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The Yield of Asset-Backed Securities After the Financial Crisis: An Empirical Approach

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ABS	Asset-Backed Securities
ABSPP	Asset-Backed Securities Purchase Programme
MBS	Mortgage-Backed Securities
APP	Expanded Asset Purchase Programme
CB	Corporate Bonds
CDO	Collateralized Debt Obligation
ECB	European Central Bank
EUR	Euro
SPV	Special Purpose Vehicle
U.K.	United Kingdom
U.S.	United States of America
USD	United States Dollar
QE	Quantitative Easing

1. Introduction

This dissertation discusses securitization of non-U.S. asset-backed securities in the aftermath of the 2007 financial crisis. Before 2007, securitization was a well-established technique used by companies to finance collections of non-tradable and non-liquid assets (Vink & Thibeault, 2008; Pinto & Alves, 2016; Szablowska, 2010). Undertaking these necessitates the originator (parent company) to found a special purpose vehicle (SPV) (Gorton & Souleles, 2005; Klee & Butler, 2002). The collection of assets is sold by the originator to the SPV (Almazan & Martin-Oliver, 2015) whose primary objective is to facilitate the securitization of the assets while ensuring that it is established for bankruptcy purposes as a legal entity separate from the originator (Gaschler, 2008; Chang, Wang, & Liao, 2009). Moreover, one central fact that makes securitization a popular financial technique is the process of repayment. Repayment and the coupons of all collections of assets issued by the SPV depend only or at least primarily on the assets respectively on the cash flows pledged as collateral to the issue (Dinca, 2014). This element is critical to all investors, since the payments from the SPV are independent of the originator's financial strengths and depend only on the financial strength of the underlying assets (Vink & Thibeault, 2008). Blum and DiAngelo (1997) as well as Choudhry and Fabozzi (2004), Fermanian (2011), and Vink and Thibeault (2008) mention that the securitization market which issues and trades the above mentioned securities, consists of three main classes: The first, comprises asset-backed securities (ABS). These are all securitization issues backed by consumer products, such as car loans, consumer or home equity loans, and credit cards, among others (Moody's Investors Service, 2002; Choudhry & Fabozzi, 2004; Vink & Thibeault, 2008; Culp & Forrester, 2015; Van Gorp & Horn, 2005; Heard & Bella Jr., 2008; Desear, 2009; Greene & Fleischmann, 2009). The second class comprises mortgage-backed securities (MBS) which are all securitization issues backed by mortgages (Elul, 2016; Malkhozov, Mueller, Vedolin, & Venter, 2016; Bernhardt, Kolbe, & Zagst, 2013; Nabin, Bhattacharya, & Rafiq, 2015; O'Neill, 2005; Geidosch, 2014). The third class comprises collateralized debt obligations (CDO), i.e. all securitization issues backed by debt obligations (Nomura, 2004; Fitch Ratings, 2004; Choudhry & Fabozzi, 2004; Vink & Thibeault, 2008; Longstaff & Rajan, 2008; Giesecke & Baeho, 2011; Deckant, 2010-2011; Adelson, 2016). Despite them being so distinct, the term "Asset-Backed Securities" is used to describe all three classes of securities. To avoid confusion, the

term “Asset-Backed Securities” is applied here to refer to the first class of securities. In the context of this study, however, we discuss—empirically—the development of the ABS market post the 2007 financial crisis.

1.1 Securitization

This chapter introduces one of the most important financing instruments-securitization—in the global fixed income market (Solomon, 2012). Securitization is a financial instrument first introduced in the 1970s in the U.S. It generates asset-backed securities (Subido, 2003; Fabozzi & Kothari, 2007; David, 1997) and was first used in the U.S. mortgages market (Moyo & Firer, 2008), but eventually evolved into an instrument that pooled many different kinds of non-tradable assets into a tradable security (Vink & Thibeault, 2008; Pinto & Alves, 2016; Jobst, 2006). Owing to this, securitization represented a new way in which financial institutions and corporations could find new sources of funding (Jobst, 2008). The steady growth of the securitization market was interrupted by the financial crisis that hit the U.S. mortgages market in 2007 (True Sale International, 2008; Longstaff & Myers, 2014; Bonaccorsi di Patti & Sette, 2016; Demyanyk & Van Hemert, 2011). Although the securitization market struggled for many years, it witnessed some recovery 2010 onwards (True Sale International, 2014; Chtourou & Hammami, 2013; Goodman, 2016).

1.1.1 Securitization History

Today, asset-backed securities have become one of the most popular financing methods in the fixed income market. It is well-known that companies use different methods—in global and regional markets—to raise money for investments and stay competitive. This dissertation discusses securitization in the non-U.S. ABS market with special emphasis on the European ABS market. Historically, securitization is a technique first applied in the U.S. mortgage market. Government-backed agencies, such as Ginnie Mae, applied this technique to pool home mortgages into mortgage-backed securities (Segoviano, Jones, Lindner, & Blankenheim, 2013; Kothari, 2006). The purpose of MBS was to lower the risk of government-backed agencies and support expanded affordable housing in the U.S. The success of this new financial instrument inspired other industries to securitize non-mortgage income-producing assets in the early 1980s (Welsher & Penrose, 2004). The first asset class securitized using the techniques developed in the mortgages market, was car loans (Vink & Thibeault, 2008;

Fermanian, 2013). Further, the success of these securitizations immediately increased the number of related issues (Hu & Cantor, 2003; Hu, 2007; Kramer-Eis & Passaris, 2015). Therefore, securities came to be backed by an increasingly diverse and ever-expanding array of assets, including bank assets— such as payments associated with corporate loans, and corporate assets—such as lease receivables (Vink & Thibeault, 2008; Jobst, What Is Securitization?, 2008). In the subsequent decades, the MBS, ABS, and CDO markets grew enormously (Han, Park, & Pennacchi, 2015; Loutskina, 2011; Lin, Chang, Chu, & Prather, 2013; Franke, Herrmann, & Weber, 2012). Securitization became one of the most prominent and important fixed income techniques in the U.S., Europe, and Japan (Prasad, 2008; Hu & Cantor, 2004). Over the years, the number of financial institutions employing securitization to transfer the risk of the pooled assets, increased. Consequently, the number of pooled asset classes increased too. Since the 1990s, securitization not only became the fastest evolving fixed income market in developed markets but also, within the emerging markets (Vink & Thibeault, 2008; Standard and Poor's, 2006). In 2007, due to the subprime MBS market in the U.S., the securitization market begun to struggle (Nadauld & Sherlund, 2009). It was widely agreed that securitization was a key cause of the 2007 financial crisis (Adrian & Shin, 2008; Brunnermeier, 2009; Gorton, 2008; Kashyap, Rajan, & Stein, 2008; Schoen, 2016; Kara, Marques-Ibanez, & Ongena, 2015; Financial Crisis Inquiry Comission, 2011). Many investors lost their trust in securities which were issued using the securitization process. The financial crisis emerged and shocked the global securitization markets (True Sale International, 2008; Covitz, Liang, & Suarez, 2013; Choi, 2013). The MBS defaulted in the U.S. mortgage market and provoked a series of reactions in the global capital markets (Couch, 2014; Shiren & Crosignani, 2009). Given this, investors avoided the entire securitization market (Myles & Thomas, 2014; Pan, 2011) with the result of a collapse of the ABS market during 2007 to 2009 (Ramcharan, Verani, & Van den Heuvel, 2016). Since 2010 however, the securitization market began to show signs of recovery through steady growth and investors started to consider ABS as good investments, again. The amount of money raised in the markets also increased ever since (True Sale International, 2014; Dalton, 2011; Dalton, 2015).

1.1.2 Legal Structure

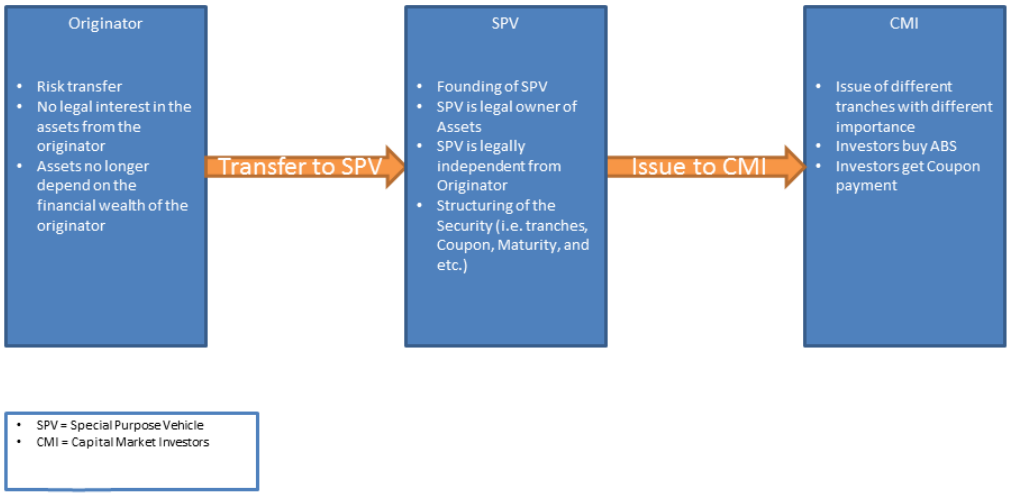
This paragraph presents the process of securitization and introduces and explains important terminology regarding the subsequent chapters in this dissertation. The

process of securitization is complex, given financial institutions and corporations try to pool and sell non-tradable assets (Vink & Thibeault, 2008; Pinto & Alves, 2016; Jobst, 2006). The main objective of securitization is to make non-tradable assets, tradable—and offer financial institutions and corporations access into the financial markets. Further, securitization enables the originator—the financial institution or corporation that owns the assets initially—to remove the assets from their balance sheets (Sidki, 2014; Dechow & Shakespeare, 2009).

1.1.3 Basic Structure

The securitization process can be divided into two steps (Pelletier, 2003; Jobst, 2008; Gorton & Metrick, 2012; Adams, 2005). Figure 1[1] provides an overview of the typical securitization process. A securitization transaction starts with the originator

Figure 1: *Securitization Process*[1]



deciding the assets that the company wants to securitize (Cetorelli & Peristiani, 2012). As a first step, the originator has to consider several factors: for example, determine the assets to be removed from the balance sheet, the assets that have the highest possibility to be sold to possible investors, and the assets that provide an appropriate risk profile for the transaction while being likely to obtain a useful credit rating (Mansini & Pferschy, 2004). Further, the originator pools those assets (Jiang, Nelson, & Vytlacil, 2014), such that they can be transferred to a so-called Special Purpose Vehicle (Jobst, What Is Securitization?, 2008; Segoviano, Jones, Lindner, & Blankenheim, 2013; Fermanian, 2013; Gorton & Metrick, 2012; Bastian, 2005). An SPV is a corporation that is founded especially for the process of securitization. The SPV buys the engaged assets from the

[1] Based on Jobst (2008)

originators (Lützenkirchen, Rösch, & Scheule, 2014), such that the assets are no longer on their balance sheets and the risks are then, transferred to the SPV. The SPV is now the legal holder of these assets. This is important for the originator and the investors. This fact is discussed in detail subsequently in this chapter. Since the SPV does not dispose of its own capital but has to finance the transaction of these assets, it issues a security—the ABS—into the capital market. After the transfer of these assets to the SPV, the pool may be structured into a security. Given securitization is complex, a syndicate of investment banks is also included in the process. The security is backed by the payment claims of the assets held by the SPV. It now has all the typical properties of a security, for instance, a final maturity date, a coupon rate, a transaction size, a rating etc. Further, one important property is the division into different tranches (Pagano & Volpin, 2012; Gorton & Pennacchi, 1990; Plantin, 2004)—or subsamples of the original pool of assets. The underlying assets of the subsamples are categorized based on their risk profiles. This strategy ensures that different pools of assets may be sold with different security characteristics, such as different risk premia. (Jobst, 2008; DeMarzo, 2005; Bougheas, 2014). Due to the categorization of the assets, the originator has the opportunity to structure tranches, differently. For instance, if one tranche has a lower risk profile, it is most likely that the coupon rate is lower than the rate of a tranche with a higher risk profile. Tranches also enable the SPV to use the principle of subordination. Hereby, higher rated tranches are privileged compared to lower rated tranches in terms of credit enhancement. If the security suffers from asset defaults, coupon payments of the higher rated tranche have the highest priority and fail last. Another important property of ABS is the principle of credit enhancement. Credit enhancement serves as an additional guarantee in order to cover against investors' payment defaults (Mandel, Morgan, & Chenyan, 2012; Standard and Poor's, 2008). The different characteristics of credit enhancement may be the principle of subordination, an excess spread, overcollateralization, and a reserve account. Excess spread describes the difference between the interest rates of the underlying pool of assets and the offered coupon on the issued security. It is a defense against losses in the case of payment defaults of the underlying assets. Overcollateralization describes the case, in which the face value of the underlying portfolio of assets is larger than the value of the security it backs. If the security suffers from defaults of the underlying assets, the larger portfolio has the ability to still make payments on the ABS. A reserve account is a defense strategy against losses up to the amount allocated for it. Credit enhancement can be either one of the

above characteristics or every possible composition. The next characteristic is credit rating. This feature implies the existence of at least one rating of a well-known rating agency. Thus, the company assigns a rating agency to rate the different tranches of the security. During this process, the originator provides all existing documents to the rating agency/agencies. The latter then, determines the probability of default for the different tranches considering all information—general, political or economic—of the documents (Bonsall, Koharki, & Neamtiu, 2015; Black, Chu, Cohen, & Nichols, 2012; Furfine, 2014). At the end of the process, the rating agency assigns a rating to all tranches. These are likely to be different due to the different risk profiles of the underlying assets. Tranches with underlying assets having lower risk profiles are assigned most probable higher ratings. Credit ratings are also positively affected by the type of credit enhancement. The security is issued after the completion of the structuring process. In the second step, the security is offered to capital market investors who are allowed to buy all the tranches issued. In addition, some of the securities can be traded on the secondary market (Jobst, 2008). This paper only considers the yields of the primary market, i.e. the gains accruing when the security is issued. The use of secondary market spreads is insufficient for the purpose of this dissertation because primary market spreads reflect the demand of risk premia more accurately than the spreads measured in the secondary market, which are often driven by analysts' expectations and brokers' "indicative prices" (Vink & Thibeault, 2008; Gabbi & Sironi, 2005).

1.1.4 Advantages of Securitization

The originator profits from the perspectives of risks and balance sheets. ABS transactions allow the originator to refinance at a reduced rate, because securitization is independent of the own issuer's credit rating (Peicuti, 2013). Moreover, the risk of assets default is transferred into the capital markets and thus, does not lie solely with the originator (Bensalah & Fedhila, 2016). Additionally, the legal transfer of the assets to the SPV impacts the originator's balance sheet and may be used to make adjustments in his favor. On the other hand, investors profit from the perspectives of payment and risk (Briggs & Beams, 2012). ABS tranches often provide a higher yield than comparable treasury securities, the so-called risk premia, although the securities provide similar credit ratings and risk profiles. The large asset portfolio, which backs the security, provides substantial risk diversification for capital market investors. The most important aspect is the legal transfer of assets to the SPV which implies that the security and its

payments no longer depend on the financial situation of the originator (Vink & Thibeault, 2008; Jobst, 2008) but solely on the underlying assets (Stakic, 2010). Investors purchase claims only on the SPV, not on the originator; so, if receivables of the engaged assets default, the originator is not obligated to reimburse the investors for possible losses. From the investor's perspective, whether the originator crashes or not, does not affect the underlying assets. Therefore, as long as the underlying assets generate enough cash flow, there is no impact on repayments for the investors.

1.2 Literature Review

Since the 1970s, extensive literature has been published on factors that impact pricing in the fixed income market. A majority of the research focuses on the yield determinants of corporate bond issues (Fabozzi & Vink, 2012). In contrast, scarce empirical evidence has been published on the factors that impact pricing of ABS issues—a major sector of the fixed income market in most developed countries. Empirical research regarding asset-backed securities using statistical models is considerably limited however, compared to that on corporate bonds. The first published study examined off-balance-sheet activities of 100 of the largest U.S. banks and was conducted by Holland (1989). The results of this study prove that off-balance-sheet activities are different types of contingencies and commitments not listed on an organization's balance sheet. Further, the study identified that banking organizations were more involved in off-balance-sheet activities given the competition in the banking sector. Another study by Borgman (1996) engaged with a dataset of more than 700 ABS issues and documented the assembly as well as the analyses of the dataset that described the pricing and other characteristics of the issues. Borgman's analyses (1996) conclude that pricing of ABS (absolute and relative yield spreads) was not only rational but also reflected interest rate and reinvestment risks, marketability, and most importantly, premia for default risk (Bakri, Ali, & Ismail, 2014).

Thomas (2002) maintains that empirical analysis is about impact on debt and equity claimants of assets sold into securitization. The paper concludes by stating that shareholders' returns increase in shareholder capitalization and bonds, which are actively traded, generate significant and substantial gains, such that wealth transfer from bondholders to shareholders appears in terms of asset-backed securities among sellers with low credit ratings (Bakri, Ali, & Ismail, 2014). Additionally, Higgins and Mason (2003) show that recourse to securitized debt may benefit not only short-term but also

long-term returns on stocks. Moreover, they may benefit long-term operating performances of sponsors. Higgins and Mason (2003) used a dataset of credit card securities to prove this. They also find similarities between the asset-backed securities market and the commercial paper market, where a firm's ability to issue was directly correlated with the credit quality of the issuing company (Bakri, Ali, & Ismail, 2014).

Pelletier's study (2004) analyzes securitization transactions. Thereby, she examines all steps and aspects relevant for a successful securitization transaction and finds that the process entails a multitude of accounting, tax, and legal issues (Bakri, Ali, & Ismail, 2014). The study concentrates on the most central of all these issues and provides some insight into the future of the securitization market. Interestingly, several studies in the years before and after the 2007 financial crisis have addressed the usage of securitization financing. For example, Ayotte and Goan (2005) analyze how ABS as a financial product can reduce bankruptcy costs for some firms (Bakri, Ali, & Ismail, 2014). These statistical models predict the conditions under which a firm can lower its overall financing costs using the principle of securitization.

Empirical research about the determinants of securitization pricing is provided by Perraudin and Wu (2008). They investigated the manufactured housing sector in 2004 and the collapse of MBS in 2007 in the U.S. subprime market. Their paper indicated the factors that influenced the spreads in asset-backed security prices during crises. They find that the pricing of securitization displayed an unusually large variation in such periods. The conventionally determined risk premium of MBS during the financial crisis was not synchronized with the market prices. Further, they notice a disagreement between the evaluations undertaken by the market and the rating agencies for this security class during periods of crisis.

1.3 Common Pricing Characteristics

This dissertation empirically investigates the yield and the pricing of the asset-backed security market. Thus, the variables on which our empirical analyses are based, form an essential part of this dissertation. For our purpose, we introduce the variables associated with the pricing of asset-backed securities—the so-called common pricing characteristics. Further, we note that the following studies are based on *primary market spreads* and termed issuance *spreads*. Hence, this section discusses the common pricing factors driving the asset-backed securities in the primary market and their expected impact on the *primary market spread*. This implies that it is imperative to understand

the common pricing factors and examine how these variables can be included in the analyses of the research papers studied here.

1.3.1 Primary Market Spread

The *primary market spread*, also called loan spread, represents the risk premium at issuance. On the basis of information at the time of issuance, the risk premium indicates the price for the risk associated with the security. This study defines the *primary market spread* as the offered yield to maturity of the security at issuance above the offered yield to maturity of a corresponding treasury benchmark at issuance (Vink & Thibeault, 2008; Collin-Dufresne, Goldstein, & Martin, 2001). Vink and Thibeault (2008), Vink and Fabozzi (2012), Gabbi and Sironi (2005), as well as Collin-Dufresne, Goldstein, and Martin (2001) suggest the following procedure to obtain a suitable treasury benchmark: First, the benchmark is obligated to provide the same currency; second, the benchmark is obligated to be issued at a comparable auction date, and third, the benchmark has to offer a comparable time to maturity. Then, we calculate the difference between these two yields. Subsequently, in this dissertation, if the *primary market spreads* are referred to, then, it must be construed that this is the difference that is under discussion. This difference also has a mathematical advantage. Since the yields may differ over years impacted not just by the common pricing factors but also by other factors such as, high or low interest rate levels in general, inflation rates, or even, the activity of a central bank, it would be imperative to edit the time series to filter out the trends that are not impacted by the common pricing factors, over the years. Since the yields of the treasuries are influenced precisely by those factors as well, the trends may be eliminated by calculating the difference between these two yields. Therefore, the yields at the auction of the securities may be adjusted to the *primary market spreads* so that this adjusted yield is a satisfactory dependent variable suited to this dissertation's purpose.

1.3.2 Default and Recovery Risk Characteristics

This subsection introduces the *default and recovery risk characteristics* to build the first group of common pricing factors (Vink & Thibeault, 2008; Gabbi & Sironi, 2005; Elton, Gruber, Agrawal, & Mann, 2004). In referring to this group, this paper examines factors such as, *credit rating, external enhancement, maturity*, and *loan to value*. The

subsequent sections describe how these factors occur in the analyses of the research papers.

1.3.2.1 Credit Rating

The most important factor impacting fixed income notes is *credit rating*. The credit rating of a loan issue reflects the likelihood of a borrower defaulting on a loan (Amira, 2004; Ammer & Clinton, 2004; Ashcraft, Goldsmith-Pinkman, & Vickery, 2011-2012; Pagano & Volpin, 2012). The *credit rating* is included in the analyses to facilitate a study of the impact of default on a securitization issue. In the bond market, empirical studies on the influential factors always include *credit rating* as a critical variable. Since we need comparable data for all the issues in the data samples of this dissertation, it is only the tranches, which are rated by at least one of the three credit rating agencies—Moody's, Standard and Poor, and Fitch—that are included. This is because market participants do not view credit ratings by these three rating agencies as redundant (Fabozzi & Vink, 2015). Table 1 provides a scale with all available credit ratings of these agencies. Moody's provides 19 different ratings and Standard and Poor's and Fitch provide 21 different ratings. This leads to a classification of 21 rating scales for the three rating agencies mentioned above.

Table 1: *Credit Rating Scale*

Assigned Value	Moody's	Standard & Poor's	Fitch
1	Aaa	AAA	AAA
2	Aa1	AA+	AA+
3	Aa2	AA	AA
4	Aa3	AA-	AA-
5	A1	A+	A+
6	A2	A	A
7	A3	A-	A-
8	Baa1	BBB+	BBB+
9	Baa2	BBB	BBB
10	Baa3	BBB-	BBB-
11	Ba1	BB+	BB+
12	Ba2	BB	BB
13	Ba3	BB-	BB-
14	B1	B+	B+
15	B2	B	B
16	B3	B-	B-
17	Caa1	CCC+	CCC+

18	Caa2	CCC	CCC
19	Caa3	CCC-	CCC-
20	-	CC	CC
21	-	D	D

For the purpose of comparison, the *credit rating* of each tranche is collected at the time of issuance. To include the *credit rating* mathematically in the analyses, it is imperative to assign a value to every rating (Vink & Fabozzi, 2012; Vink & Thibeault, 2008; Buscaino, Caselli, Corielli, & Gatti, 2012; Chen, Lesmond, & Wei, 2007; Kavussanos & Tsouknidis, 2014; Liu & Thakor, 1984). We decided to use a consistent rating classification and introduced a discrete variable which assigned a corresponding number to every rating. The variable is equal to one, when we regard the best rating of each rating agency. It is equal to two, when we regard the second best rating of each rating agency, and so on. Therefore, the variable credit rating (CR) is set as indicated here: CR = 1, CR = 2, CR = 3, CR = 4, CR = 5, CR = 6, CR = 7, …, CR = 17, CR = 20 correspond to the ratings Aaa/AAA, Aa1/AA+, Aa2/AA, Aa3/AA-, A1/A+, A2/A, A3/A-, …, Caa1/CCC+, CC (Vink & Thibeault, 2008; Liu & Thakor, 1984). Credit ratings between Caa1/CCC+ and CC and lower than CC are not available in the data samples of this dissertation. Further, with the numerical scale of the ratings, we can calculate the rating of each tranche. Therefore, it is possible to get two different cases: First, we have a tranche with only one assigned rating of the rating agencies. This case is the simplest; we take the corresponding number of the credit rating and assign this number to the tranche. If there are at least two credit ratings available for one tranche, we calculate the average value of the two or three ratings. This study uses the following common technique: We add the corresponding values of the ratings and divide the sum by the number of ratings assigned to the tranche. This paper offers an example of how this process works:

Example 1

The transaction "SC Germany Auto 2010-1" issued by the Santander Consumer Bank has two (A and B) tranches. All three rating agencies assign ratings to the B-tranche. Moody's assigns "A3", Standard and Poor's and Fitch, both assign "A". The corresponding values are 7 and 6, respectively. The sum of all ratings is equal to 19. The division leads to an average rating value of 6.33. Now, this value is chosen for the credit rating variable of this transaction. Thus, in the analyses, the rating of the B-tranche of the "SC Germany Auto 2010-1" transaction has a value of 6.33.

We expect the *credit rating* to have a positive relationship with the *primary market spread*. This means that if a tranche is assigned a better rating, the risk margin will be expected to reduce (Bayar, 2014). This study notes that the credit rating scale is an *inverse* scale, i.e. the *spread* increases as the *rating* decreases. This means that we predict an increasing *primary market spread* if the value of the variable increases as well (Reilly, Wright, & Gentry, 2010; Vink & Thibeault, 2008; John, Lynch, & Puri, 2003; Elton, Gruber, Agrawal, & Mann, 2001).

1.3.2.2 Extern Enhancement

In our studies, issues with *extern enhancement* refer to issues with credit enhancement in the form of an insurance policy guaranteed by a third party such as insurance companies. Thus, with this variable, we do not refer to *internal credit enhancements* but e*xternal credit enhancements*. The variable *extern enhancement* is introduced as a dummy which takes the value one if an *external credit enhancement* for the corresponding issue is available and zero otherwise. According to Fabozzi and Roever (2003), the evaluation for ABS transactions considers the difference between the cost of enhancement and the reduction of the coupon rate to sell the ABS. Considering this trade-off, the issuer decides whether or not it is sufficient to provide a third-party guarantee (Vink & Thibeault, 2008). Thus, we expect a negative relationship with the *primary market spread*, because *external credit enhancement* should, ceteris paribus, lower the risk of default.

1.3.2.3 Time to Maturity

Time to maturity is the third default and recovery risk characteristic variable. It is measured in years and affects the default risk premium of the ABS transaction (Merton, 1974). The variable is calculated as the difference between the issue date of the corresponding tranche and the legal maturity date. Thus, we expect the *time to maturity* to be positively related with the *spread* but we cannot accurately determine the coefficient sign of this variable apriori. From the empirical and theoretical literature, there is evidence of both coefficient signs (Merton, 1974; Vink & Thibeault, 2008; Amira, 2004; Grandes & Peter, 2004; Shin & Kim, 2013; Gabbi & Sironi, 2005).

1.3.2.4 Loan to Value

Loan to value is the last of the default and recovery risk characteristics. It is a variable which describes the cumulative levels of subordination (Vink & Thibeault, 2008; Campbell & Cocco, 2015; Deng & Quingley, 2012; Mayer, Pence, & Sherlund, 2009; Bajari, Chenghuan, & Minjung, 2008; Schwartz & Torous, 1993; Wong, Fung, & Fong, 2004). In an asset securitization transaction with more than one tranche, the cash flows are split into many classes of notes. Thereby, the classes, or loan tranches have different priority levels. The senior tranches have absolute priority in the cash flow over the junior classes. If cash flow is generated as expected, the subordination is not applicable. However, if there are payment defaults, the generated cash flow is used first, for coupon payments of the more senior classes, such that the more junior tranches experience losses. In other words, each position benefits from all the positions subordinated to it. We express the level of subordination as a percentage of the transaction's value (Vink & Thibeault, 2008). This process may also be explained with an example.

Example 2

We use a transaction with two tranches, Class B is the junior class of EUR 40 million and the senior Class A of EUR 60 million. Investors in Class A will bear the risk that if losses exceed EUR 40 million, they will lose money on their investment. This means that if losses exceed the cumulative subordination level of 40% (EUR 40 million divided by a total of EUR 100 million), the Class B tranche will be wiped out and investors of tranche A will lose money on their investment. When there is between 40% and 100% for each Euro loss on the underlying assets, the investors of the Class A tranche suffer an equal euro loss on their investment (Vink & Thibeault, 2008).

Therefore, it is important to calculate the *loan to value* ratio for each tranche of the data samples of this dissertation. If a transaction contains more than one tranche and if the size of all tranches of the transaction is available, then, the cumulative subordination level for each tranche of the transaction must be calculated. If we regard a single tranche transaction, the cumulative subordination level is 100% and no subordination exists. The loan to value ratio is calculated first, by considering the value of a loan cumulated according to the priority structure and second, by dividing this value by the total issue amount of the transaction (Vink & Thibeault, 2008). In general, the coefficient sign may be expected to be negative, i.e. with a higher *loan to value* ratio (senior tranches) so, the

originator has to grant a lower risk premium. In addition, if an issue has a lower *loan to value* ratio (junior tranches), investors require a higher coupon rate because they have a lower expected recovery rate when the underlying portfolio suffers losses. But, Vink and Thibeault (2008) analyzed ABS issues between 1999 and 2006 and they found that the relationship of the loan to value ratio of ABS transactions with the issuance spread was positive. Therefore, it is difficult to accurately determine the sign of this variable apriori so, it is important to wait for the findings of the analyses.

1.3.3 Marketability Characteristics

This subsection discusses the variables that are assigned to the group *marketability characteristics.* The second set of explanatory variables consists of *loan size, transaction size, number of tranches, number of lead managers, number of credit rating agencies, retained interest,* and the *type of interest rate* (Vink & Thibeault, 2008; Gabbi & Sironi, 2005). The following subsections present how variables occur in the analyses of this dissertation and discuss their expected influence on the *primary market spread*.

1.3.3.1 Loan Size and Transaction Size

In our studies, the variable *loan size* is determined as the natural logarithm of the issuance size of every issue among the data samples of this dissertation, i.e. the variable is determined as the size of every tranche contained in the high information samples (Gabbi & Sironi, 2005; Qi & Yang, 2009; Calem & Lacour-Little, 2004; Pennington-Cross, 2003; Vink & Thibeault, 2008) whereas, the variable *transaction size* is calculated as the natural logarithm of the issuance size of the whole transaction, i.e. the variable is determined as the sum of all tranches contained in the same transaction. Some care must be exercised when using these variables in the analyses, because transactions across countries and currencies are being considered here. In order to use these variables, we convert all the currencies with a corresponding exchange rate into Euros. The exchange rate for the transactions is calculated as the average of all market exchange rates for the issuance year. Then, we multiply the *loan size* and the *transaction size* with the exchange rate. Converting the currencies ensures the availability of comparable values for *loan* and *transaction sizes.* These can then, be included as variables in the analyses. Larger issuance sizes are associated with more secondary market liquidity, i.e. greater information is available, resulting in less uncertainty compared to situations of smaller issues. Then, a negative relationship with

the *primary market spread* is predicted. This means for higher *loan* and *transaction sizes*, the issuance *spreads* are expected to reduce.

1.3.3.2 Number of Tranches

The next variable, which is included in the analyses, is the *number of tranches.* In our studies, the number of tranches does not only refer to the ones issued but the overall number of all tranches contained in the corresponding transaction (Vink & Fabozzi, 2012; Vink & Thibeault, 2008). This means that, even if the data samples of this dissertation contain only two tranches of one particular transaction but the transaction is divided into a total of five tranches, the variable takes five as the value for both the tranches in the analyses. The process of tranching could allow the originator to reach a wider range of investors and take advantage of heterogeneous screening skills related to asymmetric information. Thus, we expect the corresponding relationship with the *spread* to be negative.

1.3.3.3 Number of Lead Managers

The *number of lead managers* represents the number of financial institutions classified as lead managers in the official prospectus of the corresponding transaction. This variable is included to provide information about the size of the syndicate. A negative coefficient sign is expected, since a larger syndicate should be able to achieve, ceteris paribus, lower *spreads* for the corresponding transaction (Vink & Thibeault, 2008; Gabbi & Sironi, 2005).

1.3.3.4 Number of Rating Agencies

The *number of rating agencies* indicates how many are involved in the process of assigning a rating to the issue (Vink & Fabozzi, 2012; Vink & Thibeault, 2008). Worldwide, there are many rating agencies involved in rating ABS transactions. However, many of them focus on their domestic markets. For better comparison, we focus on the top-three which operate globally in the ABS market. Thus, we only include ratings of Moody's, Standard & Poor's, and Fitch. If none of these agencies was involved in the rating process, the issue would not be contained in the data samples of the following analyses. The variable can take the values 1, 2, or 3 for having one, respectively two or three rating agencies involved in the rating process. Since a rating becomes more accurate if more rating agencies are involved, we predict a negative coefficient for the *number of rating agencies*. This in turn implies that if more rating

agencies are involved in the rating process, the ratings tend to be more accurate, and as a consequence, it reduces the risk premium.

1.3.3.5 Retained Subordinated Interest

The variable *retained subordinated interest* is included in the analyses, since there are many originators who may have set up this beneficial interest that absorbs the first losses of the loan (Childs, Ott, & Riddiough, 1996; Vink & Thibeault, 2008; An, Deng, Nichols, & Sanders, 2014; Ashcraft & Schuermann, 2008). It is inferior or in subordinated position compared to the other tranches of the transaction with regard to collection payments in the event of default. No clear theoretical apriori conclusion regarding the sign of the coefficient can be made. First, a retained junior tranche should not affect the probability of default of the other tranches, however, it is a signal for the originators and can potentially lead to "investors comfort" which may affect the *spread*. Nevertheless, if the coefficient sign turns out to be negative, the retained subordinated interest, ceteris paribus, positively impacts payment defaults (Hansen & Demir, 2010). Otherwise, the *retained interest* indicates the impression on a poor quality of the underlying assets, and therefore, leads to higher *spreads*. The variable *subordinated interest* is constructed as a dummy variable which takes the value 1 if the transaction has a *retained subordinated interest*, and zero, otherwise.

1.3.3.6 Type of Interest

The variable *type of interest rate* describes the type of interest rate of the corresponding issue. There are two types of interest rates in the analyses. First, we have fixed interest rates for ABS. This means, the coupon of the issue is a fixed rate for life and the investors always get the interest payments at the same rate. Second, we have the floating rate for ABS issues. These issues have a floating coupon rate which can change over the life-time of the transaction. In most cases, the floating coupon rate consists of the following structure: The basis is another floating interest rate such as, LIBOR or EURIBOR. Then, a fixed spread is added on top of the basis rate. On every coupon date, the sum of the current basis rate and the fixed spread adds up to the current interest rate. In order to include the *type of interest rate* in the studies, we constructed a dummy variable *float* which takes the value 1 if the issue has a floating coupon rate, and zero, if the issue has a fixed coupon rate (Gabbi & Sironi, 2005; Vink & Thibeault, 2008). Some caution must be exercised at this time because the value of the dummy variable refers to the type of the coupon rate of a tranche, not of the whole transaction, since

different tranches can have different types of interest rates. However, we expect the relationship with the *spread* to be positive because a fixed rate does not change during the life of the loan and is therefore, protected against changing interest rates. Thus, we predict the borrowers to raise funds at lower *spreads* than through floating rate issues. Nevertheless, since the risk of changing interest rates is also covered during the process of assigning a rating, the rating reflects the risk of raising interest rates which could lead to a poor statistical significance for the variable *float*.

1.3.4 Expected Systemic Characteristics

This subsection introduces the *expected systemic characteristics*. Within the systemic risk, we have several other risks that an ABS transaction has to face. One of them is the risk presented by the country, in which the assets are located and the legal rights in the corresponding country. Another, would be the risks that currencies have to face in the global market. The variables of interest in this section are *currency risk, emerging market,* and *creditor protection* and are introduced below.

1.3.4.1 Currency Risk

Currency risk is introduced to include the systemic risk in the analyses since it is not already incorporated into the rating of an issue (Vink & Thibeault, 2008). *Currency risk* describes the risk a value faces if the currency denomination of the collateral's cash flows and the currency denomination of the cash flow of liabilities, differ. Therefore, we include a dummy variable in the analyses. This takes the value 1 if the issue faces currency risk, and value zero, otherwise. Since *currency risk* is by definition a risk that a value may face, we expect the corresponding coefficient sign to be positive. This means, if an issue is exposed to currency risk, the *primary market spread* is expected, ceteris paribus, to be higher compared to issues which are not exposed to currency risk (Vink & Fabozzi, 2012; Vink & Thibeault, 2008).

1.3.4.2 Emerging Market

Emerging markets differ from developed markets in terms of political stability, political and economic risks, and the development of the financial market. This makes it more difficult to place a securitization in the market. Thus, origination in an emerging market is considered by rating agencies as an important risk factor (Vink & Fabozzi, 2012). We identified emerging market countries using the Morgan Stanley Country Index. The variable is constructed as follows: It takes the value 1 if a country is

identified as an emerging market country, and value zero, if the transaction is issued in a developed market.

1.3.4.3 Creditor Protection

Creditor protection is a very important variable in the process of assigning a rating to a tranche. *Creditor protection* measures the extent to which investors are protected in case the originator of the security goes bankrupt. In ABS transactions, the underlying assets are transferred into a special purpose vehicle (SPV) to isolate the assets from the originator and protect them against originators going bankrupt. Nevertheless, the SPV itself can go bankrupt if there are defaults of payments on the underlying assets. Thus, we have to obtain a suitable variable, which, on the one hand, reflects *creditor protection* and on the other, gets included in our regression model. The *creditor protection* laws vary across countries in this study. Therefore, we have gathered information on *creditor protection* in the countries of origination. La Porta *et al.* (2000) and La Porta *et al.* (2003) suggest that the four legal rights variables be considered in order to measure creditor protection for securities. One of these variables can be included in the regression model and measure *creditor protection* in each country (Vink & Fabozzi, 2012). The process is called *No automatic stay on the assets*. Vink and Fabozzi (2012) describe the variable as follows: "An automatic stay stops lawsuits, foreclosures, and all collection activity against the borrower the moment the borrower files a petition for bankruptcy petition. In general, a no automatic stay provision is viewed favorably by investors, as well as by rating agencies in assigning a credit rating, since the creditor can recover collateral" (Vink & Fabozzi, 2012, p. 521). The variable included in the regression model has the following structure: We construct a dummy variable, which takes the value 1 if there is no automatic stay on the assets in the law of the country of origination, and value zero, otherwise.

The data samples of this dissertation include the discrete as well as the dummy variables. The group of discrete variables consists of *credit rating, loan size, transaction size, loan to value, time to maturity, the number of tranches, the number of lead managers,* and *the number of rating agencies*. The variables *retained interest, extern enhancement, creditor protection, the type of interest rate, currency risk,* and *emerging market* constitute the dummy variables. Table 2 provides a final overview of—the common pricing features that are a part of the analyses studied in the course of

formulating this dissertation and the expected relationship with the yield associated with asset-backed securities.

Table 2: *Common Pricing Characteristics*

Variable	Description	Expected Impact	Source
Rating	Average value of assigned ratings	Positive relationship	Liu & Thakor (1984)[2]
Maturity	Measured in years	Positive relationship	Merton (1974)[3]
Extern	Equal 1 if extern enhancement is provided	Negative relationship	Vink & Thibeault (2008)[4]
Loan to Value	Subordination level of tranche in %	Positive relationship	Vink & Thibeault (2008)[5]
Loan Size	Natural log of the tranche's or bonds'	Negative relationship	Gabbi & Sironi (2005)[6]
Transaction Size	Natural log of the ABS transactions'	Negative relationship	Vink & Thibeault (2008)
# Tranches	Number of tranches	Negative relationship	Vink & Fabozzi (2012)[7]
# Lead Manager	Number of lead managers	Negative relationship	Gabbi & Sironi (2005)[7]
# Rating Agencies	Number of rating agencies	Negative relationship	Vink & Fabozzi (2012)[7]
Type of Interest	1 if type of interest is floating rate	Negative relationship	Gabbi & Sironi (2005)[7]
Retained Interest	1 if retained interest appears in transaction	Negative relationship	Vink & Thibeault (2008)[8]
Currency Risk	1 if tranche faces currency risk	Positive relationship	Gabbi & Sironi (2005)[7]
Creditor Protection	1 if creditor protection is provided	Negative relationship	Vink & Fabozzi (2012)
Emerging Market	1 if transaction is issued in an emerging	Positive relationship	Vink & Fabozzi (2012)

1.4 Research Objectives and Dissertation Outline

This dissertation is structured into three research papers, all of which investigate the ABS market post 2007. The ABS market experienced a major breakdown as a consequence of the 2007 crisis (True Sale International, 2008; Perraudin & Wu, 2008; Vink & Fabozzi, 2012; Fabozzi & Vink, 2012). Nevertheless, this security class revealed its importance for the fixed income market as the market began to recover in 2010. The ABS market became one of the most important fixed income markets and one popular refinancing instrument for corporations. However, empirical research regarding the recovery of the ABS market since 2010 is scarce (True Sale International, 2014; Schmalenbach-Gesellschaft, 2012). Hence, to fill research gaps regarding theoretical literature and provide empirical frameworks for practical application, the

[2] Further sources: Vink & Thibeault (2008), Vink & Fabozzi (2012), Buscaino, Caselli, Corielli, & Gatti (2012), Chen, Lesmond, & Wei (2007), Kavussanos & Tsouknidis (2014), Amira (2004), Ammer & Clinton (2004)

[3] Further sources: Gabbi & Sironi (2005), Vink & Thibeualt (2008), Amira (2004), Grandes & Peter (2004), Shin & Kim (2013)

[4] Fabozzi & Roever (2003)

[5] Further sources: Wong, Fung, Fong, & Sze (2004), Campbell & Cocco (2011), Deng & Quigley (2004), Schwartz & Torous (1993), Mayer, Pence, & Sherlund (2009), Bajari, Chenghuan, & Minjung (2008)

[6] Further sources: Qi & Yang (2009), Calem & Lacour-Little (2004), Pennington-Cross (2003)

[7] Further sources: Vink & Thibeault (2008)

[8] Further Sources: An, Deng, Nichols, & Sanders (2014), Ashcraft & Schuermann (2008), Childs, Ott, & Riddiough (1996)

first research paper empirically investigates the influence of the financial crisis on the non-U.S. ABS market.

