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SAFE Working Paper No. 391 | June 2023

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Electronic copy available at: <https://ssrn.com/abstract=4496092>

How to green the European Auto ABS market? A literature survey

Carmelo Latino, Loriana Pelizzon, Max Riedel*

Abstract

This literature survey explores the potential avenues for the design of a green auto asset-backed security by focusing on the European auto securitization market. In this context, we examine the entire value chain of the securitization process to understand the incentives and interests involved at various stages of the transaction. We review recent regulatory developments, feasibility concerns, and potential designs of a sustainable securitization framework. Our study suggests that a Green Auto ABS should be based on both a green use of proceeds and a green collateral-based methodology.

Keywords: Securitization, Car Loans, Sustainable Finance, Low-emission vehicles, Regulation

JEL Classification: G23, Q56

*Das diesem Bericht zugrunde liegende Vorhaben wurde mit Mitteln des Bundesministeriums für Bildung und Forschung unter dem Förderkennzeichen 01LA2208A gefördert. Die Verantwortung für den Inhalt dieser Veröffentlichung liegt bei der Autorin/beim Autor. This project was sponsored by the German Federal Ministry of Education and Research.

All authors are affiliated with the Leibniz Institute for Financial Research SAFE. We are grateful for fruitful discussions with Marco Angheben, Nikolai Badenhoop, Andrea Bedin, Jan-Peter Hülbert, Usman Jamil, and Ludovic Thebault. We are responsible for all remaining errors.

1 Introduction

How and to what extent can a “green” feature be introduced into the auto loan and lease securitization process? To answer this question, it is necessary to first understand the anatomy of the securitization market and define what “green” would actually mean in this context. There are multiple parties involved in the securitization process, either directly or indirectly, meaning that the green component can be introduced (i) at different stages of the process, (ii) it can vary in degree, and (iii) it can encompass different dimensions. For instance, a bank could either exclusively evaluate the greenness of a collateralized vehicle in a loan (e.g., by focusing on the CO2 emissions), it could take into account the entire value chain of the product (i.e., the greenness of the vehicle’s manufacturer and the manufacturer’s supply chain), or it could use the proceeds collected from the securitization process to finance green activities, i.e., the so-called use of proceeds approach. The time dimension of the green component should play a certain role, as the transition to a green and sustainable economy will take place over a time period of several decades. Consequently, the green component should recognize the industries’ achievements to date *and* provide forward-looking incentives for all parties to continue investing in green technologies.

Regulation and fiscal incentives are the necessary amplifiers and accelerators for the greening of the economy. A lot of time, thought and money have been spent in creating green frameworks, legislation, and providing investment incentives to market participants. Consequently, it is important to build on what has been already achieved and to learn from mistakes in order to propose long-term viable solutions. In this respect, it is essential to review recent legislative developments and studies on the effectiveness of incentives in the context of the green transition.

Why should a green component be introduced in the securitization process at all? The reasons come from long-term environmental concerns, political recognition

of this issue, consumers' support, and investors' demand for sustainable products. The environmental impacts associated with the manufacture, use, and disposal of automobiles are well documented (e.g., [Golinska, 2013](#)) and are subject to continuous improvement. Support comes from the European Commission which has adopted an action plan in 2018 with the objective to reorient capital towards sustainable investments, mainstream sustainability into risk management, and foster transparency and long-termism ([European Commission, 2018a](#)). On the consumer side, about 80% of Europeans approve energy efficiency ([European Commission, 2018b](#)), while investors have been keen to incorporate sustainability in their investment criteria in recent years ([Eccles and Klimenko, 2019](#)).

The introduction of a so-called green auto asset-backed security (Green Auto ABS) could potentially foster the sale of zero or low-emission vehicles and therefore support the European climate targets. On a global scale, Europe is presently lagging behind economies such as the USA or China when it comes to green auto securitization: in the USA multiple green securitizations have been successfully completed to date, while in China the first internationally rated Green Auto ABS was issued in 2021. In contrast, the first and only European securitization that was backed exclusively by electric and hybrid vehicle exposures was issued in 2023.¹

To assess the advantages and risks associated with a Green Auto ABS it is crucial to comprehend the characteristics of the auto securitization market and discuss the product's potential design. In the following, we start with an outline of the general auto securitization process. We then inspect how the individual parts of the process could be supplemented with the green component and review related findings on this nascent topic in existing literature. Finally, we present current and proposed regulations with the aim to understand how the green component could be defined and where the

¹The green securitizers in the respective countries are Toyota Motor Credit Corp (USA), BYD Auto Finance (China), and Toyota Financial Services Italia (Italy).

main challenges to its implementation lie.

2 Dissecting the securitization process

Auto securitization is the process of pooling auto loans and leases into an asset-backed security and selling it to institutional investors. The process involves several parties, including sponsors, special purpose vehicles, originators, car dealerships, credit rating agencies, and investors.

A sponsor is the entity that initiates the securitization transaction by selling or transferring exposures to the issuing entity, a special purpose vehicle (SPV). A SPV is a separate legal entity that is created for a specific objective; to isolate financial risk.²

An originator is a financial institution that originates the assets that will be securitized. A sponsor can also be the originator of the assets.

Originators of auto loans and leases are typically either captive banks or (non-captive) retail banks.³ A captive bank is owned by a car manufacturer and serves as its financing arm. It typically works closely with the car dealerships that are affiliated with its parent company. In contrast, a retail bank can have a financing arrangement with a car dealer but it does not need to, as it can provide a loan to its customer upon request.

