores the two-stage nature of the decision because a banks must determine both if and how much of its assets to securitize. The two decisions could in principle be influenced by different determinants or by the same determinants in different manners; a traditional Tobit model does not allow for such flexibility. In this study, we thus focus on double-hurdle models, which enable teasing out the distinction between the decision about if and how much to issue (for a detailed discussion of this class of models, see Wooldridge, 2010).

The first model that we consider is a Cragg (1971) truncated normal hurdle model. The model uses a probit specification for the selection equation, i.e., $\Pr(SEC = 1|X) = \Phi(X\gamma)$, and a truncated (at zero) normal distribution for the amount equation, i.e.,

$$f(SEC\ ratio|X, SEC = 1) = [\Phi(X\beta/\sigma)]^{-1}\phi[(SEC\ ratio - X\beta)/\sigma]/\sigma \quad (1)$$

Table 4
Descriptive statistics. This table presents descriptive statistics for the variables included in this study. *SEC ratio* is the ratio of euro-denominated structured finance products (excluding retained securities) to a bank's total assets, expressed in percentage points. *SEC* is an indicator equal to 1 when *SEC ratio* > 0 and 0 otherwise. *CBP* is an indicator equal to 1 for banks with a covered bond program and 0 otherwise. *Liquidity ratio* is computed as 1 minus the ratio of net loans to total assets. *Liquidity alt* is the ratio of liquid assets to deposits and short-term debt funding. *Loss to loans* is the ratio of loan loss reserves to gross loans. *Tier 1 ratio* is the ratio of the accounting value of a bank's equity to its risk-weighted assets. *ROE* is the ratio of a bank's operating profit to the accounting value of its equity. *Liquidity ratio*, *Liquidity alt*, *Loss to loans*, *Tier 1 ratio*, and *ROE* are all expressed in percentage points and lagged 1 year. *LNTA* is the natural logarithm of the (1-year- lagged) bank's total assets, expressed in millions of euro. *Commercial* is an indicator equal to 1 if the bank is a commercial bank and 0 otherwise. *Slope* is the difference between the 10-year and 3-year government bond yields. *GDP* is the country's GDP growth rate.

Variable	N	Mean	Std. Dev.	5% perc.	Median	95% perc.
SEC	775	0.10	0.29	0	0	1
SEC ratio	775	0.18	0.91	0.00	0.00	0.65
CBP	775	0.55	0.50	0	1	1
Liquidity ratio	775	42.54	19.63	16.86	38.31	80.65
Liquidity alt	753	36.79	61.58	3.58	20.83	96.10
Loss to loans	775	2.72	3.01	0.22	2.16	6.83
Tier 1 ratio	775	10.92	5.85	6.31	9.67	18.2
ROE	775	0.03	2.84	-0.39	0.08	0.23
LNTA	775	10.83	1.71	8.04	10.79	13.73
Commercial	775	0.68	0.47	0	1	1
Slope	775	2.42	2.70	0.14	2.16	3.75
GDP	775	0.01	0.03	−0.05	0.02	0.06

where X is a vector of explanatory variables, which in this case we assume to be the same for both the selection and amount equations.[8]

The unconditional[9] expected value of *SEC ratio* is then given by

$$E(SEC\ ratio|X) = \Phi(X\gamma)[X\beta + \sigma\lambda(X\beta/\sigma)] \tag{2}$$

where $\lambda(c)$ is the Inverse Mills Ratio (IMR), i.e., $\lambda(c) = \phi(c)/\Phi(c)$.

A potential limitation of the Cragg model is that the error terms for the selection and amount equations are assumed to be independent. Consequently, we also use a Tobit II model, which allows the two terms to be correlated. In this case, we include among the determinants of the binary decision to issue ABSs a dummy variable that is equal to one if the bank issued ABS securities in the previous year and zero otherwise (SEC_{t-1}). This is done to avoid excessive reliance on the non-linearity of the IMR for identification. The rationale for using SEC_{t-1} for this purpose is that banks that issued ABSs in the recent past are expected to be, ceteris paribus, more prepared to do so also in the future; however, the effective amount of assets securitized is more likely dependent on a bank's contingent needs. The first-time issuance of an ABS, for example, requires a significant build up of resources and expertise, which can be utilized for future transactions. From an empirical point of view, SEC_{t-1} appears to be an apt choice for identification. The pairwise correlation between SEC_t and SEC_{t-1} is 0.569, which is statistically significant at the 1% confidence level; the correlation between SEC_{t-1} and *SEC ratio*–conditioning on the latter being strictly positive–is instead 0.021, which is not statistically significant at customary confidence levels. A likelihood ratio test indicates that a Tobit II model that includes SEC_{t-1} among the selection determinants significantly (at the 1% confidence level) outperforms a nested model that does not include it. Including SEC_{t-1} also in the amount equation does not significantly (at customary confidence levels) increase the likelihood score further.[10]