As a result of the financial crisis, investors lost their trust in the securitization market such that the issuance volumes hit new lows. Since 2010, the securitization market has experienced recovery, globally. Originators as well as investors started to regain trust in the growing role that securitization began to play in the future of the world's economies despite its contribution to the financial crisis (Vink & Fabozzi, 2012; Schmalenbach-Gesellschaft, 2012; Morgan Stanley Capital International, June 2015; True Sale International, 2011; Buchanan, 2016; Hull, 2009; Schwarcz, 2013). New regulations as well as the fear of market participants regarding another breakdown should significantly impact the development of asset-backed securities (Cohen & Hoskins, 2014; Humphreys, 2012; Price, 2016; Kemp, 2014; Ceurvorst, 2014). Thus, the first research paper addresses the overall research question whether the financial crisis influenced the non-U.S. ABS market. To provide evidence that supports the overall research question, the paper investigates two research hypotheses. The first hypothesis states that the financial crisis significantly influenced the yield determinants as well as the common pricing characteristics of the ABS market. As an intuitive follow-up, the second research hypothesis states that, in comparison to the situation before that crisis, investors have to look beyond the credit ratings and employ their own risk analyses as protection against surprising losses.

With the purpose of finding evidence that supports the first research hypothesis, we compare the determinants of the *primary market spread* of ABS tranches after the financial crisis with the spread determinants prior to that crisis. After 2009, regulators throughout the world tried to set a new framework for ABS transactions, since this security class was meant to be a dominant submarket of fixed income markets worldwide (Vink & Fabozzi, 2012; Faltin-Traeger, Johnson, & Mayer, 2010). The first essay determines the influence of the new framework on the development of the ABS market. Further, we investigate whether market participants rely on different yield determinants when pricing the ABS transactions after the 2007 crisis.

To address the second research hypothesis, Essay I performs an over-reliance analysis on *credit rating*. One common view is that investors relied exclusively or at least excessively on *credit ratings* assigned to ABS tranches by rating agencies (Fabozzi & Vink, 2012; Vink & Fabozzi, 2012; Scott, 2010). After the financial crisis, regulators

recommended that ABS investors employ their own risk analysis in addition to those by the rating agencies with the purpose of being independent. Hence, we investigated whether ratings of Moody's, Standard & Poor's, and Fitch exhibited dissimilarities in the aftermath of the 2007 financial crisis and whether investors, compared with their apriori approach, looked beyond the *credit rating* and employed their own credit default risk analyses.

In the second and third research papers, the main focus lies on the European ABS market. This developed into one of the most important fixed income submarkets of Europe's fixed income market after the 2007 financial crisis. It has some specifics compared to its non-European counterparts. Several research reports by DZ Bank (2014, 2015, 2016), Creditreform (2015), and Roland Berger (2015) discuss the phenomenon that the European Auto-ABS market grew enormously after the financial crisis compared to its European ABS submarket counterparts. Although it is a very young submarket instrument, Auto-ABS have emerged as the largest European ABS submarket in the aftermath of the 2007 financial crisis with a proportion of almost 43% in 2015. As a result of the large automobile industry in Europe, Auto-ABS are a major driver of the European ABS market. Thus, the second research paper performs an in-depth analysis of the European Auto-ABS market and addresses the overall research questions regarding the determinants enabling the European Auto-ABS market to outperform its European ABS submarket counterparts. Essay II proposes two significant determinants of this outperformance. To conclude on the overall research question, Essay II addresses the first research hypothesis which states that Auto-ABS provide significant advantages for originators as well as investors compared to non-Auto-ABS issues. Hence, we investigate whether these advantages significantly explain the outperformance. With the purpose of finding evidence that supports the first research hypothesis, Essay II performs a comparison analysis on the European ABS market with respect to security risk profiles, yield determinants, and development over time.

The second hypothesis states that corporations and investors prefer Auto-ABS compared to automobile corporate bonds (Auto-CB) as refinancing instruments in the automobile industry. We analyze whether the advantages of the securitization structure leads to a volume shift in issuance away from the corporate bond into the asset-backed security market. The research paper hypothesizes that this volume shift in issuance explains a significant part of the outperformance. To provide evidence that supports the

second research hypothesis, Essay II performs a comparison analysis on Auto-ABS and Auto-CB market with respect to security risk profiles, yield determinants, and development over time.

The European Central Bank (ECB) announced in September 2014 the implementation of the largest quantitative easing (QE) programme in the history of the European Monetary Union. With the implementation of the so-called "Asset-Purchase Programme" (APP) the ECB decided to enter the European ABS market on the buy side in order to increase the inflation rate in the European Monetary Union. The programme not only consists of purchases of MBS but also, the ABS bonds whereas, the purchase of MBS was already practiced by the Federal Reserve System (FED) and the Bank of England to stabilize the mortgage markets of the U.S. and the U.K. as a consequence of the financial crisis (Hancock & Passmore, 2015; Campbell, Covitz, Nelson, & Pence, 2011; Rossner, Carlson, Kowal, Huan, & Kreitman, 2009; Erel, Nadauld, & Stulz, 2014). The purchase of ABS bonds is a novelty in the history of quantitative easing. Therefore, the third research paper discusses the influence of the ECB on the European ABS market. The so-called "Asset-backed Security Purchase Programme" (ABSPP) was implemented in November 2014 and is meant to run until at least December 2017 (as of December 2016). The ECB wants corporations to refinance at a very low level thereby, enabling an increase of the inflation rate level. Thus, the ECB itself purchases tranches of ABS transactions to refinance corporations and force investors to purchase riskier securities (tranches with higher risk profiles).

Essay III proposes three research hypotheses with respect to the overall research question whether quantitative easing influences the trajectory of the European ABS market. The first research hypothesis states that quantitative easing has affected the risk profile of European ABS transactions. To find evidence that supports this hypothesis, we analyze the risk profiles of ABS transactions prior to and during quantitative easing. As a natural follow- up, the second research hypothesis investigates whether yield determinants are influenced in the times of the ABSPP. Hence, Essay III performs a structural break analysis. The analysis reveals whether the two data samples exhibit significant dissimilarities with respect to the pricing of European ABS tranches. The last research hypothesis measures the direct influence of quantitative easing on the offered yield of European ABS transactions. To provide evidence that supports the third

research hypothesis, the paper performs panel-data fixed-effect regressions, which determine the direct influence of the ABSPP on the yield.

For the course of investigation, this dissertation is organized as follows. It provides the three research essays in chapters two, three, and four. Every paper provides a *Literature Review*, identifying the research gaps in great detail, first. Thereafter, the *Methodology* is presented in each paper, followed by the *Data Description.* The section *Conclusion* presents the results of the empirical analyses of each paper and highlights contributions to the research objectives, separately. The research essays are followed by the last chapter *Concluding Remarks.* This chapter presents *Limitations, Market Implications,* and *Future Research* avenues.

2 Non-U.S. Asset-Backed Securities: Yield Determinants and Over-Reliance on Credit Ratings

2.1 Introduction

In the wake of the financial crisis that began in the summer of 2007 in the U.S. subprime mortgage market, regulations have been strengthened by governments of major financial markets, globally. Not surprisingly, the securitization market has been focused on given the dominant role it played in the crisis and, of course, given the course of events in the securitization market during that time (Vink & Fabozzi, 2012; Faltin-Traeger, Johnson, & Mayer, 2010). According to a research report by DZ Bank (2008), the ABS market witnessed a global collapse at the time. A U.S. Treasury Department report (2009) and further research by BearingPoint (2009) discuss the future applicability of securitization as a popular financing instrument in the fixed income market. Five recommendations for the securitization market have been proposed, one of which is to reduce the over-reliance by investors on credit ratings. Research reports by DZ Bank (2011), Schmalenbach-Gesellschaft (2012), MSCI (2015), and articles by Nomura (2015), Meister (2016), Böhmert (2014) as well as Vink and Fabozzi (2012), and Franke and Krahnen (2008) discuss the recovery of the market after the 2007 financial crisis and, despite its contribution to the financial crisis, the expectations of the growing role that securitization will play in the future of the world's economies, since the balance sheets of banks are anticipated to shrink post 2007. In the same sense, a research report by the DZ Bank (2014) concludes that the recovery of ABS transactions is essential for a working real economy. However, the question arises: whether the ABS market learned from its collapse during the financial crisis and if deep wrongs, such as the over-reliance on credit ratings, were corrected during the recovery of the markets. Therefore, we examine and analyze the non-U.S. ABS market post this period and determine *how* the financial crisis influenced the ABS market. This empirical analysis investigates spread determinants of the primary market spread of ABS after the financial crisis, i.e. from beginning 2010 till the end of 2014, and compares the results with the findings of the late 1990s and the early 2000s. This aims to provide evidence that supports the conclusion that the financial crisis influenced the ABS markets and that the influence was a critical cause of the recovery of the non-U.S. ABS market.

Further, the second objective of this paper is to analyze whether there is an over-reliance on credit ratings. We discuss the research path—whether investors learned from the collapse in 2007 and employed their own credit analysis rather than rely solely on the credit ratings assigned by rating agencies. Since that crisis was in many ways also a crisis of credit ratings (Kotecha, Ryan, & Weinberger, 2010; Seoyoung, 2012), given the difficulty for investors to evaluate these structured financial products and employ their own risk analysis, most investors relied on the ratings assigned to ABS bonds by the major rating agencies (Agarwal, Barret, Cun, & De Nardi, 2010; Efing & Hau, 2015). Prior to the crisis, more than half of the securitization transactions rated by Moody's carried a rating of AAA, which is the highest possible rating in the rating process. As a consequence, almost 40,000 Moody's-rated tranches were downgraded during that time with the justification that the first assigned ratings were no longer applicable (Agarwal, Barret, Cun, & De Nardi, 2010; Ashcraft, Goldsmith-Pinkham, & Vickery, 2010; Benmelech & Dlugosz, 2009; He, Qian, & Strahan, 2011; Violi, 2010). This is in accordance with the current debate by regulators globally regarding the reliance of investors on credit ratings assigned by credit rating agencies (Partnoy, 2009; Vink & Fabozzi, 2009). One commonly held view of regulators is that investors relied solely on these ratings without considering their own analyses. Another view is that although investors might not rely exclusively on these ratings, there is an over-reliance on credit ratings or at least an excessive reliance on them (Fabozzi & Vink, 2012). For example, a report by the Financial Stability Forum (2008, p. 37) states: "Investors should address their over-reliance on ratings." Hence, this paper empirical investigates the over-reliance on credit ratings hypothesis.

To fill research gaps regarding the influence of the financial crisis on the ABS market and whether investors and other market participants learned from the collapse of the ABS market during the crisis, this paper investigates the non-U.S. asset-backed security market between 2010 and 2014. For the course of the investigation, this paper provides a *Literature Review*, identifying research gaps as well as presenting background information and research hypotheses of this paper in the next chapter. Thereafter, the used data sample is introduced within *Data Description*, i.e. we explain the structure of the data and present the variables, which we test as influencing factors. Chapter 4 presents the *Methodology* and the *Findings* regarding the first research hypothesis. Thereafter, a section with the *Methodology* and the *Findings* regarding the second research hypothesis is presented in chapter 5. After every analysis, a separate

discussion section highlights contributions to the research objectives, while the conclusion presents *Limitations, Market Implications,* and *Future Research* avenues in chapter 6.

2.2 Literature Review

Empirical research regarding asset-backed securities using statistical models, however, compared to empirical research regarding corporate bonds, is very limited. The first published study examined off-balance-sheet activities of 100 of the largest U.S. banks and was conducted by Holland (1989). The results of this study prove that off-balance-sheet activities comprise different types of contingencies and commitments that are not listed. Further, he identifies that banking organizations are more involved in off-balance-sheet activities due to their intensely competitive environments. Moreover, another study of Borgman (1996) engaged with a dataset of more than 700 ABS issues and documented its assembly and analyses while describing the pricing and other characteristics. The analysis of Borgman (1996) concludes that pricing of ABS (absolute and relative yield spreads) was not only rational but also reflected interest rate and reinvestment risks, marketability, and most importantly, the premia for default risks (Bakri, Ali, & Ismail, 2014). Empirical research about determinants of asset-backed security pricing is provided by Perraudin and Wu (2008). The paper reveals the factors that influence the spreads in asset-backed security prices during crisis periods. The authors investigated the manufactured housing sector in 2004 and the collapse of the MBS in 2007 in the U.S. subprime market.

Extant literature often mentions and analyzes the problem of over-reliance on credit rating in the capital markets. In the corporate bond market, there is no shortage of empirical research regarding the over-reliance hypothesis. Campbell and Taksler (2003) find that yield spreads are more correlated with the issuer's stock price than the assigned rating. Further, Cantor and Packer (1996) also find that there is no over-reliance on credit ratings because most of the credit information is contained in macroeconomic variables. Two further studies—Ferri, Liu, and Stiglitz (1999) and Reisen and von Maltzan (1999)—analyze the over-reliance hypothesis in the Asian financial market. They find that the over-reliance on ratings was a destabilizing factor for the 1997-98 financial crisis in the Asian market (Vink & Fabozzi, 2012). Many researches on the role of credit ratings in the 2007 financial crisis have been provided in the literature. For example, Wojtowitcz (2014) investigates the role of credit ratings in pricing the CDO

during this period. Further research regarding over-reliance on credit ratings in the securitization market is provided by Maehlmann (2012). The study investigates the over-reliance in the CDO market prior to the financial crisis. The paper finds that investors outsourced their risk analysis to rating agencies due to the complex and opaque securitization market and more critically, to avoid performing costly due diligence on the securities they had bought (Maehlmann, 2012).

For this paper, the most important research is provided by Vink and Thibeault (2008) and Vink and Fabozzi (2012). Vink and Thibeault (2008) examine the yield determinants for ABS, MBS, and CDO pricing. They use statistical models to identify the factors that influence the primary market spreads of those three financial products and prove how strong this influence is. The dataset contains non-U.S. ABS, MBS, and CDO issued between 1999 and 2006. The results of the study regarding ABS are discussed subsequently in greater detail.

Vink and Fabozzi (2012) test whether there was an over-reliance on credit ratings during the time prior to the 2007 financial crisis. Their findings show that credit ratings did impact the primary market spread of securitization transactions but cannot ascertain any over-reliance. Further, Vink and Fabozzi (2012) investigate the credit factors that influence the primary market spread after considering credit ratings. The study relies on a European floating-rate dataset for the years 1999 to 2006. They support the conclusion that there are factors which determine the spread besides credit ratings, and that investors rely on those factors as well.

2.2.1 Background Information and Hypotheses

ABS, MBS, and CDO played an important role during the collapse of the financial system in 2007 and the securitization market needed several years to recover. In accordance with current research reports by DZ Bank (2014, 2011, 2008), MSCI (2015), and Nomura (2015), this paper investigates the overall research question: "*Has the financial crisis affected the yield of ABS transaction?"* Based on the results of the studies by Oliviera, Curto, and Nunes (2012), Wang and Yao (2014), Klepsch and Wollmershaeuser (2011), as well as Harrison and Widaja (2014), which investigate the influence of the financial crisis on corporate and sovereign bonds as well as yield determinants in the fixed income market, we expect to find evidence that supports the statement that the financial crisis did influence the set of yield determinants of the non-U.S. ABS market. Hence, we propose the following first research hypothesis: *"The*

financial crisis of 2007 influenced yield determinants of ABS transactions." We perform a comparison analysis for the purpose of providing evidence that supports the first research hypothesis. First, we compare common security characteristics of ABS transactions for issues prior to and post the 2007 financial crisis. The main analysis investigates the set of yield determinants for the ABS market after the crisis and compares it to the set of yield determinants that is observed in the study of Vink and Thibeault (2008).

As a natural follow-up to the first research hypothesis and a conclusion on new regulations in the ABS market, we perform an over-reliance analysis on the credit rating. This study investigates whether investors look beyond credit ratings from rating agencies and employ their own credit default risk analysis to increase the accuracy of the pricing of ABS transactions at issuance. Based on the results of the studies of Vink and Fabozzi (2012), Vink and Fabozzi (2009), and Agrawal, Barret, Cun, and De Nardi (2010) as well as the results of research reports by DZ Bank (2014) and the Financial Stability Forum (2008) on changes of the financial crisis regarding credit ratings, we expect that investors learned from their mistakes and employed their own risk analysis to understand non-U.S. ABS issues post the 2007 financial crisis in order to avoid over-reliance on rating agencies—one of the causes of the crisis. Thus, we propose the second research hypothesis, which states: *"There is no over-reliance on the credit ratings by ABS investors after the financial crisis."* In order to find evidence that supports this hypothesis, we analyze whether risk factors which have already been considered by rating agencies during the rating assignment process, are considered by capital market investors during their own credit risk analysis processes.

2.3 Data Description

This section introduces the data samples and describes the sources used in the study. We also introduce common security characteristics and provide a univariate comparison of the different data samples.

2.3.1 Data Samples

The principal data sources of this study are Thomson Reuters and DZ Bank. For non-European ABS issued between 2010 and 2014, we used the Thomson Reuters Datastream. For European ABS issues, we used the Asset Backed Watcher, published by DZ Bank. Both Thomson Reuters and DZ Bank are leading publishers of ABS

issues. The database contains detailed information on securitization of non-U.S. securities from January 1, 2010, through December 31, 2014. The period describes the recovery of the non-U.S. ABS market until the year prior to the European "Asset Purchase Programme". The period is chosen in order to present findings, which show solely the influence of the financial crisis on the non-U.S. ABS market and exclude other possible influential sources, such as quantitative easing programmes by central banks.

The sample for this study contains information on 11,741 securitization transactions, which are worth a total of USD 1,776 billion. Since this data sample includes all transactions (ABS, MBS, and CDO), we shortlisted only the ABS issues. The 5,071 ABS issues in the sample are worth USD 1,125 billion. These are referred to as the "full sample". The observations regarding this sample are not only multiple loan tranche issues but also single loan tranche issues. Therefore, we consider a single issue (single loan tranche) as the unit of observation. If there is more than one tranche as part of the issue, we have a multiple issue (multiple loan tranches) and every tranche of the same transaction will appear as a separate observation in the database. This means, we have 1,650 ABS transactions containing a total of 5,071 tranches in the full sample. Although the full sample is comprehensive, it has two limitations for the purposes of this study. First, it provides detailed information on ABS issues dated post the financial crisis, which should be limited to non-U.S. ABS issues, and second, some issues may have incomplete information for the purpose of the analyses. Therefore, the sample may be reduced in the analyses to support hypotheses 1 and 2. First of all, the sample is reduced such that it only contains non-U.S. issues. The new subsample contains 486 non-U.S. ABS transactions with a total of 1,688 tranches. The tranches add up to USD 570 billion. We refer to this subsample as the "working sample". We need information on 12 variables for every deal. Vink and Thibeault (2008), Gabbi and Sironi (2005), Elton, Gruber, Agrawal, and Mann (2004) as well as Collin-Dufresne, Goldstein, and Martin (2001) suggest the classification of these variables into three groups. Thus, the working sample includes issues with *default and recovery risk characteristics, marketability characteristics,* and *systemic risk characteristics*. The default and recovery risk characteristics are: *Credit rating, time to maturity, extern enhancement,* and *loan to value*. The following variables are classified as marketability characteristics: *Size of the tranche, number of tranches, size of the whole transaction, number of lead managers, number of involved credit rating agencies, type of interest rate,* and *whether*

the issue has retained interest or not. The systemic risk characteristics are called *currency risk, emerging market,* and *creditor protection*. Since the *spreads* are a function of the common pricing characteristics mentioned above, we need to introduce the variables that describe our set of securities. The set of common pricing characteristics is introduced in the Tables 3, 4, and 5 below (Vink & Thibeault, 2008; Merton, 1974; Liu & Thakor, 1984; Vink & Fabozzi, 2012; Gabbi & Sironi, 2005; Elton, Gruber, Agrawal, & Mann, 2004; Collin-Dufresne, Goldstein, & Martin, 2001). Table 3 presents the default and recovery risk characteristics (Buscaino, Caselli, Corielli, & Gatti, 2012; Chen, Lesmond, & Wei, 2007; Kavussanos & Tsouknidis, 2014; Amira, 2004; Grandes & Peter, 2004; Shin & Kim, 2013; Campbell & Cocco, 2015; Wong, Fung, & Fong, 2004; Ammer & Clinton, 2004). The first column names the introduced variable. The second column describes the structure of the variables used in this study.

Table 3: *Default and Recovery Risk Characteristics*

Variable	Description	Expected Impact	Source
Rating	Average value of assigned ratings	Positive relationship	Liu & Thakor (1984)[9]
Maturity	Measured in years	Positive relationship	Merton (1974)[10]
Extern	Equal 1 if extern enhancement is	Negative relationship	Vink & Thibeault (2008)[11]
Loan to Value	Subordination level of tranche in %	Positive relationship	Vink & Thibeault (2008)[12]

The considered rating agencies are Moody's, Standard and Poor's, and Fitch. The rating values 1, …, 10 correspond to the ratings Aaa/AAA, …, Baa3/BBB-. Ratings lower than Baa3/BBB- are not purchase by the ECB and hence do not appear in our data samples.

The third column provides the expected impact of this variable on the *primary market spread* in the regression analyses (Mayer, Pence, & Sherlund, 2009; Bajari, Chenghuan, & Minjung, 2008; Deng & Quingley, 2012; Fabozzi & Roever, 2003; Schwartz & Torous, 1993). The last column provides an overview of literature, in which the variables were introduced.

Table 4: *Marketability Characteristics*

Variable	Description	Expected Impact	Source
Loan Size	Natural log of the tranche's amount	Negative relationship	Gabbi & Sironi (2005)[13]

[9] Further sources: Vink & Thibeault (2008), Vink & Fabozzi (2012), Buscaino, Caselli, Corielli, & Gatti (2012), Chen, Lesmond, & Wei (2007), Kavussanos & Tsouknidis (2014), Amira (2004), Ammer & Clinton (2004)

[10] Further sources: Gabbi & Sironi (2005), Vink & Thibeualt (2008), Amira (2004), Grandes & Peter (2004), Shin & Kim (2013)

[11] Further sources: Fabozzi & Roever (2003)

[12] Further sources: Wong, Fung, Fong, & Sze (2004), Campbell & Cocco (2011), Deng & Quigley (2004), Schwartz & Torous (1993), Mayer, Pence, & Sherlund (2009), and Bajari, Chenghuan, & Minjung (2008)

[13] Further sources: Qi & Yang (2009), Calem & Lacour-Little (2004), Pennington-Cross (2003)

Transaction	Natural log of the ABS transactions' amount	Negative relationship	Vink & Thibeault (2008)
Tranches	Number of tranches	Negative relationship	Vink & Fabozzi (2012)[13]
Managers	Number of lead managers	Negative relationship	Gabbi & Sironi (2005)[13]
Agencies	Number of rating agencies	Negative relationship	Vink & Fabozzi (2012)[13]
Float	1 if type of interest is floating rate	Negative relationship	Gabbi & Sironi (2005)[14]
Retained	1 if retained interest appears in transaction	Negative relationship	Vink & Thibeault (2008)[15]

Size and Amount describe the Euro equivalent amount at issuance. If the coupon of a transaction is floating rated, the coupon payments can vary over time and are linked to a floating interest rate, such as the 3-month EURIBOR.

Table 4 introduces the marketability characteristics (Qi & Yang, 2009; Calem & Lacour-Little, 2004; Pennington-Cross, 2003). We expect all marketability characteristics to be negatively related with the *primary market spread*. All variables should—ceteris paribus—increase the secondary marketability for the regarding transaction.

Table 5: *Systemic Risk Characteristics*

Variable	Description	Expected Impact	Source
Creditor	1 if creditor protection is provided	Negative relationship	Vink & Fabozzi (2012)
Currency Risk	1 if tranche faces currency risk	Positive relationship	Gabbi & Sironi (2005)[13]
Emerging Market	1 if tranche was issued in an Emerging Market	Positive relationship	Vink & Fabozzi (2012)

Creditor Protection describes a dummy variable that equals one if the country in which the transaction is issued provides creditor protection in the form of "no automatic stay on the assets" and zero otherwise. Currency Risk describes a dummy variable that equals one if the currency of the collateral's cash flows and the currency denomination of the cash flows of liabilities differ.

Table 5 presents the systemic risk characteristics (An, Deng, Nichols, & Sanders, 2014; Ashcraft & Schuermann, 2008; Childs, Ott, & Riddiough, 1996). Further, we include two control variables in our statistical analyses. The first control variable is called "year i". Year i describes the year dummies. Each dummy variable is equal to value 1 if issue i has been completed during the corresponding year and, has value zero, otherwise. These variables should capture the variations in fixed income market conditions (Gabbi & Sironi, 2005). Due to the highest correlation with the common pricing characteristics, the corresponding dummy variable for 2012 was excluded from the empirical analyses of this study to avoid over sensitivity. The second set of control variables are currency dummies that are equal to value 1 if security i is issued in the corresponding currency, and value zero, otherwise. These variables should capture both liquidity and credit standing (Vink & Fabozzi, 2012; Vink & Thibeault, 2008). The corresponding variable for the currency "Mexican Peso" was excluded from the analyses of this study to avoid over sensitivity, since the variable described the smallest subset of the all currency dummies.

[14] Further sources: Vink & Thibeault (2008)

[15] Further Sources: An, Deng, Nichols, & Sanders (2014), Ashcraft & Schuermann (2008), Childs, Ott, & Riddiough (1996)

In the empirical analyses of this study, the common pricing characteristics are used as variables of interest in order to determine structural differences as well as the effects of the financial crisis on the set of non-U.S. ABS issues. In the regression model, the *primary market spread* is used as a dependent variable. Following the above approach, the set of independent variables of this study consists of the common pricing characteristics. Since the time from issuance is equal to zero for all issues, the above mentioned factors are considered at the time of issuance. In order to provide comparability for all issues used in this study, it does not consider the probable changes in the variables over the time period 2010 to 2014.

The set of independent variables consists of both discrete and dummy variables. The discrete variables are *credit rating, maturity, transaction size, loan size,* as well as *loan to value, #tranches, #lead managers,* and *#rating agencies.* The set of dummy variables consists of *extern enhancement, retained interest, float, currency risk, emerging market,* and *creditor* protection. In the univariate analysis, all variables are analyzed and tested separately. The regressions measure the effects of all independent variables on the *primary market spread*. To test the over-reliance on *credit rating*, the variables, which are already considered by rating agencies, are analyzed with respect to *credit rating*.

In order to find evidence that supports hypotheses 1 and 2, we need detailed information on the common security factors of every one of the 1,688 deals. Since our aim is to determine the factors influencing the *primary market spread* of ABS issues, we select those issues that have comparable pricing data available. This implies that we select those issues, for which we can identify the common pricing factors introduced above. We are only able to investigate the extent to which the ABS transactions are priced by the common pricing features if the sample provides all the data needed for every tranche. Unfortunately, this means that the sample is further reduced. The new subsample contains 329 transactions with a total of 771 tranches. The tranches add up to a total of USD 266 billion. This subsample is now referred to as the "high information sample". It only contains issues for which, all the information is provided. Table 6 reports a comparison between the high information sample and the working sample, to examine in detail, the appearance of the variables in the two samples. Further, this paper examines the causes for the reduction of the working sample. The deals of the working sample have an average issue amount of USD 339 million. The average coupon rate of the 52% *fixed* rated deals equal 3.06%, while the 48% *floating* rated issues exhibit an

average coupon rate 2.23%. A typical ABS tranche of this sample *matures* after 11.8 years. The rate of deals exposed to *currency risk* is 0.26. The average *number of tranches* of a transaction is 3.5, whereby 55 transactions are single-issued tranches. Those transactions contain only one tranche. Moreover, the average *number of lead managers* equals 2.05. One important characteristic is the existence of a *credit rating* from at least one of the three rating agencies Moody's, Standard and Poor's, or Fitch. *Credit rating* exhibits an average value of 4.5 for the working sample. The lack of a *credit rating,* lack of existence of a maturity date, and missing information on subordination and extern enhancement are the reasons behind the reduced working sample. For instance, 466 tranches have no *credit rating* assigned while 81 further deals have no maturity dates. The other deals are filtered out, because no information is available on extern enhancement or subordination. This leads us to the statistical numbers for the high information sample. The average amount of a deal of

Table 6: *Univariate analysis of the working sample compared with the high information sample*

Variable of interest	ABS working sample			ABS high information sample			Survival
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev	rate
Coupon rate (bp)	1235	244	184	771	222	159	62.43%
Risk premium (bp)[7]	771	92	135	771	92	135	100%
Credit rating (1-21 weak)	1214	4.5	4.08	771	3.9	3.63	63.51%
Loan to value (%)[7]	771	24.00	29.67	771	24.00	29.67	100%
Time to maturity (years)	1513	11.8	10.85	771	11.5	9.57	50.96%
Issues with extern enhancement	1177	4.5%	-	771	3.8%	-	65.51%
Loan tranche size (USD mio.)	1688	339	590	771	346	559	45.68%
Transaction size (USD mio.)	486	783	973	329	779	770	67.70%
Number of tranches	486	3.5	2.36	329	3.85	2.36	67.70%
Number of lead managers	1688	2.05	0.99	771	2.18	1.11	45.68%
Number of credit rating agencies	1222	1.38	0.51	771	1.43	0.53	63.09%
Loans with retained interest[16]	771	67.2%	-	771	67.2%	-	100%
Loans with fixed rate	1542	52%	-	771	52%	-	50.00%
Loans with floating rate	1542	48%	-	771	48%	-	50.00%
Loans with currency risk	1688	26%	-	771	42%	-	45.68%
Loans in emerging markets[7]	771	31%	-	771	31%	-	100%
Loans with creditor protection[7]	771	65%	-	771	65%	-	100%

Column 1 represents the common pricing variables. Column 2 presents the number, the mean, and the standard deviation of each variable in the working sample. Column 3 describes the number, the mean, and the standard deviation of each variable associated with the high information sample. Column 4 describes the survival rate for each variable. This rate is calculated by dividing the number of issues of each variable of the high information sample by the number of issues of each variable of the working sample.

[16] The variable was only calculated for the high information sample

the high information sample is USD 346 million. The average coupon rate of *fixed* rated deals equals 2.54%, while *floating* rated deals provide an average coupon rate of 1.87%. Surprisingly, the average risk premium associated with *floating* rate deals is 1.16%, whereas the risk premium of *fixed* rated deals equals 0.72%. A typical ABS tranche of this sample *matures* after 11.5 years. The rate of issues exposed to *currency risk* is 0.42. The average *number of tranches per transaction* is 3.85, whereby 55 transactions are single unit transactions. The tranches exhibit an average *number of lead managers* of 2.18. We observe a mean value of variable *credit rating* of 3.9.

We find some similarities and some differences between the two samples. The *time to maturity*, the average *amount*, and the coupon rate of *floating* rate deals exhibit similar results. This paper observes a dissimilar coupon rate for *fixed* rated issues. This can be explained by the fact that the high information sample requires at least one *credit rating* of the three rating agencies. Almost all junior tranches are *fixed* rated and have a higher coupon rate compared to the senior tranches because they contain underlying assets with lower credibility. Hence, these assets are associated with an additional risk premium. In addition, companies frequently do not instruct rating agencies to assign a *rating* to those tranches. Since the main cause of reduction was the lack of *credit rating*, it is satisfactory that the average coupon rate of *fixed* rated deals differs enormously. Based on these findings, we highlight that the deals of the high information sample exhibit similar results compared to their working sample counterparts. Hence, we assume that the empirical results derived from the high information sample can be generalized for the whole sample. This is essential because we aim at providing results that are valid for the whole non-U.S. ABS market.

2.4 Determinants of the Primary Market Spread

This section provides evidence that supports the first research hypothesis. Therefore, regression analyses were performed to analyze the factors that investors relied on when pricing asset-backed securities after the 2007 financial crisis.

2.4.1 Methodology

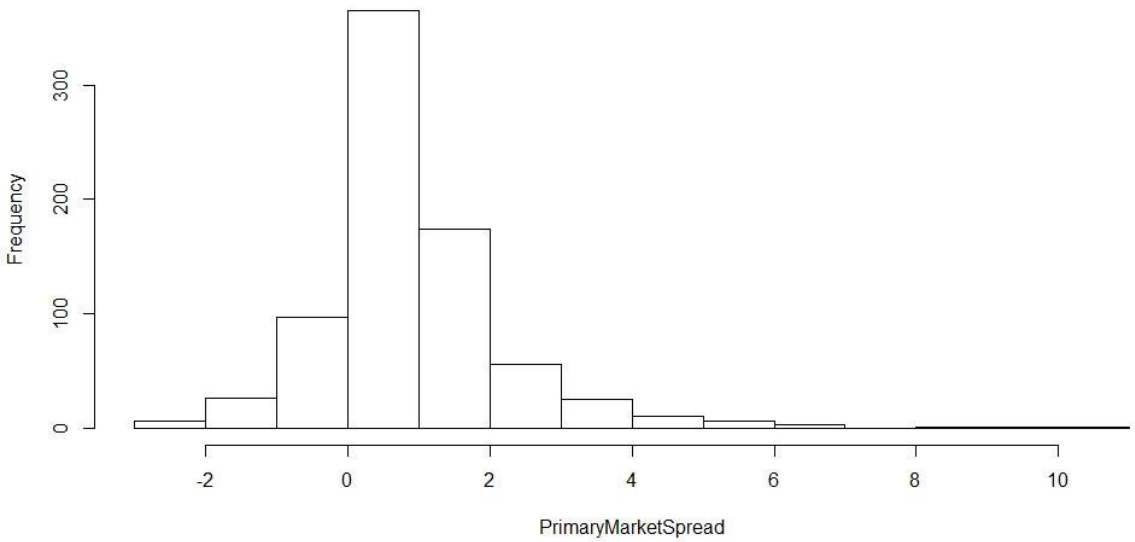
This subchapter explains the statistical methods used to analyze the data sample. First, three regression analyses were performed on single variables to determine the most important credit factors. Second, we ran an ordinary least squares regression on the whole set of pricing features. This empirical study analyzed how common pricing

factors influenced the *primary market spread* of ABS transactions after the financial crisis. Third, we also performed a residual analysis in order to investigate whether the statistical instruments provided valid results and if the interpretation of the coefficients was correct. This analysis evaluated the residuals for normal distribution with mean zero, constant variance, and homoscedasticity.

2.4.1.1 Dependent Variable

This subsection deals with the dependent variable of the regression analysis. The dependent variable is called *primary market spread* in this study. The *primary market spread*, also called loan spread, represents the risk premium. On the basis of information at the time of issuance, the risk premium is defined as the price for the risk associated with the security. This study defines the *primary market spread* as the offered yield to maturity of the security at issuance above the yield to maturity of a corresponding treasury benchmark (Vink & Thibeault, 2008; Collin-Dufresne, Goldstein, & Martin, 2001). Vink and Thibeault (2008), Vink and Fabozzi (2012), Gabbi and Sironi (2005), as well as Collin-Dufresne, Goldstein, and Martin (2001) suggest the following procedure to obtain a suitable treasury benchmark: First, the benchmark is obligated to provide the same currency. Second, the benchmark is obligated to be issued at a comparable auction date. Third, the benchmark has to offer a comparable time to maturity. Figure 2 shows a histogram of the *primary market spread* of our sample. The histogram highlights that the distribution of the dependent variable is very similar to a normal distribution. This is very important because this is one of the conditions for the

Figure 2: *Histogram of Primary Market Spread*



regression analysis to lead to valid results. Additionally, we observe the phenomenon that floating rate issues have a lower coupon rate than the fixed rated issues (Vink & Thibeault, 2008; Gabbi & Sironi, 2005; Reilly, Wright, & Gentry, 2010). But on the other hand, we see that the *primary market spread* of floating rate issues is higher than the *primary market spread* for fixed rated issues.

2.4.1.2 Independent Variables

This subsection investigates the independent variables of this study. The independent variables are all variables describing the following three categories: *Default and recovery risk characteristics, marketability characteristics,* and *expected systemic characteristics*. Further, we include dummy variables for currencies and years, in which the tranches are issued. Except for two correlation coefficients, all other coefficients of the correlation matrix do not indicate critical correlation levels between the independent variables. The only two coefficients, which indicate a critical correlation level, are the coefficients for *loan size* and *transaction size* and for *currency risk* and *emerging market*. This may be explained by the fact that many junior tranches, which are often the smaller tranches, are retained or not rated by any of the three rating agencies. Therefore, those issues are not included in the high information sample. If the *transaction size* is large, it is likely that the tranche has a large *loan size* too. The second case can be explained by the fact that issues exposed to *currency risk* are often issued in an *emerging market*. To obtain valid results, two regressions are performed as solutions to the correlation problem. The first regression includes the variables *loan size* and *currency risk*. The second regression includes the variables *transaction size* and *emerging market* in the model.

2.4.1.3 Regression Analysis

This subsection presents the regression model that analyzes the common pricing factors that influenced the *primary market spread* of ABS transactions after the 2007 financial crisis. This study uses a panel-data fixed-effects model with the following structure:

$$Y = \beta X + u,$$

where Y is the dependent variable, β is the regression coefficient, X describes the matrix of the independent variables, and u describes the error term. We present the analyses in another form with the same meaning:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_k x_{ik} + u_i \quad (i = 1,\ldots,n)$$

where $y_i, x_{il}, \beta_i,$ and u_i $(i = 1,\ldots,n, l = 1,\ldots,k)$ represent the dependent variable, the independent variable, the regression coefficient, and the error term. At this point, we note that the regression analysis is performed with an intercept β_0. We include the intercept in the analyses because we expect the risk premium to be different from zero in every case. However, even if all the coefficients from the independent variables are zero, we expect that the originator will nevertheless demand a risk premium. We perform several regression analyses: first, a regression analyses with only one independent variable to measure the impact of that variable; and second, a regression analysis with all independent variables determining the high information sample. After this, we verify the results of the regression analyses. T-tests, to check whether an independent variable is statistically significant, are also performed. If a variable is not considered statistically significant, i.e. if no statistical significance exists, then, the corresponding variable is not considered as a determinant of the *primary market spread*. Further, we also perform an F-test—to test the goodness of fit—along with a residual analysis.

2.4.1.4 Regression Structure

This subsection introduces the structure of the panel-data fixed-effects model. This paper aims to analyze the impact of the common pricing factors on the *primary market spread* of ABS transactions from 2010 till the end of 2014. First, we run three regression analyses with only one independent variable. We also investigate three variables which could have dominantly impacted the *primary market spread*. The independent variables are *credit rating*, *time to maturity* and *float*. Second, we run an ordinary least squares regression and present the results for the estimator β. The specification for our model is:

$$\begin{aligned}\text{SPREAD}_i = {} & \beta_0 + \beta_1 \text{CREDIT RATING}_i + \beta_2 \text{MATURITY}_i \\ & + \beta_3 \text{EXTERN ENHANCEMENT}_i + \beta_4 \text{LOAN TO VALUE}_i \\ & + \beta_5 \text{LOAN SIZE}_i + \beta_6 \text{\# TRANCHES}_i + \beta_7 \text{\# LEAD MANAGERS}_i \\ & + \beta_8 \text{\# RATING AGENCIES}_i + \beta_9 \text{RETAINED}_i \\ & + \beta_{10} \text{TYPE OF INTEREST RATE}_i + \beta_{11} \text{CURRENCY RISK}_i \\ & + \beta_{12} \text{CREDITOR PROTECTION}_i + \beta_{13} \text{YEAR OF ISSUE}_i \\ & + \beta_{14} \text{CURRENCY}_i + \varepsilon_i\end{aligned}$$

In this model, the variable SPREAD_i describes the *primary market spread*. The variables with the coefficients $\beta_1, \ldots, \beta_{12}$ are the common pricing factors. The last two variables are included as control variables. CURRENCY describes multiple dummy variables that are included because the issues of the high information sample are denominated in several currencies. Each dummy refers to one currency. The variables take the value 1, if the issue is denominated in the corresponding currency, and value zero, otherwise. YEAR OF ISSUE describes multiple dummy variables which represent the issuance years of the high information sample. We included four dummies in this study based on the year of issue: YEAR = 1, YEAR = 2, YEAR = 4, YEAR = 5, which correspond to 2010, 2011, 2013, and 2014. The dummies take the value 1 if the transaction was issued in the corresponding year, and value zero, otherwise. Note that the dummy variable reflecting "Mexican Peso" and the dummy variable describing 2012 were excluded from the analyses in order to avoid over sensitivity. The regression model was run to provide evidence that supported the first research hypothesis.

2.4.2 Regression Results

This section reports the first three regressions described in the section above. The results of the regressions have been exhibited in Table 7. The first regression was run on *credit rating* (independent variable) and the *primary market spread* (dependent variable).

Table 7: *Regressions on Credit Rating, Maturity, and Type of Interest Rate*

Variable	ABS issues Reg. #1	ABS issues Reg. #2	ABS issues Reg. #3
Intercept	0.1642 ***	1.1133 ****	0.6959 ****
Credit Rating	0.1947 ****	-	-
Time To Maturity	-	-0.0157 ***	-
Float	-	-	0.4629 ****
Number of Observations	771	771	771
Adjusted R^2	0.28	0.01	0.03
F-Statistics	< 2.2e-16	< 0.002	< 1.6 e-06
Significance Levels	0 '****' 0.001 ' ***' 0.01 '**' 0.05 '*' 0.1 ' ' 1		

The first column describes the coefficients, the second to fourth column describe the value of the estimated regression coefficient for the corresponding variable. The "*" describes the statistical significance of the corresponding variable, i.e. a variable has an influence on the primary market spread if it is considered as significant.