Auto loans (or leases) are collateralized by the underlying vehicles and once originated, the bank can decide to securitize them (either by its own initiative or through a sponsor) to obtain funding for its business. In the process, the assets are sold to the SPV, typically via a so-called true sale transaction, while SPV in turn raises the funds for the purchase on the capital market by issuing an ABS with regular payment promises and different seniority levels, or “tranches”.⁴ Rating agencies provide credit ratings on the tranches,

²A SPV is designed to be bankruptcy-remote, which means that its assets and liabilities are segregated from those of the originator or sponsor. Therefore, ABS investors generally do not have recourse to the originator of the underlying exposures or the sponsor.

³In some cases, large lease companies can also engage in the securitization.

⁴An ABS is typically tranching into a senior, and one or several mezzanine and junior tranches. The

based on the credit risk of the underlying pool of exposures. The most senior tranches of Auto ABS have safe-asset status similar to sovereign bonds (Gorton, 2017). The tranches are typically sold to institutional investors such as banks, insurance companies, or pension funds (Della Croce and Gatti, 2014), depending on their risk preferences. Due to the product's complexity, retail investors are generally not the target group.

In the next subsections, we describe the auto securitization market and its functioning in more detail. In particular, we focus on the main actors in the market to understand their interactions between each other and identify sustainability-related information that could be used, in a structured and transparent manner, to measure the greenness of an Auto ABS transaction.

2.1 Loan and lease origination

A vehicle is the second most expensive single item purchased by a household after a house. Therefore, the majority of vehicle purchases is financed via loans and leases that are commonly originated at dealerships.⁵

While some prospective buyers may gather information about car models online and even place orders through the internet, most buyers still prefer to visit a dealership to get a firsthand experience of the car's look and feel. As noted by Golar et al. (2021), dealerships are still the primary location for finalizing the majority of car deals. Dealers arrange auto loans through indirect auto financing by acting as middlemen between the vehicle buyer and the dealer's partner bank. The dealer's main goal is to close the car purchase before the interested buyer leaves the house and collects information about other, potentially cheaper, financing options (e.g., at the buyer's house bank). This

most junior tranche is referred to as the equity tranche since it is the first to absorb losses. DeMarzo (2005) presents a theoretical explanation for tranching. He shows that pooling assets prevents informed investors from selectively purchasing only the highest quality components of the pool, which in turn reduces the adverse selection problem that uninformed investors may face.

⁵According to Ed Paulat, GM Financial, “[f]ully amortising loans . . . [were] the preferred option for 70% of people who financed a new car [in 2015]” (Motor Finance Online, 2016).

means that dealers have some negotiation power about the financing details that they try to exercise. In particular, they have a certain degree of discretion about the interest rate charged on car loans, depending on the financing arrangements with their partnering captive and non-captive banks.

2.1.1 Captive and non-captive banks

Dealers' partner banks vary depending on business relation and product type. Franchise dealers that represent a particular car manufacturer typically work with the manufacturer's financing arm, a captive bank, when financing new cars. For the financing of used vehicles, dealers can work with the captive bank and non-captive banks, depending on the franchise contract, while independent dealers typically partner with non-captive banks. However, not all self-proclaimed captive banks are truly captive. Some specialized banks offer white label captive banking services to car manufacturers that do not have their own operating financing arm. This is usually the case for foreign car manufacturers that intend to establish a strong presence in a local market.

Regardless of the exact financing arrangement, dealers generally prefer to offer their customers loans that are financially most rewarding for their own business (Ho and Stoll, 1981). Also, captive and non-captive banks have discretion about different financing and purchasing options, e.g., when promoting the purchase of zero or low-emission (ZLEVs) and high-emission vehicles (HEVs).⁶ In this context, Beyene et al. (2022) examine the change of bank credit conditions following the Diesel scandal in 2015. The authors show that non-captive banks imposed stricter credit conditions on loans for financing diesel cars compared to captive banks. Captive banks, on the other hand, reduced interest rates relative to petrol vehicles to support HEV purchases. These findings and the close

⁶Throughout this document, in line with European Commission (2017), when referring to ZLEVs (HEVs), we refer to vehicles that emit CO₂, measured in g/km, below (above) 50 g/km. Hence, the universe of ZLEVs is comprised of both electric and plug-in hybrid vehicles, while a CO₂ threshold of 0 g/km would restrict ZLEVs exclusively to electric vehicles.

relationship between dealers and their partner banks suggest that in order to foster the purchases of ZLEVs, the incentives of manufacturers, lenders, dealers, and consumers have to be aligned.

2.2 Consumers

2.2.1 Consumer preferences

Consumer preferences and purchase decisions are essential components for high market penetration of ZLEVs in the long run. Surveys have shown that the factors of electric vehicle adoption include moral and social motives ([Kastner et al., 2021](#); [Bobeth and Kastner, 2020](#)), charging infrastructure concerns ([Haustein and Jensen, 2018](#)), and real life usage experience ([Jensen et al., 2014](#)), among others. However, preferences can change over time as shown by [Keller et al. \(2021\)](#). Covering the period 2013 to 2019, the authors find that preferences for EVs develop in an unpredictable and non-monotonous way. The most important factor that seems to dominate consumers' purchase decision throughout time is the electricity cost per 100 km, and not the vehicle's purchase price. This finding might be surprising but it is in line with studies showing that higher fuel prices induce households to buy hybrid vehicles ([Beresteanu and Li, 2011](#)) or switch cars in general ([De Borger et al., 2016](#)).