With both the Cragg and Tobit II models, we address the effect of each explanatory variable x on the securitization activity of the bank by considering the Average Marginal Effect (*AME*) of x on the unconditional expected value of *SEC ratio*. As is customary, for indicators (most notably *CBP*), the *AME* is computed as the difference between the expected unconditional value of *SEC ratio* when the indicator is equal to one and the expected unconditional value when it is equal to zero.

4. Results

In this section, we present the empirical results of our study. Section 4.1 focuses on the difference in the intensity of securitization activities between banks with and without a CBP. Section 4.2 addresses the interaction between the presence of a CBP and other characteristics of a bank in explaining its securitization activity.

[8] Cragg (1971) also proposes an alternative specification in which the amount variable is assumed to follow a lognormal distribution. A Vuong test does not reject the null hypothesis that the two models are equivalent in terms of fitness. We thus use the truncated normal hurdle model because it allows for a more straightforward interpretation of the results.

[9] "unconditional" in this setting refers to not conditioning on *SEC ratio* being strictly positive. The expected value is of course conditional on the values assumed by the explanatory variables.

[10] In unreported robustness checks, we use for identification an indicator that is equal to 1 if the bank has issued ABSs in the previous 2 (or 3) years and zero otherwise. The results are similar to those reported in the paper. The correlation between SEC_t and SEC_{t-1} is similar for observations characterized by levels of liquidity above or below the sample median, and for banks with or without a CBP.

4.1. covered bond program and ABS issuance

Table 5 presents coefficient estimates for a Cragg Model (i) and two Tobit II Models (ii, iii) of the securitization activity of a bank, excluding retained securities. For each model, we present estimates for the selection equation, the amount equation, and the Average Marginal Effect (*AME*) on the unconditional expected value of *SEC ratio* computed based on those estimates. Each model includes *CBP* and the control variables specified in Section 3. Models (ii) and (iii) differ only in terms of the proxy used for liquidity, *Liquidity ratio* and *Liquidity alt*, respectively. To account for time trends, we also include year indicators amongst the explanatory variables.

Considering the results for the Cragg model, we see that the unconditional expected level of securitization is, on average, 0.13 percentage points lower when banks have a covered bond program. The *AME* is statistically significant at the 5% confidence level. In addition to being statistically significant, the effect is economically relevant because it implies a 67% lower level of securitization relative to the mean in our sample (0.18%). A very similar result is obtained when a Tobit II model is used. The *AME* of *CBP* is −0.11 for Model (ii) and −0.13 for Model (iii), and it is statistically significant at the 10% and 5% confidence levels, respectively. The empirical results reported in Table 5 thus suggest that as predicted, banks with a CBP are ceteris paribus less inclined to issue structured finance products. Before moving to the analysis of how bank's characteristics moderate this result, it is worthwhile to briefly discuss the results obtained for the other explanatory variables.

As expected, liquidity proxies negatively correlate with the intensity of a bank's securitization, i.e., more illiquid banks engage more in securitization activities. The effect is statistically significant at the 5% confidence level, at least, for each model and liquidity proxy considered. The level of credit risk of a bank's asset, as proxied by *Loss to loans*, is also negatively related to ABS issuance, a result consistent with those reported by previous studies (e.g., Calem and LaCour-Little, 2004; Farruggio and Uhde, 2015). On average, a 1 percentage point greater level of loss allowances is associated with a reduction in the *SEC ratio* between 0.03 and 0.07 percentage points, depending on the model. The effect is statistically significant at the 10% confidence level, at least. As discussed in Section 2.1, this result can be explained in terms of an asymmetry in the information about the quality of the collateral between the bank and investors. Albeit not statistically significant at customary confidence levels, the negative sign of *Tier 1 ratio* is coherent with the idea that securitization can be used to improve the