The adjusted R^2 is greater than 0.28 which indicates a satisfactory value for only one independent variable. The F-statistic indicates that at least one of the regression

coefficients is different from zero. Hence, the model has a satisfying explanatory quality. The intercept is statistically significant at the 1% level which is the second-highest significance level. This means that if the regression coefficient of *credit rating* is zero, there is still a risk premium demanded by investors. The coefficient of *credit rating* equals 0.1947 as expected. This means that a worse *credit rating* is associated with an additional risk premium of 19.5 basis points. Further, we note that the *credit rating* is statistically significant at the 0.1% level—the highest significance level. Therefore, the variable has a strong influence on the *primary market spread*.

The next regression in Table 7 was run on *maturity* (independent variable) and the *primary market spread* (dependent variable). The adjusted R^2 lies over 0.01 and it indicates a low explanatory power for the variance. The p-value of the F-statistic indicates that the regression coefficients are different from zero. It suggests a satisfactory explanatory power of the regression. The intercept is statistically significant at the 0.1% level. *Time to maturity* has a significantly negative relationship with the *primary market spread* at the 1% level. This indicates that a longer *time to maturity* is associated with a price discount of 1.5 basis points per every additional year. The significance level shows that the model is an excellent fit and there is a significant relationship between *maturity* and *primary market spread*.

The last single regression of Table 7 was run on the dummy variable *float* (independent variable) and the *primary market spread* (dependent variable). The adjusted R^2 has a value greater than 0.02 and is as expected since we analyzed a dummy variable. The F-statistic suggests that the model has satisfying explanatory power. The intercept is statistically significant at the 0.1% level, which equals the results of the other regressions. The variable *float* is significantly and negatively related with the *spread*. The estimate of 0.4629 indicates that issues with a *floating* coupon rate are associated with an additional average risk *spread* of 46 basis points.

We conclude that the three variables exercise a strong influence on the *primary market spread*. This is not very surprising because we considered *credit rating* and *time to maturity* as two of the most dominant variables in this study. However, no clear apriori conclusion about the explanatory power of the variable *float* can be arrived at from extant literature. The results show that the *type of interest* significantly impacts the *primary market spread*. A regression on the complete model has been performed below. On the one hand, we are interested in the variables that influence the *primary market*

spread, while on the other hand, we also examine how the three variables mentioned above behave when they are put in a model together with all the other common features. The regression was run on the common pricing factors (independent variables) and the *primary market spread* (dependent variable). Due to correlation issues for the variables *transaction size* and *emerging market,* we have performed two regressions.

Table 8: *Determinants of the Primary Market Spread*

Variable	ABS issues Reg. #1	ABS issues Reg. #2
Constant	4.5839 ****	5.3481 ****
Credit Rating	0.2549 ****	0.2508 ****
Loan To Value	0.0041 ***	0.0032 ***
Time To Maturity	-0.0373 ****	-0.0363 ****
Retained Interest	-0.1739 **	-0.1909 ***
Extern Enhancement	-0.2021	-0.2278
Loan Size	-0.0318	-
Transaction Size	-	-0.2248 ****
# Tranches	-0.0113	0.0077
# Lead Managers	-0.0859 **	-0.0622 *
# Rating Agencies	0.0991	0.1145
Currency Risk	0.0698	-
Creditor Protection	-0.4361 ****	-0.4365 ****
Float	0.4824 ****	0.5368 ****
Emerging Market	-	0.0946
Number of Observations	771	771
Adjusted R^2	0.57	0.59
F-Statistics	< 2.2e-16	< 2.2e-16
Significance Levels	0 '****' 0.001 ' ***' 0.01 '**' 0.05 '*' 0.1 ' ' 1	

The dummy variables YEAR1, YEAR2, YEAR4, YEAR5, and the currency dummies are included in the regression but not reported in the above table.

Table 8 provides the results from the regression analysis that was run to determine the yield determinants of the ABS market. Further, Table 8 reports that the adjusted R^2 is higher than 0.57, which is an extraordinary value. Both adjusted R^2 describe the explanatory power of the regression. They describe the extent to which the variance of the dependent variable may be explained by the variance of the independent variables. The values are comparable to the results of the studies of Vink and Thibeault (2008), Vink and Fabozzi (2012), and Fabozzi and Vink (2012). Thus, the model displays satisfactory explanatory power of regression. The F-statistic (p-value < 2.24-16) indicates that at least one of the regression coefficients is different from zero.

The first variable is *credit rating*. We predicted an inverse relationship between *credit rating* and *primary market spread*. The variable has a significant and positive relationship with the *spread* at the 0.1% level as expected. The pattern of *credit rating* indicates that *spreads* rise by 25 basis points when ratings worsen. This observation is as predicted and makes intuitive sense. Further, the significance level indicates that *credit rating* is a yield determinant of the ABS market. This is in accordance with the results from the first single regression, in which the estimate value as well as the significance level are comparable. Further, *credit rating* exhibits significant homogeneity with respect to the standard deviations in both regressions. We observe a positive and significant relationship with the *spread* at the 1% level for the variable *loan to value*, although we do expect a negative relation. This result is similar to the results of Vink and Thibeault in 2008. They also documented a positive coefficient sign for *loan to value*. This indicates that *loan to value* is a primary yield determinant of the ABS market. The coefficient suggests that issues with higher *loan to value* (senior tranches) are associated with an additional risk premium. *Maturity* exhibits a significantly negative relationship with the *primary market spread* at the 0.1% level. Apparently, yield *spreads* generally decrease with longer *time to maturities* for ABS transactions. The results for *maturity* are very similar to the results from the single regression.

Moreover, we observe that *retained interest* is significantly and negatively related with the *spread* at the 5% level. This paper concludes that *retained interest* leads to "investors comfort" and positively influences the risk premium. The relationship of *extern enhancement* with *spread* is negative, as predicted. The results of the t-test yields an insignificant relationship. Thus, *extern enhancement* is ascertained to be no yield determinant of ABS transactions. An insignificantly negatively relationship between *loan size* and the *spread* is also reported and this indicates that yield *spreads* generally decrease with larger *loan sizes*. The statistical significance indicates that *loan size* does not influence the *primary market spread*. The variable *#tranches* is negatively related with the *spread* as expected. Thus, we did not find any support that allows issuers to exploit market factors to their advantage via tranching for ABS; or at least no advantage exists that may be associated with a lower *spread*. Nevertheless, we note that *#tranches* is statistically insignificant. Therefore, *#tranches* is not considered as a yield determinant of ABS issues. The variable *#lead managers* exhibits a significantly negative relationship with the *primary market spread* at the 5% level as predicted. Thus,

a larger conglomerate of investment banks is associated with an average price discount of 8.6 basis points. Additionally, the variable is a yield determinant of ABS issues. The variable *#rating agencies* is insignificantly and positively related with the *spread*. We predicted a negative coefficient for *#rating agencies*. One explanation could be that in the high information sample, issues with excellent rating are rated by a smaller conglomerate of rating agencies than issues without an excellent rating. This study observes an insignificantly positive relationship for *currency risk* and the *primary market spread*, i.e. issues that are exposed to *currency risk* are associated with an additional risk premium. The second to last variable *creditor protection* is significantly negatively related with the *spread*. Tranches that are issued in countries with no automatic stay on the assets are associated with a price discount compared to tranches issued in countries with no *creditor protection*. The variable is significant at the 0.1% level and therefore, consequently considered as a yield determinant of ABS transactions. The last variable of the regression is *float*. We expected a positive coefficient sign, since *floating* rate issues have higher *spread* rates than fixed rate issues. The analysis exhibits that *float* is significantly and positively related with the *primary market spread* at the 0.1% level. Thus, *spreads* rise by an average of 48 basis points when the corresponding security is issued with a *floating* rate. In addition, the significance level indicates a dominant correlation between *float* and the *primary market spread*. The results support the findings from the single regression. Hence, *float* is a yield determinant of the ABS market.

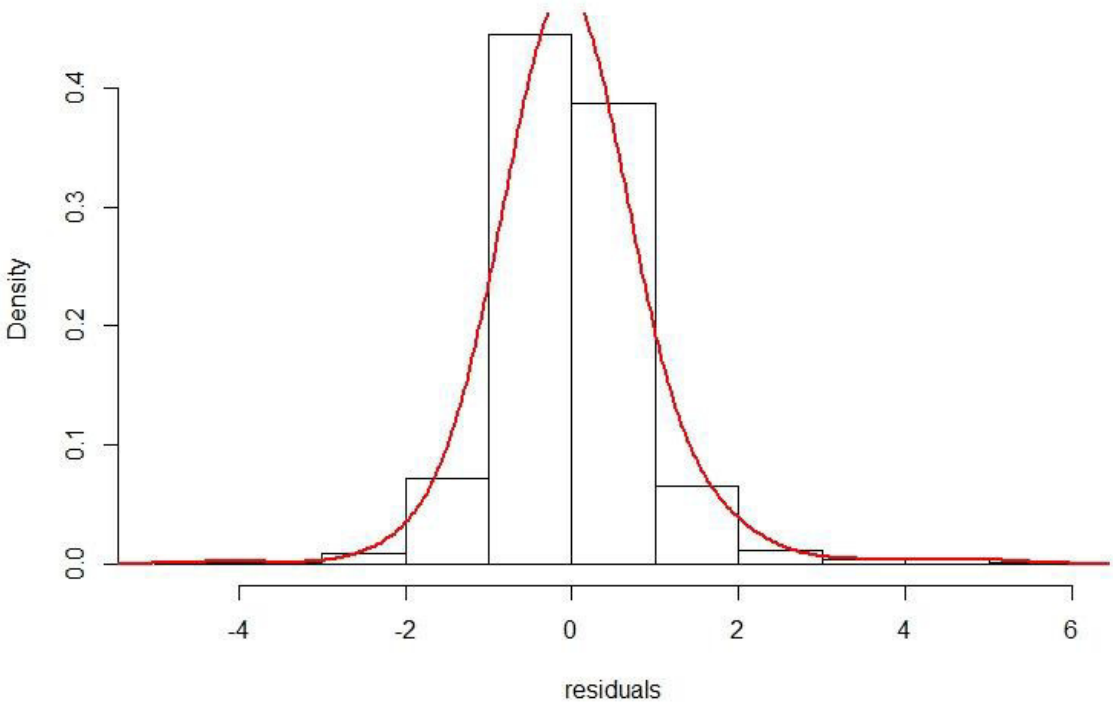
The next regression was performed without the variables—*loan size* and *currency risk*. Instead, the variables *transaction size* and *emerging market* are included in the regression analysis. The results of the regression are very similar to the results of the first regression of Table 8. Nevertheless, we observe one dissimilarity. *#tranches* exhibits a positive coefficient sign in the second regression. However, the variable is still insignificantly related with the *spread*. *Transaction size*, compared to *loan size* in the first regression, is significantly negatively related with the *spread* at the 0.1% level. Issues with a larger *transaction size* are associated with higher secondary market liquidity and an average price discount of almost 23 basis points. Hence, *transaction size* is a determinant of the *primary market spread*. The variable *emerging market* on the other hand has an insignificant and positive relationship with *spread*. Based on the results of the regressions, we suggest the following list of yield determinants of ABS transactions. *Credit rating*, *loan to value*, *time to maturity*, *retained interest*, *transaction*

size, number of lead managers, *creditor protection* and *float* are significant determining variables of the *spread* of non-U.S. ABS transactions.

As a next step, we analyze the residuals of the regressions of Table 8. The analysis of the residuals involves testing for normal distribution, analyzing the residuals plot of the regression analysis for constant variance, and performing the Breusch-Pagan test to test the residuals for heteroscedasticity.

First, we take a look at the histogram of the residuals. We add a density curve to see the distribution of the residuals. Figure 3 identifies the distribution of the residuals of the first regression very easily. We see that the residuals are normally distributed with

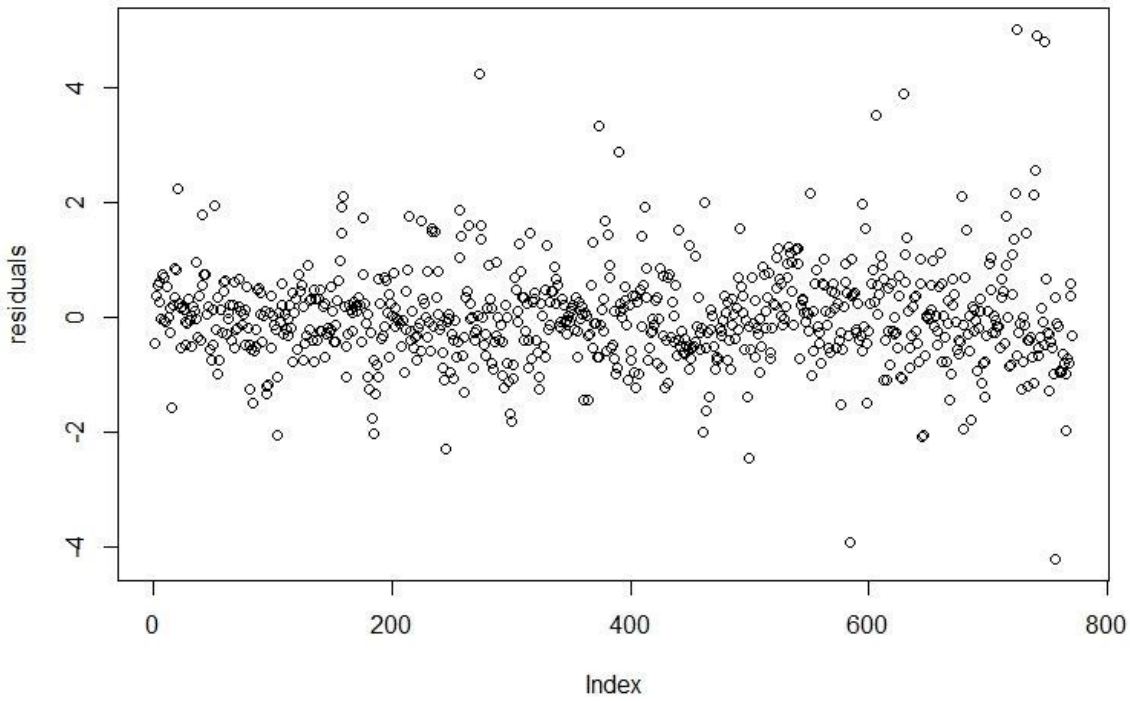
Figure 3: *Histogram of Residuals with Fitted Density Curve*



mean zero. Additionally, we observe the same result for the second regression analysis. Those results are very important for this study, since the normal distribution of the residuals as well as a mean of zero are two assumptions for the validity of the regression analysis. Thus, the results support the explanatory power of the regression. To further analyze the residuals, we test the residuals for constant variance. This means, it is very important that the variance of the residuals does not fluctuate with rising index. First, we analyze the plot of the residuals of the first regression as shown in Figure 4. The residual plot indicates that the variance of the residuals seems to be constant. We cannot detect any significant changes in the variance over the index. Further, the residual plot

of regression two exhibits the same result. But, since this is another important assumption for the correctness of the results of the regression analyses and there are some outliers in the plot, we perform the Breusch-Pagan test to eventually support the fact that our model does not contain heteroscedasticity. The Breusch-Pagan test was developed in 1979 by Trevor Breusch and Adrian Pagan. We have used this test to reject heteroscedasticity in the linear regression model. Homoscedasticity is one of the apriori conditions of a valid regression model. The null hypothesis states that there is no heteroscedasticity in the regression model. We are interested in the p-value of the Breusch-Pagan test. If the p-value is lower than a corresponding significance level, the

Figure 4: *Residual Plot*



null hypothesis will be rejected and heteroscedasticity proved to exist. For our model, the highest significance level is $\alpha = 0.1$, i.e. 10%. If the p-value is lower than 0.1, the null hypothesis will be rejected, if the p-value is greater than 0.1, the null hypothesis will be accepted and we can assume that there is no heteroscedasticity in our model. The Breusch-Pagan test shows that the p-value exceeds the level of 10%, and therefore, we can assume that the null hypothesis will be accepted. This only implies that there is a statistically significant homoscedasticity in our model therefore, it does provide valid results. A second Breusch-Pagan test for the second regression yielded the same result

and therefore, we were able to proceed with the analyses of the regression results in greater detail.

2.4.3 Regression Discussion

This section further analyzes the regression results and provides evidence that supports the first hypothesis by comparing the results of this study with the findings of Vink and Thibeault's study (2008). The comparison results enable this paper to conclude whether there have been significant changes in the set of yields of ABS transactions after the 2007 financial crisis.

Vink and Thibeault (2008) discovered the following statistically significant determinants of the *primary market spread* prior to the 2007 financial crisis for non-U.S. ABS transactions. Not surprisingly, the *credit rating* is statistically significant at the highest level. Further, *the number of tranches*, *the loan size*, *the transaction size*, and *the type of rate* are documented as determinants of the *primary market spread*. *Currency risk* was the last significant variable that Vink and Thibeault (2008) detected.

Compared to the results above, this study observes the following yield determinants of non-U.S. ABS transactions after the 2007 financial crisis—*Credit rating*, *loan to value*, *time to maturity*, *retained interest*, *transaction size*, *number of lead managers*, *creditor protection* and *the type of rate*—of the *primary market spread* for ABS transaction. All other included variables are statistically insignificant. The subsequent sections enable detailed comparisons.

2.4.3.1 Credit Rating

In empirical studies for fixed income securities, the *credit rating* is always considered the most dominant determinant for the *spread*. This study confirms the findings in literature and yields to consider *credit rating* as one of the most critical yield determinants. In Vink and Thiebeault's study (2008) *credit rating* is introduced as an inverse function. The best *credit rating* is assigned to value 1, the second-best rating is assigned to value 2, and so on. The worst *credit rating* is assigned to value 22. Credit rating has a mean value of 4.1 in their high information sample and 3.9 in their full sample. It was expected that the coefficient sign of this variable would be positive. Therefore, the variable included in this study has been constructed in the same way. The mean value of *credit rating* is 3.9 in the high information sample and 4.5 in the working sample. Both studies find a significantly negative relationship for the credit rating with

the *primary market spread* at the highest level. Thus, *credit rating* may still be viewed as a yield determinant of the ABS market.

But, if we expand the results from the analysis onto the working sample as intended, we observe a significant change for the variable. Leaving the influencing character aside, it is clear that the rating agencies have not assigned excellent ratings as easily as pre 2007. The mean value of *credit rating* is significantly higher for the working sample in this study compared to that in Vink and Thibeault (2008). This implies that post the 2007 financial crisis, investors regarded *credit rating* more critically, such that rating agencies had to adapt the process of assigning a rating. This change indicates worse ratings with respect to the mean values. We note that the results still indicated that the variable remained the most dominant determinant of the *primary market spread*. However, the financial crisis significantly impacted the pricing of the ABS transaction. After the defaults in mortgage-backed securities, the securitization market however, experienced a huge breakdown. One of the causes of the crisis was the extraordinary credit ratings assigned to the transactions. These conveyed the assumptions of a low-risk market. However, the investors were skeptical about the excellent ratings during the crisis. In order to regain credibility, rating agencies had to adapt their processes of assigning a rating and this led to a recovery in the credibility of rating agencies and consequently, a strong significance level for *credit rating*.

2.4.3.2 Loan to Value

The next variable is *loan to value*. The studies lead to different results for this variable, however, it is positively related with the *spread* in both studies, although both papers did expect a negative relationship. With respect to statistical significance, both studies have also resulted in different manifestations. Prior to 2007, the variable had an insignificant relationship with *spread*, whereas in this study, the variable *loan to value* is significantly related with the *primary market spread*, and is therefore a yield determinant for ABS issues. This is the first evidence of the fact that investors rely on different features when pricing ABS transactions in the post 2007 markets. Consequently, the subordination structure of the securities has developed adequately to function as an indicator for internal risk protection against payment defaults.

2.4.3.3 Time to Maturity

Time to maturity is an interesting variable for this study. Vink and Thibeault (2008) determine that *time to maturity* is not statistically significant for pricing ABS transactions. Our study, on the other hand, observes a significantly negative relationship with the *primary market spread* at the 0.1% level. Therefore, we can highlight the second important change in pricing asset-backed securities. *Time to maturity,* compared to the scenario pre 2007*,* is considered as yield determinant in this study.

2.4.3.4 Retained Interest

Retained interest behaves differently in the two studies. This study observes that *retained interest* is as predicted negatively related with the *spread*. Surprisingly, the coefficient sign of the variable in Vink and Thibeault's study (2008) was positive, though they expected it to be negative. Hence, issues that provide *retained interest* as internal credit enhancements are associated with a price discount after the financial crisis. Further, the significance levels have been seen to differ as well. This study considers the variable as yield determinant for the ABS market, whereas Vink and Thibeault (2008) observe an insignificant relation.

2.4.3.5 Loan Size and Lead Managers

This paper documents an insignificantly negative relationship for the variable *loan size*. The results differ from those of Vink and Thibeault's study (2008). Both papers predicted the negative results, but Vink and Thibeault (2008) observed a positive relationship with the *spread*. Further, the 2008 study considered the variable as a determinant of the *primary market spread*. This is a further interesting influence of the financial crisis. A higher *loan size* signals secondary market liquidity and is negatively related with the risk premium however, it is not a yield determinant anymore. The *number of lead managers* exhibits a negative coefficient sign in both studies. However, prior to 2007, the variable is considered insignificant and consequently, not a determinant of the *spread*. This study, based on a 5% significance level, concludes that the variable is a yield determinant. As a consequence of the crisis, the size of the conglomerate is a dependency of the set of yield determinants.

2.4.3.6 Transaction Size and Type of Rate

The next two variables exhibit the same significance levels in both studies. The relationships that *transaction size* and *floating rate* have with the *primary market spread* remain significant at the 0.1% level in both studies. The coefficient sign for *transaction size* is negative in both studies though the impact of the *type of interest* differs. This analysis observes a positive relationship for *float,* although Vink and Thibeault's study (2008) finds a negative relationship. Therefore, investors assign a different impact to the variable post 2007.

2.4.3.7 Extern Enhancement and Rating Agencies

This paragraph discusses *external enhancement* and the *number of rating agencies*. The two variables are not considered to be yield determinants in both studies. Extern enhancement is still negatively related to issuance *spread* as expected. On the other hand however, we note that the coefficient sign of the variable *number of rating agencies* differs. Vink and Thibeault (2008) determine a negative relationship as expected, whereas this study observes a positive relationship.

2.4.3.8 Tranches, Currency Risk

These two variables are the only two characteristics, which belong to the set of yield determinants prior to the financial crisis but are insignificant post 2007. Nevertheless, both empirical studies observe positive relationships for both variables. This means, the associations of the impact are the same. The results indicate that investors substitute the *number of tranches* and *currency risk* with internal credit enhancement variables as yield determinants.

Finally, the last two variables—*creditor protection* and *emerging market*—are not included in Vink and Thibeault's study (2008). Therefore, there are no comparison results for these variables.

2.4.4 Conclusion on the first Research Hypothesis

The first hypothesis addresses the set of yield determinants of the ABS market. The results indicate that there is a new set of yield determinants for the post 2007 period. *Loan to value, time to maturity, lead managers,* and *retained interest* are considered to be the new determinants for the issuance spread. Further, we observe that the *credit rating*, *transaction size*, and *the type of interest rate* are still significantly

related with the *primary market spread*. Despite these similarities, we observe important changes in the set of yield determinants in Vink and Thibeault's study (2008). After the financial crisis, the relationships of *loan size, the number of tranches* and *currency risk* with the *spread* seem to become insignificant. Further, this paper observes significant influence of the crisis on the coefficients of the common pricing characteristics. While *retained interest* and *loan size* are positively related with the spread in Vink and Thibeault's study (2008), we find negative relationships as expected. The coefficient sign for *the number of rating agencies* differs as well. Vink and Thibeault (2008) observe a negative relationship, whereas we find a positive coefficient sign. Finally, we observe a positive relationship for *float* whereas the variable is negatively related with the *spread* in their 2008 study.

Based on these findings, we accept the first research hypothesis. We conclude that the yield determinants were significantly influenced by the financial crisis. Although the study does bear some similarity with that of Vink and Thibeault's (2008), significant influence is determined with respect to significance levels and coefficient values. Further, many security characteristics seem to have developed owing to recent regulations in the non-U.S. ABS market. The new set of yield determinants reflects these. Two new spread determinants describe internal credit enhancement. This is the most important finding after 2007. As a consequence of the collapse of securitization, internal credit enhancement seems to have significantly evolved as per investors' demands. Moreover, *time to maturity,* as a measure of credit risk default, is now considered to be a spread determinant.

2.5 Over-Reliance on Credit Rating

As proposed in the introduction, an intuitive follow-up of our empirical analysis is the investigation into the over-reliance on *credit ratings*. The widely held view that investors should employ their own credit analysis might be reasonable, but may not be straightforward for some investment vehicles in the fixed income market. In the case of corporate bonds, for instance, there are well-known metrics derived from the financial statements of the issuer and the price volatility of the issuer's stock that can be used to measure the issuer's financial well- being. In contrast, the analysis of asset-backed securities is not as simple. The key element for asset-backed security transactions is to separate the credit risk of the originator from the SPV that is issuing the ABS (Vink & Fabozzi, 2012; Ayotte & Gaon, 2011; Hu & Black, 2008). Consequently, when

determining the potential explanatory variables that investors should consider when assessing ABS credit risk, we must determine what information—about the structure—is available and which factors are associated with an ABS credit analysis. The best source for factors to consider for assessing credit risk is the ABS rating process of rating agencies themselves (Vink & Fabozzi, 2012). For this reason, in the next subchapter we discuss what variables, in general, are considered by the rating agencies when assigning a rating to ABS transactions. Thereafter, we perform one further regression analysis and, in combination with the results of Table 8, this is deployed to test whether investors rely solely on credit ratings or if they employ their own credit risk analyses. If the results indicate that these variables not only capture the variable *credit rating* but also get considered as yield determinants by investors, then, this study will be able to conclude that investors look beyond the credit rating and employ their own credit risk analyses as ways to expand the credit rating of rating agencies. Following the above approach, we ran a regression on *credit rating* and on factors, which had already been considered by the rating agencies, first. Subsequently, we analyzed the results of Table 8 in order to investigate the over-reliance hypothesis.

2.5.1 Factors Considered By Rating Agencies

This study only includes factors, which are associated with the default risk. Moody's, Fitch, and Standard and Poor's focus on three areas when assigning ratings: (1) asset risks, (2) structural risks, and (3) third-party enhancement. Asset risks address the portfolio of assets backing the security. Evaluating their quality entails determining losses due to default probabilities. Structural risks describe the risks and the obligations of the tranche that the cash flow of the underlying portfolio cannot satisfy during the securitization process and the lifetime of the security (Vink & Fabozzi, 2012; La Porta, Shleifer, & Vishny, 2003; La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 2000; Acharya, Bharath, & Srinivasan, 2007; Altman, Brady, & Sironi, 2007). Third-party enhancements describe whether or not there are any guarantors involved in the transaction. For instance, if there are third-party guarantees by insurance companies, these can reduce possible losses of the underlying assets. For the purpose of including these areas in our analysis, we constructed a corresponding set of variables in section 2.3. The variables, which describe *credit rating* in the following analysis, are *external credit enhancement, internal credit enhancement, collateral origination,* and *creditor protection*. Internal credit enhancement is divided into the variables *loan to value* and *retained interest*. Collateral origination is divided into *currency risk* and *emerging*

market of section 2.3. Due to high correlation with this set of variables, the variable *emerging market* has been excluded from the analyses.

2.5.2 Methodology

The regression model for this chapter has the same structure as the regression models of section 2.4. The high information sample is analyzed to find evidence that supports the second hypothesis. The performed regression attempts to determine whether the above factors accurately describe the *credit rating*. This is important for our approach and further progress, since we need the variables to capture the *credit rating*.

2.5.3 Regression Results

The regression was run on the variables *loan to value, retained interest, extern enhancement, currency risk,* and *creditor protection* (independent variables) and the *credit rating* (dependent variable). The results are presented in Table 9.

Table 9: *Regression on Credit Rating*

Variable	Regression on Credit Rating
Intercept	3.8515 ****
Loan To Value	-0.0193 ****
Retained Interest	-0.7830 ***
Extern Enhancement	-1.5808 **
Currency Risk	0.8523 ***
Creditor Protection	1.1023 ****
Number of Observations	771
Adjusted R^2	0.08
F-Statistics	< 1.12e-12
Significance Levels	0 '****' 0.001 ' ***' 0.01 '**' 0.05 '*' 0.1 ' ' 1

The regression of Table 9 focuses on the significance levels and indicates if *credit rating* can be captured through the set of variables used. We note that all variables are significantly related to *credit rating*. This indicates a strong relationship between our set of variables and the rating. *Loan to value* and *creditor protection* are significant at the 0.1% level. *Retained interest* and *currency risk* are significant at the 1% level. *Extern enhancement* is significant at the 5% level. The multiple R^2 and the adjusted R^2 indicate satisfactory explanatory power.

As a next step, this study analyzes the results of the regression presented in Table 8 in order to verify the preferences of the investors. We focus on the significance levels of the variables already included in the process of assigning a rating. If investors look beyond the credit rating and employ their own default risk analysis to adjust the risk premium, we observe that some of the variables develop a significant relationship with the *primary market spread*. Table 10 presents the shortened results of the regression of Table 8 in section 2.4.

Table 10: *Over-reliance on credit rating*

Variable	Regression on Over-Reliance
Credit Rating	0.2549 ****
Loan To Value	0.0041 ****
Retained Interest	-0.1739 **
Extern Enhancement	-0.2021
Currency Risk	0.0698
Creditor Protection	-0.4361 ****
Number of Observations	771
Adjusted R^2	0.57
F-Statistics	< 2.2e-16
Significance Levels	0 '****' 0.001 ' ***' 0.01 '**' 0.05 '*' 0.1 ' ' 1

The *credit rating* is significant at the 0.1% level. The results of the five variables which should have been reflected by the *credit rating* are very interesting. Three variables are significant determinants of the *primary market spread*. On the one hand, *extern enhancement* and *currency risk* are insignificantly related with the spread. On the other hand, *loan to value*, *retained interest*, and *creditor protection* have a significant relationship with the *spread. Loan to value* and *creditor protection* exhibit significance levels of 0.1%, whereas *retained interest* shows a level of 5%. We conclude that three out of five variables are yield determinants in the ABS market even though they have already been considered by rating agencies.

2.5.4 Regression Discussion

Based on the results of Table 9 and Table 10, this study concludes that there has been no over-reliance on *credit rating* by investors in ABS transactions in the post 2007 period. We observe three variables already considered by rating agencies when

assigning a rating. These have significant relationships with the *spread*. *Loan to value*, *retained interest*, and *creditor protection* constitute the set of yield determinants that indicate that investors adjust the risk premium with their own default risk analysis because the *credit rating* does not accurately reflect the default risk of ABS. As mentioned in section 2.4.3.1, the ratings of the issues were significantly worse after the 2007 financial crisis. An explanation for the displayed results of the variables *retained interest* and *creditor protection* could be that rating agencies calculated ratings too conservatively as a result of the financial crisis. Consequently, investors look beyond credit ratings and employ their own default risk analysis. This means, investors adjust the risk premium and reduce the spread if the issue provides *retained interest* or *creditor protection*. For high rated tranches which are mostly senior tranches, investors consider the assigned rating as too good. Hence, a higher *loan to value* ratio is associated with an additional risk premium. Overall, this is evidence that the financial investors employ their own credit default risk analysis and look beyond the *credit ratings* of rating agencies. The findings indicate that there is no longer an over-reliance on the *credit rating* in the ABS market. Hence, based on these findings, this study accepts the second research hypothesis.

2.6 Conclusion

This paper empirically investigated the asset-backed security market after the 2007 financial crisis. Choudhry and Fabozzi (2004) mention that this market can be divided into three main categories: ABS, MBS, and CDOs. The research concentrated on ABS issues between 2010 and 2014 and examined 771 ABS issues all of which offered the information needed for a full analysis. The high information sample was worth USD 266 billion.

This paper investigated the influence of the financial crisis on the non-U.S. ABS market. The research path includes the analysis of two research hypothesis. The first hypothesis states that the financial crisis influenced the set of pricing determinants of the ABS market. Hence, to find evidence that supported this hypothesis, we performed a comparison analysis of the ABS yield determinants. First, we investigated how common pricing characteristics compared for the two subsamples. We found that many of the common pricing factors exhibited significant dissimilarities, with respect to the security features.

Further, we analyzed the impact of the financial crisis on yield determinants in a panel-data fixed-effects regression model. This paper found significant changes in the set of yield determinants when pricing ABS transactions. The variables *loan to value, time to maturity, number of lead managers* and *retained interest* were considered yield determinants after the 2007 crisis. Interestingly, two (*loan to value* and *retained interest*) out of the four variables represented internal credit enhancement instruments. This result indicates that investors primarily relied on internal credit enhancement as a consequence of the default rates during the financial crisis. *Loan size, the number of tranches* as well as the *currency risk* were not contained in the list of yield determinants of ABS transactions, anymore. Additionally, we observed transitions with respect to the impact of pricing features. The relationships of *retained interest, loan size, float,* and *the number of rating agencies* with the *spread* behaved differently for the two data samples. Post crisis, as expected, *retained interest* and *loan size* were seen to be negatively related with the *spread*. One explanation of the coefficient sign of *retained interest* was that the internal credit enhancement instruments were associated with a price discount since they reduced the default probability of the corresponding security. The negative coefficient sign of *loan size* meant that larger issues, on average, were associated with higher secondary market liquidity. Surprisingly, investors associated a *larger conglomerate of rating agencies* with an additional risk demand.

A further consequence of that crisis was that *floating* rate issues, in contrast to the scenario before the crisis, were related with an increased risk premium. While this study observes that *credit rating* is the most dominant determinant of the *primary market spread*, this paper considers it as evidence that credit rating agencies learned from the crisis and assigned more conservative *ratings* thereafter. This is supported by the significant lower average *credit rating* in our sample. This finding emphasizes an important impact of the financial crisis on the securitization market. It has been held that *credit rating* played a major role in the outbreak of the financial crisis and to avoid rating downgrades, the quality of the *credit ratings* provided was essential. Our findings with respect to *credit rating* suggest an adjustment of the rating assignment processes and so, based on the results of the comparison analysis, we accept the first research hypothesis.

As a natural follow-up, this paper also investigated the hypothesis on the over-reliance on *credit ratings*. The literature suggests that the *credit rating* was one cause of the breakdown of the securitization market in 2007 (Fabozzi & Vink, 2012; Vink &

Fabozzi, 2012; Agarwal, Barret, Cun, & De Nardi, 2010; Financial Stability Forum, April 2008; True Sale International, 2008; True Sale International, 2014). However, this paper attempts to find out if *credit rating* is still the most dominant yield determinant. There is no evidence to support over-reliance. So, the results indicate that investors had to employ their own credit default risk analysis and consider variables beyond *credit rating* to measure the default risk of the securities. This conclusion is supported by results regarding pricing factors and this has already been considered during the rating process. We find that investors had to look beyond ratings and rely on these pricing features in addition to *credit rating*. Based on these findings, this study accepted the second research hypothesis.

As a result of the empirical studies in this research paper, we conclude that the financial crisis significantly influenced the yield as well as the pricing process for non-U.S. ABS issues. Further, we observed no evidence to support the view regarding over-reliance on *credit rating*. This indicates that capital market investors adjusted their investment process and employed their own risk default analysis.

The substantial changes associated with the financial crisis constituted a critical contribution to current research and activities in the work field. Further, it was found that the estimates concerning the size of each variable's impact on the spread as well as the significance levels, the importance of internal credit enhancement, the adjustments in the rating process, and the knowledge that investors employ their own risk analysis, could possibly interest investment banks and corporations involved in the securitization market. The results could also be used in the process of structuring technical features of certain issues. In addition, the findings of this paper have an important implication for investors in the fixed income sector. Both private and institutional investors interested in optimal asset allocation may be interested in the determinants of the *primary market spread* of asset-backed securities. Portfolio managers, who take positions in the fixed income and securitization sector, can take the findings into account when deciding to execute buy/sell orders on their portfolios.

The generality of our analysis is limited to the non-U.S. ABS market. In this study however, all U.S. ABS transactions as well as those for MBS and CDOs were excluded from the analysis. Further research could be carried out on the MBS and CDO markets to understand the changes that were brought about by the financial crisis in the U.S. MBS market. Corresponding research will likely lead to a deeper understanding of the impact of the financial crisis on the securitization market. Moreover, the empirical

model only consists of factors which could be mathematically included in the analysis. An in-depth analysis of the current regulations in order to include new practical frameworks in the analysis is useful for researchers who are especially interested in the development of the securitization market. Further, portfolio managers and investment banks may be interested in the connection between theory and practical applications in matters of portfolio diversification and issuance advisory, respectively. Finally, future-oriented research could be carried out on the European Central Bank's "expanded asset purchase programme". It is of interest if this programme does not only affect the secondary market yield of asset-backed securities but also, the issuance *spreads* of European asset-backed security transactions. Additionally, it may be of interest to study how the impact on the yield of ABS transactions could affect the economic situation of the European Monetary Union. This could be an interesting contribution to the European ABS, MBS, and CDO markets.

3 ABS, Auto-ABS and Auto-CB Comparisons: Evidence From the European ABS Market

3.1 Introduction

The European asset-backed security (ABS) market experienced significant recovery after suffering a breakdown during the 2007 financial crisis. Since 2010, the ABS market had become one of the most important fixed income markets in Europe. An increasing number of companies refinanced their sales market and loan services through securitization. This paper investigates one specific asset class of the European ABS market: Automobile asset-backed securities (Auto-ABS). Auto-ABS significantly outperformed the development of every other ABS asset class and proved to be the most important driver of the European ABS market. Although other asset classes experienced stagnation, Auto-ABS transactions showed a steady growth in the aftermath of the 2007 financial crisis. They remained major pillars for the recovery of the European ABS market since 2010 (Porter, 2015). According to research reports by the rating agency Creditreform Financial Research (2015) and Roland Berger Strategy Consultants (2016), the average issue amount of automotive ABS quintupled compared to years prior to the 2007 financial crisis. While in 2010, the European ABS market was considered homogenous with comparable submarkets, the Auto-ABS market grew significantly more than other submarkets. As of 2016, the proportion of the automobile industry equals more than 43% of the whole issue amount in the European ABS market, and equals over 30% overall for the last six year period. Due to this performance, the Auto-ABS market advanced to the largest submarket in the European ABS market. Hence, this paper investigates the causes of the extraordinary development of the Auto-ABS market in order to present explanations for this outperformance. The analysis has been undertaken in two steps. This study investigates the differences between the European automotive ABS market and the European ABS market without automobile transactions. Therefore, we analyze the structure of Auto-ABS compared to their non-Auto ABS counterparts as well as the determinants of the primary market spread. We expect to find differences in several pricing and risk factors which indicates a more comfortable situation for investors in the automobile market. According to a research report by DZ Bank (2015), the Auto-ABS became a more interesting investment vehicle for investors after the 2007 financial crisis, compared to other ABS asset classes, due to

the low default rate of this market. Although the securitization market is said to be the main reason for the financial collapse in 2007 (Covitz, Liang, & Suarez, 2013), automobile ABS issues were always secure investments. The defaults in the European automobile ABS market amounted to only 1.5% (True Sale International, 2013).

Second, this paper investigates a phenomenon noticed in the European automobile industry after the 2007 financial crisis and describes the second cause for the Auto-ABS outperforming other issues in the market. Different refinancing instruments were used by the automobile industry to refinance their sales and loan services market. The two most popular techniques were corporate bonds and securitization that enabled companies to raise money to finance future investments and transfer credit risks to the financial markets. Since the first issuance of an automobile asset-backed security in the European asset-backed security market in the early 2000s, corporate bonds were always mentioned as the preferred refinancing instrument (Roland Berger, 2016). After the financial crisis however, the European fixed income market experienced a contrasting development. According to research reports by DZ Bank (2013) and Roland Berger Strategy Consultants (2016), the automobile ABS market grew in importance for automotive companies. Companies wished to become independent from the non-backed corporate bonds and tended to use the asset-backed financing technique to refinance their sales market for two reasons. First, as a consequence of the large proportion of leasing or financed cars in Europe (True Sale International, 2013), almost 70% of the purchased cars of European automobile companies were leasing or credit-financed cars (Roland Berger, 2016). Thus, there was large potential for the use of the asset-backed financing technique in the automobile industry (Fiedler, 2016). Second, ABS transactions tended to be issued at a discounted price compared to non-backed corporate bonds (True Sale International, 2015). This trend was even more glaring in 2015. Hence, this paper attempts to empirically investigate if the increase in the Auto-ABS market and the decrease in the Auto-CB market with respect to issuance volumes could be explained by technical advantages of ABS transactions. The objective is to find the advantages of securitization as compared to corporate bonds for the automobile industry as well as investors for this may offer evidence that this shift has led to further development in the two markets.

To fill research gaps, this paper empirically investigates the European ABS market and the European automobile market after the 2007 financial crisis. We compare the European automobile asset-backed securities with European automobile corporate

bonds and the European asset-backed securities market without automobile asset-backed security transactions. We provide empirical analyses performed on second-hand data samples. A total of two univariate and six regression analyses are performed in order to address the research hypotheses.