The extent to which EVs will become a common means of transportation is still uncertain due to multiple reasons. For instance, [Jensen et al. \(2014\)](#) observe that the purchase intention for EVs decreases after the individual real life trial period of using the vehicle, while [Keller et al. \(2021\)](#) find that prospective buyers are concerned about batteries catching fire and the general environmental friendliness of EVs (e.g., due to electricity being generated in coal-fired power plants).

To promote the uptake of ZLEVs, such and similar consumer concerns need to be addressed. Some ways to achieve this include providing extended battery warranties

or implementing targeted information campaigns (Krupa et al., 2014). In addition, well-designed financial incentives can stimulate demand, which we will address in the next section.

2.2.2 Financial incentives

One approach to promote low-emission mobility is to offer preferential loan conditions (e.g., lower interest rates) for ZLEVs. Banks determine loan conditions based on their risk exposures that are driven by factors such as the probability of default on the loan repayment and the loss given default (LGD). The former metric depends on borrower's credit risk, while the latter depends on the value of the underlying collateral. Whether there actually exists a risk-differential between ZLEVs and HEVs is not obvious and requires proper investigation.⁷ The following paragraphs aim to shed some light on this open question.

Credit risk A borrower's credit risk depends on his or her financial circumstances. In general, higher wealth or income are accompanied with lower risk of defaulting on the loan repayment schedule. The channel through which a green component could affect a borrower's credit risk is thus the disposable income. A ZLEV that positively impacts the borrower's disposable income can reduce the credit risk and may consequently justify preferential interest rates from the bank's perspective. The following aspects of a ZLEV could affect disposable income: tax exemptions, environmental programs, and costs associated with travel, vehicle maintenance, and repair.

Tax exemptions of various forms are a common approach to incentivize the purchase of certain vehicle types. For instance, in 2009 Germany introduced a motor vehicle tax exemption for passenger cars emitting CO₂ below a certain threshold (95 g/km from

⁷The European Commission High-Level Expert Group on Sustainable Finance recommends that the European Commission investigate whether there is a risk-differential justifying the introduction of "green supportive" and "brown penalising" factors (HLEG, 2018).

2014), while taxing every additional gram of CO₂ with two euros. Similar taxation-related incentives exist in the United States (Sallee, 2011), Canada (Chandra et al., 2010), Switzerland (Alberini and Bareit, 2019), and many EU countries (see ACEA, 2022).⁸ Tal and Nicholas (2016) provide support for the effectiveness of this fiscal measure. In their preference survey of plug-in vehicle owners in the United States, the authors find that more than 30% of sales are attributed to the federal tax credit.

Two types of environmental programs were popular over the last decades: scrappage programs and environmental bonuses. The former is intended to provide economic incentives to purchase a new, more fuel-efficient vehicle when trading in an old car. Such programs were introduced around the globe, with varying degree of success (see, e.g., Mian and Sufi, 2012; Müller and Heimeshoff, 2013). The latter type is intended to incentivize the purchase of electric and hybrid cars by offering a discount on the purchase price. Such programs were introduced in Austria (E-Mobilität), Germany (Umweltbonus), France, Sweden (Klimatbonus), and the United States (see ACEA, 2022). Clinton and Steinberg (2019) demonstrate the effectiveness of direct purchase rebates for the US market.

Regarding maintenance and repair cost differences between ZLEVs and HEVs, studies have not reached a consensus yet. For instance, Iwata and Matsumoto (2016) find that the per-kilometer travel cost of hybrid vehicles is much lower than that of petrol vehicles even after accounting for depreciation costs. According to Propfe et al. (2012), the maintenance and repair costs for ZLEVs are lower than for conventional cars. However, findings suggest that the total cost of ownership (TCO) for electric vehicles is below that of internal combustion engine vehicles in countries like Norway, while in other countries they are either at par or higher (Levay et al., 2017). Even if the TCO of ZLEVs were lower, this would not necessarily mean high disposable income for the vehicle owner.

⁸The European Automobile Manufacturers' Association (ACEA) provides a broad and a comprehensive study of the tax exemptions for ZLEVs around the globe. The reports are available at yearly frequency dating back to 2001.

Improved technical efficiency may result in increased consumption due to the *rebound effect* (Fronzel et al., 2008; Small and Dender, 2007). The rationale behind the rebound effect is that with a lower cost of driving, people tend to drive more, offsetting the energy savings that could have been attained otherwise. If the rebound effect is sufficiently large, the justification for implementing policy measures that promote energy efficiency can be weakened (Sorrell and Dimitropoulos, 2008). In the space of energy-efficient vehicles, Seebauer (2018) studies adopters of electric cars in Austria and finds that social norms for environmentally conscious consumption may increase the rebound effect. Nevertheless, De Haan et al. (2007) does not find a rebound effect for hybrid and electric vehicles in Switzerland.

To summarize, fiscal incentives targeting ZLEVs bear the potential to positively affect borrowers' disposable income and thus reduce their credit risk. In addition, when electricity is cheaper than the fossil alternatives, consumers can benefit from reduced fuel costs, resulting in incremental income. Nevertheless, the relationship between ZLEVs' TCO and credit risk remains an open question.

Collateral value An auto loan is typically collateralized by the purchased vehicle. The main role of collateral is to reduce the lender's asymmetric information about the borrower's credit risk and, therefore, to avoid credit rationing (Bester, 1985; Igawa and Kanatas, 1990). The lender is thus exposed to the borrower's credit risk and, in case of a default, to the collateral's resale value.