Table 5
Covered bond program and securitization activity. This table presents coefficient estimates of a Cragg (i) and two Tobit II (ii, iii) models for the securitization activities of banks. The dependent variables are *SEC* and *SEC ratio* for the selection and amount equations of the models, respectively. SEC_{t-1} is the 1-year lag of *SEC*. All of the other variables are as defined in Table 4. Standard errors robust to heteroskedasticity and clustered by bank are reported in parentheses. No. observations is the number of bank-year observations included. No. banks is the number of distinct banks. No. issuing is the number of bank-year observations for which $SEC = 1$. The Average Marginal Effect (*AME*) of each variable on the unconditional expected value of *SEC ratio* is reported for each model. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

	(i) Cragg model			(ii) Tobit II model			(iii) Tobit II model, alt		
	Selection	Amount	*AME*	Selection	Amount	*AME*	Selection	Amount	*AME*
CBP	−0.520**	−0.603	−0.130**	−0.292	−0.601	−0.110*	−0.329*	−0.605	−0.128**
	(0.259)	(0.841)	(0.062)	(0.200)	(0.484)	(0.056)	(0.185)	(0.480)	(0.058)
Liquidity ratio	−0.030***	−0.073**	−0.009***	−0.024***	−0.011	−0.005***			
	(0.010)	(0.032)	(0.003)	(0.006)	(0.016)	(0.002)			
Liquidity alt							−0.005**	−0.004	−0.001**
							(0.002)	(0.006)	(0.001)
Loss to loans	−0.184***	−1.018**	−0.072**	−0.111**	−0.136	−0.031*	−0.111**	−0.127	−0.034*
	(0.067)	(0.471)	(0.030)	(0.051)	(0.170)	(0.017)	(0.053)	(0.179)	(0.019)
Tier 1 ratio	0.007	−0.132	−0.003	0.021	−0.106	−0.007	0.007	−0.137	−0.012
	(0.027)	(0.205)	(0.012)	(0.019)	(0.150)	(0.013)	(0.016)	(0.128)	(0.012)
ROE	−0.013	4.162	0.137	0.013	3.087	0.296	−0.004	3.052	0.298
	(0.017)	(4.683)	(0.325)	(0.059)	(2.284)	(0.212)	(0.054)	(2.727)	(0.263)
LNTA	0.607***	−1.825***	0.064*	0.432***	−0.916***	−0.016	0.284***	−1.044***	−0.047**
	(0.140)	(0.558)	(0.034)	(0.100)	(0.286)	(0.030)	(0.063)	(0.188)	(0.019)
Commercial	0.374	−0.276	0.065	0.288	0.554	0.092	0.249	0.635	0.102
	(0.316)	(0.790)	(0.058)	(0.242)	(0.596)	(0.057)	(0.230)	(0.604)	(0.063)
Slope	0.136	1.810*	0.089*	0.128	−0.049	0.017	0.107	−0.101	0.011
	(0.107)	(0.998)	(0.053)	(0.095)	(0.203)	(0.030)	(0.080)	(0.181)	(0.027)
GDP	1.482	5.969	0.506	−0.293	3.957	0.328	−2.079	5.502	0.132
	(5.262)	(45.566)	(1.846)	(5.088)	(14.198)	(1.793)	(5.128)	(13.410)	(1.846)
SEC_{t-1}				1.821***			1.903***		
				(0.271)			(0.249)		
Year indicators	Yes	Yes		Yes	Yes		Yes	Yes	
σ		1.613			1.500			1.459	
λ					−0.195			−0.249	
No. Observations	775			775			753		
No. Banks	134			134			133		
No. Issuing	74			74			74		

regulatory capital position of a bank. Banks with better operative performance (i.e., higher *ROE*) appear to securitize more, even though the average effect is not statistically significant. Mixed results are obtained for the bank's size: the *AME* of *LNTA* is positive for Model (i) and negative for Models (ii) and (iii). It is also interesting to notice how *LNTA* appears to impact the decision to securitize and the level of securitization conditional on issuance in opposite directions, thus confirming the importance of using double-hurdle models. Finally, both *Slope* and *GDP* exhibit a positive *AME*, a result that is consistent with those of Maddaloni and Peydró (2011).