For the course of the investigation, this paper provides a *Literature Review* and identifies the research gaps in great detail, in chapter 2. In chapter 3, we present the *Methodology* followed by the *Data Description.* The following section *Results* presents the results of the empirical analyses. After every analysis, the section on Discussion highlights contributions to the two major research objectives separately, while the conclusion presents the *Limitations, Market Implications,* and *Future Research* avenues in chapter 6.

3.2 Research Hypotheses

3.2.1 Background Information

Blum and DiAngelo (1997) as well as Choudhry and Fabozzi (2004), Jobst (2006), Vink and Thibeault (2008), and Fermanian (2011) mention that the European securitization market consists of three main security classes: asset-backed securities (ABS), mortgages-backed securities (MBS), and collateral debt obligations (CDO). Therefore, the term asset-backed security is used to describe both, one of the three classes as well as all three classes together. This paper differentiates between these two terms. If the term “asset-backed securities” is used, we refer to the single security class. The term “securitization” is applied to describe all three classes together. The ABS market consists of all securitization issues backed by consumer products, such as car loans or credit card loans, among others (Moody's Investors Service, 2002; Choudhry & Fabozzi, 2004; Vink & Thibeault, 2008). The ABS class is the main class of interest in this study. The MBS market describes securitization issues backed by mortgages. CDOs are issues backed by debt obligations (Nomura, 2004; Fitch Ratings, 2004; Choudhry & Fabozzi, 2004; Vink & Thibeault, 2008). Within this study, those two classes only serve the purpose of distinguishing the term asset-backed security. There is no further empirical importance attached to this analysis. In the context of this paper, we investigate the development of the European ABS market. The main focus lies on ABS issues in the European automobile market after the 2007 financial crisis. The Auto-ABS

market outperformed the European ABS market and became the most important submarket with a proportion of more than 43%.

The phenomenon of the Auto-ABS submarket, although it is a very young securitization class, and its extraordinary performance compared to the other asset-backed security classes after the financial crisis is something that can only be observed in the European ABS market. This does not appear in other global ABS markets, e.g. in the U.S. ABS market and this is attributed to the large and strong automobile industry in the European economy—which has a larger proportion in the European ABS market than in any other market in the world (True Sale International, 2013; True Sale International, 2015; Roland Berger, 2016).

3.2.2 Literature Review and Hypotheses

Empirical research on the European asset-backed securities and asset-backed securities in the European automobile market is very limited. Vink and Fabozzi (2008) investigate the over-reliance hypothesis for European floating rate asset-backed securities from 1999 to 2006. Uhde and Farrugio (2015) as well as Uhde, Farrugio, and Michalak (2012) analyze securitization in European banking. Further, Atkins (2013) discusses investment opportunities in the European securitization market for U.S. investors. Schuetz (2011) investigates the securitization market in Europe for reasons as to why banks securitize. The paper finds that European banks use securitization as a funding tool and one for capital arbitrage and performance improvement.

O'Connor (2013) investigates the Auto ABS Market in 2012 and analyzes changes in regulation, spreads, and performances of the securities. Risi (2013) analyzes the stability of rating for asset-backed securities in the automobile market. The paper finds that ratings are expected to remain stable. Terrazan (2006) analyzes the term-structure of credit spread of Euro denominated corporate bonds and finds that after the risk adjustment, the idiosyncratic factors between different rating classes are similar.

In literature, securitization in the European automobile market is often mentioned as a young method of funding (Jobst, 2008; Creditreform Financial Research, 2015). Further, there is no in-depth research about securitization in the European automobile market. However, securitization in the European automobile market is the main topic of several research reports drafted by Creditreform Financial Research (2015), Roland Berger Strategy Consultants (2016), and by DZ Bank (2013, 2015). One would expect that pricing characteristics of this very young security class would be influenced by

older security classes in the European ABS market. Further, one would expect that investors would await the initial statistics about a new security class before heavily investing in a new fixed income vehicle. However, the research reports observe that there is exceptional performance noted in the European Auto-ABS submarket compared to their non-Auto-ABS counterparts and therefore, raise the question—to what extent can the outperformance of the automobile market compared to the remaining European ABS market be explained by differences in the characteristics as well as different spread determinants between these asset classes? (True Sale International, 2013; True Sale International, 2015; Roland Berger, 2016; Creditreform Financial Research, 2015). Further, the research reports by Creditreform Financial Research (2015), Roland Berger Strategy Consultant (2016), and DZ Bank (2013, 2015) raise the question—what are the determinants responsible for the exceptional performance of the Auto-ABS market? Hence, this paper proposes the overall research question: "*What are the determinants of the outperformance of the Auto-ABS market?"* We divide this question into two research hypotheses. Based on the results of the research reports by Creditreform Financial Research (2015), Roland Berger Strategy Consultants (2016), and DZ Bank (2013, 2015), we propose the first research hypothesis: *"Auto-ABS transactions provide advantages for investors and originators in comparison to their non-Auto-ABS counterparts."* To find evidence that supports the first research hypothesis, we investigate the European ABS market with respect to differences between the risk profiles of the asset classes in order to find advantages of Auto-ABS transactions. Thereafter, we evaluate whether investors rely on different pricing factors for the two asset classes. This means, we test for different yield determinants and whether these determinants highlight advantages for the Auto-ABS class.

Additionally, the reports claim that European automobile companies try to replace CB issues with ABS issues in order to refinance their sales and loan services market (Roland Berger, 2016). Thus, this study performs an in-depth analysis of the European automobile market. This paper analyzes the differences of the two most popular funding methods in the automobile market: corporate bonds and asset-backed securities. We provide empirical research to compare European Auto-ABS and European Auto-CB for the purpose of explaining the replacement of issues in the CB market with issues in the ABS market. Although corporate bonds and asset-backed securities are both refinancing instruments for companies in the fixed income market and show similarities in structure, credit factors, and issuance processes, we also observe significant differences between

the two security classes. The main difference lies in the risk profile of the security classes. ABS transactions tend to be a lower risk investment vehicle compared to corporate bonds, since their payments are independent of the originator's credit quality and only depend on the assets' quality (Vink & Thibeault, 2008). In order to describe the different risk profiles of the two security classes, we have to divide the common security characteristics into two sets of variables: The first set of variables contains the common pricing characteristics of European Auto-ABS. The set is chosen based on the empirical research performed by Vink and Thibeault (2008), Vink and Fabozzi (2012), Fabozzi and Vink (2012), as well as Maris and Segal (2002) and Childs, Ott, and Riddiough (1996). The second set contains the common pricing features of European Auto-CB and is chosen based on the empirical research regarding corporate bonds performed by Gabbi and Sironi (2005), Van Landshoot (2008), Collin-Dufresne, Goldstein, and Martin (2001), Elton, Gruber, Agrawal, and Mann (2001), Hyman, Dor, Dynkin, and Horowitz (2015) as well as Huang, Huang, and Oxman (2015), Lin, Liu, and Wu (2011), Jacoby and Shiller (2010), Eom, Helwege, and Huang (2004), and Bhanot (2003). On the one hand, there are many pricing variables, which are valid for both security classes, such as *credit rating* (Longstaff, Mithal, & Neis, 2005; Kozhemiakin, 2007; Vink & Thibeault, 2008). Credit rating agencies assign ratings to both corporate bonds and asset-backed security to describe the probability of default of the corresponding security. On the other hand, we include variables that are only applicable to asset-backed securities, for instance the *number of tranches, the level of subordination* or *credit enhancement*. These variables are essential for describing the risk profile of asset-backed securities and indicate possible advantages of securitization compared to corporate bonds transactions.

Based on the development Auto-ABS in the European automobile industry and the findings of the study of Ayotte and Gaon (2005) together with the observations of research reports by Roland Berger Strategy Consultant (2016), Creditreform Financial Research (2014), as well as DZ Bank (2015), who find that ABS provides significant advantages compared to their CB counterparts, we propose the following second research hypothesis: *"Investors as well as automobile companies rely on advantages of securitization compared to corporate bonds."* The second research hypothesis suggests that the increased popularity of the securities may be explained by the special structure of ABS transactions compared to corporate bonds. To find evidence that supports the second research hypothesis, we first resolve the questions on whether differences in the

security characteristics highlight advantages of the securitization compared to corporate bonds or not. Thereafter, we determine the reliance of investors on common pricing characteristics. This means, we investigate whether the advantages of ABS transactions are reflected by the different yield determinants.

This study explores these hypotheses by performing statistical tests on quantitative data samples. For both research hypotheses, a univariate analysis is performed to determine differences in the attributes of the securities and regression analyses are performed to observe whether there exist different yield determinants.

In the next section, we pursue our research path by discussing the common pricing characteristics and their expected impact on the primary market spread, in greater detail.

3.3 Research Methodology

The empirical analysis presented in this study is restricted to European asset-backed security issues and European automobile bond issues–for which data on common pricing characteristics and *spreads* were available or computable–completed by European companies during 2010-2015. The period was chosen since the European ABS market underwent slow recovery from the financial crisis since the beginning of 2010 yet the European Auto-ABS market faced some uncertainty with respect to the VW Diesel crisis in October 2015 (True Sale International, 2013; True Sale International, 2015). The issuance *spreads* over the corresponding maturity benchmark reflected investors' perceptions of the risk of loss of security. Moreover, the *spread* also represented liquidity conditions of the corresponding security (Gabbi & Sironi, 2005). As such, they were a function of the common pricing characteristics. These can be divided into three main categories: *Default and recovery risk characteristics, marketability characteristics,* and *systemic risk characteristics* (Gabbi & Sironi, 2005; Vink & Thibeault, 2008; Elton, Gruber, Agrawal, & Mann, 2001; Collin-Dufresne, Goldstein, & Martin, 2001). Common pricing characteristics describe the structure of the analyzed securities. Within the univariate analyses, the common security characteristics describe the risk profile. Within the panel-data fixed-effects model, the common pricing features form the set of independent variables. Following this reasoning, our empirical analyses involve regressions of the following form:

$$SPREAD_i = DEFAULT_i + RECOVERY_i + MARKETABILITY_i + SYSTEMIC_i + \varepsilon_i$$

where:

$SPREAD_i$ = the difference between yield to maturity at issuance of the security and the yield of maturity at auction of a corresponding currency benchmark;

$DEFAULT_i$ = the default risk of the issue i;

$RECOVERY_i$ = the expected recovery rate in case of default of issue i;

$MARKETABILITY_i$ = the expected secondary marketability, e.g. liquidity for issue i;

$SYSTEMIC_i$ = the systemic risk for the issue i;

Note that this study is based on the *primary market spreads* of the issues. The reason we use issuance *spreads* is because of the difficulty in obtaining reliable secondary market *spreads*, which are typically derived from pricing matrices or driven by analysts' expectations as well as brokers' "indicative prices" (Vink & Fabozzi, 2012; Vink & Thibeault, 2008; Gabbi & Sironi, 2005). Hence, *primary market spreads* provide a more accurate measure of the actual pricing of a security and the actual risk premium demanded by investors than secondary market spreads (Vink & Thibeault, 2008; Gabbi & Sironi, 2005; Vink & Fabozzi, 2012). The *primary market spread*, also called loan spread, represents the risk premium. On the basis of information at the time of issue, the risk premium is the price for the risk associated with the security. This study defines the *primary market spread* as the offered yield to maturity of the security at issuance above the yield to maturity at auction of a corresponding treasury benchmark (Vink & Thibeault, 2008; Collin-Dufresne, Goldstein, & Martin, 2001). Vink and Thibeault (2008), Vink and Fabozzi (2012), Gabbi and Sironi (2005), as well as Collin-Dufresne, Goldstein, and Martin (2001) suggest the following procedure to obtain a suitable treasury benchmark: First, the benchmark is obligated to provide the same currency, second, the benchmark is obligated to be issued at a comparable auction date, and third, the benchmark has to offer a comparable time to maturity.

Following the above approach, the independent variables for the empirical analyses are introduced and discussed in the following Tables (Vink & Thibeault, 2008; Vink & Fabozzi, 2012; Gabbi & Sironi, 2005; Merton, 1974; Liu & Thakor, 1984).

Table 11: *Default and Recovery Risk Characteristics*

Variable	Description	Expected Impact	Source
Rating	Average value of assigned ratings	Positive relationship	Liu & Thakor (1984)[17]
Maturity	Measured in years	Positive relationship	Merton (1974)[18]

[17] Further sources: Vink & Thibeault (2008), Vink & Fabozzi (2012), Buscaino, Caselli, Corielli, & Gatti (2012), Chen, Lesmond, & Wei (2007), Kavussanos & Tsouknidis (2014), Amira (2004), Ammer & Clinton (2004)

[18] Further sources: Gabbi & Sironi (2005), Vink & Thibeualt (2008), Amira (2004), Grandes & Peter (2004), Shin & Kim (2013)

Extern	Equal 1 if extern enhancement is provided	Negative relationship	Vink & Thibeault (2008)[19]
Loan to Value	Subordination level of tranche in %	Positive relationship	Vink & Thibeault (2008)[20]

The considered rating agencies are Moody's, Standard and Poor's, and Fitch. The rating values 1, …, 15 correspond to the ratings Aaa/AAA, …, B2/B. Ratings lower than B2/B do not appear in our data samples.

Table 11 exhibits the default and recovery risk characteristics (Buscaino, Caselli, Corielli, & Gatti, 2012; Chen, Lesmond, & Wei, 2007; Kavussanos & Tsouknidis, 2014; Amira, 2004; Grandes & Peter, 2004; Shin & Kim, 2013; Campbell & Cocco, 2015; Wong, Fung, & Fong, 2004; Ammer & Clinton, 2004). The first column names the introduced variable. The second column describes the structure of the corresponding variable. The third column provides the expected impact of this variable on the *primary market spread* in the regression analyses (Mayer, Pence, & Sherlund, 2009; Bajari, Chenghuan, & Minjung, 2008; Deng & Quingley, 2012; Fabozzi & Roever, 2003; Schwartz & Torous, 1993). The last column provides an overview of literature, in which the variables were introduced.

Table 12: *Marketability Characteristics*

Variable	Description	Expected Impact	Source
Size	Natural log of the tranche's or bonds' amount	Negative relationship	Gabbi & Sironi (2005)[21]
Amount	Natural log of the ABS transactions' amount	Negative relationship	Vink & Thibeault (2008)
Tranches	Number of tranches	Negative relationship	Vink & Fabozzi (2012)[22]
Managers	Number of lead managers	Negative relationship	Gabbi & Sironi (2005)[22]
Agencies	Number of rating agencies	Negative relationship	Vink & Fabozzi (2012)[22]
Float	1 if type of interest is floating rate	Negative relationship	Gabbi & Sironi (2005)[22]
Retained	1 if retained interest appears in transaction	Negative relationship	Vink & Thibeault (2008)[23]

Size and Amount describe the Euro equivalent amount at issuance. If the coupon of a transaction is floating rated, the coupon payments can vary over time and are linked to a floating interest rate, such as the 3-month EURIBOR. Retained interest is an internal credit enhancement measure, which describes if the originator retains interest in order to overcome first losses of the underlying assets.

Table 12 introduces the marketability characteristics (Qi & Yang, 2009; Calem & Lacour-Little, 2004; Pennington-Cross, 2003). We expect all marketability characteristics to be negatively related with the *primary market spread*. All variables should, ceteris paribus, increase the secondary marketability for the concerned transaction.

[19] Further sources: Fabozzi & Roever (2003)

[20] Further sources: Wong, Fung, Fong, & Sze (2004), Campbell & Cocco (2011), Deng & Quigley (2004), Schwartz & Torous (1993), Mayer, Pence, & Sherlund (2009), Bajari, Chenghuan, & Minjung (2008)

[21] Further sources: Qi & Yang (2009), Calem & Lacour-Little (2004), Pennington-Cross (2003)

[22] Further sources: Vink & Thibeault (2008)

[23] Further Sources: An, Deng, Nichols, & Sanders (2014), Ashcraft & Schuermann (2008), Childs, Ott, & Riddiough (1996)

Table 13: *Systemic Risk Characteristics*

Variable	Description	Expected Impact	Source
Currency Risk	1 if tranche faces currency risk	Positive relationship	Gabbi & Sironi (2005)[22]
Creditor	1 if creditor protection is provided	Negative relationship	Vink & Fabozzi (2012)
Emerging	1 if transaction is issued in an emerging market	Positive relationship	Vink & Fabozzi (2012)

Currency Risk describes a dummy variable that equals one if the cash flow of the coupon rate is denominated in a different currency than the cash flows derived from the underlying assets. Creditor Protection describes a dummy variable that equals one if the country in which the transaction is issued provides creditor protection in the form of "no automatic stay on the assets" and zero otherwise. Emerging Markets describes a variable that equals one if the transaction is issued in an MSCI classified Emerging Market.

Table 13 presents the systemic risk characteristics (An, Deng, Nichols, & Sanders, 2014; Ashcraft & Schuermann, 2008; Childs, Ott, & Riddiough, 1996). Further, we include control variables in our statistical analyses. The first control variable is called "year i". Year i describes the dummy variables for each year. Each dummy variable is equal to 1 if issue i has been completed during the corresponding year, and zero, otherwise. These variables should capture the variations in fixed income market conditions (Gabbi & Sironi, 2005). Due to the highest correlation with the common pricing features, the year dummy for 2013 is excluded from the analyses to avoid over sensitivity. The second set of control variables are currency dummies that are equal to 1 if security i is issued in the corresponding currency, and zero, otherwise. These variables should capture both liquidity and credit standing (Vink & Fabozzi, 2012; Vink & Thibeault, 2008). Due to the smallest subsets of our ABS sample as well as our CB sample, the currency dummy for Swiss Franc is excluded from the analyses to avoid over sensitivity.

The empirical analyses presented in this study consists of the univariate as well as the regression analyses. For the regression analyses of this paper, the issuance *spread* is used as the dependent variable. The common security characteristics mentioned above form the set of independent variables. Given the time from issuance is equal to zero for all issues, the factors mentioned above must be considered at the time of issuance. In order to provide comparability for all issues in this study, it does not consider probable changes in the variables over the time period 2010-2015.

The set of independent variables consists of both discrete and dummy variables. The discrete variables are *credit rating*, *maturity*, *amount*, *size*, as well as *loan to value, #tranches*, *#lead managers*, and *#rating agencies*. The set of dummy variables consists of *extern enhancement*, *retained interest*, *float*, *currency risk*, and *creditor protection*. In the univariate analysis, all variables are analyzed and tested separately. The regressions determine the effects of all independent variables on the *primary market spread*.

3.4 Data Description

This chapter introduces the data samples of this study. It is concerned with the European ABS market as well as the European automobile market. For the samples describing the European automobile market, we only include transactions of one of the six largest automobile companies in Europe. Hence, we include transactions of Volkswagen, PSA, Renault, BMW, Fiat, and Daimler. The smaller companies have not issued enough transactions to be considered significant for the automobile ABS or automobile CB market.

3.4.1 Data Samples

The principal data sources of this study are DZ Bank and Thomson Reuters. For the European corporate bonds issued between 2010 and 2015, the appropriate source was Thomson Reuters Datastream. For European ABS issues, the Asset Backed Watcher, published by the DZ Bank, was chosen as the appropriate data source. Both Thomson Reuters and the DZ Bank are known leading publishers of European CB and ABS issues.

3.4.1.1 European ABS Market

The first database contains detailed information on European ABS from January 1, 2010, through September 30, 2015. This paper refers to this sample as the "ABS full sample". The ABS full sample contains information on 633 European asset-backed security tranches issued in 285 transactions with a total value of EUR 256 billion. Although the full sample is comprehensive for the purpose of this study, there is one limitation. For comparison, we need the transactions to provide information on *default and recovery risk characteristics, marketability characteristics,* and *systemic risk characteristics.* Tranches, for which detailed information about these variables is not available, are deleted from the sample. The reduced sample is called the "ABS high information sample". The ABS high information sample contains 468 asset-backed security tranches issued in 255 transactions with a total value of EUR 187 billion.

The ABS high information sample is divided into two further samples for the purpose of this study. First, we need data samples describing the European automobile ABS market. The "Auto-ABS sample" consists of 122 tranches issued in 68 transactions with a total value of EUR 52.3 billion.

Table 14: *Comparison of the ABS samples*

Variable of interest	ABS full sample			ABS high information sample			Survival rate
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev	
Coupon rate (bp)	663	155	143	468	147	133	70.73%
Risk premium (bp)[7]	468	99	122	468	107	110	100%
Credit rating (1-21 weak)	663	3.78	3.66	468	3.45	3.18	70.73%
Loan to value (%)[7]	468	21.52	29.67	468	19.34	25.33	100%
Time to maturity (years)	663	11.80	9.85	468	11.28	7.49	70.73%
Issues with extern enhancement	523	4.5%	-	468	4.7%	-	89.68%
Loan tranche size (EUR mio.)	555	354	479	468	386	501	45.68%
Transaction size (EUR mio.)	285	783	651	255	771	661	89.47%
Number of tranches	285	2.96	1.31	255	2.87	1.19	89.47%
Number of lead managers	598	2.05	0.99	468	2.29	0.97	78.43%
Number of credit rating agencies	663	1.59	0.51	468	1.72	0.53	70.73%
Loans with retained interest[24]	468	65.8%	-	468	62.18%	-	100%
Loans with fixed rate	663	21%	-	468	24%	-	70.73%
Loans with floating rate	663	79%	-	468	76%	-	70.73%
Loans with currency risk	663	11.3%	-	468	8.11%	-	70.73%
Loans in emerging markets[7]	468	1.25%	-	468	1.06%	-	100%
Loans with creditor ürotection[7]	468	63.89%	-	468	64.74%	-	100%

Column 1 represents the common pricing variables. Column 2 presents the number, the mean, and the standard deviation of each variable in the working sample. Column 3 describes the number, the mean, and the standard deviation of each variable associated with the high information sample. Column 4 describes the survival rate for each variable. This rate is calculated by dividing the number of issues of each variable of the high information sample by the number of issues of each variable of the working sample.

Second, we need a data sample containing information on European ABS excluding the automobile market. The total value of the "ABS ex. Auto sample" is EUR 127 billion and the total number of tranches is 346 issued in 187 transactions. Table 14 reports a comparison of the ABS working sample and the ABS high information sample. Due to the high survival rates, high information issues are not dissimilar from their counterparts in the full sample. Thus, we assume that any empirical results derived from the high information sample can be generalized to the larger population including all issues.

3.4.1.2 European Automobile Corporate Bond Market

The second database contains detailed information on the issuance of European Automobile corporate bonds between January 1, 2010 and September 30, 2015. Hereafter, we refer to this sample as the "CB full sample".

[24] The variable was only calculated for the high information sample.

The CB full sample of this study contains detailed information on 544 corporate bond transactions in the European automobile market, which are worth a total of EUR 183 billion. As in the ABS data samples, we need the transactions in the CB full sample to provide information on common pricing characteristics (Collin-Dufresne & Goldstein, 2001). Thus, we need the transactions to provide information on the following set of variables: *Credit rating, extern enhancement, time to maturity, size of the transaction, number of lead managers, number of involved rating agencies, currency risk, creditor protection* and *type of interest rate* (Campbell & Taksler, 2003; Cantor & Packer, 1996; Chen, Lesmond, & Wei, 2007; Gabbi & Sironi, 2005; Grandes & Peter, 2004; Kavussanos & Tsouknidis, 2014; Reilly, Wright, & Gentry, 2010; Elton, Gruber, Agrawal, & Mann, 2001; Collin-Dufresne, Goldstein, & Martin, The Determinants of Credit Spread Changes, 2001). *Internal credit enhancement* is not provided by such corporate bonds. *Emerging markets* are also not applicable to this special case, since the corporate bonds of the six largest automobile companies are only issued in developed markets. The variable *extern enhancement* is not available in the CB full sample. For the purpose of comparison then, we have to reduce the sample by referring to transactions which do not provide all the requisite information. The "CB high information sample" consists of 414 transactions with a total value of EUR 138 billion.

Table 15: *Comparison of the CB samples*

Variable of interest	CB full sample			CB high information sample			Survival rate
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev	
Coupon rate (bp)	544	268	184	413	256	159	76.10%
Risk premium[25] (bp)	413	126	133	413	126	158	100%
Credit rating (1-21 weak)	507	8.1	2.18	413	7.68	1.84	81.66%
Time to maturity (years)	532	3.48	1.98	413	3.57	2.32	77.82%
Transaction size (EUR mio.)	544	318	333	413	334	323	76.10%
Number of lead managers	534	2.05	1.37	413	2.07	1.20	77.53%
Number of credit rating agencies	507	1.78	0.51	413	1.99	0.35	81.66%
Loans with fixed rate	536	72%	-	413	67%	-	77.24%
Loans with floating rate	536	28%	-	413	33%	-	77.24%
Loans with currency risk	544	47%	-	413	43%	-	76.10%
Loans with creditor protection[5]	413	28%	-	413	28%	-	100%

Column 1 represents the common pricing variables. Column 2 presents the number, the mean, and the standard deviation of each variable in the working sample. Column 3 describes the number, the mean, and the standard deviation of each variable associated with the high information sample. Column 4 describes

[25] The variable was only calculated for the high information sample.

the survival rate for each variable. This rate is calculated by dividing the number of issues of each variable of the high information sample by the number of issues of each variable of the working sample.

A comparison between the common variables in the full sample and the high information sample in Table 15 reveals that due to the high survival rates, high information issues are not dissimilar from their counterparts in the full sample. Thus, we assume that any empirical results derived from the high information sample can be generalized to the larger population including all issues.

3.5 Empirical Results

This chapter provides evidence that supports the two research hypotheses. To be more specific, an in-depth comparison analysis of Auto-ABS, Auto-CB, and European non-Auto-ABS is performed. The comparison analysis consists of two parts: First, a comparison analysis of Auto-ABS and European ABS transactions excluding Auto-ABS is provided. Thereafter, Auto-ABS are compared to their Auto-CB counterparts. The comparisons are based on a univariate analysis and panel-data fixed-effects regressions. The univariate statistics analyze differences in risk profiles of the two asset classes in each case. Thereafter, as a natural follow-up, we investigate investors' reliance on the common pricing factors. The regression model evaluates the set of yield determinants of each security class. The analyses aim to provide evidence that explains the exceptional performance of the Auto-ABS submarket. We expect to observe important dissimilarities, which emphasize the advantages of Auto-ABS compared to their non-Auto-ABS and Auto-CB counterparts.

3.5.1 European Asset-Backed Security Market

This subsection performs an in-depth comparison analysis in the European ABS market. First, the common pricing security characteristics are evaluated separately. Thereafter, as a natural follow-up, they form the set of variables in a panel-data fixed-effects regression model.

3.5.1.1 Descriptive Analysis

The objective of this subchapter is to evaluate the extent to which the risk profile of Auto-ABS differs from the non-Auto-ABS in the European ABS market. European Auto-ABS grew into the most important submarket in the European ABS market. Its proportion in the primary market increased to over 43% in 2015. Further, the Auto-ABS market became the only submarket to show steady growth in the context of issuance volumes since 2010. Hence, the question arises—what are the factors that explain the

exceptional performance of the automobile industry compared to the remaining ABS market? Table 16 analyzes the security characteristics of the ABS subsamples, separately. The Auto-ABS sample is labelled "Auto-ABS", whereas the non-Auto-ABS sample is labelled "European ABS".

Table 16: *Univariate Comparison of the Characteristics of the European ABS Market*

(1) Variable of interest	(2) Security Class		(3) Variable of interest	(4) Security Class	
	High Information Sample			High Information Sample	
	European ABS	Auto-ABS		European ABS	Auto-ABS
Primary Market Spread (bp)			Retained Interest (dummy)		
Number	346	122	Number	346	122
Mean	121.9	63.91	Mean	0.55	0.77
Median	90.0	51.85	Median	-	-
Min.	-143.0	-37.60	Min.	-	-
Max	900.0	495.0	Max	-	-
Std. Dev.	118.24	66.27	Std. Dev.	-	-
Loan to Value (%)			Number of Tranches		
Number	346	122	Number	346	122
Mean	23.27%	8.82%	Mean	3.12	2.18
Median	14.95%	3.39%	Median	3.0	2.0
Min.	0.0%	0.0%	Min.	1.0	1.0
Max	100.0%	100.0%	Max	6.0	5.0
Std. Dev.	25.97%	19.69%	Std. Dev.	1.25	0.66
Time to Maturity (years)			Number of Lead Managers		
Number	346	122	Number	346	122
Mean	12.60	7.55	Mean	2.30	2.25
Median	9.94	6.88	Median	2.0	2.0
Min.	1.04	5.69	Min.	1.0	1.0
Max	50.03	12.49	Max	3.0	5.0
Std. Dev.	8.25	1.93	Std. Dev.	0.85	1.28
Loan Tranche Size (€ millions)			Number of Rating Agencies		
Number	346	122	Number	346	122
Mean	371.16	428.53	Mean	1.73	1.69
Median	252.19	452.0	Median	2.0	2.0
Min.	0.1	13.0	Min.	1.0	1.0
Max	3963.0	2785.03	Max	3.0	3.0
Std. Dev.	371.16	444.50	Std. Dev.	0.53	0.50
Transaction Size (€ millions)			Creditor Protection (dummy)		
Number	187	68	Number	346	122
Mean	835.92	787.92	Mean	0.60	0.89
Median	600	800.0	Median	-	-
Min.	14.37	49.80	Min.	-	-
Max	5831.92	3242.85	Max	-	-
Std. Dev.	873.52	409.52	Std. Dev.	-	-
Credit Rating (1-15 weak)			Floating Rate Issue (dummy)		
Number	346	122	Number	346	122
Mean	3.86	2.80	Mean	0.77	0.74
Median	2.0	1.0	Median	-	-
Min.	1.0	1.0	Min.	-	-
Max	20.0	8.0	Max	-	-
	3.69	2.01		-	

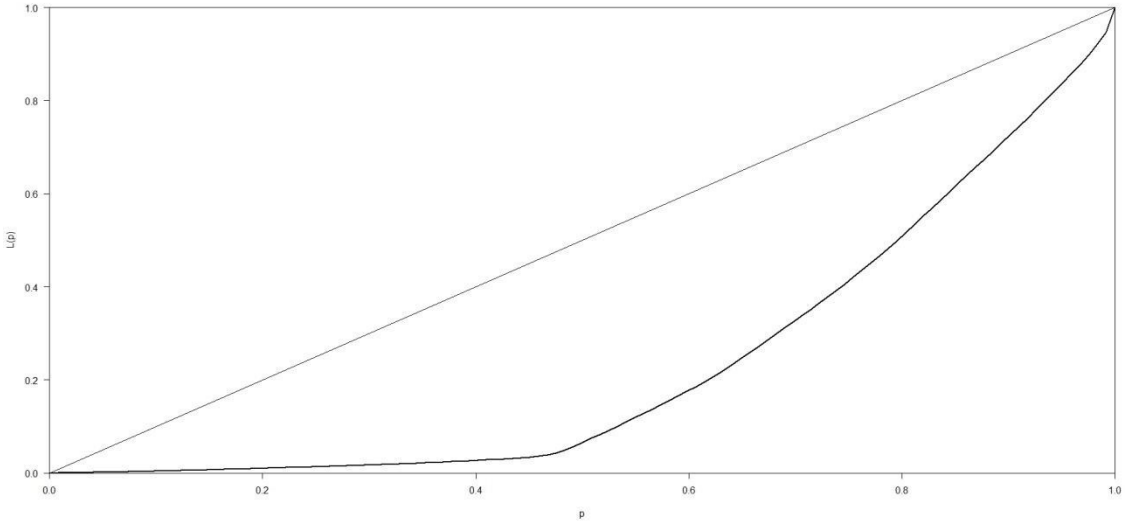
Std. Dev.			Std. Dev.		-
Extern Enhancement (dummy)			Currency Risk (dummy)		
Number	346	122	Number	346	0
Mean	0.02	0.10	Mean	0.11	-
Median	-	-	Median	-	-
Min.	-	-	Min.	-	-
Max	-	-	Max	-	-
Std. Dev.	-	-	Std. Dev.	-	-

The sample European ABS describes the characteristics of the European ABS market excluding the automobile market. The sample Auto-ABS describes the characteristics of European automobile ABS. The variables SPREAD and LTV are measured in percentage points. MATURITY has the unit years. The variables SIZE and AMOUNT have the unit million Euros. The variable RATING is measured in a scale from 1 to 21. The variables TRANCHES, LEAD MANAGERS, and RATING AGENCIES describe the number of the tranches and the number of corresponding conglomerate, respectively. The variables EXTERN ENHANCEMENT, RETAINED INTEREST, FLOAT, CURRENCY RISK, and CREDITOR PROTECTION are dummy variables.

Note that the lowest *primary market spread* of the European ABS sample equals -1.43%, which is a relatively wide negative spread compared to all the other tranches. This enormous negative spread is the result of *time to maturity* equaling 29 years and an offered yield at auction of 2% with a fixed coupon rate. This is a very low yield at auction for an almost 30 year asset-backed security in the year 2011. Compared to this low yield at auction, the corresponding currency treasury 30 year benchmark was offered with a yield at 3.43%, which was a usual yield for a 30 year European treasury bond in 2011. Thus, due to a "triple A" rating and a very extensive internal credit enhancement, the originator was able to offer a yield at auction 143 basis points lower than the corresponding currency treasury benchmark. We still consider the chosen benchmark as suitable, since the time to maturity is 30 years (which means that treasury benchmarks offer a higher yield at auction) and the lower yield of the security can be explained by the low risk of default and the extensive internal credit enhancement of the originator.

The following section discusses the main findings of Table 16. The relative pricing of asset securitization issues shows that the average (median) *spreads* are significantly lower for Auto-ABS, with 63.91 basis points (51.85 bps) than they are for non-Auto-ABS, with 121.9 basis points (90 bps). This means that Auto-ABS are associated with only half the risk premium than their non-Auto-ABS counterparts. Auto-ABS exhibit the larger average (median) loan tranche size, amounting to EUR 428.5 million (EUR 452 million) – an average EUR 57 million more than the average tranche size of non-Auto-ABS tranches. The median value for non-Auto tranches is only EUR 252.2 million. Thus, non-Auto-ABS tranche sizes tend to be substantially smaller than for Auto-ABS transactions. This is reinforced by the observation that a typical non-Auto-

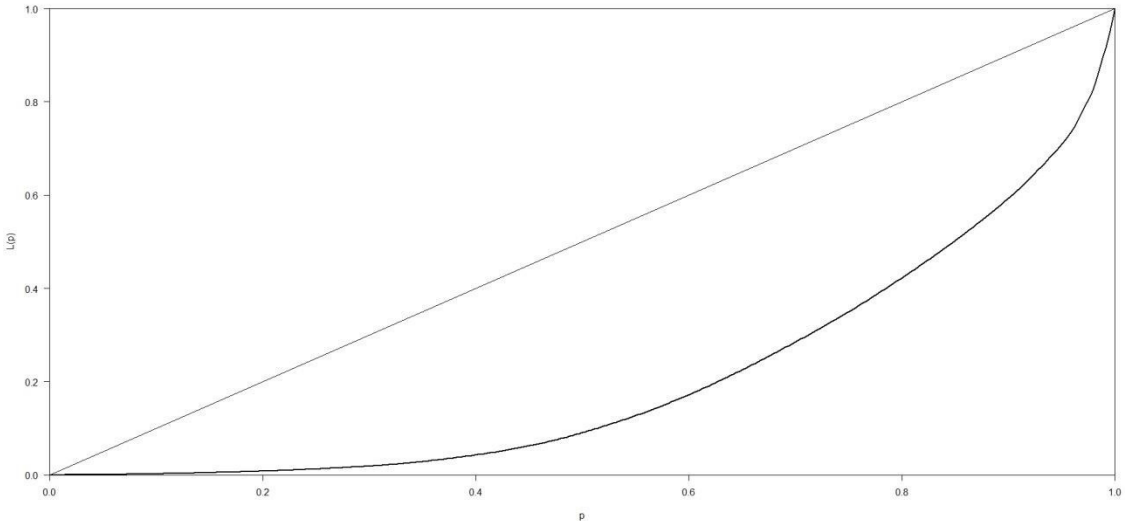
Figure 5: *Lorenz Curve of Size for the Auto-ABS Sample*



ABS transaction in our sample is divided, on average, into more tranches. We discuss this later in this chapter in more detail. Further, the European ABS market, as indicated by the standard deviation, exhibits significant heterogeneity with respect to the loan tranche size.

Figure 5 above, shows the Lorenz Curve for the European Auto-ABS market. It has the following characteristics: The smallest half of the issues is worth less than 10% of the total issue amount, the smallest 60% shares 19% of the total issue amount, and the largest 20% of the issues share 50% of the total issue amount. Compared to these results, the Lorenz Curve for the remaining ABS market in Figure 6 exhibits that the smallest 50% of the issues are worth approximately 10% of the total amount. Moreover, the smallest 60% shares 18% of the total issue amount in the remaining market and the smallest 80% shares approximately 41% of the total amount. This means that the largest 20% of the issues are worth approximately 59% of the total amount in the market. Thus,

Figure 6: *Lorenz Curve of Size for the ABS ex. Auto Sample*



while the smaller issues have a similar relative amount in the market compared to automobile industry, we indicate a difference for the largest 20% of the issues. For the automobile industry, the largest 20% were worth 50% of the total amount, whereas the in the remaining market, 59% of the total amount was shared by the largest 20% of the issues. As opposed to the loan tranche size, the non-Auto-ABS transactions exhibit the larger average transaction size (*amount)* with EUR 836 million. On the other hand, the Auto-ABS exhibits an average transaction size of EUR 788 million. Surprisingly, we find different results for the mean value and the median. The Auto-ABS exhibits the larger median transaction size of EUR 800 million, whereas the non-Auto-ABS only exhibits a median transaction size of EUR 600 million.

The risk *spreads* suggest that the Auto-ABS in our sample, on average, tend to be less risky than their non-Auto-ABS counterparts. This is also confirmed by variable *rating*. Since *credit rating* and *spread* tend to have an inverse relationship, it is obvious that the average *credit rating* for Auto-ABS tranches (2.80) is significantly lower than the *credit ratings* for non-Auto-ABS tranches (3.86).

This is a main indicator that issues in the automobile market provide a lower risk profile than issues in the remaining market. This can be explained by the pool of underlying assets. The automobile companies pool high quality automobile loans and leasing credits for the ABS market, which has a very low expected default risk. Further, the weighted average life of the underlying assets tends to be lower than *the time to maturity* of the security and hence, results in a lower default risk.

Further, Auto-ABS are far more likely to provide credit enhancement than non-Auto-ABS tranches. Both variables *extern enhancement* and *retained interest* describe a form of credit enhancement instrument, which, ceteris paribus, lead to lower default risk and therefore, to a lower risk profile. The Auto-ABS tranches are more likely to have internal (external) credit enhancement than the non-Auto-ABS tranches. A total of 77.1% (9.8%) of all the Auto tranches provides credit enhancement compared to only 54.9% (2.3%) of the non-Auto tranches.

As mentioned before, a typical non-Auto-ABS transaction in our sample is split into an average number (median) of 3.1 (3.0) *tranches* per transaction, which is higher than the average number (median) for Auto-ABS transactions in our sample, with 2.18 (2.0) *tranches* per transaction. With *spread* levels and *credit ratings*, this study introduced risk measures that acted as evidence of the riskiness of an ABS transaction.

In addition, the *number of lead managers* involved in the transactions also provided indirect evidence of the riskiness of the loan—or at least indicated the difficulty the underwriters had to face during the issue (Vink & Thibeault, 2008). The average number (median) of participating *lead managers* for the automobile ABS was 2.25 (2.0) and was almost identical with the average number of participating *lead managers* for the remaining market, which equaled 2.3 (2.0). This meant that there was no additional difficulty in underwriting a non-Auto transactions and that the European ABS market exhibited significant homogeneity with respect to the *number of lead managers*.

Auto-ABS issues have an average of 1.689 *rating agencies* involved compared to the similar average of 1.73 *rating agencies* for non-Auto-ABS. As for the *number of lead manager*, the European ABS market exhibits significant homogeneity with respect to the *number of rating agencies*.

Non-Auto-ABS tranches are more likely to be floating rate issues than Auto-ABS tranches. We observe that 77% of the non-Auto tranches are offered with floating coupon rates, while only 74% of the Auto tranches are offered as floating rate issues. The results are not surprising, since floating rate issues tend to offer greater flexibility. On the other hand, fixed rate securities eliminate a major source of cash flow uncertainty, but in general, lead to a longer *maturity* which, ceteris paribus, increases the risk profile and the probability of default.

Observations for *currency risk* only occur in the non-Auto ABS sample. We find that an average of 11% of the issues face currency risk. The findings suggest that non-Auto-ABS—more frequently—contain a mismatch between the originators' home country currencies and the currency of loan repayment.

Finally, this study finds that Auto-ABS tranches are far more likely to be issued in a country, which provides *creditor protection* than non-Auto-ABS tranches (88.5% versus 60%). In general, a 'no automatic stay' provision is viewed favorably by investors and explains the lower *spreads* for the automobile industry. The difference can be explained by the fact that European Auto ABS are issued in smaller sets of countries than the non-Auto transactions.

The results of the univariate analysis over the whole time period merit a greater in-depth analysis in order to understand the variations over time. Thus, in this chapter, we provide a univariate analysis for each year in our data sample, to determine the development of the differences between the Auto-ABS and the non-Auto-ABS tranches

in the European ABS market. The variables *loan to value, extern enhancement, number of tranches, number of lead managers, number of rating agencies, currency risk, type of interest rate,* and *creditor protection* do not exhibit changes over time. Thus, the following analysis is carried out on the variables *primary market spread, credit rating, time to maturity, loan size, transaction size,* and *retained interest*.