Information about collateral values is asymmetrically distributed not only between borrowers and lenders, but also among lenders themselves. In particular, vertically integrated lenders, i.e., captive banks, have superior information about the quality of collateral as opposed to non-integrated lenders. This was demonstrated by Stroebel (2016) for property developers in the United States. Similar to car manufacturers, property developers use their affiliated financing arms to finance their customers' real

estate purchases. [Stroebel \(2016\)](#) finds that the better-informed lender's collateral portfolio outperforms that of the non-integrated lender. The latter compensates for this information disadvantage by charging higher interest rates. While a similar study was not yet conducted for European captive automobile lenders, [Barron et al. \(2008\)](#) show in their theoretical model that the differences in lending behavior between captive finance companies and independent lenders can also lead to the adoption of more lenient credit standards by the former ones. The downside of collateral use from a lender's perspective is that it generates borrower moral hazard with regard to the pledged asset's maintenance or "care" ([Igawa and Kanatas, 1990](#)). Loan overcollateralization, periodic collateral maintenance requirements, or inspections can reduce this issue.

There are reasons to believe that the green component will affect a vehicle's collateral value and therefore the lender's LGD. The collateral value is tied to the vehicle's depreciation rate, market demand, and consequently the resale price. Given the current state of the technologies, it is plausible to expect that the depreciation rates of HEVs and ZLEVs will differ.⁹ However, the empirical findings on this topic are yet mixed. On the one hand, [Gilmore and Lave \(2013\)](#) find that higher fuel economy vehicles, such as hybrid cars, retain a higher proportion of their initial price in the used car market. On the other hand, [Schloter \(2022\)](#) shows that electric vehicles have a substantially higher depreciation compared to petrol vehicles (13.9% versus 10.4% per annum). However, it is worth mentioning that technological improvements, competition, and restrictions on certain technologies or fuel types will affect the future demand for ZLEVs, their depreciation rates, and their resale prices.¹⁰

⁹According to [European DataWarehouse \(2022\)](#), for a sample of European auto loans, it seems that residual values for electric vehicles have witnessed a steady growth between 2017 and 2021, establishing them as the frontrunners in terms of value retention. Following closely behind are petrol vehicles, which also demonstrate favorable residual values.

¹⁰For instance, there is a global trend in the attempt to phase out internal combustion engine vehicles over the next several decades ([Meckling and Nahm, 2019](#); [Fulton et al., 2019](#); [Burch and Gilchrist, 2018](#)), which will likely positively affect demand for ZLEVs. Prices can be influenced in either direction, depending on the forces at play. Competition, as seen recently in the electric vehicle market, may prompt

In relative terms, since HEVs are fiscally discouraged products (e.g., via additional CO2 taxation), they are likely to be traded at a discount in the medium to long run, suggesting that the resale price of ZLEVs will include a green price premium. Whether such differences in the fundamentals of the collateral values of ZLEVs and HEVs could justify an interest rate discount for ZLEVs via the LGD channel is an open question.

2.3 Car dealerships

Car dealerships partner with banks to provide on-site financing options to prospective buyers. The partner banks set interest rates based on borrowers' credit history and loan attributes, while dealers can add an additional amount, known as a markup or dealer rate, to the bank's interest rate to cover their costs for facilitating the loan. The total interest rate paid by the borrower is the combined amount of the bank's interest rate and the dealer rate (Jiang et al., 2022; Cohen, 2012). This approach can result in customers paying more for the vehicle than they would have if they had secured financing elsewhere (Davis and Frank, 2011).¹¹ For the U.S. market, White and Munger Jr (1970) find that most car buyers are seemingly not aware of such arrangements between the dealer and the bank as they usually fail to seek the lowest-cost loan for which they could have qualified. Dealers may also make auto loans more attractive to customers. For instance, they offer lower interest rates, as was shown by Melzer and Schroeder (2017) for vehicle buyers with expected binding usury limits. Or they may even offer zero-percent financing to counter a sudden drop in vehicle demand (Copeland and Hall, 2011). To spur sales, automobile manufacturers frequently use promotions that include cash incentives. These incentives may be targeted directly to customers through well-publicized advertisements

manufacturers to cut their prices. A prominent example is Tesla Motors, which has lowered its prices several times within a short period of time (He, 2023). On the other hand, systemic disruptions, such as the Covid-19-induced semiconductor shortage or supply bottlenecks for raw materials, can lead to a longer-term increase in vehicle prices (Coffin et al., 2022), both in the new and used car markets.

¹¹From conversations with industry representatives, we understand that the concept of the dealer markup rate is more widespread in the U.S. than in Europe.

or indirectly through cash payments to dealers for each settled sale. [Busse et al. \(2006\)](#) find that direct targeting is more effective than indirect targeting, as dealers attempt to maximize profits by reducing the pass-through rate of cash rebates to customers. They conclude that direct targeting can reduce information asymmetries and increase the buyer's negotiation power vis-à-vis the dealer.

Dealers could play a crucial role in the decarbonization of the transportation sector. For instance, they could provide consumers with a detailed breakdown of the TCO for both HEVs and ZLEVs. This could involve explaining upfront purchase costs, ongoing operating costs, and potential incentives or subsidies. However, it seems that instead of promoting ZLEV purchases, car dealerships pose a barrier at the point of sale, as they perceive these vehicles to have a limited business case viability compared to traditional petrol and diesel vehicles ([Zarazua de Rubens et al., 2018](#)). For example, focusing on small towns and rural areas in Sweden, [Eriksson and Olsson \(2022\)](#) find that rural car dealers tend to endorse conventional cars. Similarly, [O'Neill et al. \(2019\)](#) report that car dealers predominantly steer customers toward conventional cars in Ireland.