4.2. Moderating role of rationales for securitization

In this section, we investigate the moderating role of a bank's characteristics on the relationship between *CBP* and ABS issuance. In particular, we focus on the proxies for the three main rationales for securitization (i.e., funding/liquidity, credit risk, and regulatory capital requirements). As discussed in Section 2.2, we expect the difference between banks with and without a CBP to be especially prominent for banks more likely to securitize for funding/liquidity reasons. To better gauge the interaction between rationales for securitization and the availability of CBs as an alternative to ABSs, we estimate four Tobit II models, including the cross-product of *CBP* and *Liquidity ratio* (i), *Liquidity alt* (ii), *Loss to loans* (iii), or *Tier 1 ratio* (iv). The coefficient estimates are reported in Table 6. The four models also include the control variables of Models (ii) and (iii) of Table 5.

Fig. 1 illustrates the average marginal effects computed based on coefficient estimates for Models (i)–(iv) of Table 6. For each model, we compute the *AME* of *CBP* for different values of the bank characteristic *x*, where *x* is *Liquidity ratio, Liquidity alt, Loss to loans, or Tier 1 ratio*, depending on the model. We also compute the difference in the average marginal effect of *x* itself between banks with and without a covered bond program for different levels of *x*. We expect the difference in the unconditional expected level of securitization between banks with and without a CBP to be greater for more illiquid banks, i.e., for banks more likely to issue ABSs for funding/liquidity reasons. We also expect a stronger (negative) marginal effect of *Liquidity ratio* or *Liquidity alt* on the level of securitization for banks without a CBP, especially when the bank's asset are very illiquid (i.e., for low values of the liquidity proxy considered). For the reasons discussed in Section 2.2, we do not instead expect a significant difference in the ABS issuance of banks with and without a CBP when credit risk and regulatory capital requirement-driven needs are more likely to be the main determinants of securitization.

As expected, the marginal effect of *CBP* monotonically decreases with the level of *Liquidity ratio*. The difference in the unconditional expected value of *SEC ratio* between banks with and without a covered bond program is statistically significant at the 5% (1%) confidence level when *Liquidity ratio* is less than 41% (35%). For extremely illiquid banks –i.e.,

Table 6
Covered bond program and securitization determinants. This table presents coefficient estimates of a Tobit II models for the securitization activity of each bank. The dependent variables are *SEC* and *SEC ratio* for the selection and amount equations of the model, respectively. *Interaction* represents for Models (i), (ii), (iii), and (iv) the cross-product of *CBP* and *Liquidity ratio*, *Liquidity alt*, *Loss to loans*, and *Tier 1 ratio*, respectively. SEC_{t-1} is the 1-year lag of *SEC*. Other controls include *ROE*, *LNTA*, *Slope*, and *GDP*. All other variables are as defined in Table 4. Standard errors robust to heteroskedasticity and clustered by bank are reported in parentheses. No. observations is the number of bank-year observations included. No. banks is the number of distinct banks. No. issuing is the number of bank-year observations for which $SEC = 1$. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

	(i) *Liquidity ratio*		(ii) *Liquidity alt*		(iii) *Loss to loans*		(iv) *Tier 1 ratio*	
	Selection	Amount	Selection	Amount	Selection	Amount	Selection	Amount
CBP	−0.818**	−3.030***	−0.493***	−1.784***	−0.530	−1.522**	−1.441***	0.357
	(0.389)	(0.882)	(0.232)	(0.624)	(0.355)	(0.731)	(0.545)	(1.773)
Interaction	0.013*	0.057***	0.005	0.032***	0.116	0.465*	0.108**	−0.099
	(0.007)	(0.015)	(0.004)	(0.007)	(0.102)	(0.275)	(0.054)	(0.184)
Liquidity ratio	−0.030***	−0.030**			−0.023***	−0.011	−0.027***	−0.008
	(0.008)	(0.015)			(0.006)	(0.016)	(0.006)	(0.016)
Liquidity alt			−0.007**	−0.011**				
			(0.003)	(0.005)				
Loss to loans	−0.107**	−0.044	−0.115**	−0.219	−0.185**	−0.340	−0.113**	−0.140
	(0.052)	(0.153)	(0.055)	(0.156)	(0.087)	(0.238)	(0.053)	(0.167)
Tier 1 ratio	0.020	−0.097	0.006	−0.141	0.019	−0.041	−0.042	−0.034
	(0.021)	(0.125)	(0.017)	(0.114)	(0.020)	(0.151)	(0.045)	(0.248)
SEC_{t-1}	1.818***		1.917***		1.821***		1.778***	
	(0.273)		(0.249)		(0.273)		(0.255)	
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
σ		1.351		1.405		1.426		1.446
λ		−0.344		−0.327		−0.215		−0.188
No. Observations	775		753		775		775	
No. Banks	134		133		134		134	
No. Issuing	74		74		74		74	