Table 17: *Univariate Comparison of the Characteristics of the European ABS Market 2010-2012*

(1) Variable of interest	(2) Year and security class					
	2010		2011		2012	
	European ABS	Auto-ABS	European ABS	Auto-ABS	European ABS	Auto-ABS
Primary Market Spread (bp)						
Number	23	9	82	21	67	20
Mean	134.5	110.9	156.3	117.9	126.2	58.53
Median	110.0	123.9	129.8	104.4	91.0	33.5
Min.	30.0	41.9	-143.0	35.9	-39.0	-14.1
Max	350.0	221.7	900.0	495.0	387.2	185.0
Std. Dev.	92.67	59.24	143.5	101.3	104.4	51.96
Credit Rating (1-15 weak)						
Number	23	9	82	21	67	20
Mean	3.91	2.89	3.79	2.81	3.07	2.35
Median	1.0	1.0	1.0	1.0	1.0	1.0
Min.	1.0	1.0	1.0	1.0	1.0	1.0
Max	17.0	6.0	17.0	5.0	11.0	5.0
Std. Dev.	4.47	2.26	4.27	1.97	3.08	1.76
Time to Maturity (years)						
Number	23	9	82	21	67	20
Mean	12.43	6.88	15.59	7.55	9.77	7.99
Median	12.40	7.13	12.06	6.09	7.89	6.06
Min.	1.26	5.74	3.52	5.81	1.04	5.84
Max	32.73	8.11	42.58	12.49	29.10	12.46
Std. Dev.	7.22	0.94	10.65	2.52	6.21	2.10
Loan Tranche Size (Euro millions)						
Number	23	9	82	21	67	20
Mean	330.2	331.5	393.2	413.9	460.3	408.1
Median	275.0	474.5	231.3	476.6	314.4	308.1
Min.	22.4	19.1	9.0	23.0	6.14	28.0
Max	900.0	905.0	3502.5	956.0	3963.0	1000
Std. Dev.	267.7	317.8	5842	390.7	700.3	389.0
Transaction Size (Euro millions)						
Number	16	5	44	11	39	14
Mean	543.3	602.0	1022.0	809.4	869.9	616.4
Median	553.5	519.1	617.0	815.6	668.4	800.0
Min.	100.0	500.0	21.55	535.5	133.7	49.8
Max	900.0	942.5	5832.0	1050.0	5073.0	1030.1
Std. Dev.	236.1	190.6	1257.6	165.7	997.5	378.5
Retained Interest (dummy)						
Number	23	9	82	21	67	20
Mean	0.61	0.78	0.48	0.57	0.51	0.6
Median	1.0	1.0	0.0	1.0	1.0	1.0
Min.	-	-	-	-	-	-
Max	-	-	-	-	-	-
Std. Dev.	-	-	-	-	-	-

The sample European ABS describes the characteristics of the European ABS market excluding the automobile market. The sample Auto-ABS describes the characteristics of European automobile ABS. The variable SPREAD is measured in percentage points. MATURITY has the unit years. The variables LOAN SIZE and TRANSACTION SIZE have the unit million Euros. The variable RATING is measured in a scale from 1 to 21. RETAINED INTEREST is a dummy variable.

Table 18: *Univariate Comparison of the Characteristics of the European ABS Market 2013-2015*

(1) Variable of interest	(2) Year and security class					
	2013		2014		2015	
	European ABS	Auto-ABS	European ABS	Auto-ABS	European ABS	Auto-ABS
Primary Market Spread (bp)						
Number	74	29	78	21	22	22
Mean	81.34	42.22	117.4	30.81	119.9	58.27
Median	59.48	46.7	88.0	29.0	84.29	47.71
Min.	-98.8	-37.6	-10.1	-10.5	20.60	13.0
Max	595.0	141.4	426.0	84.0	443.8	275.0
Std. Dev.	115.8	36.68	102.1	25.84	107.5	60.43
Credit Rating (1-15 weak)						
Number	74	29	78	21	22	22
Mean	3.43	2.91	4.76	2.76	4.66	3.02
Median	1.5	1.0	4.0	1.0	3.5	2.0
Min.	1.0	1.0	1.0	1.0	1.0	1.0
Max	12.0	6.0	20.0	5.0	13.5	8.0
Std. Dev.	3.00	2.11	3.78	1.94	3.58	2.24
Time to Maturity (years)						
Number	74	29	78	21	22	22
Mean	11.07	7.68	13.41	6.70	12.48	8.05
Median	8.03	7.07	13.16	5.99	8.52	7.54
Min.	3.04	5.84	3.96	5.69	3.91	5.83
Max	29.98	11.07	50.03	11.12	28.50	11.26
Std. Dev.	6.99	1.83	7.19	1.36	8.65	1.85
Loan Tranche Size (Euro millions)						
Number	74	29	78	21	22	22
Mean	392.4	466.5	283.1	498.6	301.2	383.8
Median	303.5	450.0	186.0	500.0	227.2	206.1
Min.	3.25	16.2	0.10	16.3	5.50	13.0
Max	2960.0	2785.0	1984.1	1250.0	888.0	1286.3
Std. Dev.	518.6	564.8	339.7	465.8	297.3	414.7
Transaction Size (Euro millions)						
Number	40	16	36	11	11	11
Mean	807.6	868.2	751.1	958.8	851.6	781.7
Median	564.2	719.2	598.2	952.5	720.9	717.0
Min.	52.3	244.5	180.0	516.3	335.4	400.0
Max	3500.0	3242.8	2339.0	1291.3	2000.0	1339.4
Std. Dev.	732.8	669.4	507.1	222.7	467.5	296.7
Retained Interest (dummy)						
Number	74	29	78	21	22	22
Mean	0.58	0.72	0.60	0.95	0.59	1.0
Median	1.0	1.0	1.0	1.0	1.0	1.0
Min.	-	-	-	-	-	-
Max	-	-	-	-	-	-
Std. Dev.	-	-	-	-	-	-

The sample European ABS describes the characteristics of the European ABS market excluding the automobile market. The sample Auto-ABS describes the characteristics of European automobile ABS. The variable SPREAD is measured in percentage points. MATURITY has the unit years. The variables

LOAN SIZE and TRANSACTION SIZE have the unit million Euros. The variable RATING is measured in a scale from 1 to 21. RETAINED INTEREST is a dummy variable.

Table 17 presents the results for the years 2010-2012, while Table 18 exhibits the results for the years 2013-2015. The results for the *primary market spread* support the hypothesis that Auto-ABS has become more interesting over time compared to their non-Auto-ABS counterparts. The difference between the *spreads* of the two security classes is significantly higher for the last three years than it is for the first three years of the data sample. We note that the median value of the risk premium was higher for Auto-ABS in 2010 but eventually, Auto-ABS were associated with a price discount during 2011-2015. The *credit ratings* of Auto-ABS were significantly better during that time. Further, we note that the rating of Auto-ABS, on average, exhibited greater homogeneity than that of non-Auto-ABS. The *time to maturity* varied over time for non-Auto-ABS, while exhibiting constant results for Auto-ABS. This further supported the hypothesis that Auto-ABS provided a significantly lower risk profile than their non-Auto-ABS counterparts.

Loan tranche size and *transaction size* behaved inconsistently over time for both these security classes. We noted reductions in the mean (median) value of the loan tranche size and the transaction size as well as a rise in values for the mean (median) for both security classes. Finally, retained interest behaved differently for the two security classes. While on the one hand, we did note a constant mean (median) value for non-Auto-ABS issues, the variable exhibited a steady growth for Auto-ABS transactions. Thus, relatively more Auto-ABS issues provided internal credit enhancement, which was an additional indicator for the lower risk profile.

Before proceeding to the next section, in which we analyze yield determinants, we should briefly summarize the results of our univariate comparison. This paper investigates how common pricing factors compare for the European ABS samples. This means, we analyzed common security characteristics for Auto-ABS transactions and non-Auto-ABS transactions. The purpose was to provide insights into the common pricing characteristics associated with the European ABS market and to elaborate on any substantial differences between the two asset classes, which could explain the exceptional performance of the Auto-ABS market. We found that most of the common pricing features between the two asset classes in fact differed significantly, especially characteristics that described the risk profile. Therefore, we noted that the risk profiles of the two asset classes differed. We understood one of the causes of the performance of

the Auto-ABS issues. In addition, we observed that the European ABS market exhibited both significant homogeneity and difference in the context of the common security characteristics. We documented, for instance, that:

1. Auto-ABS tend, on average, to be less risky than their non-Auto counterparts. Auto-ABS have a significantly lower *spread*, a significantly higher *credit rating*, and a significantly lower *currency risk* in comparison with non-Auto tranches;
2. Non-Auto-ABS transactions show a significantly larger *transaction size*, whereas Auto-ABS tranches show a significantly larger *loan tranche size*. This is explained by a significantly larger number of tranches for non-Auto-ABS;
3. Non-Auto-ABS tranches have significantly longer *maturity* levels than Auto-ABS tranches;
4. Non-Auto-ABS tranches have a significantly higher cumulative level of subordination, while Auto-ABS are far more likely to provide additional credit enhancement;
5. Similarities are documented for the *number of lead manager*, the *number of rating agencies,* and the *type of interest rate*.
6. Over time, the characteristics of Auto-ABS developed in favor compared to their non-Auto-ABS counterparts. As a result, we observe that the difference of the average *spreads* increases over time.

We document a significantly lower risk profile for Auto-ABS tranches, which explains the significantly lower *primary market spread*. This may interest investors as well as originators. Investors benefit from the lower risk profile in terms of a lower default probability. The automotive industry benefits from the lower risk premia in terms of lower costs. Therefore, the risk profile explains a significant part of the superior performance of the Auto-ABS market. A natural follow-up of this study would be an investigation into the extent to which the asset classes are priced by the common factors. Thus in the next section, we investigate the yield determinants of the European ABS market.

3.5.1.2 Regression Analysis

This section investigates the extent to which the two asset classes are priced by common characteristics. Its purpose is to analyze the impact of the common security features on the *primary market spread*. We anticipated that the *primary market spreads* associated with the two asset classes were influenced differently and this could be another cause for the superior performance of the Auto-ABS market. To further investigate the first research hypothesis, six regression analyses were run on the common variables and the *spread*. We performed the Breusch-Pagan tests on every regression with the result of homoscedasticity, using the methodology proposed by Breusch and Pagan (1979). The regressions followed the model, presented in the methodology chapter.

Table 19 presents the regressions performed on the common pricing characteristics (independent variables) and the *primary market spread* (dependent variable) for the Auto-ABS sample and the European ABS sample. Regressions 1 and 2 are the main regressions for this chapter, while regressions 3 to 6 are performed to determine whether corporate characteristics, such as *the number of lead manager, the number of rating agencies, retained interest,* and *type of interest* have a greater explanatory power than variables associated with the underlying assets, such as *credit rating, time to maturity, loan size,* and *number of tranches*.

Table 19: *Determinants of the Primary Market Spread of the European ABS Market*

Variable	European ABS Reg. #1	Auto-ABS Reg. #2	European ABS Reg. #3	Auto-ABS Reg. #4	European ABS Reg. #5	Auto-ABS Reg. #6
Constant	0.238	0.101	0.501	-0.537	2.25 ****	1.62 ****
Credit Rating	0.203 ****	0.190 ****	0.183 ****	0.180 ****	-	-
Loan To Value	0.001	0.001	-	-	-	-
Time To Maturity	-0.012 *	0.008	-0.006	0.029	-	-
Extern Enhancement	0.154	0.150	-	-	-	-
Loan Size	-0.078 **	0.053	-0.088 **	0.016	-	-
Transaction Size	-0.231 ****	0.045	-	-	-	-
# Tranches	0.081 **	0.210 **	0.064	0.170 **	-	-
# Lead Managers	-0.188 ***	-0.021	-	-	-0.211 ***	0.007
# Rating Agencies	0.122	-0.015	-	-	-0.479 ****	0.060
Retained Interest	0.263 **	-0.361 ***	-	-	0.269 **	-0.545 ****

Float	0.423 ****	-0.150	-	-	0.00006	-0.389 **
Currency Risk	0.045	-	-	-	-	
Creditor Protection	-0.391 ***	-0.109	-	-	-	
Emerging Market	0.247	-	-	-	-	
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	346	122	346	122	346	122
Adjusted R^2	0.56	0.55	0.53	0.53	0.16	0.30
F-Statistics	< 2.2e-16	< 1.81e-14	< 2.2e-16	7.38e-16	1.34e-09	4.37e-07
Significance Levels	0 '****' 0.001 ' ***' 0.01 '**' 0.05 '*' 0.1 ' ' 1					

The control variables $Year_i$ and $Currency_i$ were included in the analysis but are not presented in the above table. The results for the variables Transaction Size and Loan to Value were arrived by separate regressions for the Auto-ABS sample due to high correlation of these variables. The results for the variables Transaction Size and Loan Size were arrived by separate regressions for the European ABS sample due to high correlation of these variables.

Table 19 reports the following results for the first two regressions. The F-statistics on whether coefficients are jointly different from zero as well as adjusted R^2 are reported at the bottom of the Tables. Overall, the model performs relatively well for the two asset classes. The adjusted R^2 is around 0.55 for the Auto-ABS sample, and over 0.56 for the ABS ex. Auto sample. This is comparable to results of studies regarding the ABS market by Vink and Fabozzi (2012) and Vink and Thibeault (2008). This indicates that the model explains a significant proportion of the spread over the sample period. Table 19 shows that the *credit rating* is significant at the 0.1% level for both samples. The pattern of the *credit rating* variable indicates that *spreads* rise when ratings worsen. This result is as predicted and makes intuitive sense. Further, we report similar coefficients of *credit rating* between the asset classes. Clearly, investors of the European ABS market consider *credit rating* as dominant yield determinants for the whole ABS market.

We included two types of credit enhancements in our regression analyses: *external* by a third company, for instance an insurance company, and *internal* through a retained interest by the originator. The *external credit enhancement* dummy variable is insignificant and positive for both asset classes, which is a surprising result. On the contrary, we observe a significant, negative relationship at the 1% level between *retained interest* and the *spread* for the Auto-ABS sample and a significant, positive relationship at the 5% level for the non-Auto-ABS tranches. This is a surprising result, since we predicted a negative relationship. However, investors associate an additional average risk premium of 26 basis points with non-Auto tranches if the transaction

provides *internal credit enhancement*. For Auto-ABS, we reported an average price discount of 36 basis points.

The variable *maturity* is insignificantly and positively related with the spread for Auto-ABS tranches and significantly and negatively related with the spread at the 10% level for non-Auto-ABS. The second result is surprising, since we expected the maturity to be positively related with the *spread*. Apparently, yield *spreads* generally decrease with longer *maturity* for non-Auto ABS. Nevertheless, these findings also merit greater in-depth analysis of the nature of the assets than what we can provide here. *Loan* and *transaction sizes* behave differently in our samples. They are insignificantly and positively related to the *primary market spread* for Auto-ABS, while exhibiting a significant and negative relationship with the *spread* for non-Auto-ABS at the 5% and 0.1% levels, respectively. However, for Auto-ABS issues, this evidence may support illiquidity in the form of a downward-sloping demand curve. The negative relationship of *loan* and *transaction* sizes with the *spread* for non-Auto-ABS transactions indicates that, on average, larger issues are associated with a price discount.

We observe a significant and positive relationship with *spreads* for *number of tranches* across the whole European ABS market with significance levels at 5%. Apparently, a higher *number of tranches* is associated with an additional risk premium. It may be argued that tranches have a positive relationship with default. This means that the originator especially, in a situation of a higher degree of information asymmetry between himself and the investors with regard to the underlying collaterals, would benefit from a higher *number of tranches* per transaction. On the other hand, investors could associate an increase in the *number of tranches* with an additional increase in the risk, which would require an extra risk premium (Vink & Thibeault, 2008). This finding is in accordance with the results of the *number of tranches* in the univariate analysis. For Auto-ABS, we reported an average increase of *spreads* by 21 basis points for every additional tranche, while for non-Auto-ABS, we reported an average increase of the *spread* by 8 basis points. The dummy variables *number of lead managers* and *number of rating agencies* were seen to behave differently for Auto-ABS and non-Auto-ABS tranches. While the *spread* and *number of lead managers* were insignificantly and negatively related for Auto-ABS, they exhibited a significant negative relationship for non-Auto-ABS. While the coefficient sign is the same, investors have been thought to consider the *number of lead managers* as yield determinant only for the non-Auto-ABS market. We documented an insignificant and positive relationship for the *number of*

rating agencies for Auto-ABS, while the variable was insignificantly and positively related with *spreads* for the ABS ex. Auto sample. Nevertheless, the coefficient sign for the non-Auto-ABS was surprising, since we predicted a negative relationship. A greater *number of rating agencies* should achieve, ceteris paribus, a more accurate rating.

Float is insignificantly related with *spreads* for the Auto-ABS market, while we observe a strong significant and positive relationship with the *primary market spread* for non-Auto-ABS at the 0.1% level. This indicates that for Auto-ABS tranches, the *spread* is associated with, on average, a price discount of 15 basis points for *floating* rate issues. On the other hand, the average increase of *spreads* for the non-Auto sample equals 42 basis points. The positive relationship can be explained by the default risk for longer *maturity* issues with a *floating* interest rate. Since the interest rate on a fixed rate issue does not fluctuate during the lifetime of the security, the securities are typically protected to avoid the risk of rising interest rates (Vink & Thibeault, 2008). This is a further explanation for the higher risk premia of the univariate analysis, since 77% of the issues contained in the non-Auto sample are floating rate issues. *Creditor protection* exhibits different results for the European ABS market. While *spreads* and *creditor protection* are insignificantly and negatively related for Auto-ABS, they show a significant and positive relationship for non-Auto-ABS at the 1% level. *Spreads* reduce on average by 11 basis points for automobile issues when *creditor protection* is available and 39 basis points for non-Auto ABS. Thus, investors consider the availability of *creditor protection* as a determinant of the *primary market spread* for the non-Auto sample.

The last two variables of our regression model, *currency risk,* and *emerging market*, only occur in the ABS ex. Auto sample. Both variables are insignificantly and positively related with *spreads*. The results of the coefficients signs are as expected and make intuitive sense. *Currency risk* as well as *emerging market risk* are associated with a higher default risk.

In the following paragraph, we discuss the results of the regressions 3 to 6. We split the common pricing characteristics into two smaller groups. The first group contains variables that can be associated with the underlying assets. The second group contains variables that can be associated with the originating corporation and its choices for the issuance process. The regressions are performed in order to analyze the group which contributes the greater part to the explanatory power of the first two regressions. Table 19 shows that the variables associated with the underlying assets, contribute the

greater part to the explanatory power of the first regression model for both security classes. However, the analysis finds differences in the results for the variables. While *credit rating* behaves in the exact same manner for both security classes, we document significant differences for *loan size* and *the number of tranches. Loan size* has a negative and significant relationship with the *spreads* for the non-Auto-ABS sample, while the variable is positively and insignificantly related with the *spread* for the Auto-ABS sample. On the other hand, *the number of tranches* exhibits a positive and insignificant relationship with the risk premium for the non-Auto ABS issues, whereas the variable is positively and significantly related with the *primary market spread* at the 5% level for Auto-ABS. *Time to maturity* is insignificantly related with the *spread* for both security classes. However, we document differences in the coefficient signs for this variable. *Time to maturity* exhibits a negative relationship with the risk premium for non-Auto-ABS while having a positive relationship with the spread for Auto-ABS issues. The second group of variables contributes the lower part to the explanatory power of the first model for both security classes. First, we note that the adjusted R^2 is almost twice the value of the non-Auto-ABS sample for the Auto-ABS sample, which indicates that variables, which are associated with the originator, are more significant to investors of Auto-ABS than to investors of their non-Auto-ABS counterparts. Second, we find differences in the results for the variables of the second group. The *number of lead managers* as well as *the number of rating agencies* are negatively and significantly related with the *spread* for non-Auto-ABS while having a positive and insignificant relationship with the *spread* for Auto-ABS issues. *Retained interest* is positively and significantly related with the *spread* at the 5% level for non-Auto-ABS and has a negative and significant relationship at the 0.1% level for Auto-ABS. Finally, *the type of interest rate* has a negative and significant relationship with the risk premium at the 5% level for Auto-ABS and is insignificantly and positively related with the *spread* of non-Auto-ABS.

This subsection investigates the extent to which the two asset classes are priced by common factors. Our purpose was to analyze the impact of common pricing characteristics on *primary market spreads.* We expected that investors rely on different pricing factors for the two samples. The findings provide evidence that indicates that Auto-ABS are priced differently compared to their non-Auto-ABS counterparts. We documented, for example, that:

1. *Credit rating, retained interest*, and *the number of tranches* are yield determinants for Auto-ABS, while non-Auto-ABS issues are additionally priced by *loan and transaction size, the number of lead managers, the type of interest,* and *creditor protection*;
2. Lenders tend to offer a discount for Auto-ABS issues with *retained interest* and surprisingly demand an additional risk premium for non-Auto-ABS issues;
3. *Credit rating, loan to value, maturity, extern enhancement, the number of tranches, the number of lead managers*, and *creditor protection* exhibit the same coefficient signs;
4. *Retained interest, loan size, transaction size, the number of rating agencies*, and *the type of interest* exhibit different coefficient signs;
5. Variables, which are associated with the underlying assets, contribute a greater part of the explanatory power for both security classes. However, those variables behave differently for the two security classes;

In the next section, we discuss the results of the two previous subsections and summarize the results of the first comparison analysis between Auto-ABS issues and non-Auto-ABS issues.

3.5.1.3 Discussion

This subsection discusses the results of the previous comparison analysis. Based on the results of the previous two subchapters, we accept the first hypothesis. The results provide evidence that supports the hypothesis that the Auto-ABS market provides advantages with respect to security risk profiles compared to the non-Auto-ABS market. Further, we find that investors rely on pricing advantages of Auto-ABS transactions. We documented that Auto-ABS have a significantly lower risk profile than non-Auto-ABS, which leads to a significantly lower average *primary market spread* for the Auto-ABS issues. The average *primary market spread* for this asset class equals 64 basis points, whereas non-Auto-ABS have to pay a risk premium of, on average, 122 basis points.

As a natural follow-up, we analyzed the extent to which *spreads* of the two asset classes were priced by the common security characteristics. We observed that more than half of the pricing factors exhibited dissimilar results with respect to significance levels,

coefficient signs, or impact. This was in accordance with the findings of the univariate analysis. Especially, the results for dominant variables like *retained interest*, *the number of tranches*, and *the type of interest* which illustrated the significant differences between the two samples. *Retained interest* is a determinant of the *spread* for both samples, but is negatively related with the spread for Auto-ABS, while having a positive relationship with *spreads* for non-Auto-ABS. The *number of tranches* has a significant and positive relationship with the *primary market spread* for both asset classes. Hence, investors associate a higher *number of tranches* with an additional risk premium. Auto-ABS *floating* rate issues are associated with a price discount, while non-Auto-ABS *floating* rate issues are associated with an additional risk premium. These findings further support the conclusion with respect to lower risk profile of Auto-ABS and contribute to the significantly lower *spreads*.

As a result of the comparison analysis, we are able to accept the first research hypothesis and conclude that dissimilarities between the Auto-ABS submarket and the non-Auto-ABS submarket explain a significant part of the exceptional performance of automobile issues. The analysis revealed that there were strong and significant differences between the two submarkets. The advantages of Auto-ABS indicate that the development of the European Auto ABS market into the most dominant submarket is the result of different risk profiles as well as different yield determinants. If the European automobile ABS market also continues its development during new circumstances, for instance quantitative easing in the European Monetary Union, the findings of this study will merit greater in-depth analysis. It will be of interest especially to scholars who study the European securitization market.

The next section undertakes a comparison analysis between the Auto-ABS and the Auto corporate bonds with the purpose of explaining the shift of issuance volumes between the two markets. Research reports by Creditreform Financial Research (2015) and the DZ Bank (2013, 2015) consider the shift as additional cause driving the superior performance of the Auto-ABS submarket.

3.5.2 European Automobile Market

This section analyzes the differences between corporate bonds and asset-backed securities in the European automobile market. Both techniques are mentioned to be most important refinancing instruments for market sales and loan services in the European automobile market (True Sale International, 2013; Creditreform Financial Research, 2015). A European automobile ABS is backed by automobile or leasing

credits of the automobile company. For the purpose of securitization, the automobile company (parent company) transfers the portfolio of assets to a bankruptcy-remote special purpose vehicle (SPV). The SPV is a legal entity, which is legally separate from the seller. This means that the security is independent of the originator's credit quality. The repayment of investors depends primarily on the assets and their generated cash flows and not on the financial situation of the parent company (Vink & Thibeault, 2008; Jobst, 2008; Pelletier, 2003; Segoviano, Jones, Lindner, & Blankenheim, 2013; Fermanian, 2013; Riddiough, 2011). Asset-backed security transactions are associated with a lower risk profile than corporate bonds, since they are independent of the originator's credit quality. Further advantages are that ABS issues generate the interest payments solely from the underlying car or leasing credits, and are independent of the earnings of the originator. The advantage of corporate bonds is the independence from an underlying asset portfolio. Corporate bonds can be issued without the existence of coverage in the originator's asset portfolio, since repayments are solely generated from the earnings of the originator. Research reports by Creditreform Rating Agency (2015) and the DZ Bank (2015) mention that the automobile industry shifts refinancing activities from the corporate bond market into the asset-backed security market. This paper analyzes if the structure, the risk profile as well as pricing factors explain this shift and hence, provide a second cause for the exceptional performance of the Auto-ABS submarket.

3.5.2.1 Descriptive Analysis

This subsection performs a univariate analysis for the European automobile market. The objective is to analyze to what extent do Auto-ABS differ from Auto-CB. The European Auto-ABS grew into the most important submarket in the European ABS market. Its proportion in the primary market increased to over 43% in 2015. This development is hypothesized to be explained partly through dissimilarities between automobile ABS and automobile CB, which leads to a shift of issuance activities by the automotive industry. Table 20 presents a comparison of the discrete as well as dummy characteristics for the European automobile market. The Auto-ABS sample is labelled "Auto-ABS" in the subsequent Tables, whereas the CB high information sample is labelled "Auto-CB". For purposes of comparison, we only consider common pricing characteristics provided by both samples in this analysis.

Table 20: *Comparison of the Characteristics of the European Automobile Market*

(1) Variable of interest	(2) Security Class		(3) Variable of interest	(4) Security Class	
	High Information Sample			High Information Sample	
	Auto-ABS	Auto-CB		Auto-ABS	Auto-CB
Primary Market Spread (bp)			Number of Rating Agencies		
Number	122	413	Number	122	413
Mean	63.91	127.8	Mean	1.69	1.99
Median	51.85	79.60	Median	2.0	2.0
Min.	-37.50	-47.00	Min.	1.0	1.0
Max	495.0	743.40	Max	3.0	3.0
Std. Dev.	66.27	140.69	Std. Dev.	0.50	0.35
Time to Maturity (years)			Creditor Protection (dummy)		
Number	122	413	Number	122	413
Mean	7.55	3.57	Mean	0.89	0.28
Median	6.88	3.03	Median	-	-
Min.	5.69	1.01	Min.	-	-
Max	12.49	25.04	Max	-	-
Std. Dev.	1.93	2.33	Std. Dev.	-	-
Loan Tranche Size (€ millions)			Floating Rate Issue (dummy)		
			Number	122	413
Number	122	413	Mean	0.74	0.33
Mean	428.53	334.06	Median	-	-
Median	452.0	200	Min.	-	-
Min.	13.0	20.13	Max	-	-
Max	2785.03	1500	Std. Dev.	-	-
Std. Dev.	444.50	324.19			
Credit Rating (1-15 weak)			Currency Risk (dummy)		
Number	122	413	Number	0	413
Mean	2.80	7.67	Mean	-	0.43
Median	1.0	7.0	Median	-	-
Min.	1.0	5.0	Min.	-	-
Max	8.0	15.0	Max	-	-
Std. Dev.	2.01	1.84	Std. Dev.	-	-
Number of Lead Managers					
Number	122	413			
Mean	2.25	2.07			
Median	2.0	2.0			
Min.	1.0	1.0			
Max	5.0	6.0			
Std. Dev.	1.28	1.21			

The sample Auto-ABS describes the characteristics of European automobile. The sample Auto-CB describes the characteristics of European automobile CB. The variable SPREAD is measured in percentage points. MATURITY has the unit years. The variable SIZE has the unit million Euros. The variable RATING is measured in a scale from 1 to 21. The variables LEAD MANAGERS and RATING AGENCIES describe the number of the tranches and the number of corresponding conglomerate, respectively. The variables EXTERN ENHANCEMENT, FLOAT, CURRENCY RISK, and CREDITOR PROTECTION are dummy variables.

The relative pricing of the two samples shows that average (median) *spreads* are statistically and significantly lower for Auto-ABS, with 64 basis points (52 bps) than they are for Auto-Bonds, with 127.8 basis points (79.6 bps). We document that the *primary market spread* for Auto-ABS is, on average, half the *primary market spread* for

Auto-Bonds. Hence, investors associate Auto-Bonds with a significantly higher risk profile than Auto-ABS. An ABS tranche *matures*, on average, after 7.5 years, compared to an average of 3.56 years for CB. Both security classes, as indicated by the standard deviation, exhibit significant homogeneity with respect to *maturity*. One surprising finding is that the minimal value of the ABS sample is larger than the third quantile value of the CB sample. This means 75% of all corporate bonds have a lower *maturity* than the ABS issue with the lowest *maturity*. The difference can be explained by the fact that a longer *time to maturity* is associated with a higher default risk for Auto-CB, since they do not provide any additional credit enhancement. In contrast, the Auto-ABS issues provide credit enhancement and thus are protected against the first losses of the underlying portfolios.

Auto-ABS exhibit a larger average (median) *loan size* of EUR 428.5 million (EUR 452 million) than Auto-Bonds with EUR 334.06 million (EUR 200 million). Both samples exhibit, as indicated by standard deviation, significant heterogeneity with respect to *loan size*. For instance, the average standard deviation for loan size of Auto-ABS is EUR 444.5 million while for Auto-Bonds, it is EUR 324.2 million.

Auto-ABS, on average, tend to be less risky than their Auto-Bonds counterparts. This is also confirmed by the *credit rating*. Since *credit rating* and *spread* tend to have an inverse relationship, it is obvious that the average *credit rating* for Auto-ABS is significantly lower, with 2.80, than for Auto-Bonds, with 7.70. The findings are in accordance with the expectation that the structure of ABS transactions reflect lower perceived risk than the structure of corporate bonds, because loan repayments of ABS transactions are backed by large amounts of car or leasing credits that are relatively liquid and make the issue less risky. Further, the independence of the originator and the provided credit enhancement lower the default risk and lead to a lower risk profile for Auto-ABS. Nevertheless, the relatively strong average *credit rating* for Auto-ABS indicates that the underlying asset portfolios are of high quality. On the one hand, *spread* levels and *credit rating* provide direct evidence of the riskiness of these two financing techniques .The *number of rating agencies* and the *number of lead managers* on the other hand also provide indirect evidence of the riskiness of the transaction—or at least serve as an indicator of the difficulty of underwriting the issue. The average number (median) of participating *lead managers* for Auto-ABS is 2.25 (2.0) and this is insignificantly larger than the average of 2.1 (2.0) for Auto-Bonds. The similarities between the findings for this variable are additionally documented in the standard

deviation. The average standard deviation with respect to the *number of lead managers* for Auto-Bonds is 1.21, which is only insignificantly lower than the average of 1.28 for Auto-Bonds. Though similar to the *number of lead managers*, we find only slight differences for the *number of rating agencies*. Auto-Bonds have an average of 1.99 (median 2.0) *rating agencies* involved, which is insignificantly higher than the 1.7 (2.0) *rating agencies* for Auto-ABS. Thus, both security classes tend to be equally difficult to rate, and the same *number of rating agencies* needs to be involved to convince investors to participate in the transactions.

Auto-ABS tranches are more than twice as likely to be *floating rate* issues compared to Auto-Bonds. In particular, one would expect Auto-ABS to have a relatively higher percentage of fixed rate issues because Auto-ABS report the higher average maturity (7.5 years) and the issuance of fixed rate securities would eliminate a major source of cash flow uncertainty inherent to a longer maturity. However, the findings indicate that *floating rate* issues tend to offer more flexibility for the automobile industry.

Moreover, Auto-ABS are three times as likely to be issued in a country that provides *creditor protection,* than their Auto-CB counterparts. Almost 90% of all Auto-ABS securities are issued in countries with no automatic stay on the assets, while only every third Auto-CB transaction provides *creditor protection*. Finally, the last variable of interest is *currency risk.* This variable is only calculated for the Auto-CB sample since the Auto-ABS sample does not contain issues that face *currency risk*. Almost half the Auto-CB issues face *currency risk* (43.34%). This finding suggests that Auto-Bonds contain a mismatch between the originators' home country currencies and the currency used for loan repayment. One obvious interpretation is that the corporate bond market is almost 3.5 times as big as the asset-backed security market with respect to the number of issues (413 versus 122). Further, the corporate bond market extends to more countries than the Auto-ABS market. Therefore, corporate bonds are issued in more currencies than Auto-ABS. Hence, it is more likely that an Auto-Bond will face significant *currency risk* than Auto-ABS issues.

The results of the univariate analysis over the whole time period merit a greater in-depth analysis in order to analyze variations over time. Therefore, this section provides a univariate analysis for each year in our data sample. This aims to determine development of the differences between the Auto-ABS and Auto-CB. The variables

number of lead managers, number of rating agencies, currency risk, type of interest rate, and *creditor protection* do not exhibit changes over time. Thus, the following analysis is carried out on the variables *primary market spread, credit rating, time to maturity,* and *loan size*.

Table 21: *Comparison of the Characteristics of the European Automobile Market 2010-2012*

(1) Variable of interest	(2) Year and security class					
	2010		2011		2012	
	Auto-ABS	Auto-CB	Auto-ABS	Auto-CB	Auto-ABS	Auto-CB
Primary Market Spread (bp)						
Number	9	26	21	99	20	93
Mean	110.9	208.2	117.9	112.2	58.53	141.0
Median	123.9	201.0	104.4	73.3	33.5	178.7
Min.	41.9	1.40	35.9	-47.0	-14.1	-9.4
Max	221.7	436.4	495.0	576.3	185.0	743.4
Std. Dev.	59.24	135.36	101.3	122.99	51.96	160.2
Credit Rating (1-15 weak)						
Number	9	26	21	99	20	93
Mean	2.89	8.71	2.81	7.61	2.35	7.7
Median	1.0	9.25	1.0	7.0	1.0	7.0
Min.	1.0	6.5	1.0	6.0	1.0	6.0
Max	6.0	11.5	5.0	11.33	5.0	13.0
Std. Dev.	2.26	1.71	1.97	1.23	1.76	1.67
Time to Maturity (years)						
Number	9	26	21	99	20	99
Mean	6.88	3.87	7.55	2.98	7.99	3.51
Median	7.13	3.08	6.09	3.02	6.06	3.03
Min.	5.74	1.02	5.81	1.02	5.84	1.02
Max	8.11	10.03	12.49	7.02	12.46	10.03
Std. Dev.	0.94	1.91	2.52	1.43	2.10	1.7
Loan Tranche Size (Euro millions)						
Number	9	26	21	99	20	99
Mean	331.5	491.7	413.9	256.2	408.1	346.0
Median	474.5	500.0	476.6	110.7	308.1	167.1
Min.	19.1	30.0	23.0	25.0	28.0	20.1
Max	905.0	1000.0	956.0	1250.0	1000	1500.0
Std. Dev.	317.8	298.7	390.7	296.1	389.0	356.1

The sample Auto-ABS describes the characteristics of European Automobile ABS. The sample Auto-CB describes the characteristics of European automobile CB. The variable SPREAD is measured in percentage points. MATURITY has the unit years. The variable SIZE has the unit million Euros. The variable RATING is measured in a scale from 1 to 21.

Table 22: *Comparison of the Characteristics of the European Automobile Market 2013-2015*

(1) Variable of interest	(2) Year and security class					
	2013		2014		2015	
	Auto-ABS	Auto-CB	Auto-ABS	Auto-CB	Auto-ABS	Auto-CB
Primary Market Spread (bp)						
Number	29	85	21	68	22	42
Mean	42.22	127.1	30.81	78.14	58.27	84.41
Median	46.7	61.8	29.0	50.65	47.71	61.05
Min.	-37.6	-5.0	-10.5	-7.4	13.0	1.7
Max	141.4	649.1	84.0	411.0	275.0	332.5

Std. Dev.	36.68	168.3	25.84	90.96	60.43	76.79
Credit Rating (1-15 weak)						
Number	29	85	21	68	22	42
Mean	2.91	7.71	2.76	7.48	3.02	7.42
Median	1.0	7.0	1.0	7.0	2.0	7.0
Min.	1.0	6.0	1.0	5.5	1.0	5.0
Max	6.0	15.0	5.0	14.0	8.0	13.67
Std. Dev.	2.11	2.12	1.94	2.13	2.24	2.18
Time to Maturity (years)						
Number	29	85	21	68	22	42
Mean	7.68	3.73	6.70	3.89	8.05	4.04
Median	7.07	3.04	5.99	3.03	7.54	3.27
Min.	5.84	1.01	5.69	1.02	5.83	1.28
Max	11.07	20.03	11.12	25.04	11.26	15.03
Std. Dev.	1.83	2.67	1.36	3.32	1.85	2.58
Loan Tranche Size (Euro millions)						
Number	29	85	21	68	22	42
Mean	466.5	316.7	498.6	334.8	383.8	427.8
Median	450.0	190.0	500.0	250.0	206.1	321.6
Min.	16.2	29.5	16.3	30.0	13.0	40.0
Max	2785.0	1250.0	1250.0	508.6	1286.3	1344.1
Std. Dev.	564.8	309.3	465.8	287.9	414.7	368.7

The sample Auto-ABS describes the characteristics of European Automobile ABS. The sample Auto-CB describes the characteristics of European automobile CB. The variable SPREAD is measured in percentage points. MATURITY has the unit years. The variable SIZE has the unit million Euros. The variable RATING is measured in a scale from 1 to 21.

Table 21 provides the results for the years 2010-2012, whereas Table 22 provides the results for the years 2013-2015. The results for the *primary market spread* support the hypothesis that Auto-ABS become more interesting as an investment vehicle compared to their Auto-CB counterparts. The *spreads* of Auto-CB exhibit a higher average during every year of the sample, which indicates that investors prefer Auto-ABS compared to Auto-CB as lower *spreads* signal a higher demand for these securities. We also note that the risk premium for Auto-ABS exhibits greater homogeneity every year, as indicated by the standard deviation with respect to it. The *credit ratings* of Auto-ABS are significantly lower for the whole period of time than the *ratings* of their Auto-CB counterparts. The results for *credit rating* support the hypothesis that Auto-ABS, post the 2007 financial crisis, have lower risk profiles compared to their Auto-CB counterparts and therefore, are more important for the European automobile industry in order to refinance their sales and loan services. *Time to maturity* is found to significantly vary over time for Auto-CB, while exhibiting constant results for Auto-ABS during the six year period. This finding further indicates that Auto-ABS provide a significantly lower risk profile than Auto-CB issues.

Loan size exhibits very interesting results for this study. We document that since 2012 the Auto-CB sector has been suffering a continuous decline in issuance sizes in

total, even though the average value did rise in 2015. A combination of declining numbers of issues and declining average *loan sizes* seems to have led to a drop by almost 50% in the total issuance sizes since 2012. For Auto-ABS, on the other hand, Tables 21 and 22 exhibit a larger issuance size in total in 2013, 2014, and 2015 compared to the total issuance size in 2012. Further, neither a decline in the issuance number nor a decline in the average *loan size* since 2012 has been observed. This supports the hypothesis that Auto-ABS have become more important for European automobile corporations in order to refinance their sales and loan services market. Moreover, the results indicate that issuance volumes have shifted from the Auto-CB market into the Auto-ABS market.

Before proceeding to the next section, in which we analyze the impact of the common pricing characteristics on the *primary market spread* by security class, we should briefly summarize the results of the univariate comparison. This section investigates how common pricing factors compare for the European automobile market with respect to the two most important financing instruments for that industry. The purpose is to provide insights into the common pricing characteristics associated with the automobile market and elaborate any substantial differences as may exist between the financing techniques, which could explain the shift of issuance into the ABS market. We find that most of the common pricing characteristics between the two security classes in fact differ significantly, especially factors that describe the risk profile of the securities. In addition, we observe that the European automobile market exhibits significant homogeneity for some of the common pricing characteristics. We document, for instance, that:

1. Auto-ABS, on average, tend to be less risky than their Auto-Bonds counterpart. Auto-ABS have a significantly lower *spread*, a significantly better *credit rating*, and a significantly lower *currency risk* in comparison with Auto-Bonds;
2. Auto-ABS are far more likely to be *floating* rate securities than Auto-Bonds;
3. Auto-ABS show a significantly larger *transaction size* compared to Auto-Bonds;
4. Auto-ABS have significantly longer *maturity* levels;

5. Similarities are documented for the *number of lead manager* and the *number of rating agencies*.
6. Since 2012, a shift has been observed in the volume of issuance from the Auto-CB market to the Auto-ABS market.

We document a significantly lower risk profile for Auto-ABS tranches for every year of the sample, which explains the significantly lower *primary market spread*. This is very interesting for investors as well as for the originators. Investors benefit from the lower risk profile in terms of a lower probability of default, whereas the automotive industry benefits from the lower risk premia in terms of lower costs. Therefore, the risk profile indicates that the automobile industry as well as investors rely on the advantages of securitization, which explains the shift in volumes of issuance to the European Auto-ABS market. A natural follow-up of this study would be an investigation into the extent to which the asset classes are priced by common factors. Therefore, the next section further addresses the second research hypothesis.