In summary, literature documents that dealers can utilize various tools to promote the sales of ZLEVs. These tools may be both of informational and financial nature. Dealers can educate prospective buyers about the benefits of ZLEVs and they can provide financial incentives such as cash rebates, low interest rates, or reduced sale prices. However, it is crucial to ensure that information is disseminated transparently and objectively, and that green promotions have a high pass-through rate to the vehicle buyers. A promising approach, for instance, is public advertising. Fully transparent advertising empowers customers with the necessary information and bargaining power to fully benefit from the financial incentives.

2.4 Banks

Banks have a variety of funding needs, including the need to meet regulatory capital requirements, to finance loan and investment portfolios, and to manage liquidity. One way that banks can raise funds is through the issuance of ABS. A key benefit of issuing ABS is that it allows banks to raise funds without having to issue equity or debt. Thus, securitization provides banks with an additional source of funding, allowing for funding sources diversification and making bank lending less sensitive to cost of funds shocks (Loutskina, 2011).¹² Additionally, once a ABS is issued, it can serve as collateral for obtaining liquidity from central banks (see, e.g., Van Bakkum et al., 2017).

Securitization can be a useful tool for managing interest rate, currency and credit risk. By issuing ABS that are tied to specific assets or pools of assets, banks can transfer some of the risk associated with those assets to investors (Ambrose et al., 2005; Michalak and Uhde, 2012). This can be particularly advantageous for banks that are seeking to maintain a strong capital position or that are facing regulatory constraints on their ability to issue new debt.

In general, securitization is an instrument that can be used to convert illiquid loans into liquid securities (Loutskina, 2011), and it thus holds an important role in bank's liquidity and funding management. The collected funds from an ABS issue enable banks to originate more loans to borrowers, which can help to increase the flow of credit to households and businesses, and promote economic growth (Baradwaj et al., 2015) or the transition to a sustainable economy. Nevertheless, securitization also entails certain risks for the originator of the underlying assets or the sponsor. The originator (or sponsor) must retain no less than 5% of the material net economic interest to signal to investors that the underlying exposures have a certain quality (Krahen and Wilde, 2022). In case

¹²As an alternative to loan securitization, a bank can also sell its whole loan portfolio to specialized buyers that are interested in holding consumer finance exposures.

of a deterioration in the credit quality of the underlying assets, the originator (or sponsor) is therefore typically the first to absorb losses.

Besides the general advantages of securitization, banks could benefit from issuing green ABS for two particular reasons. First, green ABS could reduce the number of stranded assets in originators' portfolios, thereby mitigating their climate-related risks, as outlined in Section 4.1. Second, in light of the recent EU regulation on sustainable finance, banks have strong incentives to promote their EU taxonomy aligned portfolios. This could be achieved via green ABS transactions, as discussed in detail in Section 4.2.

2.5 Auto ABS

The worldwide first auto loan ABS were issued in the United States in the late 1980s by General Motors Acceptance Corporation (GMAC), which was the financing arm of General Motors. In Europe, the first Auto ABS were offered in the early 2000s. The European market grew rapidly and peaked in 2007. The Global Financial Crisis (GFC) had a ripple effect on all securitization markets, including the Auto ABS market. This led to increased regulation of the financial industry and thus to higher compliance costs for issuers of ABS, which reduced the profitability of this market segment. To revive the market, regulators put in recent years efforts to increase standardization and transparency of the securitization process.¹³ Also the European Central Bank (ECB) actively supported the securitization market through measures such as providing collateral, regulatory, and quantitative easing for ABS (Braun, 2018).¹⁴

Auto ABS are the fourth largest form of securitization in the EU (ESRB, 2022). In the years 2011 to 2021, the yearly volume of new Auto ABS issuances in the Europe

¹³To exemplify this notion, consider the STS initiative outlined in Section 4.

¹⁴The ECB performed collateral easing by reducing the minimum credit rating for Eurosystem collateral-eligible ABS in 2012, it advocated against discriminatory regulatory treatment of ABS in forthcoming regulations in 2013, and it introduced the Asset-Backed Securities Purchase Programme (ABSPP) in 2014.

was between EUR 20 and 30 billion ([Creditreform Rating, 2022](#)). Germany typically accounted for about one-third of all new issuances, followed by Spain, France and the UK. The market was largely dominated by captive banks, with Volkswagen emerging as the main issuer and holding a market share of over 16% in H1 2022.

The issuance of Auto ABS benefits both loan originators and investors. Loan originating banks can use the proceeds from the sale of an Auto ABS to fund new auto loans, which can help to increase the flow of credit to households and businesses. Auto ABS investors benefit from the issuance of these securities as they typically offer attractive yields. Additionally, Auto ABS offer investors an opportunity to gain exposure to the auto loan market, which can be an attractive option for those looking to diversify their portfolios.

From the risk perspective, one of the main concerns for banks is the credit risk of the underlying auto loans. Since banks have to keep some “skin-in-the-game” by usually retaining the riskiest tranche (i.e., the equity tranche), they need to ensure that both the pool of originated and the pool of securitized auto loans are well diversified and of high credit quality, otherwise, it can lead to a higher rate of defaults and result in losses for the bank ([Krahn and Wilde, 2022](#)).¹⁵ Similarly, for investors one of the main risks is the potential for losses in the event of excessive defaults on the underlying exposures. This could occur if the distribution of exposures is unbalanced: the so-called concentration risk can arise if, for instance, the collateral pool is comprised of a certain type of cars (e.g., diesel cars). Such risk can materialize in the wake of an unforeseen external event like the Diesel scandal in 2015.¹⁶ Additionally, a variety of vehicle-related risks could emerge from

¹⁵Studies show that the design of a retention scheme matters ([Fender and Mitchell, 2009](#); [Nicoló and Pelizzon, 2008](#)). In fact, the retention of the equity tranche does not necessarily have to be the optimal form of retention and, depending on the setup, other types can dominate it.