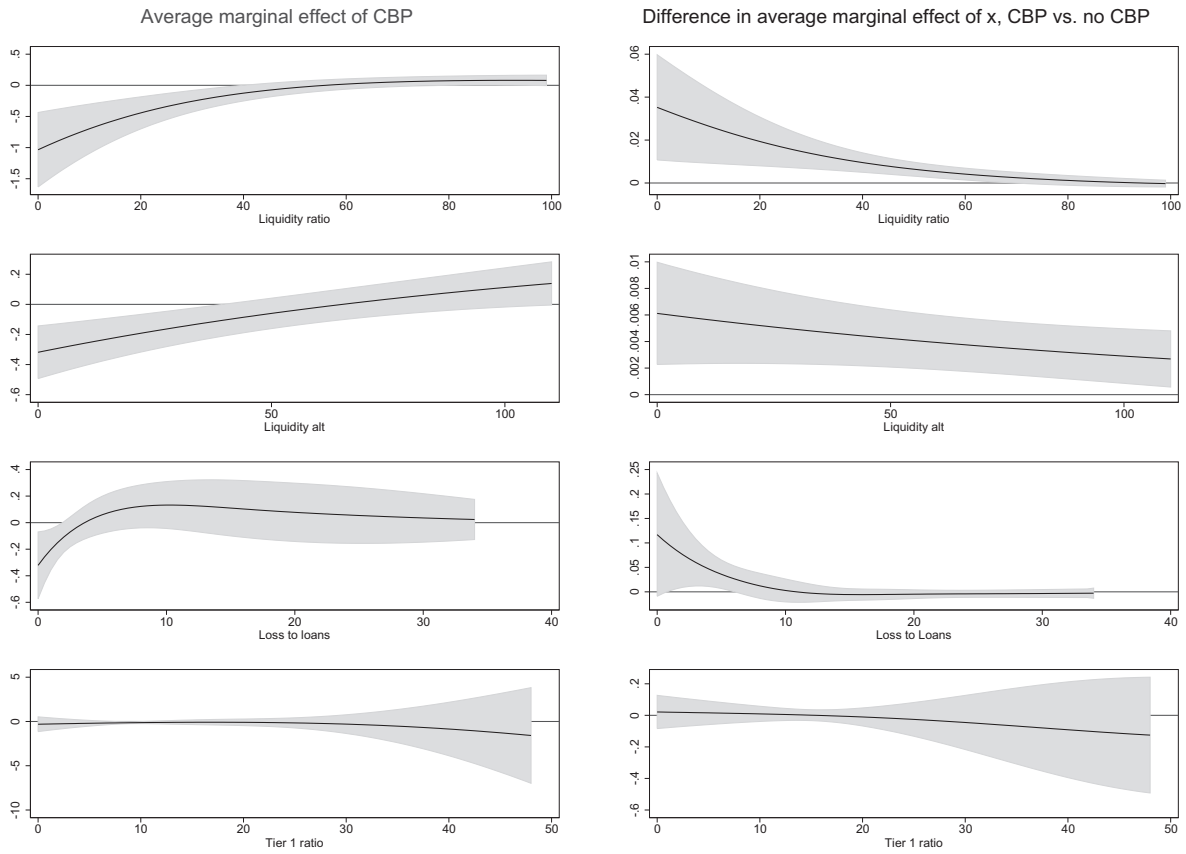

Fig. 1. Average marginal effects. This figure presents the average marginal effects on the unconditional expected value of *SEC ratio*. Each of the four rows focuses on a different bank characteristic *x*, where *x* is *Liquidity ratio* (first row), *Liquidity alt* (second row), *Loss to loans* (third row), or *Tier* 1 *ratio* (fourth row). The effects presented in the first, second, third, and fourth row are based on the coefficient estimates for Model (i), (ii), (iii), and (iv), respectively, as presented in Table 6. The column on the left presents the (average) difference in the unconditional expected level of securitization between banks with and without a covered bond program (CBP), computed for different levels of *x*. Negative values indicate a lower securitization activity by banks with a CBP. The column on the right presents the difference in the average marginal effect of *x* between banks with and without a CBP, also computed for different levels of *x*. Positive values indicate a higher (i.e., less negative) marginal effect for banks with a CBP. The grey areas represent the 95% confidence intervals.