3.5.2.2 Regression Analysis

This subsection examines the determinants of *primary market spreads* using an ordinary least squares fixed panel-data framework, with *primary market spread* as the dependent variable and the common pricing variables as the independent variables. In order to find additional support for hypothesis 2, we evaluate the results for the regressions for the European automotive industry. We anticipate that the *primary market spreads* associated with the two security classes are influenced differently by common security characteristics. Thus, the regressions of this subsection are run on the *primary market spread* (dependent variable), the common pricing characteristics (independent variables) of the CB high information sample, and the Auto-ABS high information sample. Regressions 1 and 2 are the main regressions here, while regressions 3 to 6 are performed to determine whether corporate characteristics, such as *the number of lead managers, the number of rating agencies,* and *type of interest* have greater explanatory power than variables, which are associated with the underlying assets, such as *credit rating, time to maturity,* and *loan size*. The results are presented in Table 23.

Table 23: *Determinants of the Primary Market Spread of the European Automobile Market*

Variable	Auto-ABS Reg. #1	Auto-CB Reg. #2	Auto-ABS Reg. #3	Auto-CB Reg. #4	Auto-ABS Reg. #5	Auto-CB Reg. #6
Constant	0.101	-2.020 ****	-0.537	-3.53 ****	1.62 ****	1.683 ***
Credit Rating	0.190 ****	0.490 ****	0.180 ****	0.522 ****	-	-
Time To Maturity	0.008	0.029	0.029	0.081 ****	-	-
Loan Size	0.053	0.076	0.016	0.183 ****	-	-
# Lead Managers	-0.021	0.100 **	-	-	0.007	0.258 ****
# Rating Agencies	-0.015	-0.137	-	-	0.060	0.145
Float	-0.150	-0.826 ****	-	-	-0.389 **	-1.264 ****
Currency Risk	-	-0.216	-	-	-	-
Creditor Protection	-0.109	-0.007	-	-	-	-
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	122	413	122	413	122	413
Adjusted R^2	0.55	0.72	0.53	0.69	0.30	0.40
F-Statistics	< 2.5e-13	< 2.2e-16	< 7.38e-16	< 2.2e-16	< 4.37e-07	< 2.2e-16
Significance Levels	0 '****' 0.001 ' ***' 0.01 '**' 0.05 '*' 0.1 ' ' 1					

The control variables $Year_i$ and $Currency_i$ were included in the analysis but are not presented in the above table. The results for the variables Transaction Size and Loan to Value were arrived by separate regressions for the Auto-ABS sample due to high correlation of these variables. The results for the variables #Lead Managers and Loan Size were arrived by separate regressions for the Auto-CB sample due to high correlation of these variables.

Table 23 reports the following results for the first two regressions. The F-statistics on whether coefficients are jointly different from zero as well as adjusted R^2 are reported at the bottom of the Tables. Overall, the model performs relatively well for the two asset classes. The adjusted R^2 is around 0.55 for the Auto-ABS sample, and over 0.72 for the Auto-CB sample. This is comparable with the results of studies regarding the ABS market by Vink and Fabozzi (2012) and Vink and Thibeault (2008), and studies regarding the CB market by Elton, Gruber, Agrawal, and Mann (2001), and Huang, Huang, and Oxman (2015). Table 23 shows that *credit rating* is statistically significant for both Auto-Bonds and Auto-ABS at the 0.1% level. Further, the findings show that *credit rating* is positively related with the *spreads* for both samples. However, the impact of *credit rating* on the *spread* differs substantially for the two classes. For instance, *spreads* rise 49 basis points for Auto-Bonds when *ratings worsen*, which is significantly higher than for Auto-ABS. Thereby, *spreads* rise, on average, 19 basis

points when *credit ratings* worsen one level. One interpretation of the higher extra risk demand could be that investors dramatically lose faith in Auto-CB if *ratings* lower. *Maturity* has an insignificant and positive relationship with *spread* for CB issues, and is insignificantly and negatively related with *spread* for Auto-ABS. This is one explanation for the significantly lower *maturity* for Auto-CB as seen in subsection 3.5.2.1. Apparently, *spreads* generally decrease with shorter *maturity.* This encourages automobile companies to assign, on average, relatively short *maturities* to their corporate bonds.

Loan size behaves similarly for both security samples. The variable exhibits a positive and insignificant relationship with the *primary market spread*. In addition, we observe a higher coefficient value for the Auto-CB sample. Thus, larger issues of both samples are, on average, associated with a price increase. The *number of lead managers* is significantly and positively related with the *spread* for Auto-Bonds at the 5% level and has an insignificant negative relationship with *spreads* for Auto-ABS tranches. One explanation could be found in the differences between the evaluation criteria used by investors and capital markets for corporate bonds in comparison with Auto-ABS. On the other hand, the *number of rating agencies* is insignificantly and negatively related with *spreads* for both classes. *Currency risk,* which only appears in the CB high information sample, is insignificantly and negatively related with *spread*. This finding is a little surprising and makes no intuitive sense, since issues, which face *currency risk*, are intuitively associated with a higher risk. Hence, *currency risk* should, ceteris paribus, be associated with an additional risk premium. The variable *creditor protection* exhibits similar results for both samples. We observe an insignificant and negative relationship with *spreads*.

Finally, *float* has a strong negative relationship with *spreads* for Auto-CB at the 0.1% level, and an insignificant negative relationship with *spreads* for Auto-ABS. This indicates that Auto-ABS borrowers, on average, have to pay an extra risk premium of 15 basis points through fixed-price issues in comparison with floating-price issues. Fixed-rate Auto-CB, on average, are associated with a large extra risk premium of almost 83 basis points. This can easily be explained by interest rates that do not fluctuate on these securities and that the securities are typically protected to avoid the risk of rising interest rates (Vink & Thibeault, 2008).

In the following paragraph, we discuss the results of the regressions 3 to 6. We split the common pricing characteristics into two smaller groups. The first group

contains variables that can be associated with the underlying assets that should be securitized. The second group consists of variables which can be associated with the originating corporation and their choices for the issuance process. The regressions are performed in order to analyze which group contributes the greater part to the explanatory power of the first two regressions. Table 13 exhibits that the variables, which are associated with the underlying assets, and contribute the greater part to the explanatory power of the first regression model for both security classes. However, the analysis observes the differences regarding the significance levels with respect to the variables. The factors of the first group exhibit the same coefficient signs for both security classes. While *credit rating* exhibits the same significant level for both security classes, we observe different levels for *time to maturity* and *loan size.* Both variables are positively and significantly related with the *primary market spread* for Auto-CB, while having a positive and insignificant relationship with the risk premium for the Auto-ABS sample. Further, we observe significant differences in the coefficients for all variables of this group. Variations of these variables have a significantly greater influence on the *spread* of Auto-CB than they have on the *spread* for their Auto-ABS counterparts. The second group of variables contributes the lower part to the explanatory power of the first model for both security classes. We determine significant differences for the two security samples. First, we note that the adjusted R^2 is almost half the value for both security classes compared with the adjusted R^2 values of the first group, which indicates that variables, which are associated with the originator, are less significant to investors. Second, we find differences in the results for the variables of the second group. The *number of lead managers* is positively and significantly related with the *spread* for Auto-CB, while having a positive and insignificant relationship with the *spread* for Auto-ABS issues. *The number of rating agencies* is positively and insignificantly related with the *spread* for Auto-ABS, but has a negative and insignificant relationship for Auto-CB. Finally, *the type of interest rate* has a negative and significant relationship with the risk premium at the 5% level for Auto-ABS. It is significantly and negatively related with the *spread* of Auto-CB at the 0.1% level.

This subsection investigates the extent to which the two security classes are priced by common factors. Our purpose was to analyze the impact of common pricing characteristics on *primary market spreads* for the two security classes. We anticipated that investors relied on different pricing features for each sample. The results provided evidence that the two security classes did indeed exhibit different yield determinants.

We documented, for example, that:

1. *Credit rating, retained interest*, and the *number of tranches* are yield determinants for Auto-ABS, while the yield determinants for Auto-Bonds consist of *credit rating*, the *number of lead managers*, and the *type of interest*;
2. This study noted that, except for *credit rating*, the yield determinants of Auto-ABS solely consisted of common ABS pricing;
3. The variables with the same coefficient signs for both samples were: *credit rating, time to maturity loan size,* the *number of rating agencies*, the *type of interest*, and *creditor protection*;
4. The *number of lead managers* was the only variable that exhibited a different coefficient sign;
5. Variables, which were associated with the underlying assets, contributed a greater part of the explanatory power for both security classes. However, those variables behaved differently between the two security classes.

In the next section, we discuss the results of the previous two subsections and summarize the results of the second comparison analysis between the Auto-ABS issues and Auto-Bond issues.

3.5.2.3 Discussion

This subsection discusses the results of the previous comparison analysis. Based on the results of the comparison analysis for the European automobile sector, we accept the second research hypothesis. The results provide evidence that supports the hypothesis that the Auto-ABS market provides advantages with respect to security risk profiles compared to the CB market. Further, we find that investors rely on pricing advantages of ABS transactions. We documented that Auto-ABS had a significantly lower risk profile than Auto-Bonds. Moreover, this led to a significantly lower average *primary market spread* for Auto-ABS issues. The average *primary market spread* for this asset class is 64 basis points. In contrast, Auto-Bonds exhibit an average risk premium of 128 basis points.

As a first step of the comparison analyses, we analyzed differences in common security characteristics for the two classes. This paper observed that the structure of asset-backed security transactions led to advantages for the automobile industry and the capital market investors. The structure with an underlying asset portfolio of car or leasing credits also created significantly better *credit ratings*, with an average *credit rating* of 2.80, which equaled a rating between Aa1/AA+ and Aa2/AA. Auto-Bonds, on the other hand, exhibited an average *credit rating* of 7.67, which equaled a rating between A3/A- and Baa1/BBB+. Further, this finding indicated that investors appreciated the credit enhancement instruments provided in ABS transactions. Overall, we found that Auto-ABS are far less expensive[26] and have far better risk profiles than their Auto-Bond counterparts. Thus, the univariate analysis implies why the automobile industry intensified their appearance in the European ABS market.

Second, we investigated the extent to which *spreads* of the two asset classes were priced by common pricing characteristics. We observed that *credit rating* was the only mutual determinant of the *primary market spread*. Surprisingly, investors of Auto-ABS relied solely on common pricing features, which only appeared for the securitization transaction, such as *number of tranches* and *retained interest*. Except for *credit ratings*, investors of Auto-ABS did not rely on any common security factors, which also described the pricing of corporate bond issues. This supported the results of the univariate analysis. The advantages of the ABS structure are dominant determinants that caused the shift of issuance volumes into the ABS market.

As a result of the comparison analysis, we were able to accept the second research hypothesis and conclude that differences in the Auto-ABS market and the Auto-Bond market explained a significant part of the exceptional performance of Auto ABS issues. The analysis revealed that the dissimilarities and the development of the European Auto ABS market into the most dominant submarket were a result of the presence of diverse risk profiles and distinct pricing factors. Based on significant advantages for securitization issues to refinance car or leasing credits, the automobile industry expanded their activities in the Auto-ABS market, which increased the outperformance of Auto-ABS in the European ABS market.

[26] With respect to Risk Premium.

3.6 Conclusion

Research reports by Creditreform Financial Research (2015), Roland Berger Strategy Consultant (2016), and DZ Bank (2013, 2015) investigated that the European Auto-ABS market developed into the most dominant European ABS submarket since the recovery of ABS in the year 2010. Based on these research reports, this paper investigated the European ABS market after the 2007 financial crisis, in greater detail. The aim was to bring in new insights that could explain the outperformance of Auto-ABS transactions in Europe. After the financial crisis in 2007, the European automobile ABS market became the largest ABS submarket in Europe. We anticipated two main causes for this: The first hypothesis was that the European Auto-ABS transactions provided greater advantages compared to their non-Auto-ABS counterparts and hence, were more suitable for ABS investors. Section 5.2 addressed the second research hypothesis. We hypothesized that securitization provided advantages for the automobile sector as an instrument for refinancing compared to corporate bonds. A research report by DZ Bank (2013) found that automotive companies superseded corporate bonds with securitization as refinancing instruments. After 2010, the European capital market experienced an ascending trend for this phenomenon.

Thus, to find evidence that supported the first research hypothesis, we performed a comparison analyses for the European ABS market. We analyzed common security characteristics of the European ABS market issues over 2010-2015. This procedure aimed to provide an in-depth analysis of the risk profiles for the different ABS security classes. Within the univariate analysis, we observed that half the common pricing characteristics exhibited distinct results. The dissimilarities were especially found for characteristics, which described the security's risk profile, for example the *credit rating*, *maturity*, and *internal credit enhancement*. Similarities were found, for example, for the *number of lead managers*, the *number of rating agencies*, and *loan* as well as *transaction size*. Thereafter, as a natural follow-up, we performed regressions on the *primary market spread* and the common pricing characteristics for the two ABS samples of this study to evaluate the extent to which the yield determinants for the European Auto-ABS market and the European non-Auto-ABS market differed. This indicated the preferences of the European ABS investors and offered evidence that explained the exceptional performance of Auto-ABS transactions. The regressions revealed that nine common pricing factors exhibited different results for the European Auto-ABS market and the non-Auto-ABS market. Different results were defined in the

manner of: different impacts (coefficient value), different coefficient signs, or different significance levels. Three of the nine factors exhibited different results for both, the significance level and the coefficient sign. Based on these findings, this paper concluded that, despite the similarities found in the analysis, the European Auto-ABS market did provide significant advantages in comparison to their non-Auto-ABS counterparts. Thus, Auto-ABS was preferred by investors, which explains their performance.

In order to find evidence that supports the second research hypothesis, we investigated the European automobile industry in greater detail. We analyzed common security characteristics of the most dominant refinancing instruments (ABS, CB) to determine the risk profiles of the security classes. We found that capital market investors associated corporate bonds with a bad risk profile. For instance, the average *credit rating* of the CB market in our sample equaled almost 8, while the average *rating* of the ABS market in our sample was between 2 and 3. The risk profile resulted in an average *primary market spread* of corporate bonds that was twice the *spread* for asset-backed securities. Therefore, the structure of ABS was associated with advantages not only for the originator but also for the capital market investors. The findings supported the hypothesis that the European automobile market considered securitization more attractive as an instrument for refinancing 75% of their market sales comprising chiefly of car or leasing credits.

As a natural follow-up, we determined the yield determinants for both security classes to evaluate the extent to which investors relied on different pricing factors and whether dissimilarities could explain the shift in issuance volumes into the Auto-ABS market. We found that there were significant dissimilarities in list of yield determinants of the ABS and CB in the automobile industry. Surprisingly but interestingly, we found that, except for *credit rating,* no yield determinant of the CB market was simultaneously a yield determinant for Auto-ABS. Further, this study observed that investors in the European automobile ABS relied solely on common pricing characteristics, which described the instrument of securitization. As a result, this study concluded that Auto-ABS provided significant advantages for the purposes of automobile corporations and fixed income investors. Moreover, the findings did indicate that a significant part of the outperformance of the European Auto-ABS submarket could be explained by these advantages. Both, the better risk profile for Auto-ABS and the different sets of yield

determinants could indicate reasons for the shift in issuance volumes into the ABS market.

The comparison analyses highlighted evidence that answered the overall research question regarding the causes of the outperformance of Auto-ABS in the European ABS market. Based on the findings with respect to the two research hypotheses, we can therefore, conclude the overall research question and maintain that the advantages of Auto-ABS compared to non-Auto-ABS as well as to Auto-CB are the main causes of the outperformance of the Auto-ABS submarket.

The results of this study significantly contribute to the current research and to activities in the work field. Further, the results of the univariate analysis as well as the estimates of the regressions concerning the size of each variable's impact on the *primary market spread* may interest investment banks and corporations involved in the European securitization market. Additionally, the findings of this paper have important implications for investors of the automobile ABS market as well as for investors of the European fixed income sector. Portfolio managers, who take positions in the European fixed income and securitization sector, can consider these results when deciding to build optimal portfolios.

This study provides statistical analyses aiming to enrich the current understanding of the European ABS market and develop a framework of the market for further research. The quantitative research design was appropriate for gaining an in-depth understanding of the research objectives. The quantitative research design and its appropriateness for our purpose notwithstanding, the results are limited to the underlying mathematical models and analyses. Different models and different structures of variables will likely lead to an additional insight into the development of the European ABS market.

Moreover, the study is limited to the chosen period of time for the data sample. Further research may be carried out on the development of the European automobile ABS market after the VW-crisis in the U.S. and European automobile market. It is of interest if the market can expand the growth trajectory despite the negative impact on the European and especially, the German automobile companies (Padbidri, 2016). Further, an empirical contribution to current events could provide an analysis of spread changes, price changes, and changes in credit ratings for the European automobile ABS sector. In addition, future researchers could possibly contribute by investigating the impact of the European Central Bank's "expanded asset purchase programme". It is of

interest whether this programme did affect the primary as well as the secondary market yields of European asset-backed securities.

4 Has Quantitative Easing affected the European Asset-backed Security Market? An Empirical Analysis

4.1 Introduction

In the wake of the 2007 financial crisis, asset-backed securities (ABS) became one of the most popular financing instruments in the European fixed income market. In terms of quantitative easing (QE), the fixed income market became perhaps the most influential capital submarket. Central banks, such as the European Central Bank (ECB), used quantitative easing to stabilize the financial markets after that crisis (Arestis & Karakitsis, 2014; Melvin, 2016; Aggarwal, Paul, & Aggarwal, 2016; Joyce, Liu, & Tonks, 2014). While in most cases, QE was reduced between the years 2011 and 2015 (Mahajan, 2015; Joyce, McLaren, & Young, 2012), the ECB expanded it in 2014. Historically, the ECB started the largest QE programme in the European Monetary Union ever. In addition to interest rate changes, the ECB started an asset-purchase programme—the "Expanded Asset-Purchase Programme (APP)"—in November 2014 with a total volume of EUR 1.1 trillion until September 2016 (Priftis & Vogel, 2016). As of December 2016, the ECB not only expanded the duration of the programme until at least December 2017, but also expanded the volume to more than EUR 2.2 trillion (van Lerven, 2016; Priftis & Vogel, 2016).

The activities of the ECB are not limited to asset purchases in the secondary market but also include purchases in the primary market. Within the APP, the ECB is expected to expand its total assets from EUR 2.038 trillion in September 2014 to almost EUR 4.5 trillion in December 2017. This, on achievement, will be the largest balance sheet total in the history of the European Monetary Union. This paper investigates one specific part of the APP. The study focuses on the influence of the "Asset-Backed Security Purchase Programme (ABSPP)" on the European asset-backed security market. The European ABS market experienced a continuous recovery after its breakdown during the crisis. In 2015, the total value of the European primary ABS market equaled EUR 213 billion, which was an increase of almost 20% compared to 2014. Research reports by AXA (2015) and DZ Bank (2015) investigated the impact of the ABSPP on the securitization market and evaluated the necessity of implementing the QE of the ECB. Further, research reports by Pimco (2015) and Allianz (2015) determined whether the APP had the expected impact on the financial markets, such as the European securitization market. Further, research reports by DZ Bank (2015, 2016) investigated the impact of the ABSPP on the secondary market

and the changes brought about as a result. They observed the development of secondary market prices compared to prices prior to the implementation of the APP in 2015 and discussed possible impact on the development of the secondary ABS market in 2016, respectively.

These research reports, then, not only evaluate the development in prices as brought about by these asset-backed securities, which are suitable for the APP, but also note the price development in the European ABS market in total. Moreover, a research report by Helaba (2016) investigates the changes in the APP after the ECB press conference in March 2016, where the ECB announced the further expansion of the QE programme of 2014. The progress of the QE programme is discussed until March 2016 while the impact of the expansion on the fixed income market in the European Monetary Union is given equal importance.

As of June 2016, the ECB purchased asset-backed securities worth more than EUR 20 billion. Thus, in addition to current research, this paper empirically investigates the impact of QE on the European primary ABS market. This study analyzes the effects of QE on common security characteristics of the primary ABS market as well as on the primary market spread. Further, we examine if QE was also directly influencing the yield of Euro-denominated ABS.

To fill research gaps, this paper empirically investigates the European ABS market. This study addresses the quantitative easing programme of the European Central Bank. To be more specific, it analyzes the impact of the "Asset-Backed Security Purchase Programme" on the European ABS market. The paper compares European asset-backed securities before and during the period of quantitative easing. This paper provides empirical analyses performed on second-hand data samples. A total of one univariate, three student t-tests, one Chow-test, and five regression analyses are performed with the aim of finding evidence that supports the research hypotheses.

Through the course of the investigation, this paper is organized as follows: Chapter 2 provides a *Literature Review*, identifying the research gaps in great detail. This is followed by the *Methodology*, *Data Description,* and *Results* which comprises the results of the empirical analyses. After every analysis, is a section that discusses the contributions to the two major research objectives, separately. The conclusion presents the *Limitations, Market Implications,* and *Future Research*.

4.2 Literature Review and Hypotheses

According to Blum and DiAngelo (1997) as well as Choudhry and Fabozzi (2004), Fermanian (2011), and Vink and Thibeault (2008), the European securitization market consists of three main security classes: Asset-backed securities (ABS), mortgage-backed securities (MBS), and collateralized debt obligations (CDO). Often, the term "asset-backed securities" is used to describe all three security classes, together. To avoid confusion, if this paper refers to asset-backed securities, it indicates the asset class "asset-backed securities".

Research regarding quantitative easing around the world concerns itself with many different effects of the quantitative easing programmes. Mann and Klachkin (2015) investigate how quantitative easing of the Federal Reserve Bank has affected the U.S. Treasury Auction Market. They find that the relationships of the influential factors with the yield of the treasury bonds change with QE. Further, they find that correlations develop differently with QE and that QE exercises a downward pressure on bond yields. Lo Duca, Nicoletti, and Martínez (2016) investigate the role of U.S. quantitative easing on the global corporate bond issuance. They find that U.S. QE strongly impacts the gross corporate bond issuance not only in advanced but also, in emerging economies. Especially, asset holdings and purchases initiate investors to move to other asset classes, leading to stronger corporate bond issuance across the globe. Olsen (2014) analyzes the impact of the quantitative easing programmes of the Federal Reserve Bank on equity prices in the U.S. The paper finds that due to asset purchases through the U.S. Federal Reserve in the fixed income market, investors have been able to drive stock prices in the U.S. equity market.

Gern, Jannsen, and Kooths (2015) discuss transmission channels and risks across quantitative easing in the European Monetary Union. They find that QE in the European Monetary Union comes with various risks and leads to unintended consequences in the European economies. Steeley (2015) investigates the side effects of QE in the U.K. bond market. He finds that QE leads to a sustained reduction in the costs of trading as well as elimination of return regularities.

Christensen and Rudebusch (2012) investigate the response of interest rates on the U.S. and the U.K. quantitative easing programmes. They observe different results for these regions. Declines in the U.S. yields mainly reflect lower expectations of future short-term interest rates, while on the other hand, declines in the U.K. yields are explained through reduced term premiums. Mortimer-Lee (2012) analyses the effects

and risks of the global monetary policy. He finds different risks taken from different central banks. Das (2014) describes the expectations and hopes of the negative interest rate policy of the ECB.

In literature, there is scarce research on the asset purchase programme of the European Central Bank. Research reports by the DZ Bank (2015, 2016), Helaba (2016), and AXA (2015) investigate the impact of the programme on the European securitization market. The analyses are thereby, limited to the secondary market. They find that yields of ABS, MBS, and CDO vary during the time of QE. The spreads over the three asset classes tighten with an increasing number of asset purchases in the European securitization market. In fact, in 2015, the spread tightened almost 50% compared to spread levels of 2014. Moreover, credit rating changes become significantly more positive during QE than before the implementation of the APP. The increase in volume as well as the longer duration of the APP are expected to influence the secondary market even more. On the other hand, the research reports find that due to the negative interest levels, investors avoid European securitization transactions in search for high yields and high returns. Low interest levels drive investors into markets with higher returns, such as high-yield bonds, corporate bonds, or equity markets. Asset-backed securities tend to have lower premiums as a result of lower risk profiles and may not be interesting enough for investors after the March 2016 decline in interest rates.

Nevertheless, the research reports raise the question, whether the "Asset-Backed Security Purchase Programme" not only influences the secondary market but also, the primary market. Hence, this paper proposes the overall research question: "*Has quantitative easing affected the primary European asset-backed security market?*" We divide this question into three research hypotheses. Based on the results of Mann and Klachkin (2015), Christensen and Rudebusch (2012) as well as the observations of the effects of the ABSPP on the secondary market in the research reports by AXA (2015) and DZ Bank (2015), we hypothesize that QE has affected the primary European ABS market and that common pricing variables differ significantly in value between the issues before and after November 2014. Hence, the first research hypothesis states: "*Quantitative easing has affected the security characteristics of European ABS issues*". Further, based on the findings of Gern, Jannsen, and Kooths (2015) and the observations regarding the secondary market in research reports by DZ Bank (2016) and Helaba (2016), we expect differences in the pricing factors of asset-backed securities in the

European market due to quantitative easing, and propose the second research hypothesis, which states: "*ABS investors rely on different yield determinants in the time of QE*". Lastly, based on the results of Lo Duca, Nicoletti, and Martínez (2016), Das (2014), and Steeley (2015) and the observations of the research reports by DZ Bank (2015, 2016), we expect QE to provide evidence on the influence of the primary market spread on ABS issues. Hence, we propose the third research hypothesis: "Q*uantitative easing affected the primary yield of ABS issues".*

The first hypothesis addresses the market regarding issuance, yield, and market structure. The second hypothesis investigates whether QE has led to a structural change with respect to the yield determinants of European ABS. Within the third research hypothesis, we analyze the extent to which QE has affected the primary market spread for European ABS issues.

Overall, we hypothesize that the European ABS primary market is influenced by QE. A univariate analysis is performed to evaluate differences in the security characteristics of the data sample to find support for the first hypothesis. A Chow test analyzes the second research hypothesis. The Chow test, also defined as an econometric test, is a special test for structural change, which determines whether the estimates in a regression analysis are equal in the subsamples of the original data sample. Chow (1960) states that "the standard F-test for the equality of two sets of coefficients in linear regression models" be termed a Chow test (Vink & Thibeault, 2008). Since we have documented the extent to which the pricing factors for different subsets of the European ABS market show significant differences, we conclude our empirical analyses by examining the factors that impact the primary market spread of our securities. A panel-data fixed-effects model is used to investigate the relationships between the common pricing characteristics and the primary market spread. Should hypothesis 2 be accepted, we will perform ordinary least square regressions on different subsamples of the European ABS market. The third hypothesis investigates whether QE is a yield determinant, and thus provides direct evidence for the impact on the yield of the European ABS market during the ABSPP. This analysis investigates whether quantitative easing is associated with a direct influence on the primary market spread. In this manner, quantitative easing, as a quantitative variable, is included in the panel-data fixed-effects model.

4.3 Research Methodology

The empirical analysis presented in this study is restricted to European asset-backed security issues—for which data on common pricing characteristics and *spreads* were available or computable—denominated in Euro during 2010-2016. The issuance *spreads* over the corresponding maturity benchmark reflect investors' perceptions regarding the risks of loss. Moreover, the spread also represents liquidity conditions for the corresponding security (Gabbi & Sironi, 2005). As such, they are a function of the common pricing characteristics (Liu, Shi, Wang, & Wu, 2009), which can be divided into three main categories: *Default and recovery risk characteristics, marketability characteristics,* and *systemic risk characteristics* (Gabbi & Sironi, 2005; Vink & Thibeault, 2008; Elton, Gruber, Agrawal, & Mann, 2001; Collin-Dufresne, Goldstein, & Martin, 2001).

Following this reasoning, our empirical analyses involves regressions, univariate analyses, and several statistical methods in order to find support for the research hypotheses and determine the impact of the ABSPP on the European primary asset-backed security market.

Note that, as a result of the analysis of the European primary asset-backed security market, this study is based on the *primary market spreads* of the issues. In order to analyze the yield of ABS transactions at issuance, this study has to model a variable that represents the yield of the transactions and, include the variations over the time period. The *primary market spread*, also called loan spread, represents the risk premium. On the basis of information available at the time of issue, the risk premium is the price for the risk associated with the security. This study defines the *primary market spread* as the offered yield to maturity of the security at issuance above the yield to maturity at auction of a corresponding treasury benchmark (Vink & Thibeault, 2008; Collin-Dufresne, Goldstein, & Martin, 2001). Vink and Thibeault (2008), Vink and Fabozzi (2012), Gabbi and Sironi (2005), and Collin-Dufresne, Goldstein, and Martin (2001) suggest the following procedure to obtain a suitable treasury benchmark: First, the benchmark is obligated to be Euro-denominated; second, the benchmark is obligated to be issued at a comparable auction date; and third, the benchmark has to offer a comparable time to maturity.

Within the next paragraph, to find support for the research hypotheses, we discuss the common pricing characteristics and their expected impact on the *primary*

market spread. Since the *spreads* are a function of common pricing characteristics, we need variables that describe our set of securities. The list of common pricing characteristics is introduced in the Tables 24, 25, and 26 below (Vink & Thibeault, 2008; Vink & Fabozzi, 2012; Gabbi & Sironi, 2005; Merton, 1974; Liu & Thakor, 1984). Table 24 reports the default and recovery risk characteristics (Buscaino, Caselli, Corielli, & Gatti, 2012; Chen, Lesmond, & Wei, 2007; Kavussanos & Tsouknidis, 2014; Amira, 2004; Grandes & Peter, 2004; Shin & Kim, 2013; Campbell & Cocco, 2015; Wong, Fung, & Fong, 2004; Ammer & Clinton, 2004). The first column names the introduced variable. The second column describes the structure of the variable in this study.

Table 24: *Default and Recovery Risk Characteristics*

Variable	Description	Expected Impact	Source
Rating	Average value of assigned ratings	Positive relationship	Liu & Thakor (1984)[27]
Maturity	Measured in years	Positive relationship	Merton (1974)[28]
Extern	Equal 1 if extern enhancement is provided	Negative relationship	Vink & Thibeault
Loan to Value	Subordination level of tranche in %	Positive relationship	Vink & Thibeault

The considered rating agencies are Moody's, Standard and Poor's, and Fitch. The rating values 1, …, 10 correspond to the ratings Aaa/AAA, …, Baa3/BBB-. Ratings lower than Baa3/BBB- are not purchased by the ECB and hence do not appear in our data samples.

The third column provides the expected impact of this variable on the *primary market spread* in the regression analyses (Mayer, Pence, & Sherlund, 2009; Bajari, Chenghuan, & Minjung, 2008; Deng & Quingley, 2012; Fabozzi & Roever, 2003; Schwartz & Torous, 1993). The last column provides an overview of literature, in which the variables were introduced.

Table 25: *Marketability Characteristics*

Variable	Description	Expected Impact	Source
Loan Size	Natural log of the tranche's amount	Negative relationship	Gabbi & Sironi (2005)[31]
Transaction Size	Natural log of the ABS transactions' amount	Negative relationship	Vink & Thibeault (2008)
Tranches	Number of tranches	Negative relationship	Vink & Fabozzi (2012)[32]
Managers	Number of lead managers	Negative relationship	Gabbi & Sironi (2005)[32]
Agencies	Number of rating agencies	Negative relationship	Vink & Fabozzi (2012)[32]
Float	1 if type of interest is floating rate	Negative relationship	Gabbi & Sironi (2005)[32]

[27] Further sources: Vink & Thibeault (2008), Vink & Fabozzi (2012), Buscaino, Caselli, Corielli, & Gatti (2012), Chen, Lesmond, & Wei (2007), Kavussanos & Tsouknidis (2014), Amira (2004), Ammer & Clinton (2004)

[28] Further sources: Gabbi & Sironi (2005), Vink & Thibeualt (2008), Amira (2004), Grandes & Peter (2004), Shin & Kim (2013)

[29] Further sources: Fabozzi & Roever (2003)

[30] Further sources: Wong, Fung, Fong, & Sze (2004), Campbell & Cocco (2011), Deng & Quigley (2004), Schwartz & Torous (1993), Mayer, Pence, & Sherlund (2009), and Bajari, Chenghuan, & Minjung (2008)

[31] Further sources: Qi & Yang (2009), Calem & Lacour-Little (2004), Pennington-Cross (2003)

[32] Further sources: Vink & Thibeault (2008)

Retained Interest	1 if retained interest appears in transaction	Negative relationship	Vink & Thibeault (2008)[33]

Size and Amount describe the Euro equivalent amount at issuance. If the coupon of a transaction is floating rated, the coupon payments can vary over time and are linked to a floating interest rate, such as the 3-month EURIBOR. Retained interest is an internal credit enhancement measure, which describes if the originator retains interest in order to overcome first losses of the underlying assets.

Table 25 introduces the marketability characteristics (Qi & Yang, 2009; Calem & Lacour-Little, 2004; Pennington-Cross, 2003). We expect all marketability characteristics to be negatively related with the *primary market spread*. All variables should, ceteris paribus, increase the secondary marketability for the regarding transaction.

Table 26: *Systemic Risk Characteristics*

Variable	Description	Expected Impact	Source
Creditor Protection	1 if creditor protection is provided	Negative relationship	Vink & Fabozzi (2012)
Quantitative Easing	1 if tranche was issued during QE period	Negative relationship	

Creditor Protection describes a dummy variable that equals one if the country in which the transaction is issued provides creditor protection in the form of "no automatic stay on the assets" and zero otherwise. QE describes a dummy variable, which is equal to one if a tranche was issued during the QE period, and zero otherwise.

Table 26 presents the systemic risk characteristics (An, Deng, Nichols, & Sanders, 2014; Ashcraft & Schuermann, 2008; Childs, Ott, & Riddiough, 1996). Further, we include one control variable in our statistical analyses. The control variable is called "year i". Year i describes the year dummies. Each dummy variable is equal to 1 if issue i has been completed during the corresponding year, and zero, otherwise. These variables should capture the variations in fixed income market conditions (Gabbi & Sironi, 2005). Due to the highest correlation with the common pricing characteristics, the year dummy for 2012 is excluded from the regression model to avoid over sensitivity.

In the empirical analyses of this study, the common pricing characteristics are used as variables of interest with the purpose of determining structural differences as well as effects of QE on the set of European ABS issues. In the univariate analyses as well as in the statistical tests, the pricing factors combined with the *primary market spread* are compared among themselves. In the regression analyses, the *primary market spread* is used as a dependent variable. Following the above approach, the set of independent variables in this paper consists of the common security features. Since time from issuance is equal to zero for all issues, the factors mentioned above are considered

[33] Further Sources: An, Deng, Nichols, & Sanders (2014), Ashcraft & Schuermann (2008), Childs, Ott, & Riddiough (1996)

at the time of issuance. In order to provide comparability for all issues in this study, the probable changes in the variables over the time period are not considered here.

The set of independent variables consists both of discrete and dummy variables. The discrete variables are *credit rating*, *maturity*, *transactions size*, *loan size*, as well as *loan to value, #tranches*, *#lead managers*, and *#rating agencies*. The set of dummy variables consists of *extern enhancement*, *retained interest*, *float*, *currency risk*, *quantitative easing,* and *creditor protection*. In the univariate analysis, all variables are analyzed and tested, separately. The regressions measure the effects of all independent variables on the *primary market spread*.

4.4 Data Description

This chapter introduces the data sample and presents and discusses important factors for the following analyses. The data sample describes the European asset-backed security market and provides details about the properties of the transactions.

4.4.1 Data Samples

The principal data source for this segment is the Asset Backed Watcher, published by DZ Bank. The DZ Bank is a leading publisher of European ABS issues. We construct a unique dataset of various metrics, which contains detailed information on securitization of European securities from January 1, 2010, through June 30, 2016. The period indicates the time when the European ABS market experienced a recovery from the 2007 financial crisis until some uncertainty faced by the European ABS market after June 2016 with regard to the "Brexit" vote in the U.K. (True Sale International, 2016). In the following sections, we refer to this sample as the "full sample".

The full sample contains information on 591 European asset-backed security tranches issued in 231 transactions with a total value of EUR 186 billion. Although the full sample is comprehensive, for the purpose of this study, we note that it has one limitation. For comparison, we need the transactions to provide information on *default and recovery risk characteristics, marketability characteristics,* and *systemic risk characteristics.* The following variables are classified as default and recovery characteristics: *Credit rating, time to maturity, extern enhancement,* and *loan to value.* The group of marketability characteristics consists of: *Size of the tranche, number of tranches, size of the whole transaction, number of lead managers, number of involved credit rating agencies, type of interest rate,* and *whether the issue has retained interest*

or not. The systemic risk characteristic is *creditor protection* (Vink & Thibeault, 2008; Vink & Fabozzi, 2012). Tranches, for which detailed information about the above variables are not available, are deleted from the full sample. Further, we restrict the full sample to the limitations of the ABSPP. The main reason for reduction is the restriction on transactions—those that have been issued by an originator based in the European Monetary Union and those, which have been denominated in Euro. Further reasons for reduction are the *credit rating* limit, credit enhancement targets, and the structure of the underlying asset portfolio. The reduced sample is called the "high information sample". The high information sample contains 369 asset-backed security tranches issued in 209 transactions with a total value of EUR 152 billion.

Table 27: *Comparison of the ABS samples*

Variable of interest	ABS full sample			ABS high information sample			Survival
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev	rate
Coupon rate (bp)	591	148	133	368	134	103	62.27%
Risk premium (bp)[7]	368	89	87	368	89	87	100%
Credit rating (1-21 weak)	591	3.68	2.77	368	3.45	2.68	62.27%
Loan to value (%)[7]	368	16.83	21.56	368	16.83	21.56	100%
Time to maturity (years)	591	12.62	9.13	368	13.27	8.04	62.27%
Issues with extern enhancement	523	4.8%	-	368	5.2%	-	70.36%
Loan tranche size (EUR mio.)	555	399	426	368	413	522	66.31%
Transaction size (EUR mio.)	231	855	705	209	871	803	90.48%
Number of tranches	231	2.76	1.15	209	2.57	0.98	90.48%
Number of lead managers	574	2.08	0.93	368	2.17	0.74	64.11%
Number of credit rating agencies	591	1.49	0.59	368	1.60	0.54	62.27%
Loans with retained interest[34]	368	61.41%	-	368	61.41%	-	100%
Loans with fixed rate	591	27%	-	368	30.98%	-	62.27%
Loans with floating rate	591	73%	-	368	69.02%	-	62.27%
Loans with creditor protection[7]	368	56.79%	-	368	56.79%	-	100%

Column 1 represents the common pricing variables. Column 2 presents the number, the mean, and the standard deviation of each variable in the working sample. Column 3 describes the number, the mean, and the standard deviation of each variable associated with the high information sample. Column 4 describes the survival rate for each variable. This rate is calculated by dividing the number of issues of each variable of the high information sample by the number of issues of each variable of the working sample.

A comparison between the common pricing variables in the high information sample and the full sample in Table 27 reveals that issues of both samples are not dissimilar to their counterparts. Hence, we assume that any empirical results derived

[34] The variable was only calculated for the high information sample.

from the issues of the high information sample can be generalized to the larger population in the full sample.

4.5 Empirical Results

This section investigates how common pricing characteristics compared for the European ABS market before and after the implementation of quantitative easing through the European Central Bank in November 2014. The aim here is to provide extensive insights into the common pricing factors associated with the European ABS market, and elaborate on any substantial differences between the transactions issued before the APP and transactions issued during the QE. We hypothesized that the common pricing characteristics between the two subsamples differed significantly in value, and therefore, an effect of quantitative easing on the European ABS market was measurable. Moreover, we compared two further subsamples of the high information sample included in this paper. Research reports by the DZ Bank (2014, 2015, 2016) indicated that the influence of the asset-purchase programme was significantly higher on high-quality credit rating issues and issues that provided higher levels of subordination, e.g. senior tranches. This was a result of restrictions of the European Central Bank purchases, which primarily focused on tranches of asset-backed securities with the above characteristics. High-quality credit rating issues were filtered with the variable *credit rating*. The following breaking point has been used in the empirical analyses: *credit rating* has to be better or equal to four (Aa3/AA-). The senior tranche of each transaction is chosen to describe issues with higher subordination levels. In the following, the tranches issued before the implementation of the asset-purchase programme by ECB are called “ABS”. Tranches issued during quantitative easing are called “QE”.

4.5.1 Univariate Analysis

This section investigates how common pricing characteristics compare for the securities before and after the implementation of the ECB quantitative easing programme. First, we determine the differences between the subsamples for the purpose of providing insight into the effects of quantitative easing on the European ABS market. Second, we use a parametric test—Student’s t-test—to compare whether the distribution of the values reported for the securities of the high information sample are significantly different when the implementation of the ABSPP is used as a breaking point. Table 28 contains the summary statistics of the discrete variables for the common pricing factors.

Each security class is categorized by two sets of observations. The first set relates all the asset-backed security information for the subsample containing only tranches that are issued before the implementation of quantitative easing in the European securitization market. The second set is associated with all the asset-backed security information for the subsample and contains only tranches that are issued during the period of quantitative easing by the ECB.