¹⁶The Diesel scandal negatively affected used car prices and customers’ willingness to buy a diesel car, as documented for the Israeli market by [Ater and Yoseph \(2022\)](#), and it induced a negative spillover effect to unaffected products of the same manufacturer, as observed in the U.S. market by [Che et al. \(2023\)](#). However, to our knowledge and following discussions with industry representatives, no risk materialized to Auto ABS investors in the aftermath of the scandal.

regulatory changes for certain vehicle types (e.g., a ban of combustion engines), product defects (e.g., battery explosions in EVs), or geopolitical factors (e.g., supply shortages of gas, petrol or electricity).¹⁷ These risks could adversely affect the collateral values of asset pools that are overly focused on a particular vehicle category, whether HEVs or ZLEVs. Therefore, ensuring adequate diversification of the collateral pool is crucial. The process of achieving this within a strictly green collateral pool remains an area needing further research.

3 Green securitization

There is presently no universally agreed-upon definition for green securitization ([Petit and Schlosser, 2020](#)). It could be based on two distinct criteria. The first criterion is the use of proceeds (UoP) approach, where the ABS issuer commits to use the funds received from the securitization to finance future green projects or assets (e.g., by providing credit to finance ZLEV purchases). The second criterion pertains to the predominant green feature of the underlying collateral. In this so-called collateral-based approach, the greenness of the ABS is determined by the environmental characteristics of the assets in the pool. For instance, auto loans and leases could be labelled green depending on the CO₂ emissions of the underlying vehicles.

In the case of the UoP approach, the securitization of non-green exposures and the commitment to use the proceeds to finance green assets create a green feedback loop through which originators can increase the proportion of green loans in their portfolios.

¹⁷Recent history has witnessed instances of vehicle bans, battery-related risks, and supply-related issues. [Holland et al. \(2021\)](#) discuss the ban of gasoline vehicles and show that a transition to electric vehicles is not optimal at the current level of substitutability as a gasoline vehicle production ban would lead to large deadweight losses. Conversely, [Plötz et al. \(2019\)](#) argue that a well-designed car ban could play a strong role in achieving long-term GHG and air-pollution targets. In the realm of batteries, [Christensen et al. \(2021\)](#) assert that lithium-ion batteries have penetrated everyday life faster than our understanding of the risks and challenges associated with them. Finally, [Wu et al. \(2019\)](#) points out that the electric vehicle supply chain is different from the traditional auto industry, noting that the risk level of the electric vehicle supply chains in China is between “general” and “high”.

[Agliardi \(2022\)](#) analyzes the impact of such a setup on banks' portfolio exposures and their alignment with global climate targets. The findings suggest that this approach can lead to more resilient and mission-aligned financing institutions, underscoring its potential as a viable solution for promoting sustainable finance.

[Petit and Schlosser \(2020\)](#) note that employing the UoP approach could result in a transaction that is only partially considered "green" because it is possible for brown assets to still serve as collateral for the securities being issued. In contrast, the collateral-based approach is only feasible if there already exists a sufficiently large pool of green assets to create an ABS. This is a drawback for those originators, who hold a low share of green assets in their portfolios. However, in aggregate, the collateral-based approach would provide an incentive to originate more green loans and leases. Hence, while banks would diversify their investments in (future) green activities in the medium to long term under the UoP approach, the collateral-based approach could have a much more immediate and direct impact on the composition of banks' auto loan portfolios, which would promote the transition to low-emission mobility. Undoubtedly, both approaches would add a distinct green feature to the Auto ABS, making it an attractive investment product to different types of investors.

As a matter of fact, studies show that institutional investors care about climate and carbon risks across different asset classes (e.g., [Bolton and Kacperczyk, 2021](#); [Krueger et al., 2020](#)). [Capasso et al. \(2020\)](#) find that companies with a high carbon footprint are perceived by the market as, *ceteris paribus*, more likely to default. Such risk considerations are both due to financial and non-financial motives, including regulatory requirements, protection of investor's reputation, and peer pressure. As a result, demand for green investments is outstripping supply, with institutional investors seeking to buy green fixed income products via a variety of investment channels, including ABS. In fact, asset managers rank clean transport among the most preferred green investments,

according to survey evidence from European asset managers (Sangiorgi and Schopohl, 2021). These findings suggest that there is space for a Green Auto ABS in the securitization market. However, Beyene et al. (2022) find that increased transparency on the environmental performance of cars following the Diesel scandal may not be enough to affect banks' financing of HEVs. In addition, demand for green investments cannot be met at any price. Sangiorgi and Schopohl (2021) find that an important factor in investing in a green fixed income product is competitive pricing compared to its non-green counterpart. Studies also highlight that transparency and comparability in environmental, social, and governance (ESG) reporting play an essential role in the investment decision of institutional investors across the globe (Amel-Zadeh and Serafeim, 2018; Eccles et al., 2017). For issuers of green products reporting costs are a key factor that needs to be considered, but there are positive effects attached to it: Flammer (2021) shows that investors respond positively to green bond issuance announcements, benefiting corporate issuers in terms of an increase in ownership by long-term investors.