Liquidity ratio approaching 0– the availability of a CBP is estimated to be associated with approximately 1-percentage-point lower levels of securitization. The negative effect of *Liquidity ratio* on the unconditional expected value of *SEC ratio* is significantly (at the 5% confidence level) stronger for banks without a CBP throughout most of the variable's domain, and it is bigger for more illiquid banks. For example, for a bank characterized by a *Liquidity ratio* of 20%, a 1-percentage-point decrease in asset liquidity is associated with a 0.02-percentage-point stronger negative effect on securitization for banks without a CBP. When *Liquidity ratio* is equal to 10%, the difference increases to 0.03 percentage points. Interestingly, this functional form is entirely driven by the *AME* of banks without a covered bond program, as illustrated in Fig. 2. Whereas the *AME* of *Liquidity ratio* is greater (in absolute terms) for more-illiquid banks, it is close to zero and not statistically significant throughout the whole range for banks with a CBP. The latter observation is consistent with the results reported by Carbó-Valverde et al. (2011), who find that banks do not securitize for funding purposes. We demonstrate that this is true only for banks who actually have access to CBs as an alternative funding instrument. As shown in Figs. 1 and 2, very similar results are obtained when *Liquidity alt* is used instead of *Liquidity ratio* as a proxy for a bank's funding/liquidity needs.

As for the other explanatory variables, credit risk does not seem to play an important role in explaining potential differences in the securitization activity of banks with and without a CBP. The difference in the average unconditional expected value of *SEC ratio* between the two is statistically significant at the 5% confidence level only for very low levels ($< 5\%$) of *Loss to loans*, i.e., when banks are very unlikely to issue ABSs to remove the riskiest assets from their balance sheets. As expected, regulatory capital also does not appear to play a significant role in explaining the differences in the securitization activity of the two groups of banks.

All in all, the results presented in this section suggest that the difference in the securitization activity of banks with and without a CBP is mainly driven by the banks most likely to issue ABSs as a funding tool.