Table 28: *Univariate Comparison of the Discrete Characteristics for European ABS*

(1) Variable of interest	(2) Security class					
	High Information Sample		High Rating Issues		Senior Tranche Issues	
	ABS	QE	ABS	QE	ABS	QE
Primary Market Spread (bp)						
Number	262	106	168	57	152	57
Mean	92.94	77.52	67.43	46.64	68.29	48.59
Median	73.55	64.50	59.50	45.80	55.65	42.80
Min.	-143.0	-47.0	-143.0	-47.0	-98.80	-47.00
Max	595.0	306.0	263.0	126.0	379.2	255.0
Std. Dev.	92.58	69.43	70.06	35.53	74.73	47.97
Credit Rating (1-15 weak)						
Number	262	106	168	57	152	57
Mean	3.24	3.98	1.49	1.83	1.87	2.54
Median	2.0	3.0	1.0	1.0	1.0	1.0
Min.	1.0	1.0	1.0	1.0	1.0	1.0
Max	10.0	10.0	4.0	4.0	9.5	9.0
Std. Dev.	2.66	2.67	0.96	0.95	1.94	2.07
Loan to Value (%)						
Number	262	106	168	57	152	57
Mean	16.94%	16.55%	21.69%	19.4%	21.93%	19.13%
Median	7.95%	10.81%	11.72%	11.0%	12.36%	13.02%
Min.	0.00%	0.00%	0.0%	0.00%	0.00%	0.58%
Max	100.00%	72.50%	100.0%	72.5%	100.0%	72.50%
Std. Dev.	23.41%	16.21%	25.43%	18.75%	24.60%	17.64%
Time to Maturity (years)						
Number	262	106	168	57	152	57
Mean	12.35	15.55	12.91	14.70	13.11	15.01
Median	9.51	14.98	9.61	13.02	10.40	14.41
Min.	3.52	3.91	3.52	5.82	3.52	3.91
Max	50.0	43.86	42.58	43.86	50.03	43.86
Std. Dev.	7.95	7.86	8.29	7.81	8.34	8.30
Loan Tranche Size (Euro millions)						
Number	262	106	168	57	152	57
Mean	411.2	417.9	543.9	557.9	668.6	723.9
Median	296.9	277.1	475.8	500.0	549.0	633.5
Min.	0.1	1.0	9.0	1.0	21.6	100.0
Max	3502.5	3015.0	3502.5	2590.0	3502.5	3015.0
Std. Dev.	520.96	525.68	540.78	437.36	551.71	554.87
Transaction Size (Euro millions)						
Number	152	57	132	45	152	57
Mean	850.1	921.1	793.8	849.6	850.1	921.1
Median	683.1	796.9	630.0	796.9	683.1	796.9
Min.	52.3	144.2	49.8	144.2	52.3	144.2
Max	5832.0	4077.0	5832.0	3000.0	5832.0	4077.0

Std. Dev.	835.98	710.84	848.52	495.21	835.98	710.84
Number of Tranches						
Number	262	106	168	57	152	57
Mean	2.61	3.32	2.53	3.12	2.45	2.88
Median	2.0	3.0	2.0	2.0	2.0	2.0
Min.	1.0	2.0	1.0	2.0	1.0	2.0
Max	5.0	6.0	5.0	6.0	5.0	6.0
Std. Dev.	0.85	1.23	0.82	1.31	0.85	1.23
Number of Lead Managers						
Number	262	106	168	57	152	57
Mean	2.19	2.11	2.27	2.19	2.19	2.04
Median	2.0	2.0	2.0	2.0	2.0	2.0
Min.	1.0	1.0	1.0	1.0	1.0	1.0
Max	5.0	4.0	5.0	4.0	5.0	4.0
Std. Dev.	0.70	0.82	0.72	0.81	0.69	0.84
Number of Rating Agencies						
Number	262	106	168	57	152	57
Mean	1.65	1.48	1.75	1.53	1.66	1.49
Median	2.0	1.0	2.0	1.0	2.0	1.5
Min.	1.0	1.0	1.0	1.0	1.0	1.0
Max	3.0	3.0	3.0	3.0	3.0	3.0
Std. Dev.	0.53	0.56	0.50	0.57	0.54	0.57

Table 28 provides a univariate analysis of the discrete variables of the high information sample, the high rating sample, and the high subordination sample categorized with the implementation of QE as breaking point. Column 1 represents the common pricing characteristics. Column 2 presents the values associated with each variable.

Note that the lowest *primary market spread* of the European ABS market equals -1.43%, which is a relatively wide negative spread compared to all other tranches. This enormous negative spread is a result of a *time to maturity* equal to 29 years and an offered yield at auction of 2% with a fixed coupon rate. This has been seen as a very low yield at auction for an almost 30 year asset-backed security in the year 2011. Compared to this low yield at auction, the corresponding currency treasury 30 year benchmark was offered with a yield at 3.43%, which was a usual yield for a 30 year European treasury bond in 2011. Thus, due to a "triple A" rating and a very extensive internal credit enhancement, the originator was able to offer a yield at auction 143 basis points lower than the corresponding currency treasury benchmark. We still consider the chosen benchmark as suitable, since the time to maturity is 30 years (which means that treasury benchmarks offer a higher yield at auction) and the lower yield of the security can be explained by the low risk of default and the extensive internal credit enhancement of the originator.

Table 29 contains the summary statistics classified by the dummy variables of the common pricing factors.

Table 29: *Univariate Comparison of the Dummy Characteristics for European ABS*

(1) Variable of interest	(2) Security class					
	High Information Sample		High Rating Issues		Senior Tranche Issues	
	ABS	QE	ABS	QE	ABS	QE
Extern Enhancement (dummy)						
Number	262	106	168	57	152	57
Mean	0.07	0	0.10	0	0.11	0
Median	-	-	-	-	-	-
Min.	-	-	-	-	-	-
Max	-	-	-	-	-	-
Std. Dev.	-	-	-	-	-	-
Retained Interest (dummy)						
Number	262	106	168	57	152	57
Mean	0.60	0.66	0.65	0.74	0.61	0.72
Median	-	-	-	-	-	-
Min.	-	-	-	-	-	-
Max	-	-	-	-	-	-
Std. Dev.	-	-	-	-	-	-
Creditor Protection (dummy)						
Number	262	106	168	57	152	57
Mean	0.63	0.43	0.61	0.42	0.57	0.46
Median	-	-	-	-	-	-
Min.	-	-	-	-	-	-
Max	-	-	-	-	-	-
Std. Dev.	-	-	-	-	-	-
Floating Rate Issue (dummy)						
Number	262	106	168	57	152	57
Mean	0.70	0.66	0.77	0.84	0.74	0.70
Median	-	-	-	-	-	-
Min.	-	-	-	-	-	-
Max	-	-	-	-	-	-
Std. Dev.	-	-	-	-	-	-

Table 29 provides a univariate analysis for the dummy variables of the high information sample, the high rating sample, and the high subordination sample categorized with the implementation of QE as breaking point. Column 1 represents the common pricing characteristics. Column 2 presents the values associated with each variable.

Table 30 shows the results for the parametric Student's t-test for all three security classes classified by the common pricing characteristics.

Table 30: *Two-Sample t-Tests Assuming Unequal Variances for European ABS*

(1) Variable of interest	(2) Security class		
	High Information Sample ABS versus QE	High Rating Issues ABS versus QE	Senior Tranche Issues ABS versus QE
Primary Market Spread (bp)	-1.74 *	-2.90 ***	-2.24 **
Credit Rating (1-15 weak)	2.39 **	2.34 **	2.13 **
Loan to Value (%)	-0.18	-0.73	-0.91
Time to Maturity (years)	3.52 ****	1.47	1.47
Loan Tranche Size (Euro millions)	0.11	0.20	0.64
Transaction Size (Euro millions)	0.61	0.28	0.61

Extern Enhancement (0/1)	-4.52 ****	-4.19 ****	-4.22 ****
Retained Interest (0/1)	1.18	1.27	1.65 *
Number of Tranches	4.84 ****	3.06 ***	2.40 **
Number of Lead Managers	-0.81	-0.67	-1.25
Number of Rating Agencies	-2.72 ***	-2.57 **	-1.91 *
Creditor Protection (0/1)	-3.55 ****	-2.45 **	-1.41
Floating Rate Issue (0/1)	-0.77	1.17	-0.50
Significance Levels	0 '****' 0.001 ' ***' 0.01 '**' 0.05 '*' 0.1 ' ' 1		

Table 30 represents significance tests for the differences in values between the European ABS issued before and after the implementation of QE by ECB. * indicates the significance level of the difference of the common pricing characteristics of the two corresponding subsets. All other common pricing do not differ significantly between the two subsets at the 10% significance level.

4.5.1.1 Univariate Results

This subsection discusses the findings reported in Tables 28, 29, and 30. The results of the univariate analysis are simultaneously discussed with the results of the parametric tests. High rating issues have to provide a *rating* better than or equal to 4 while high subordinated issues have to be the senior tranche of their transaction. The values reported in Table 30 are t-statistics. This paper observes that many of the pair-wise comparisons for the high information sample, the high rating sample, and the senior tranche sample indicate statistically significant differences between the common pricing characteristics associated with the different subsamples of the high information sample of European ABS.

The relative pricing of asset-backed security issues shows that the average (median) *spreads* are statistically and significantly lower for QE issues for the high information sample, the high quality rating issues, with 77.52 basis points (64.50 basis points) and 46.64 basis points (45.80 basis points), and the senior tranches, with 48.59 basis points (442.80 basis points), than they are for the ABS issues, with 92.94 basis points (73.55 basis points), 67.43 basis points (59.50 basis points), and 68.29 basis points (55.65 basis points). Hence, ABS issues, on average, tend to be less risky than their QE counterparts. This is also confirmed by the *credit rating*. Since *credit rating* and *spread* tend to have an inverse relationship, it is very surprising that the average *credit rating* of ABS, with 3.24, 1.49 , and 1.87, is significantly lower than the credit rating for QE issues, with 3.98, 1.83, and 2.54, for the three analyzed subsamples. Most observers would have predicted that QE loans have lower *credit ratings*, since the risk premia are lower on average. Hence, the results indicate the first impact of the ECB. The ECB, as a new participant, is heavily investing in the primary market, which leads to lower *spreads* for

QE issues, even though they tend to have worse risk profile. On the one hand, *spread* level and *credit rating*, in general, provide direct evidence of the riskiness of an ABS transaction, but on the other hand, the *number of rating agencies* and *the number of lead managers* involved in the rating process also provide (indirect) evidence of the riskiness of a loan (Vink & Thibeault, 2008). The average number (median) of participating *lead managers* is around 2.20 (2.0) for both security classes and all subsamples. ABS issues have an average of 1.65 (median 2.0) *rating agencies* involved for all subsamples, which is significantly higher than the average of 1.53 (median 1.0) *credit rating agencies* involved for QE issues. Thus, the difficulty to underwrite the issues, indicated by the *number of lead managers,* has not changed during the ABSPP. It is difficult to explain why QE issues have a significantly lower *number of rating agencies* involved in the rating process though one possible factor could be that the ECB is not restricting its activities in the ABS market to a *number of rating agencies* higher than one. The ECB officially announced that issues, which are considered for purchase, only need to provide one *credit rating* better than 10 (Baa3/BBB-). Thus, this announcement could lead to the significantly lower *number of rating agencies,* in consideration that originators could issue the transaction at lower costs when involving a smaller conglomerate of rating agencies.

Statistically, the *loan tranche size* and the *transaction size* are not significantly different for the subsamples of the ABS and QE issues. However, ABS issues exhibit the lower average (median) *loan tranche size* with EUR 411.2 million (EUR 296.9 million) for the high information sample, EUR 543.9 million (EUR 475.8 million) for high rating issues, and EUR 668.6 million (EUR 549 million) for the senior tranches compared to EUR 417.9 million (EUR 277.1 million), EUR 557.9 million (EUR 500.0 million), and EUR 723.9 million (EUR 633.5 million), respectively, for QE issues. Not surprisingly, QE issues exhibit the larger, on average (median) *transaction size* for the high information sample, the high rating sample, and the senior tranche sample, amounting to EUR 921.1 million (EUR 796.9 million), EUR 849.6 million (EUR 796.9 million), and EUR 921.1 million (EUR 144.2 million) compared to EUR 850.1 million (EUR 683.1 million), EUR 793.8 million (EUR 630.0 million), and EUR 850.1 million (EUR 683.1 million) for the ABS sample. Although the issuance volume increased considerably during quantitative easing, the APP has not significantly affected the European ABS market with respect to *loan* or *transaction size*. The two variables exhibit similar results in the t-statistics for all subsamples. This is reinforced by the

observation that a typical ABS transaction in our sample is divided into more *tranches*. Moreover, they participate differently in the asset cash flows, and thus, reduce the size of each loan tranche in the transactions (Vink & Thibeault, 2008). In a typical QE transaction of our data sample, for example, the average *number (*median) *of tranches per transaction* is 3.32 (3.0): significantly higher than the average number (median) of 2.61 (2.0) *tranches* for the ABS issues. This finding can also be observed for the high rating sample with 3.12 (2.0) tranches for QE issues compared to 2.53 (2.0) *tranches* for ABS transactions, and for the senior tranches with 2.88 (2.0) for QE issues versus 2.45 (2.0) *tranches* for ABS issues, respectively. Further, the *cumulative subordination level,* measured by the variable *loan to value* in each transaction is layered, so that each position benefits from all the positions subordinated to it in terms of credit protection and default risk. We find that ABS issues have the higher average *loan to value* level for all three subsamples with 16.94% for the high information sample, 21.69% for the high rating issues, and 21.93% for the senior tranches. The counter values for the QE issues are 16.55%, 19.4%, and 19.13%, respectively. Further, we find that the QE issues have the higher median *loan to value* ratio for the high information sample with 10.81% compared to 7.95%. For senior tranches, it is 13.02% compared to 12.36%, while ABS issues provide the higher median *loan to value* level for high rating, with 11.72% compared to 11.0%. The results show that the average of the *cumulative subordination level* is higher compared with the median across all classes and subsamples. This indicates that tranching is more comprehensive at the senior levels of an asset-backed security structure. However, the measured differences in the samples of this study are not significant.

A QE tranche of average size *matures* 15.55 years after issuance for the high information sample, which is significantly longer than the 12.35 years for ABS issues. Moreover, a QE tranche *matures* after 14.70 years for the high rating sample, and after 15.01 years for the high subordinated sample, which is longer than 12.91 years and 13.11 years for the ABS issues, respectively. Still, the data samples, as indicated by the standard deviation, exhibit significant heterogeneity with respect to *maturity*. For example, average standard deviation for *maturity* is 7.95 years for the European ABS issues, and 7.86 years for QE issues.

Extern enhancement only appears for the ABS samples in our study. An average of 7% of the tranches of the high information sample are protected by a third-party credit guarantee. Additionally, we find an average of 10% and 11% of tranches that provide

external credit enhancement for the high rating issues and senior tranches, respectively. QE issues over all three subsamples are significantly more likely to provide *internal credit enhancement* through *retained interest* than ABS issues (66% versus 60%, 74% versus 65%, and 72% versus 61%). On the other hand, ABS issues are significantly more likely to be issued in a country that provides *creditor protection* than QE issues. This study finds that 63%, 62%, and 57% of the ABS tranches are issued in countries with *creditor protection*, while only 43%, 42%, and 46% of the QE tranches are issued in those countries, respectively. Thus, we find that since the implementation of the APP, companies from, for example, France or Italy expanded their activities in the European ABS market. Hence, the results suggest that the ECB provides further incentives for companies in the European Monetary Union to participate in the securitization market.

Finally, ABS issues tend more likely to be *floating rate* credits than QE issues with 70% compared to 66% for the high information sample and 74% compared to 70% for the senior tranches, while on the other hand, high rating QE issues are more likely to be *floating rate* credits than high rating ABS issues with 84% versus 77%, respectively. Thus, with respect to the coupon rate, which can be a dominant risk factor in consideration of a changing interest rate environment, the European ABS market shows significant homogeneity through all subsamples. This is also indicated by the standard deviation with respect to the *type of interest rate*. The standard deviations of the two asset classes exhibit similar results throughout all subsamples.

4.5.1.2 Univariate Results: Conclusion

Before proceeding to the next section of this paper, in which we analyze the impact of the common pricing factors on the *primary market spread*, we briefly summarize the result of the univariate analysis. The main purpose of this section is to investigate how the common pricing features are influenced through quantitative easing. This study provides insight into the common characteristics associated with the European ABS market before and after the implementation of the ABSPP. This paper finds that most of the common pricing characteristics between ABS and QE issues in fact differ significantly. Based on these results, we accept the first hypothesis that states that quantitative easing significantly affects the characteristics of European ABS issues. In the first analysis of this study, we observe that there are important univariate differences to consider. We document, for example, that:

1. QE issues, on average, tend to be less expensive for the originators than their ABS counterparts, even though they tend to have, on average, a worse risk profile than ABS issues. This is indicated by a significantly lower *spread* and a significantly higher *credit rating* throughout all subsamples;
2. QE issues have significantly longer *maturity* levels than ABS issues;
3. ABS issues are significantly more likely to receive *extern credit enhancement* than their QE issue counterparts, while on the other hand QE issues provide higher *internal credit enhancement* than their ABS counterparts. This can be explained by restrictions for asset-backed security transactions in order to qualify for the ABSPP;
4. QE issues are divided into significantly more *tranches per transactions* compared to ABS issues;
5. QE issues have a significant lower average *number of rating agencies* involved.

After the first analysis, this study concludes that the ECB, through quantitative easing, is significantly influencing the primary asset-backed security market. The univariate differences show the enormous effect of asset purchasing in a fixed income market. The payoff profile of asset-backed securities changed during quantitative easing with a definite gain for the originators. This was indicated by the significantly lower prices, described by *primary market spreads*. Interestingly, the appearance of the ECB as a participant in the European ABS market has led to worse risk profiles for the securities. This supports the fact that originators increasingly share the risks of the underlying assets with the capital markets. However, despite the higher risk profiles, originators are able to issue their transactions at lower costs. Hence, we conclude that the ECB effectively realizes the goal of simplifying the money supply for European corporations. Additionally, quantitative easing influences the economic structure as well as economic coherence and expectations. This is indicated by the higher risk profiles of QE issues, which lead, against all economic expectations, to lower risk premia and record issuance volume. A natural follow-up of this study would be the investigation regarding the extent to which the two security classes are priced by the common pricing features.

4.5.2 Regression Analysis

4.5.2.1 Methodology

This section investigates the effect of quantitative easing on pricing factors of the European ABS market. Further, this study analyzes the extent to which the *primary market spreads* of the high information sample, high rating issues, and high subordinated issues are influenced by the European Central Bank. We anticipated that the *primary market spreads* associated with the two subsamples of the European ABS market would be influenced differently by the common pricing characteristics. In order to find support for hypothesis 2, we performed the Chow test and evaluated the Chow statistics. The subsequent sections provide a brief explanation of the further steps of our analyses. First, an ordinary least squares regression was run on the *primary market spread* (dependent variable) and the common pricing characteristics (independent variables) under the assumption that quantitative easing had no effect on the European ABS market and both samples had the same explanatory variables. Second, we obtain coefficients from separate regressions for both subsamples, and thus, run two further regressions: one for the European ABS before QE and one for European ABS after the implementation of QE in the European Monetary Union. In a next step, this paper, based on the residual sum of changes of each regression, computed an F-test of structural change—the Chow test. If the computed F-value exceeds the critical level, hypothesis 2 is to be accepted. We reject hypothesis 2 if the computed F-value remains smaller than its critical level. If hypothesis 2 is accepted, we will perform two regressions in order to determine the impact of the pricing variables on the *primary market spread* for the two subsets separately for comparison. Therefore, we evaluate the influence of QE on the impact of the yield determinants. Should hypothesis 2 be rejected, only one regression will be run to examine the relationships between the common pricing variables and the *primary market spread*. Lastly, the impact of QE as dummy variable for the high information sample is determined. The impact of QE for the high rating sample and the high subordinated sample are determined in separate regressions at the end of this chapter.

All regressions are based on the same panel-data fixed-effects model, which is:

$$\begin{aligned}\text{SPREAD}_i = {} & \beta_0 + \beta_1\text{CREDIT RATING}_i + \beta_2\text{MATURITY}_i \\ & + \beta_3\text{EXTERN ENHANCEMENT}_i + \beta_4\text{LOAN TO VALUE}_i \\ & + \beta_5\text{LOAN SIZE}_i + \beta_6\text{TRANSACTION SIZE}_i + \beta_7\text{\# TRANCHES}_i \\ & + \beta_8\text{\# LEAD MANAGERS}_i + \beta_9\text{\# RATING AGENCIES}_i \\ & + \beta_{10}\text{RETAINED}_i + \beta_{11}\text{TYPE OF INTEREST RATE}_i \\ & + \beta_{12}\text{CREDITOR PROTECTION}_i + \beta_{13}\text{QE}_i + \beta_{14}\text{YEAR OF ISSUE}_i \\ & + \varepsilon_i\end{aligned}$$

In this panel-data fixed-effects model, the control variables YEAR OF ISSUE have been included as additional independent variables. We constructed seven dummy variables based on the year of issue. YEAR=1, YEAR=2, YEAR=3, YEAR=4, YEAR=5, YEAR=6, and YEAR=7 that correspond to 2010, 2011, 2012, 2013, 2014, 2015, and 2016. Their value was 1 if the corresponding tranche was issued in the corresponding years, and zero, otherwise. These variables would capture the variations in asset-backed security market conditions (Vink & Thibeault, 2008). Due to the highest correlation with the common pricing characteristics, the year dummy for 2012 was excluded from the regression model to avoid over sensitivity. For the regressions with respect to issues within the period of QE, the year dummy for 2014 was excluded due to the highest correlation with the common pricing features to avoid over sensitivity.

For the separate regressions, the dummy variable QE was excluded since the variable did not change for either one of the two subsets and made sense to be included only when both subsets were run jointly in a regression.

4.5.2.2 Chow Test

A Chow test is performed to investigate whether the *primary market spreads* associated with the two subsets of the European ABS market are influenced differently by common pricing factors when the implementation of QE by the ECB is chosen as the breaking point. The Chow test is a particular test for structural change, also defined as an econometric test, to determine whether the coefficients in a regression model are the same in separate subsamples with a prior determined breaking point (Vink & Thibeault, 2008). The following Chow test shows the extent to which asset-backed securities in the Euro Monetary Union are priced by common pricing variables. Hereby, we analyze whether or not to reject hypothesis 2, which states that the estimates of the common pricing factors are statistically and significantly different for both subsamples.

The p-value of the Chow test equals 0.001, which means it remains smaller than its critical level. Based on this result, we accept hypothesis 2. Hence, the *primary market spreads* associated with the two subsamples are influenced differently by the common pricing characteristics. Following our analyses, we may conclude that our results confirm current market views. In accordance with current research reports, we conclude that the ABSPP of the ECB does significantly influence the fixed income market in the European Monetary Union. In conformity with research reports regarding secondary market *spreads* of ABS issues, we observe similar results for the primary market: namely, that the European Central Bank influences the set of yield determinants of European asset-backed securities through quantitative easing. In the following section, we discuss the relationship between the pricing variables and *primary market spreads* for each subsample of the European ABS market separately, for comparison.

4.5.2.3 Regression Results

This subsection examines the yield determinants of the two subsamples using ordinary least squares regressions, with *spread* as the dependent variable and the common pricing characteristics as independent variables. Based on the results from the Chow test, we run two regressions for each subset of the European ABS market, separately, to determine differences in the value of the coefficients as well as the significant levels. After the comparison of the results for the two regressions, we perform three further regressions to analyze whether quantitative easing provides direct evidence to influence the yield of the European ABS issues. Table 31 reports the results for the first two regressions of the panel-data fixed-effects model. The regressions were run on the *spread* (dependent variable) and the common security features (independent variables).

Table 31: *Determinants of European asset-backed securities – Before and During QE compared*

	ABS issues	QE issues
Variable	Reg. #1	Reg. #2
Constant	0.92	1.426 *
Credit Rating	0.177 ****	0.146 ****
Loan To Value	-0.0004	-0.002
Time To Maturity	0.001	-0.009
Extern Enhancement	-0.06	-
Loan Size	-0.021	-0.082 *
Transaction Size	-0.173 ***	-0.110
# Tranches	0.183 ****	-0.007

# Lead Managers	-0.204 ***	0.139 **
# Rating Agencies	-0.072	-0.137
Retained Interest	0.199 *	-0.302 **
Float	0.457 ****	0.061
Creditor Protection	-0.093	-0.099
Number of Observations	262	106
Adjusted R^2	0.44	0.52
F-Statistics	< 2.2e-16	1.218e-12
Significance Levels	0 '****' 0.001 ' ***' 0.01 '**' 0.05 '*' 0.1 ' ' 1	

The dependent variable is defined as the margin yielded by the security at issue above a corresponding benchmark. The dependent variable is measured in basis points. The independent variables are as follows: A credit rating variable: CR=1, CR=2, CR=3, …, CR=15, correspond to credit ratings: Aaa/AAA, Aa1/AA+, Aa2/AA, …, B2/B; Loan to Value is the subordination level expressed as a percentage of the transaction's initial principal balance; Maturity is the time to maturity from issuance measured in years; Extern Enhancement as dummy variable takes the value of 1 if the issue has an extern enhancement; Loan Size is the natural log of the tranche amount in millions of Euros; Transaction Size is the natural log of the issue amount of the transactions in million Euros; #Tranches is the number tranches per transactions; #Lead Managers is the number lead managers participating in the issuance of the transaction; #Rating Agencies is the number of rating agencies involved in the rating process of the tranches at the time of issuance; Float has a dummy of 1 if the tranche has a floating rate coupon and zero if the rate is fixed for the life of the loan; Retained Interest is a dummy variable that takes 1 if retained subordinated interest as beneficial interest in a securitization transaction is provided by the originator. Creditor Protection is a dummy variable that takes the value of 1 if the transaction is issued in a country, which provides no automatic stay in the assets; Year dummy variables are included but not reported in the table. Due to correlation, time to maturity was excluded in the regression. The presented result for time to maturity was arrived by a separate regression in a second step.

Overall, the model performed relatively well. The adjusted R^2 is just over 0.44 for the ABS sample and 0.52 for the QE sample, respectively. The results are comparable with the results of studies on the ABS market by Vink and Fabozzi (2012) as well as Vink and Thibeault (2008). This indicates that the model does explain a significant proportion of the *spreads* over the sample's periods.

Table 31 reports that the *credit rating* variable is statistically the most significant characteristic at the 0.1% level. Yield *spreads* generally increase (decrease) for high (low) rated asset-backed securities in both samples. The impact of this variable is almost equal for both samples: a bad rating is associated with a price extra of 17 basis points respectively 15 basis points. This is an expected result, since the *primary market spread* and *credit rating* tend to have an inverse relationship. *Loan to value* is insignificantly and negatively related with the *primary market spread* for both samples. This observed result is as predicted, because issues that provide a higher *loan to value* ratio are additionally secured through subordination. Moreover, in general, senior tranches have a better *loan to value* ratio and are expected to be issued at lower risk *spreads* than the subordinated loans. One explanation for the negative impact could be that the *credit ratings* of the tranches in the samples were considered too high. Hence, this credit

enhancement variable led to a minimal balance of the *spreads*. A 1% increase in subordination level is associated with a price discount of 0.2 basis points for QE issues and a price discount of 0.04 basis points for ABS issues, respectively. For both samples, the *time to maturity* is insignificantly related with the corresponding risk premium. However, yield *spreads* generally increase (decrease) with longer *maturity* for the ABS (QE) issues sample. Hence, *time to maturity* is the first variable, which exhibits a different impact for the two subsamples. This paper observes the first effects of quantitative easing on the pricing of European asset-backed securities. Merton (1974) and Chen, Lesmond, and Wei (2007) show that risk premia can either increase or decrease with maturity, depending on the risk of a security. Thus, issues with longer *maturity* are associated with a lower risk during QE than prior to the ABSPP. Originators have to offer a lower *primary market spread* for comparable issues with respect to *time to maturity*. QE issues are associated with an average price discount of 0.9 basis points for every additional year's *maturity*, while ABS issues are associated, on average, with a price extra of 0.1 basis points for every additional year's *maturity*.

We included two different types of credit enhancements in our model. *Internal credit enhancement* is described through the variable *retained interest.* The second type of credit enhancement is introduced by *external credit enhancement.* Both variables exhibit different results within our comparisons of the two subsamples. There are no issues with *external credit enhancement* in our sample during the period of quantitative easing. For ABS issues, we find an insignificant and negative relationship with the *primary market spread*. This relationship is as expected since an *external credit enhancement* reduces the risk of default and thus can lead, ceteris paribus, to a lower risk premium. One explanation for the non-appearance of issues with *external enhancement* during the period of quantitative easing could be that originators relinquished this feature based on the non-requirement to provide *external credit enhancement* by the ECB. Further, it would be easier for originators to issue tranches without a third-party guarantee at lower costs. However, *internal credit enhancement* is required for consideration in the ABSPP. Nevertheless, we observe different results for the two subsamples. *Retained interest* is significantly and positively related with the *primary market spread* at the 5% level for ABS issues, whereas the variable is significantly but negatively related with the *spread* for the QE sample. The results for the ABS issues are surprising for this paper, because *internal credit enhancement* should, ceteris paribus, reduce the risk of default. We predicted a negative relationship

with *spreads* for European ABS tranches. However, one explanation could be that investors considered *internal credit enhancement* as a sign of lower credit quality prior to the quantitative easing programme. Another explanation could be that investors of QE issues associated *credit ratings*, in which *retained interest* was included as a factor that determined the default risk, as too high and balanced the risk premium with price discounts. Moreover, we observed that the coefficients for both samples differed significantly. We found that, on average, ABS issues had to pay an additional 20 basis points, while QE issues were associated with an average price discount of 30 basis points. This, on the other hand, may be explained through the regulations of the ABSPP. Since *internal credit enhancement* is required by the regulations of the ECB, the impact of the variable should be, in general, higher for QE issues. The findings for these two variables merit a greater in-depth analysis into the consequences of quantitative easing for credit enhancement of asset securitization. As a result, *credit enhancement* is the second common pricing factor, which influences the *primary market spread* differently after the implementation of quantitative easing.

Loan size behaves differently in our samples. Whereas *loan spread* and *loan size* are insignificantly and negatively related for ABS issues, they have a significant and negative relationship for QE issues at the 10% level. The negative relationship between *loan size* and *spread* means that, on average, larger issues are associated with a price discount. The significance could be explained by the fact that the market expects the ECB to purchase parts of larger issues and thus, tranches with a larger *loan size* which can be issued at a lower risk premium. *Transaction size* has a significantly negative relationship with *spreads* for ABS issues at the 1% level, and an insignificant and negative relationship for QE issues. One may interpret a significant negative relationship between *transaction size* and *spread* as evidence of a positive liquidity effect related not only to the size of each tranche but also, with the size of the entire issue. The findings for the two variables suggest that during quantitative easing, the market participants—such as the ECB—consider the *loan size* more important than the *size* of the whole transaction.

The *number of tranches* behaves completely differently for the two samples. For the ABS sample, we observe a significant, positive relationship with the *spread* at the 0.1% level, whereas for the QE issues, an insignificant and negative relationship between the *number of tranches* and the risk premium is exhibited. For every additional *tranche*, originators of transactions prior to the ABSPP have to pay an additional risk

premium of 18.3 basis points. Transactions during quantitative easing, are associated with a price discount of 0.7 basis points per every additional *tranche*. The positive relationship with the *spread* is surprising. We expected the relationship to be negative, since investors would benefit from more *tranches* in the transaction through subordination. However, investors prior to the ABSPP associated an increase in *the number of tranches* with an additional increase in risk defaults. This paper suggests that this finding merits more detailed research.

The discrete variable *number of lead managers* behaves differently for both our samples. Whereas *spread* and *number of lead managers* exhibit a significantly negative relationship for the ABS sample at the 1% level, they are significantly and positively related for the QE sample at the 5% level. Further, QE issues are associated with an extra risk premium of 14 basis points for every additional investment bank in the conglomerate, while the spread reduces by 20 basis points for every one of the ABS issues. While a clear interpretation of these contrasting results is difficult to provide, one explanation could be found in the different tasks for investment banks engaged in the securitization process as a result of certain requirements of the ABSPP. However, the variable is an important yield determinant for both samples. The *number of rating agencies* involved in the issuance process has an insignificantly negative relationship with *spreads* for both subsamples. However, we find different coefficients in both regressions. The *spread* is associated with an average price reduction of 7 basis points for the ABS sample for every additional rating agency and 14 basis points for the QE sample. The findings are as expected. Investors consider ratings more accurate if more rating agencies are involved in the rating process given every additional rating agency is deemed a sign of stability which grants the originators a discount on the risk premia.

Creditor protection, described by no automatic stay on the assets, exhibits similar results for both the ABS and the QE samples. The findings indicate that *creditor protection* and *primary market spread* are insignificantly and negatively related for both samples. Thus, although we find changes in the market participants in countries with *creditor protection* in the univariate analysis, investors do not rely on *creditor protection* as one of the yield determinants for the European ABS issues. Finally, this study observes that the *type of interest* is a determinant of the *primary market spread* before the implementation of quantitative easing, but is no yield determinant during quantitative easing. *Float* exhibits a significantly positive relationship with the *primary market spread* for the ABS sample at the 0.1% level but is insignificantly and positively

related with the *spread* for QE issues. This indicates that originators, on average, have to pay an extra risk premium—of almost 46 basis points for the ABS sample—through floating rate notes compared to the fixed rated notes. The 6.1 basis points for the QE sample have a rather small impact for floating rate issues. These findings are in contrast to studies from before the 2007 financial crisis. Prior to that crisis, investors demanded an additional risk premium for fixed rated notes. Since the interest rates declined continuously since the financial crisis in the European Monetary Union, we find evidence for an opposite trend. Investors believe that, as a result of low interest rates, floating rate notes do not pay off as before, such that floating coupon rate notes are associated with an additional risk premium. During quantitative easing, floating and fixed rated notes exhibit similar risk premia in the European ABS market.

To conclude the analysis of this section, we determine direct evidence of the impact of quantitative easing on the European ABS market. In order to realize satisfying results, we perform three further regression analyses: The first analysis is run on the high information sample, the second regression is run on the high rating sample, and the third regression is run on the senior tranche sample. Other than in Table 31, the regressions are performed on loans which have been issued before the implementation of the ABSPP and loans which have been issued during the ABSPP jointly, instead of separately. This paper follows this approach for all three regressions. To analyze the impact of quantitative easing accurately, we include a variable called "QE" that equals 1 if the loan tranche was issued during the ABSPP, and zero, otherwise. For the purpose of this subsection, we are only interested in the results regarding this variable. With the help of these results, we uncover evidence as to whether the ECB does directly influence the *primary market spread* of European ABS. This could result in the expansion of the findings that the ECB is significantly influencing both common security characteristics and the set yield determinants of ABS issues through the ABSPP. Table 32 shows the results of the three regression analyses, which were run on the *primary market spread* (dependent variable) and the common pricing characteristics as well as the variable QE (independent variables).

Table 32: *Impact of Quantitative Easing on the Primary Market Spread of European ABS*

Variable	High Information Reg. #3	High Rating Reg. #4	Senior Tranches Reg. #5
Constant	0.728	0.159	0.245
Credit Rating	0.177 ****	0.260 ****	0.186 ****

Loan To Value	0.001	0.001	0.003
Time To Maturity	0.001	0.005	-0.004
Extern Enhancement	-0.293 *	-0.532 ****	-0.397 **
Loan Size	0.001	0.005	0.193
Transaction Size	-0.143 **	-0.039	-0.199
# Tranches	0.120 ***	0.020	0.023
# Lead Managers	-0.095 *	-0.156 ****	-0.133 **
# Rating Agencies	0.017	-0.028	0.0153
Retained Interest	0.109	0.075	-0.080
Float	0.479 ****	0.785 ****	0.690 ****
Creditor Protection	0.074	0.020	-0.084
Quantitative Easing	-0.354 ****	-0.434 ****	-0.348 ****
Number of Observations	368	225	209
Adjusted R^2	0.35	0.44	0.37
F-Statistics	< 2.2e-16	< 2.2e-16	<2.2e-16
Significance Levels	0 '****' 0.001 ' ***' 0.01 '**' 0.05 '*' 0.1 ' ' 1		

The dependent variable is defined as the margin yielded by the security at issue above a corresponding benchmark. The dependent variable is measured in basis points. The independent variables are as follows: A credit rating variable: CR=1, CR=2, CR=3, …, CR=15, correspond to credit ratings: Aaa/AAA, Aa1/AA+, Aa2/AA, …, B2/B; Loan to Value is the subordination level expressed as a percentage of the transaction's initial principal balance; Maturity is the time to maturity from issuance measured in years; Extern Enhancement as dummy variable takes the value of 1 if the issue has an extern enhancement; Loan Size is the natural log of the tranche amount in millions of Euros; Transaction Size is the natural log of the issue amount of the transactions in million Euros; #Tranches is the number tranches per transactions; #Lead Managers is the number lead managers participating in the issuance of the transaction; #Rating Agencies is the number of rating agencies involved in the rating process of the tranches at the time of issuance; Float has a dummy of 1 if the tranche has a floating rate coupon and zero if the rate is fixed for the life of the loan; Retained Interest is a dummy variable that takes 1 if retained subordinated interest as beneficial interest in a securitization transaction is provided by the originator. Creditor Protection is a dummy variable that takes the value of 1 if the transaction is issued in a country, which provides no automatic stay in the assets. QE is a dummy variable that takes value 1 if a tranche is issued during the period of QE and zero otherwise; Year dummy variables are included but not reported in the table.

This paper finds consistent results for all three samples. QE and the *primary market spread* have a significant and negative relationship at the 0.1% level. Thus, the findings indicate that quantitative easing significantly influences the yield of European ABS issues. Table 32 exhibits that, on average, the European ABS issues are associated with a price discount of 40 basis points. This is true of when they were issued during the ABSPP. Hence, the results of the regression are consistent with the results of the univariate comparison, the Chow test, and the regressions of the previous sections. Interestingly, no significant difference in the coefficients of the different samples is observed. Thus, the ECB does not only influence *the primary market spread* of tranches, which are more likely to be purchased (like high rating tranches or senior tranches) but also all tranches, which meet the requirements of the ECB and thus are considered for purchase during the ABSPP. This means that quantitative easing impacts

the European ABS market directly and indirectly through the announcement of requirements for purchase.

4.5.2.4 Regression Results: Conclusion

Subsection 5.2 investigated the extent to which the ABSPP influenced the pricing features of the European asset-backed securities. The purpose was to analyze the changes regarding the impact of common pricing features on the *primary market spreads* for the European ABS market. The Chow test exhibited a significant p-value for our data sample. This means that the Chow test statistic was higher than the critical level, and therefore, we accepted the second research hypothesis, which stated that the *primary market spreads* associated with European asset-backed securities were influenced differently by common pricing characteristics since the launch of the ABSPP. Based on the results, we had to perform the regression analyses to determine the yield determinants for the two subsamples. Applying the same pricing estimation model to both subsamples revealed that the common pricing factors associated with European asset-backed securities impacted differently on the *primary market spread*. These results were exhibited by the value of the coefficients as well as the significant levels of the underlying variables. We documented, for example, that:

1. lenders demand lower *spreads* for QE issues with longer *maturity* as compared to ABS issues;
2. lenders tend to offer a discount for QE issues with higher *loan sizes*, while tending to offer a discount for ABS issues with a higher *transaction size*;
3. ABS issues are much more sensitive with respect to the process of *tranching*;
4. investors tend to offer a discount for ABS issues with a greater conglomerate of investment banks as compared to demanding a higher risk premium for QE issues with a greater conglomerate of investment banks;
5. QE issues are more sensitive for *internal credit enhancement* as compared to ABS issues; the higher sensitivity is linked with a *spread* discount for QE issues compared to a higher risk premium for ABS issues;
6. investors demand a much higher risk premium for ABS issues if they provide a *floating* interest rate than for QE issues;

The third research hypothesis stated that quantitative easing was a significant determinant of the *primary market spread* of European ABS issues. The findings of the last section indicate that we have the evidence that supports this hypothesis based on the results of the last three regression analyses. The regressions exhibit that the variable "QE", which describes if a tranche was issued before or during quantitative easing, is a dominant determinant of the risk premium of European ABS issues. This is indicated by the relatively great value of the coefficients for all three subsamples as well as the significance level of 0.1% in all three regressions.

Our major contribution lies in the fact that the existence of substantial differences between European asset-backed securities—since the launch of the ABSPP and the impact of common pricing variables on the *spread*—could indicate that these securities are priced differently during quantitative easing. Investment banks in charge of structuring the technical features of certain issues as well as the originators may find the estimates useful tools with regard to the size of impact of each variable on the *primary market spread*, today.

4.6 Conclusion

The European Central Bank announced during a press conference in September 2014 that the low inflation rate (Moro Visconti, 2016), as a result of the financial crisis and the Euro crisis in Europe, would be raised with the instruments of quantitative easing. Hence, in addition to low base rates, the ECB would launch an asset purchase programme in order to supply the markets with money. So more investments by corporations would help raise the inflation rates. The programme to bring this about was called the "Asset Purchase Programme (APP)" and launched in October 2014. As of June 2016, the programme consisted of a total investment volume of EUR 1.7 trillion. It would end in December 2017 at the earliest. The APP itself consists of several separate asset purchase programmes, and is the most interesting programme in this study that is concentrated on the European asset-backed security market. The programme has purchased asset-backed securities in the secondary market as well as the primary market since November 2014. As of June 2016, more than EUR 20 billion of assets were purchased by the ECB in the European ABS market. As an addition to and expansion of studies with respect to the effects of the ABSPP on the secondary market, this research concentrates on the European ABS primary market.

Therefore, this paper empirically investigated the differences in the European ABS market since 2010. The data sample was divided into two subsamples. The first

sample contained Euro asset-backed securities issued between January 2010 and November 2014, while the second subsample consisted of transactions issued after November 2014. We investigated how common pricing characteristics compared for the two subsamples and found that many of the common pricing factors exhibited significant dissimilarities, with respect to the security features. Based on the results, we accepted the first research hypothesis that the common pricing features differed significantly in value between the two time periods.