To summarize, the increasing demand for sustainable and environmentally friendly transportation, regulatory pressure to reduce emissions, and investor demand for green investment products, lead in recent years to discussions about a potential design and introduction of a Green Auto ABS. There are various proposals on how a Green Auto ABS could be constructed. They range from purely green asset pools consisting solely of loans and leases on ZLEVs to a green proceeds approach where the originator commits to finance assets and projects that comply with the EU taxonomy. The next section provides an overview of recent regulatory developments and discussions on this topic.

4 Regulation

4.1 Green securitization framework

Over the course of the last decade, the European securitization market has been subject to multiple regulatory frameworks. However, it was not until recent years that this market entered into the realm of sustainability debates. Following the GFC in 2008, the EU introduced the first regulation in 2009 with the goal to mitigate risks, to create a level playing field for securitization transactions across the EU, and to promote market transparency and investor protection.¹⁸ Most notably, it required financial vehicle corporations to disclose statistics on their assets and liabilities on a quarterly basis. The regulation was recast in 2013, requiring issuers of securitized products to disclose more information about the underlying assets and the structure of the securitization transaction.¹⁹ In 2017, the EU introduced new due diligence requirements, risk retention rules, and the creation of a new category of simple, transparent, and standardized (STS) securitizations.²⁰ The STS framework came into effect in 2019 with the aim to revive the securitization market by providing benefits to issuers and investors.²¹ A remarkably novel component of this framework was the requirement to publish data (where available) on the environmental impact of the assets underlying the securitizations.²² In 2021, the STS framework was further amended and the regulation set out the goal to develop

¹⁸See Regulation (EC) No. 24/2009.

¹⁹See Regulation (EU) No. 1075/2013.

²⁰See Regulation (EU) No. 2017/2402.

²¹For issuers, STS securitizations benefit from a more favorable regulatory treatment, including lower capital requirements for banks that invest in STS securitized products. For investors, STS securitizations offer a higher degree of transparency, standardization, and quality assurance, which can increase the attractiveness of the investment. On May 2022, the ESAs launched a joint consultation paper on the Draft Regulatory Technical Standards (RTS) with regard to the content, methodologies and presentation of disclosures pursuant to Art 22(4) and 26d(4) of Regulation (EU) 2017/2402. As the proposed RTS does not contain any specific principal adverse impact (PAI) indicator in relation to auto loans and leases, indicators are derived from the EU Taxonomy regulation.

²²The STS framework did not provide a definition of the environmental performance measures. This led to an inconsistent reporting practice due to different definitions of energy performance certificates (e.g., for cars) across euro area countries.

a sustainable securitization framework that should be based on the European Banking Authority (EBA) report ([EBA, 2022](#)).²³

The EBA report provides multiple avenues for a sustainable securitization framework. An important consideration in setting out the framework is to ensure that securitization products are not put at a competitive disadvantage vis-à-vis other types of funding instruments. For this reason, the EBA advises to build the framework on the voluntary EU Green Bond Standard (EU GBS) and to adjust it for the particular nature of securitization transactions.²⁴ As a general rule, to obtain the green label under the EU GBS, a bond-issuing company must use 100% of the bond proceeds to finance EU taxonomy-aligned investments even if the company is not green as a whole or the bond is not secured by green assets. In the case of an ABS transaction this UoP approach would practically (and unintentionally) result in a pure collateral-based approach. To understand this, we have to remember that in an ABS transaction loan origination and securitization are performed by two separate entities; the loan-originating financial institution and the ABS-issuing SPV. According to the EU GBS definition, the UoP approach should apply at the issuer level, which is the SPV. In a true sale transaction, the SPV uses its proceeds to purchase the securitized pool of collateral from the loan-originating bank, which would imply that the underlying exposures would have to comply with the EU taxonomy, effectively turning the UoP approach into a collateral-based approach.²⁵ Such an application of the EU GBS has two major shortcomings. First, the issuance of a green ABS would not require the lender to use the proceeds to finance new, taxonomy-aligned loans. Second, there is currently a lack of available green collateral that can be securitized, making the UoP approach impractical

²³See Regulation (EU) 2021/557.

²⁴The EU GBS was developed to establish a common set of criteria for what constitutes a “green” bond and it aims to apply to wide array of fixed income products, including ABS.

²⁵Only true sale transactions are within the scope of the EU GBS. Due to their complexity, synthetic securitizations are not considered for the sustainable securitization framework.

at the SPV level. As a possible solution, the EU GBS could be amended for securitization transactions by requiring the UoP approach to apply at the originator level instead of the issuer level. This “adjusted EU GBS” would ensure that future loans would be used exclusively to finance taxonomy-aligned assets and activities. However, the pool of securitized assets would in this case not be required to be EU taxonomy aligned, leaving room for “adverse green selection of assets”. This effect can occur if originators are incentivized to sell their stale, “brown” assets through a green ABS. To mitigate this risk, investors should be provided with sustainability information on the underlying collateral pool, making the underlying exposures comparable across securitizations.