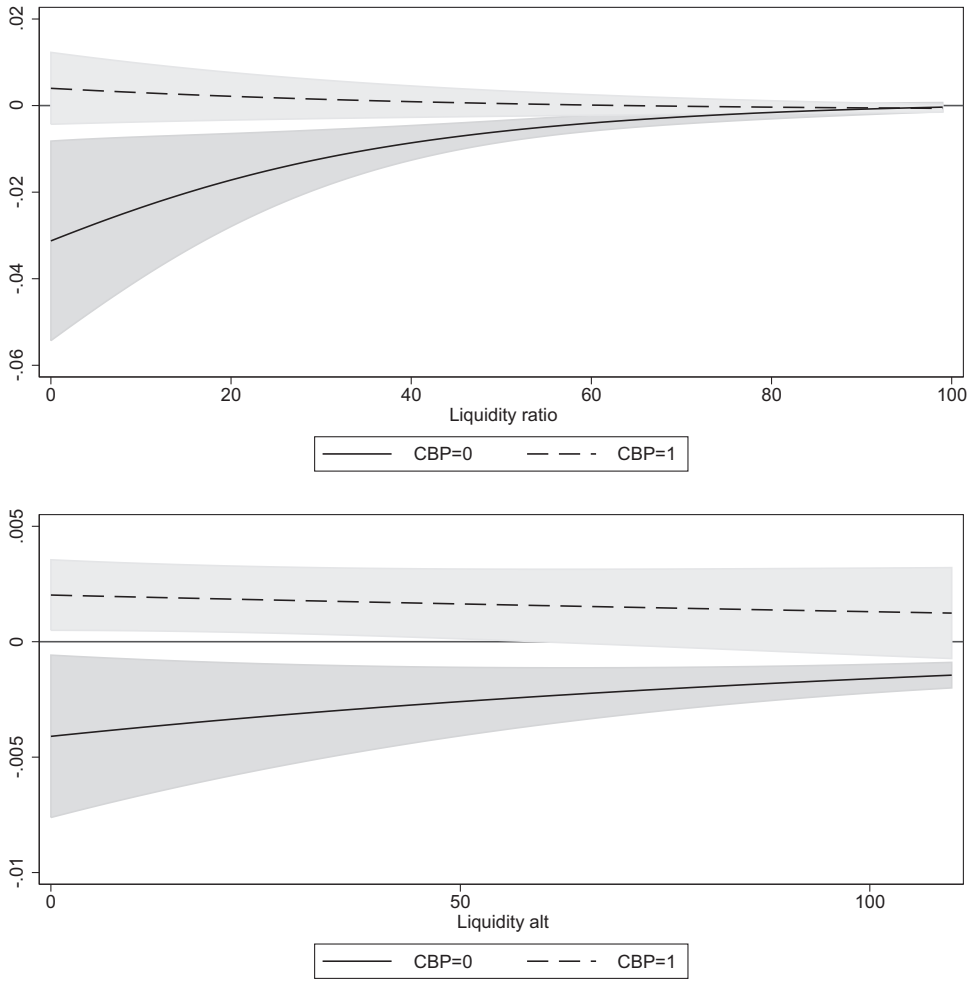

Fig. 2. Average marginal effect of liquidity: banks with and without a covered bond program. This figure presents the average marginal effect of *Liquidity ratio* (first row) or *Liquidity alt* (second row) on the unconditional expected value of *SEC ratio* for banks with (dotted line) and without (continuous line) a covered bond program, for different levels of liquidity. The marginal effects are computed based on the coefficient estimates for Models (i) and (ii), as presented in Table 6. The grey areas represent the 95% confidence intervals.

5. Conclusions

In this paper, we investigate how the ability to issue covered bonds (CBs) affects the securitization activity of European banks. asset-backed securities (ABSs) and CBs are both fixed-income securities linked to ring-fenced assets. However, CBs do not allow banks to transfer credit risk to the same extent as ABSs do.

The resulting mitigation of asymmetric information and agency problems provide CBs with a comparative advantage as a funding tool over ABSs, albeit not as a method to transfer credit risk.

Using a sample of 775 observations of 134 European banks between 2007 and 2013, we demonstrate that banks with a covered bond program (CBP) securitize ceteris paribus less of their assets. The difference is mainly driven by banks characterized by a low level of asset liquidity. Proxies for a bank's need to transfer credit risk and/or meet regulatory capital requirements do not seem equally relevant. A reduction in asset liquidity is associated with an expected increase in ABS issuance only for banks without a CBP. This suggests that ABSs are still regarded as a viable funding tool, but only for banks that are not able to resort to CBs.

Our results thus demonstrate that CBs play an important role in the decisions of European banks to securitize their assets. In the aftermath of the crisis, European institutions such as the ECB and the newly created European Banking Association (EBA) have considered a well-functioning ABS market as pivotal in providing SMEs with credit and banks with a diversified source of funding.[11] A further reduction in the diversification of funding sources could in fact result in higher bankruptcy costs

[11] See, for example, the joint document by the ECB and the Bank of England: "The impaired EU securitization market: causes, roadblocks and how to deal with them". www.ecb.europa.eu/pub/pdf/other/ecb-boe_impaired_eu_securitisation_marketen.pdf

(Colla et al., 2013) and systemic risk (Oura et al., 2013). Moreover, the current capital constraints associated with the use of ABSs as a funding tool are passed through to financed companies (Carbó-Valverde et al., 2015). In this context, several initiatives have been proposed to revitalize the market, especially for securities backed by corporate loans (Aiyar et al., 2015). Despite this trend, some of the currently proposed regulations seem to go in the direction of further favoring CBs over ABSs. For example, in the context of the Basel III liquidity coverage requirements, the EBA proposed in 2013 to base liquidity measurements on bid-ask spreads. This would once again favor CBs, even if alternative measurements would suggest ABSs are often as or even more liquid than CBs (Perraudin, 2014). In pursuing their target to revitalize the European ABS market, regulators should keep in mind the potential effect of rules that may increase the comparative advantage of CBs relative to ABSs.

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