Further, we analyzed the data sample by performing a structural break analysis. We documented that the Chow test statistic was higher than the critical level. This indicated the evidence that supported the second research hypothesis, which stated that the *primary market spread* associated with European asset-backed securities was influenced differently by common pricing variables for the two time periods. As a natural follow-up, this paper performed two regression analyses on the *primary market spread* as the dependent variable and the common pricing characteristics as the independent variables. The procedure aimed to provide an in-depth analysis of the results of the Chow test. We found that the regression analyses supported the result of the Chow test. The risk premium of the European ABS was differently influenced by the common pricing variables during quantitative easing compared to before the ABSPP was implemented. This study observed that pricing variables did not only differ significantly in value with respect to their coefficients but also, with respect to the significance levels. The analysis revealed three major changes that occurred in the findings. First, we documented that the coefficients of variables could differ significantly in value. For example, for the variable *type of interest.* Investors tended to associate floating interest rate notes during quantitative easing with a lower additional risk premium in comparison to their non-quantitative easing counterparts. Second, this study found that the coefficient signs differed for several variables, for instance, for the variable *number of lead managers.* We observed that the *number of lead managers* was significantly and negatively related with the *primary market spread* for the non-quantitative easing sample, while it had a significant and positive relationship with the *spread* for their quantitative easing counterparts. Third, the analysis exhibited significant differences for the significance levels of the set of common pricing factors. Only the variable *credit rating* exhibited the same significance as the determinant of the *primary market spread* for both subsamples at the 0.1% level. All other yield determinants for European ABS transaction resulted in different significance levels.

To conclude the research path, we analyzed the influence of the quantitative easing yield of the European ABS market. The findings of the coefficients as well as the significance levels indicated that quantitative easing was a dominant yield determinant of European asset-backed securities. This suggested that quantitative easing did not only indirectly influence the risk premium through changes with respect to the common pricing features but also exercised a direct impact since QE was a determinant of the *primary market spread*. The results provide thus provide the necessary evidence that supports the third research hypothesis. Based on the findings with respect to the three research hypotheses, we conclude on the overall research question that quantitative easing has significantly affected the European primary ABS market.

Thus, this study provides research that fills gaps in current field research in the context of the European ABS market. The three analyzed hypotheses are contributions to today's questions regarding the impact of quantitative easing on the European Monetary Union. Based on our results, we accept all three research hypotheses. These lead us to our main research question of Chapter 2, which states that quantitative easing is significantly affecting the European ABS market. Hence, with respect to the statistical and empirical results, we provide evidence that supports the main research question. We document that quantitative easing affects the investment decisions of investors of the European ABS market. Due to the participation of the ECB in the fixed income market, investors are forced to invest in ABS tranches with worse risk profiles. This is indicated by the significantly higher risk profile of European ABS since the beginning of the ABSPP. Further, as a consequence of the ECB's attendance on the buy side, investors gain significantly lower risk premiums for their investments in the ABS market. Hence, as intended by the ECB, originators are able to refinance their sales at a significantly lower price than before the implementation of QE. This is in accordance with research by, for example, the DZ Bank, which analyzes the impact of quantitative easing on the secondary market. They also document that the ABSPP is influencing the *spread* of asset-backed securities in the secondary market. While on the one hand, the inflation rate is still low, and therefore, the APP is commonly considered to be ineffective or a failure, we observe that the APP influences a company's refinancing prowess in the capital markets as expected. Further, the ECB seems to have reached its goal to supply companies in the Euro area with low cost money through quantitative easing. The results indicate that intervention of the ECB leads to lower costs for originators when issuing asset-backed securities even though the securities offer a higher risk profile

compared to their non-quantitative easing counterparts. Since the ECB purchases tranches of asset-backed securities with low risk profiles, investors of asset-backed securities in the Euro area are forced to purchase tranches with higher risk profiles but with lower risk premia.

The results of this study contribute significantly to current research and activities in the work field. Further, the results of the univariate analysis as well as the estimates of the regressions concerning the size of each variable's impact on the *primary market spread* are expected to be of interest to investment banks and corporations involved in the European securitization market. Additionally, the findings of this paper have an important implication for investors in the ABS market in the Euro area as well as for investors in the fixed income sector. Portfolio managers, who take positions in the European fixed income and securitization sector, can also consider the results when deciding to build optimal portfolios. Finally, the findings for the European ABS market indicate that the whole European fixed income market has been significantly impacted by the APP of the ECB.

This study provides statistical analyses aiming to enrich the current understanding of the European ABS market and developing a framework of the market for further research. The quantitative research design was appropriate to gain an in-depth understanding of the research objective. Although the richness arising from our quantitative research design and the appropriateness for the purposes of this study, the results are limited to the underlying mathematical models and analyses. Different models and different structures of variables will likely lead to additional insights into the development of the European ABS market.

Moreover, the study is limited to the chosen period of time for the data sample. A valuable contribution to research could be further studies on the development of the European ABS market after the "Brexit" vote in the U.K.. Whether the market can expand the growth despite the predicted negative impact for the European fixed income market will be of interest. Further, this study is limited to the asset-backed security market. Future researchers can contribute to the work field by investigating the development of mortgage-backed securities and collateralized debt obligations. Findings with respect to these two securitization submarkets may interest scholars who are keen to understand the influence of APP on the entire European securitization market.

5 Concluding Remarks

This dissertation aimed at enabling an understanding of the development of the asset-backed security market after the 2007 financial crisis. To reach this objective, the post-crisis ABS market was investigated using an empirical strategy on three secondary and large-scale data sets. The results have been presented and discussed within this dissertation. This section summarizes the approaches as well as the models and key findings of the three essays. Choudhry and Fabozzi (2004) mention that the securitization market can be divided into three main categories: ABS, MBS, and CDOs. Research papers investigated the first main category of this market—ABS transactions—after the financial crisis. Securitization and especially MBS and CDO transactions constituted some of the largest fixed income markets globally in the early 2000s. With the fall of the U.S. mortgage market and the subsequent financial crisis, the whole securitization market collapsed—securities defaulted and most of the non-defaulted securities got downgraded by all the rating agencies. This led to investors losing their trust in the securitization market and the issuance volumes hit new lows. Since 2010, the securitization market began experiencing a recovery, globally. Originators as well as investors started to regain trust in the growing role that securitization would play in the future of the world's economies again, despite its contribution to the financial crisis (Vink & Fabozzi, 2012; Schmalenbach-Gesellschaft, 2012; Morgan Stanley Capital International, June 2015; True Sale International, 2011).

New regulations as well as the fear of another breakdown in the market significantly impacted the development of the yield associated with asset-backed securities. Hence, the first research paper investigated the *influence* of the financial crisis on non-U.S. ABS transactions issued between 2010-2014. The period described the recovery of the ABS market until the year prior to the implementation of the European Asset Purchase Programme. The overall research path of Essay I was divided into two research hypotheses. The first hypothesis addressed the influence of that crisis on the yield determinants associated with non-U.S. ABS issues. Further, one commonly held view of regulators was that investors, prior and during the crisis, relied solely on ratings of credit rating agencies without considering their own analyses (Fabozzi & Vink, 2012). The second research hypothesis investigated the influence of the financial crisis on the risk analysis of ABS transactions by investors. The study determined the

evidence that supported the hypothesis that investors looked beyond credit ratings and employed their own risk analysis on ABS transactions.

The empirical data sample of the first research paper contains 771 tranches of 321 non-U.S. asset-backed security transactions. The analysis of this data sample is divided into two analyses. First, we analyzed the yield determinants and compared them to yield determinants before the financial crisis in order to provide evidence that supported the first research hypothesis. Thereafter, the first essay performed an over-reliance analysis on the credit rating. The over-reliance analysis found evidence that supported the hypothesis that investors employed their own risk analysis and looked beyond the credit rating provided by rating agencies. The paper found that there was a significant influence of the financial crisis on the yield of the non-U.S. ABS transactions. The first research hypothesis was accepted based on the results of the analysis of yield determinants. First, a univariate analysis observed the financial crisis together with new regulations, as a result of that crisis and this, significantly influenced the security characteristics. For instance, credit ratings were significantly lower in the data sample after the financial crisis compared to the data sample prior to the crisis. This indicated that rating agencies were adjusting the process of assigning a rating and undertaking stricter analysis of the default risks. Further, a significantly higher number of issues provided internal credit enhancement to lower the default risk of the security and hedge the cash flows of the underlying assets. Consequently, the transactions were divided into more tranches after the 2007 to increase the level of subordination, which absorbed the first losses and guaranteed the coupon payments. However, despite the higher number of tranches, both the loan size and transaction size increased after the financial crisis to increase the liquidity of the securities in the secondary market. Another very important change documented was in the number of lead managers. We found a significantly greater conglomerate of investment banks involved in the issuance process, which indicated greater difficulty in underwriting ABS transactions after the crisis. Second, a comparison analysis of the yield determinants of non-U.S. ABS transactions was performed to evaluate changes in the preferences of fixed income investors. The study highlighted significant changes in the list of yield determinants for the ABS market. We found four variables as significant influential factors of the spread, which had not been considered by investors before the financial crisis. The most important changes were document as the variables that described internal credit enhancements. Two out of four new yield determinants described the instruments of

internal credit enhancement. Investors of asset-backed securities relied on these variables in order to calculate a fair risk premium considering the risk profile of the securities. Moreover, we observed three further changes in the list of yield determinants of asset-backed securities. The loan size, the number of tranches, and the currency risk were no longer considered yield determinants, although they had been determinants of the primary market spread in the study of Vink and Thibeualt (2008).

An intuitive follow-up on the analyses in coherence with the breakdown of this market during the financial crisis would constitute an analysis of over-reliance on credit rating. Hence, this paper provides evidence that supports the second research hypothesis. This conclusion is based on results regarding pricing factors that are already considered by rating agencies. The paper observes that irrespective of whether credit rating is still the most significant determinant of the primary market spread, investors look beyond the ratings and rely on these factors as an addition to the credit rating. The results indicate that investors employ their own credit default risk analysis for ABS transactions. Investors evaluate these variables for their own risk analysis and decide whether or not the credit rating is accurate or if the corresponding risk premium has to be adjusted. As a consequence of the results of the over-reliance analysis, essay I accepts the second research hypothesis.

Summarized, the first research paper provides evidence that supports the overall research question, which stated that the financial crisis has a great influence on the non-U.S. ABS market. The results indicate that both preferences and decisions of investors as well as originators are affected by the financial crisis. Furthermore, an over-reliance as in the years prior to the financial crisis does not appear in our sample. This indicates that the markets adjust properly to both new regulations and proposals of regulators in order to prevent the events from 2007 from repeating themselves.

The second and third research papers strive to examine the European ABS market. After the financial crisis, the European ABS market experienced disparities compared to its non-European ABS counterparts. The European automobile industry captured a significant part of the European economy and hence was more important for the economic development of a region than any other automobile industry in the world. Not surprisingly, the European automobile industry refinanced their market sales and loan services in the European ABS market. Nevertheless, the proportion of the so-called Auto-ABS had been very small until the financial crisis but suddenly developed into the most important submarket in the European ABS market with a market share of almost

43% in issuance volume as of 2015. Within the second research paper, we investigated the phenomenon that Auto-ABS enormously outperformed the development of all other ABS subclasses. This observation only appeared in the European ABS market. Hence, the second research paper addressed the research question of *how* the Auto-ABS market was able to outperform the rest of the European ABS market and develop into a major driver and flagship of the European ABS market (Porter, 2015). The data sample for this study contains 468 European ABS tranches and 413 automobile corporate bonds (Auto-CB), issued between 2010 and 2015. The empirical study hypothesized two reasons for the outperformance of the Auto-ABS sector compared to its non-Auto-ABS counterparts. The first hypothesis stated that European Auto-ABS transactions provided advantages compared to their non-Auto-ABS counterparts and hence, were more suitable for ABS investors. Further, we anticipated that securitization could provide significant advantages for the automobile sector as a refinancing instrument compared to corporate bonds.

A comparison analysis of the European ABS market provided evidence that supported the first research hypothesis. We analyzed common pricing characteristics for Auto-ABS and non-Auto-ABS tranches over the period of time, first. We observed that more than half of the set of common pricing features differed for Auto-ABS. Surprisingly, these variables described the risk profile of an ABS tranche. First and foremost, the results exhibited great dissimilarity for the credit ratings of the two security classes. We found that Auto-ABS had a significantly lower credit rating assigned by rating agencies. Second, Auto-ABS exhibited a significantly lower time to maturity, a higher rate of internal credit enhancement, and a lower rate of issues that faced currency risk. Hence, this led to a significantly lower risk profile associated with Auto-ABS and yielded in a lower primary market spread. The study revealed a mean primary market spread for non-Auto-ABS tranches of 122 basis points, whereas Auto-Bonds offered, on average, 64 basis points as risk premium. This effect was even more measurable over the period of 2010-2015. The difference between the average spreads evolved over 2010-15 and we documented a significantly higher difference within the last three years compared to the first three years of our sample period. Hence, after an acceleration time, Auto-ABS outperformed the rest of the European ABS market more intensely.

As a natural follow-up, a panel-data fixed-effects regression model was undertaken to continue the comparison analysis on the set of yield determinants. The

most important difference was documented in the variable that described internal credit enhancement. For non-Auto-ABS tranches, the model exhibited a positive relationship with the spread. This was a surprising result, since internal credit enhancement should, ceteris paribus, reduce the default risk of the corresponding security. This meant that investors could consider credit ratings for non-Auto-ABS with internal credit enhancement as too good and could associate the risk premium of these issues with an additional spread extra of 26 basis points. Investors of Auto-ABS associated issues that provided internal credit enhancement with an average price discount of 36 basis points. These findings indicated that investors of European ABS issues relied on the advantages of Auto-ABS transaction and preferred to invest in this asset class. Hence, based on the results of the comparison analysis, we were able to accept the first research hypothesis. We concluded that the advantages of Auto-ABS explained a significant portion of the outperformance of this asset class in the European market.

To follow our approach, a second comparison analysis was performed to provide evidence that supported the second research hypothesis. We hypothesized that advantages of ABS bonds compared to corporate bonds explained a significant part of the outperformance of the Auto-ABS market. The structure of ABS transactions encouraged automobile corporations to shift issuance volumes from the CB market into the ABS market when refinancing their market sales and loan services. We observed that Auto-ABS were associated with a significantly lower risk profile than their Auto-CB counterparts. So, credit ratings for Auto-ABS were significantly lower than for Auto-CB. This led us to one of the most dominant characteristics of asset-backed securities. Originators could then provide internal credit enhancement for ABS transactions. Therefore, the securities relied solely on the credit quality of the underlying assets and remained independent, compared to corporate bonds, from the originator's credit quality. This led to a significantly lower primary market spread for Auto-ABS compared to their Auto-CB counterparts. The paper exhibited a primary market spread that was, on average, twice as high for Auto-CB. This was a major incentive for the automobile industry to use securitization instead of corporate bonds to refinance their market sales and loan services.

The second part of the comparison analysis investigated the extent to which investors relied on common pricing features when pricing ABS or CB. Unsurprisingly, as common in the fixed income market, the credit rating was the most dominant pricing variable for both the Auto-ABS as well as the Auto-CB. Besides this mutual variable,

the two security classes seemed priced by different variables. For example, the number of lead managers and the type of interest rate were yield determinants for Auto-CB. Capital markets investors relied on common ABS features, such as the number of tranches and internal credit enhancement. This indicated that investors appreciated the structure of asset-backed securities. Features, such as internal credit enhancement and the process of subordination, reduced the risk profile associated with European Auto-ABS transactions. These results provided evidence that supported the hypothesis that investors and originators in the automobile industry relied on advantages of the asset-backed security market. This in turn supported the hypothesis that the automobile industry shifted issuance volume from the corporate bond market into the asset-backed security market. Based on these findings, we accepted the second research hypothesis that Auto-ABS provided advantages for originators as well as investors of the automobile industry compared to their Auto-CB counterparts. This led to the conclusion that the result explained another significant part of the superior performance of the Auto-ABS market. Considerably more, it was an acknowledgement of the assets' quality provided by the European automobile industry. Hence, in future the development of the Auto-ABS market in Europe could further become a driver of the whole European ABS market. Moreover, this security class could become even more important for the European ABS market as a flagship for investors and as evidence of the importance and the functionality of securitization in the world's economies.

The third research paper investigated the European Central Bank's "Asset-Purchase Programme". More specifically, the "Asset-Backed Security Purchase Programme". In September 2014, the ECB announced that the low inflation rate in the European Monetary Union, as a result of the financial crisis and the Euro crisis in Europe, would be raised with the instruments of quantitative easing. This quantitative easing programme would inject money into the Financial Markets through asset purchases. Historically, the ECB started the largest QE programme in the European Monetary Union ever. In addition to changing interest rates, the ECB started the purchase of assets in November 2014 with a total volume of EUR 2.2 trillion until at least December 2017. This means, the ECB will double its total assets during this QE programme. In November 2014, the ECB started the ABSPP. ABS tranches are purchased in both, the secondary market as well as the primary market. The third research paper addressed the overall research question *how* quantitative easing affected the European ABS market. We expected to find evidence that supported the overall

research question, since the ECB was willing to intervene in the European fixed income markets. As a consequence of the low inflation rate, the ECB wanted European corporations to invest money in the markets to increase the money supply. Corporations would be able to refinance at very low cost levels to increase the investment rate. In the case of the ABSPP, the ECB would purchase tranches of asset-backed securities for two reasons: First, throughout this channel, the ECB would supply corporations with direct money for investments in exchange for the cash flows of the underlying assets of the tranches. And second, the ECB intended to force investors to purchase tranches of securities with a higher risk profile, since the lower risk tranches had been purchased by the ECB.

This research path provided evidence that supported the three research hypotheses, which analyzed the research question. The first hypothesis stated that the security risk profiles differed significantly during quantitative easing. As a follow-up, we anticipated that the implementation date of the ABSPP was a structural break point for the European ABS market. The third hypothesis addressed evidence that supported direct influence of quantitative easing on the offered yield of ABS issues. We investigated all three hypotheses with empirical and quantitative methods. The high information sample of the third essay contained 369 European Euro-denominated ABS tranches issued between January 2010 and June 2016.

We investigated how common security characteristics compared for the two subsamples, first. We found that many of the common pricing factors exhibited significant dissimilarities, with respect to the risk profiles. ABS issues exhibited, during quantitative easing, a significantly worse risk profile than their non-QE counterparts. For instance, credit ratings were significantly lower in the period before QE. As a consequence of the market participation of the ECB, European corporations were able to issue higher risk securities at lower costs, as indicated by the significant lower primary market spread during the times of quantitative easing. The results indicated that the ECB encouraged European corporations to securitize asset portfolios with higher credit default risk. The findings were as expected, since the ECB was willing to simplify the refinancing process for originators at lower costs. Based on the results of the univariate comparison analysis, we accepted the first research hypothesis that the risk profiles of the securities differed significantly in value between the two time periods.

A structural break was revealed during the empirical analyses of the second hypothesis. The structural break was determined on the implementation date of the ABSPP and indicated that the securities were priced differently during the quantitative easing period. As an intuitive follow-up, we analyzed the pricing characteristics with a panel-data fixed-effects regression model. We found that yield determinants, such as time to maturity, loan size, the number of lead managers, the number of tranches, the type of interest, and internal credit enhancement, exhibited dissimilar results for the two subsamples of the European ABS market. As a consequence of quantitative easing, we observed evidence that the set of yield determinants experienced significant adjustments with respect to significance levels and coefficients. Based on the results of the structural break and regression analyses, we accepted the second research hypothesis. Essay III provided evidence that quantitative easing caused a structural break in the European ABS market.

As the last part of our research approach, regression analyses on different subsets of the European ABS market were performed to analyze whether quantitative easing significantly influenced the offered yield, associated with the securities of the subsamples. Not surprisingly, the variable *quantitative easing* exhibited a significant and negative relationship with the primary market spread at the 0.1% level. The coefficient of the variable indicated that the investors associated issues during quantitative easing with an average price discount of 35 basis points. This meant that quantitative easing was not only influencing the risk premium indirectly through the changes in the set of common pricing features and the set of yield determinants but also directly, as a yield determinant of European ABS issues. Hence, with respect to the statistical and empirical results, we accepted the third research hypothesis that QE was directly influencing the offered yield of the European ABS market.

The research paper concludes on the overall research path that quantitative easing is significantly influencing the European ABS market. This is indicated by the results regarding the risk profile, lower risk premiums for investors as a result of the attendance of the ECB on the buy side, and the direct influence of *quantitative easing* on the spreads. The findings of Essay III are in accordance to current research by, for example, the DZ Bank with respect to the spreads on the secondary ABS market.

Table 33 summarizes the key findings of the three research essays of this dissertation.

Table 33: *Overview of Essays: Key Findings*

Essay (Chapter)	***Key Findings***
Essay 1 (Chapter 2): Non-U.S. Asset-Backed Securities: Yield Determinants and Over-Reliance on Credit Rating	➢ Revealed significant changes in the list of yield determinants of the Non-U.S. ABS market after the financial crisis ➢ Detected that internal credit enhancement, compared to prior that crisis, has become one of the dominant variables for the ABS market ➢ Observed significant changes for the credit rating of ABS compared to prior that crisis and concluded that rating agencies changed the process of assigning a rating after the massive number of downgrades during the crisis. ➢ Identified that investors do not over-rely on the credit rating after the financial crisis but employ their own default risk analysis
Essay 2 (Chapter 3): ABS, Auto-ABS and Auto-CB Comparisons: Evidence From the European ABS Market	➢ Identified that Auto-ABS transactions provide significant lower risk profiles than their non-Auto-ABS and Auto-CB counterparts ➢ Detected that automobile corporations in Europe shift issuance volume from the corporate bond market into the asset-backed security market to exploit advantages of securitization ➢ Highlighted different yield determinants for Auto-ABS transactions that could explain the significantly lower primary market spread for this security class compared to non-Auto-ABS and Auto-CB
Essay 3 (Chapter 4): Has Quantitative Easing Affected the European Asset-Backed Security Market? An Empirical Analysis	➢ Showed that the European Central Bank through quantitative easing is heavily influencing the European ABS market ➢ Pointed out that European corporations are able to sell ABS with higher risk profiles at lower spreads ➢ Confirmed the structural break with the implementation of ABSPP in the data sample of European ABS transactions ➢ Emphasized the significant changes in both the common security characteristics as well as the yield determinants between the data sample of prior quantitative easing and the data sample during quantitative easing

5.1 Implications for Theory

This section will summarize the theoretical value of this dissertation and present three central implications. It will also reflect the structure of the research objectives and will first discuss the role of yield determinants in the ABS market compared with theoretical expectations. Second, it will outline the extension of existing knowledge regarding the impact of the 2007 financial crisis on the securitization market. Third, the

sections here will also detail the impetus that emerged for the sophistication and elaboration of asset-backed securities as a channel of quantitative easing. Limitations and potential for further research will be presented to conclude this section.

5.1.1 The Role of Yield Determinants in the ABS Market after the Financial Crisis

For more than four decades of research in the fixed income market, scholars have investigated the list of yield determinants for all kinds of fixed income securities and analyzed their impact on the yield associated with the corresponding security. For matters of securitization, yield determinants have been analyzed for asset-backed securities, mortgage-backed securities, and collateralized debt obligations before the financial crisis as well as for mortgage-backed securities after 2007. The biggest contribution of this dissertation is fueling the research into the list of yield determinants associated with asset-backed securities in the fixed income market. We built a framework of common pricing characteristics, which most accurately described a security in the ABS market. Further, this dissertation discussed the expected influence of these variables on the primary market spread in two ways. First, we deduced the impact of the common pricing features from a theoretical and economical point of view, and second, we reviewed older studies for the realized impact of the variables of practical data samples on the ABS market. However, today, science has only had the last ten years to investigate the list of yield determinants of securitization transactions, although this security class has developed into one of the largest fixed income markets since the 1980s (Ryan, Tucker, & Zhou, 2016; Lengwiler, 2016). Putting an effort in this endeavor, as this dissertation did, seems essential. It will in its later stages result in positive spillover effects, especially regarding the discovery of new insights that are useful for scholars who are interested in the behavior of yield determinants of fixed income markets and how practical frameworks, for example, new regulations after the financial crisis, can influence the theoretical point of view on these pricing characteristics or discover new pricing features that have to be used to reflect the developed pricing process of these markets. Recognizing that the scope of research on the list of yield determinants of ABS invites new perspectives on the single variables, this dissertation consequently presents the statistical summary, their impact on the primary market spread, and their significance levels. Further, the newly achieved perspectives on the single variables leads to new perspectives on the pricing of process of ABS transactions, which are useful for scholars who are especially interested in the pricing frameworks of fixed income securities. We also provide insights that are useful

for scholars who are interested in the realization of regulations regarding the securitization market and the influence of their implementation on the pricing framework and pricing process of securitization transactions. In combination with research regarding mortgage-backed securities and collateralized debt obligations, Essay I and Essay II could serve as examples of how a deeper understanding of the pricing process of securitization transactions can lead to the emergence of new research questions regarding the prevention of wrong pricing of this asset class before and during the financial crisis.

The research provides new theoretical insights for scholars regarding the interaction between the common pricing characteristics in this fixed income subsector. First and foremost, the interaction between yield determinants and the credit rating presents an essential change in the markets. The over-reliance analysis of Essay I provides new theoretical findings for scholars who are especially interested in the development of the importance of credit rating agencies in the fixed income market. Further, Essay I provides an approach for a credit default analysis which merits future research regarding the development of a new credit default analysis framework for the securitization market. Thus, Essay I could serve as an example of how a deeper understanding of the investor's usage of his own credit default analysis can create new research questions regarding the importance and future existence of credit rating agencies in the ABS market.

5.1.2 Asset-Backed Securities and the Financial Crisis

During the last decade of research in the fixed income market, scholars have investigated the impact of the financial crisis on many fixed income securities and studied how the single security classes adapt post the breakdown. For matters of securitization, the consequences have been analyzed for mortgage-backed securities, considering their contribution to the financial crisis. One big contribution of this dissertation to the work is the research regarding the influence of the 2007 financial crisis on the non-U.S. asset-backed securities market. In addition, the impact on the European ABS market is further investigated separately and in greater detail. ABS transactions were not only immediately influenced by the financial crisis but were also one of the triggers. We used our framework of common pricing characteristics to empirically investigate the development of the ABS market after the 2007 financial crisis compared to the scenario prior to 2007. Further, this dissertation discussed the phenomenon of the Auto-ABS transactions and their highly remarkable performance in

the European ABS market as well as the impact of this phenomenon on the development of the European ABS market and the future applicability of securitization in Europe.

First, we deduced the impact of the financial crisis on the common pricing features from a theoretical and economical point of view, supported our hypothesis with empirical analyses, and compared the results to findings of the time period pre 2007. Second, we analyzed the single years of the ABS market post 2007 to determine the development in greater detail. In-depth analyses of yield determinants of the non-U.S. and European ABS market, as an intuitive follow up, completed the studies. However, today, science has only recently started the research process of investigating into the impact of the financial crisis on the primary market of securitization, despite the contribution of asset-backed securities to that crisis and the recovery which the primary securitization market is experiencing with respect to issuance volumes, since 2010. This dissertation aims to study the positive spillover effects, especially regarding the discovery of new insights that may be useful for scholars who are interested in the interaction of primary and secondary market. Further, this dissertation investigates the behavior and the development of fixed income markets after the financial crisis and how practical frameworks can influence the theoretical point of view on these markets. Recognizing that the scope of research on the impact of the financial crisis on the ABS market invites new perspectives on the development of the fixed income sector all over the world and especially in Europe, this dissertation consequently presents statistically significant changes in the ABS markets, their impact on the primary market and their consequences for investors as well as originators.

Further, the newly achieved perspectives on the influence of the financial crisis leads to new perspectives on the issuance process of ABS transactions, which are useful for scholars who are especially interested in the primary market of fixed income securities. We also provide insights that are useful for scholars who are interested in the realization of regulations regarding the securitization market and the influence of their implementation on the primary market. As an extension of research regarding the development of the secondary ABS market, essay I and essay II could serve as examples of how a deeper understanding of the influence of the financial crisis on ABS transactions could enable the emergence of new research questions regarding the future development and applicability of securitization as an important part of the fixed income market. The research also provides new theoretical insights for scholars regarding European ABS submarkets, with a special focus on Auto-ABS transactions. First and

foremost, the highly remarkable performance of Auto-ABS in the European market presents an essential change in that market. The comparison analysis of essay II provides new theoretical findings for scholars who are especially interested in the development of the European ABS market after the 2007 financial crisis and in the research findings with respect to the largest European ABS submarket. Further, essay II provides an in-depth analysis of the yearly development of that market. During the time period we studied, the European ABS market reached a market proportion of 43% of the European primary ABS market. Essay II could then, serve as an example of how a deeper understanding of the investors' and originators' preferences could lead to the emergence of research questions regarding the future development of European ABS submarkets.

5.1.3 Quantitative Easing in the European ABS Market

During the last two years in the fixed income market, new research questions emerged regarding the quantitative easing programme of the European Central Bank. For the matters of securitization, the consequences of the Asset-Backed Security Purchase Programme on the European securitization market should be investigated. The contribution of this dissertation to the field on the impact of quantitative easing on the securitization market heralds a new research path regarding the influence of the ECB on the European fixed income market associated with asset-backed securities. The ECB decided to implement the ABSPP in November 2014 with the goal of purchasing securities in both the primary and the secondary market. Thus, the ABS transactions were immediately influenced by quantitative easing since November 2014. Scholars have investigated the impact of the APP on the secondary fixed income market in the European Monetary Union. To expand current research, especially the research on the first asset-backed security quantitative easing programme ever, this dissertation investigated the influence of the ABSPP on the primary market of European Euro-denominated ABS transactions. In addition to a comprehensive structural break analysis, we also used our framework of common pricing characteristics to empirically investigate the influence of the ABSPP on that market after November 2014 in comparison with the market of the time period prior to November 2014.

First, we deduced the impact of quantitative easing on the common pricing features from a theoretical and economical point of view and supported our hypothesis with empirical analyses. Second, we analyzed the data sample of the European Euro-denominated ABS market with respect to a structural break in November 2014 in

greater detail. Third, an in-depth analysis of the yield determinants of the European ABS market, as an intuitive follow-up, as well as an in-depth analysis of the variable *QE*, which took the value one if the tranche was issued during quantitative easing, and zero, otherwise, completed the study. However, science has only recently started investigating the impact of quantitative easing on the European fixed income market, despite rich research regarding quantitative easing in the U.S., the U.K., and Japan. The previous findings are mainly addressed to examine the impact of quantitative easing on interest levels or government securities. There is scarce research to address non-government securities, such as corporate bonds or asset-backed securities. In the case of the European APP, only studies regarding the influence of the ECB on the secondary security market have been carried out. Putting an effort in this endeavor, as this dissertation did, seems essential. It will in its later stage result in positive spillover effects, especially regarding the discovery of new insights that are useful for scholars who are interested in the behavior and the development of fixed income markets after quantitative easing and how practical frameworks, such as central bank decision and low inflation rates, can influence the theoretical point of view on these markets. Recognizing that the scope of research on the impact of quantitative easing on the ABS market invites new perspectives on the development of the fixed income sector globally and especially in Europe, this dissertation consequently presented statistical significant changes in the ABS markets, their impact on the primary market and their consequences for investors as well as originators.

Furthermore, the newly achieved perspectives on the influence of the ECB lead to new perspectives on the issuance process of ABS transactions, which are useful for scholars who are especially interested in the primary market of fixed income securities. As an extension of research regarding the development of the secondary ABS market, Essay III could serve as an example of how a deeper understanding of the influence of quantitative easing on ABS transactions emerges new research questions regarding the future development and applicability of securitization as an important part of the fixed income market. The research also provides new theoretical insights for scholars regarding the financing techniques of European corporations, with a special focus on corporations that use securitization to refinance their market sales and loan services. First and foremost, the drop in the primary market spread presented an essential change in that market. The empirical analysis of Essay III provides new theoretical findings for scholars who are especially interested in how central banks force investors, primarily

institutional investors, to purchase and invest in tranches of ABS transaction that provide a significant higher risk profile. The findings indicate that the ECB is providing European corporations an easier and more cost-efficient access to the financial markets.

5.1.4 Limitations and further Research Potentials

This section discusses the limitations of empirical analyses of the three essays and outlines further research potential with respect to the findings. This dissertation, however, faced methodological and conceptual constraints which will be outlined subsequently such that there are constructive perspectives offered for future research.

First, the generality of our analysis is limited to the non-U.S. ABS market in Essay I and the European ABS market in the Essays II and III. In the essays, all the U.S. ABS transactions as well as the MBS and CDOs were excluded from the analysis. Further research could be carried out on the U.S. securitization market as well as the MBS and CDO non-U.S. and European markets. Corresponding research will likely lead to a deeper understanding of the impact of the financial crisis on the securitization market. Moreover, future researchers can contribute by considering the influences of quantitative easing on all fixed income markets in the European Monetary Union, especially the MBS and CDO in that field.

Second, the empirical models, used in all three essays as well as the structural break analysis only consist of factors, which could be mathematically included in the analyses. Credit factors that are not quantitatively describable have been excluded. Another set of quantitative variables could likely lead slightly different results for the same data samples. In addition, our set of variables put into another framework could likely result in slightly different conclusions. Corresponding data analysis will likely lead to important additional insights, for example new pricing characteristics of the ABS markets could be observed as well as new yield determinants could be detected.

Third, the conclusions of the essays result from findings, which are derived from high information samples within a certain time period. The time periods in Essays I, II, and III were chosen due to events that could probably influence the dynamics of these markets. Hence, further research could be carried out on these events; in fact, industry-specific research could be useful for scholars who remain interested in the wide ranging influence of the political referendum in the United Kingdom leading to “Brexit” and how it could impact the European securitization market (True Sale International, 2016; Kerr, 2016; Bell, 2016). In this case, research could be useful for scholars interested in either the development of the U.K. ABS market compared to their non-U.K. European

ABS counterparts or the U.K. housing market. It could be of special interest if the falling prices in housing and real estate could influence the U.K. MBS and the European MBS markets (Bell, 2016). In addition, research could be carried out on the U.K. submarkets, especially the automotive market that is dependent on exports and securitization. The development as well as an adaption of originators to new market conditions could be useful for scholars who are equally interested in the U.K. ABS market. The influence of and the sensitivity to political changes, such as the U.S. presidential elections of November 2016, and its impact on the global securitization markets could be an interesting contribution to the field (True Sale International, 2016). In addition, future researchers could contribute by observing the development of the European submarkets especially, the Auto-ABS market in Europe, which is the most important submarket and driver of the European ABS market but which currently faces uncertainties due to VW emission scandal—an issue that could affect not only the secondary market but also the primary market if investors happened to lose their trust in it.

5.2 Implications for Investment Practice

While our research path on the one hand, provides a variety of theoretical implications in the work field, we chose a research path that also provides a variety of practical implications. The findings of the essays of this dissertation are of interest for originators and investment banks on the sell-side and investors, such as portfolio managers, fund managers as well as institutional investors on the buy-side of securitization. Lastly, the results of the essays may interest both regulators and central banks regarding the consequences of their actions on the development of the ABS market. Reflecting the introduced structure of the research objectives, this subchapter will first discuss findings for the sell-side of the ABS market. Second, the extension of existing knowledge for the buy-side of that market will be outlined. Third, the impact for regulators and central banks will be summarized.

5.2.1 Implications for the ABS sell-side

The findings of the three essays may interest investment banks involved in the securitization process as well as originators of ABS transactions. Essays I, II, and III provide interesting findings about estimates concerning the size of each variable's impact on the spread as well as each variable's significance level for non-U.S. ABS transactions (Essay I) as well as the European ABS market (Essay II and III). The

estimates, associated with the list of common pricing features, give some indication for two important impacts of the variables. First, the value of the estimate indicates the extent to which the variable influences the primary market spread, which could be interesting in the process of securitization with respect to the choice of characteristics for the security. Second, the sign of the estimates indicates the relationship with the primary market spread and illustrates the preferences of investors and what relationship investors expect for the pricing feature and the primary market spread. The significance levels of the common pricing characteristics disclose the list of yield determinants of the primary ABS market and thus, present the pricing variables that investors rely on, when pricing ABS transactions. This could be very important for the sell-side of the ABS market, since the knowledge of the list of yield determinants could be interesting especially with regard to the choice of underlying assets for the security. Underlying assets could be chosen in order to fulfill technical criteria, which could help originators sell the transactions at lower repayment costs and investment banks in order to find investors for the security with respect to merchandising.

In addition, Essay I provides findings regarding the importance and over-reliance on the pricing characteristic *credit rating*. Originators employ credit rating agencies in order to assign a credit rating to the different tranches of the transaction. Essay I supported the hypothesis that investors on the one hand, still relied on the ratings, assigned by credit rating agencies, but also, on the other hand, employed their own default risk analysis in order to both not over-rely on the provided ratings and, if necessary, adjust the ratings. This could be an important contribution for the sell-side because then, the originators would be able to equip the securities with pricing characteristics, such as internal credit enhancement, that investors relied on when employing their own default risk analysis. Further, investment banks could merchandise the securities with reference to those variables in order to differentiate the security from other ABS and persuade investors to purchase the corresponding securities.

Essay II provides findings, which could be interesting for originators and investment banks involved in the securitization process, especially in the European ABS market. The conclusion regarding the differences between the Auto-ABS submarket and other security submarkets could be used as a framework for originators and investment banks when issuing European ABS bonds. Originators could combine the advantages of the own security class with the decisive advantages of the European Auto-ABS market in order to construct a security which can be sold to the capital markets at low costs.

Further, the combined advantages could be presented to investors in the merchandising and selling process as buying argument to reach higher bid-to-cover ratios.

Essay III provides findings, which could be interesting for the sell-side of the European ABS market based on the current nature of the topic of Essay III as well as the currency of the applicability of the results presented in the research paper. The essay supports the hypothesis that the quantitative easing programme of the European Central Bank directly impacts the European ABS market and yields the conclusion that the sell-side of the European ABS market has to adapt to the forced changes in the primary market in order to exploit all advantages the ECB is providing for the sell-side. Especially, originators could profit from the presented and documented results of essay III for the purpose of refinancing the corporation at lower costs. The choice of underlying assets as well as the structure of the security plays an important role for a low primary market spread. In times of low interest rate levels and quantitative easing programmes in the most important fixed income submarkets, this could be an advantage not only compared with other ABS but also with their non-ABS fixed income counterparts.

5.2.2 Implications for the ABS buy-side

The findings of the three essays may interest portfolio managers, fund manager, as well as institutional investors on the buy-side of the non-U.S. as well as the European ABS markets. The results of the three essays regarding the yield determinants of the corresponding ABS market are essential for both private and institutional investors who are interested in investing in those securities. Investors of fixed income securities could use the findings of this dissertation when determining whether or not to invest in an asset-backed security. The findings provide itemized results for the pricing characteristics of ABS and thus, are of interest to investors who determine their investment in the ABS market in great detail.

Additionally, the findings may be of interest to portfolio managers as well as fund managers and investment or asset management companies who are constantly determining the optimal asset allocation of their portfolios. In addition, portfolio managers and fund managers who take positions in the fixed income market especially in the securitization sector, can consider these findings when deciding to execute buy/sell orders on their portfolios. Further, the findings on the estimates concerning the size of each variable's impact on the spread, associated with the ABS market, could be important with respect to their contribution to the risk profile of the corresponding

security. Further, the introduction of variables that may be used in order to employ an individual default risk analysis is expected to make investors further independent from the credit ratings provided by the rating agencies. Besides, especially the findings with respect to the default risk variables may interest portfolio managers and fund managers during the portfolio optimization process with respect to the portfolio risk.

As a consequence of a low inflation rate in the European Monetary Union, the ECB interfered in the European fixed income market and started—in November 2014—the largest quantitative easing programme in the history of the ECB. Thus, the findings of Essay III may interest the ABS buy-side with regard to the influence of the ECB as a new market participant. In addition, the essay highlights important changes attributed to the participation of the ECB and these could be used by portfolio managers, fund managers as well as investment strategists to adapt their portfolios and future investments strategies to the new circumstances.

5.2.3 Implications for regulators and central banks

As a consequence of the changes in the ABS market due to new regulations, regulators may find this dissertation interesting especially as they will see the impact their regulations make on a fixed income market. Further, the results provide regulatory insights on the practical influence the regulations have on the development of single security classes, sector-specific markets, and the ABS market in total. In addition, the results show how regulations that directly impact some variables, indirectly influence an entire set of common security characteristics of an asset-class.

Finally, the findings of Essay III may interest the European Central Bank as well as other central banks especially in the context of quantitative easing on securitization and other fixed income submarkets. Essay III provides information on the development of the European ABS market under quantitative easing and consequently, presents the influence of the current monetary policy of the ECB on the common security characteristics, the risk profiles, as well as the yield spreads of the corresponding ABS transactions. The ECB might be interested in reactions and adaptations of the ABS sell-side as well as the ABS buy-side. The essay provides findings regarding the changes in preferences on the buy-side and the forced investments due to the quantitative easing strategy. On the contrary, the central banks may also be interested in the issuance behaviors of the originators due to the changed circumstances. Thus, the results are of interest since they allow central banks to reflect their quantitative easing strategies and

provide useful information regarding the future implementation of fixed income quantitative easing programmes.

6 References

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7 Declaration of Honor

I herewith formally declare upon my word of honor that I have written the submitted dissertation independently. I did not use any outside support except for the quoted literature and other sources mentioned in the paper. I clearly marked and separately listed all of the literature and all of the other sources which I employed when producing this academic work, either literally or in content. This dissertation has not been handed in or published before in the same or similar form.
In the submitted dissertation the written copies and the electronic version are identical in content.

Ich erkläre hiermit ehrenwörtlich, dass ich die vorliegende Arbeit selbstständig angefertigt habe. Sämtliche aus fremden Quellen direkt und indirekt übernommene Gedanken sind als solche kenntlich gemacht. Die Dissertation wurde bisher keiner anderen Prüfungsbehörde vorgelegt und noch nicht veröffentlicht.

Sebastian Claus Wenz
January 19, 2017

8 Academic Background

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