The scope of sustainability-related data on the underlying portfolio has yet to be determined. The opinions on this topic vary considerably across market participants and stakeholders.²⁶ The consensus view is that sustainability disclosure requirements should be standardized, simple, and harmonized. The reporting costs should be reasonable and the scope of the requirements should not deviate from those for other financial products. In addition, the sustainability indicators should be obtainable by both captive and non-captive auto lenders. There is a strong preference to collect data at the level of securitized exposures and not at the level of the car manufacturers, as the latter information is not readily available to lenders and issuers, and it poses a

²⁶For a detailed overview, please refer to the joint consultation paper on the principal adverse impact indicators conducted by the European Supervisory Authorities (JC, 2023, 2022) and the corresponding responses from participating stakeholders.

disproportionate burden in several respects.^{27,28} Market participants suggest to report information such as the share of ZLEVs in the securitized portfolio, the average CO2 emissions of underlying vehicles, or their European emission standard.²⁹ Furthermore, the loan originator should disclose its policy for evaluating sustainability factors in the credit granting process. According to [EBA \(2022\)](#), there are three potential avenues for a sustainable securitization framework. In each approach, the EU taxonomy alignment of both the proceeds and the underlying collateral portfolio plays a role, but to different degrees. The most flexible (light green) approach allows for a choice at the originator level; an ABS could be labelled green if the transaction is either comprised predominantly of green collateral (e.g., above 2/3 of the portfolio) or if it meets the “adjusted EU GBS” framework (i.e. 100% of green use of proceeds at originator level). In the more restrictive (medium green) approach, the green label could be obtained (i) either by a combination of a certain green collateral share (e.g., above 50% of the portfolio) *and* a commitment to use a specific share of the proceeds (e.g., above 51% of UoP) to finance taxonomy-aligned assets or (ii) if the transaction meets the “adjusted EU GBS” framework. The last (dark green) approach would encompass an integrated framework, requiring a minimum share of green collateral in the underlying portfolio and full compliance with the “adjusted EU

²⁷ESG information at the manufacturer level (e.g., social and employee, respect for human rights, anti-corruption and anti-bribery matters) poses a data collection challenge, particularly for non-captive lenders, as they must rely on third-party vendors and the completeness and accuracy of their data sets. ESG information may also not be readily available for used vehicles whose manufacturers have merged with another company and no longer have a separate identity or who have gone out of business. In addition, the timing of data collection and dealing with subsequent updates are challenging issues. For instance, the constantly evolving ESG information could be collected at different points in time: (i) at the vehicle construction date, (ii) at the auto loan origination date, or (iii) at the auto loan securitization date. Subsequent data updates could either be ignored (i.e., the green label of the Auto ABS would not change during its lifetime) or the data could be updated periodically (i.e., the green label of the Auto ABS could potentially be revised, depending on factors such as changes in sustainability thresholds).

²⁸Regardless the type and scope of exposure-level information, [ESMA \(2021\)](#) is explicit on its quality: proxy data is not permitted. The originator must always provide actual information on the specific underlying exposures.

²⁹Some market participants suggest to link a vehicle’s green label to its Euro emission standard. Since the legal requirements on air pollution for vehicles are getting steadily stricter, linking the green label to the Euronorm would ensure that the label takes into account the technological progress over time.

GBS” framework.

In conclusion, there is no one-size-fits-all approach in the development of a green label for securitization transactions. Various stakeholders agree on the necessity to adopt simple and transparent sustainability criteria that do not create an uneven playing field among securitizers or disadvantage the asset class relative to other financial instruments. Overall, a dual approach utilizing both the use of proceeds and collateral-based methodologies seems to be inevitable, although the specific details remain to be clarified.

4.2 Green asset ratio

Green auto securitization would not only benefit institutional investors, such as insurance companies, pension funds, and mutual funds who commit to investing in green assets, but it would also entail benefits for banks originating the deals. By retaining the equity tranche, originators will be effectively compelled to keep a green asset in their portfolios. This is in the interest of banks, as they will have to report the Green Asset Ratio (GAR) from 2024.

As a matter of fact, Article 8 of the EU Taxonomy imposes an obligation on both financial and non-financial entities to reveal key performance indicators pertaining to the taxonomy. In particular, financial entities are required to disclose an indicator that shows the extent of their exposure to activities that meet the taxonomy criteria. Hence, credit institutions subject to disclosures under the Non-Financial Reporting Directive (NFRD)—those with more than 500 employees—will be required to disclose their GAR.³⁰ The GAR refers to the proportion of a credit institution’s assets that finance and are invested in EU taxonomy-aligned economic activities as a proportion of the total covered asset (Partiti, 2023). Investors will be able to use the GAR to identify both the top performers and underachievers in green finance. A substantially low GAR score may

³⁰See Directive 2014/95/EU.

raise concerns about a bank's ESG profile and therefore deter certain investor groups. To the extent that the GAR can influence investors' decisions, banks will have a strong incentive to improve their exposure to sustainable products to lower their cost of capital (see e.g., [Pástor et al., 2021](#) and [Cornell 2021](#)). Therefore, banks issuing a Green Auto ABS can benefit from the retention of the equity tranche as it will contribute to their GAR, similarly to bonds issued according to the EU Green Bond standard.³¹ More generally, as regulators and policy makers around the globe increase their focus on sustainable finance, any improvement in the GAR will help banks to meet regulatory requirements and comply with sustainability-related reporting and disclosure obligations.

5 Conclusion

In this paper, we present a comprehensive survey of the existing literature on auto asset-backed securities and examine the relevant regulatory advancements in this field. By considering the entire value chain of the securitization process, we explore how a green auto asset-backed security, and the corresponding sustainable securitization framework, could be designed.

We find that the green component can be incorporated into various stages of the securitization process. However, it is not straightforward at which stage of the process its introduction is most efficient in terms of balancing various stakeholders' needs and constraints. In addition, the functioning of the economic channels at play is not yet well established. Therefore, further research is needed on this emerging topic.

³¹See [Brühl \(2023\)](#) for a discussion of the benefits and limitations of the GAR.

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