Working Paper Series

No 99 / August 2019

Securisation special purpose entities, bank sponsors and derivatives

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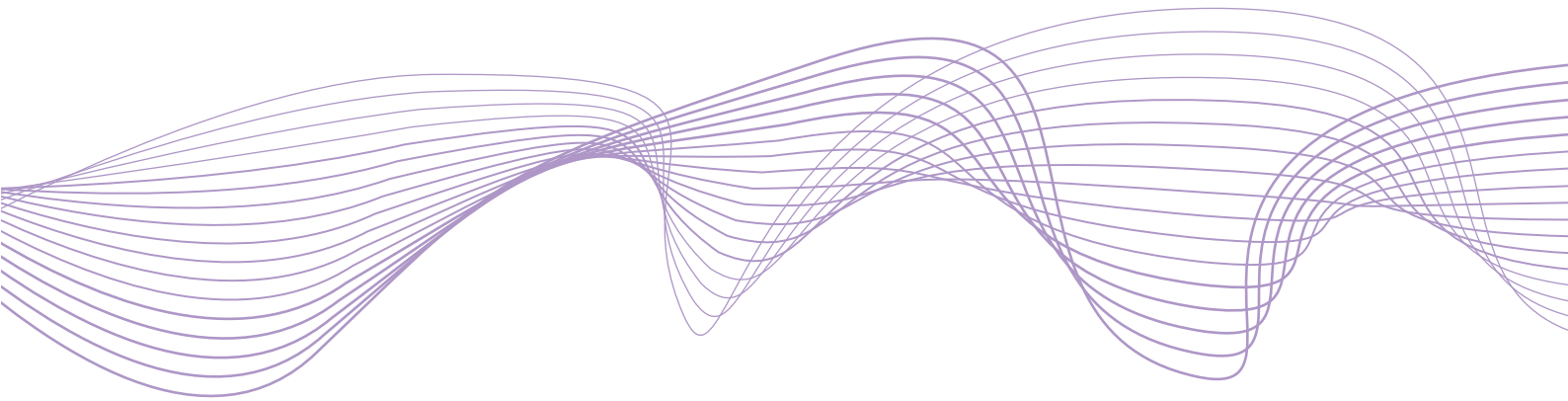

ESRB
European Systemic Risk Board
European System of Financial Supervision

Abstract

This paper documents the use of derivatives by securitisation special purpose entities (SPEs), also known as financial vehicle corporations (FVCs), domiciled in Ireland using transaction-level data established by the European Market Infrastructure Regulation. We show that these entities primarily engaged in interest rate derivatives over the period of 2015–2017. We find that larger entities that already engage in international capital markets are more likely to have derivative exposures. We also show that entities sponsored by banks and non-bank financial institutions are relatively more likely to engage in derivative markets. The characteristics of these bank sponsors are important in determining SPEs' engagement in derivative markets. SPEs' heavy reliance on debt finance coupled with their strong interconnectedness with bank sponsors underscores the importance of continuous monitoring and macroprudential surveillance of their derivative activities.

JEL classification: F30, F36, G15, G23.

Keywords: derivatives, shadow banking, FVCs, SPEs, EMIR, market-based finance.

1. Introduction

Market-based finance, or "the raising of equity or debt through the financial markets rather than through the banking system" (Lane and Moloney, 2018), has grown in prominence compared to traditional bank-based financial intermediation over the last decade. Despite this, non-bank financial institutions within the market-based finance sector are generally not subject to the same standards of prudential regulation as banks.

Some types of non-bank financial institutions such as special purpose entities (SPEs) are not prudentially regulated as independent entities. As these entities are heavily reliant on debt finance, with no substantial equity buffers, the investors take on the full risk of the exposures of the vehicles. As a result, the risk of contagion and step-in from these entities is significant (Acharya et al., 2013). This is particularly relevant as the SPEs are strongly interconnected with the banking system through their sponsor linkages. In addition to being funded by debt, SPEs can engage in complex financial instruments such as derivative contracts (Kenny et al., 2016). However, in contrast to the growing literature on other types of non-bank institutions (Koski and Pontiff, 1999; Cici and Palacios, 2015), there is little evidence on why SPEs use derivatives and to what extent the use of derivatives varies with respect to firm and sponsor characteristics.

In this paper, we fill this gap by examining the use of derivatives by SPEs engaged in securitisation, also known as financial vehicle corporations (FVCs). These entities are set up as off-balance sheet vehicles used in the securitisation process. While they are domiciled in Ireland, they have significant linkages to sponsors internationally (see Figure 2). They are also highly interconnected with banks.

Sponsor linkages are of crucial importance from a financial stability perspective. During the financial crisis, many SPEs in Europe and the US

received sponsor support through liquidity and credit lines. In some cases, the losses from off-balance sheet vehicles were taken onto the sponsor bank's balance sheet (Acharya et al., 2013). Therefore, financial shocks experienced by these entities in derivative markets can quickly spill over to their sponsors and the banking system. As such, understanding the business models and choices made by these entities is crucial in the development of monitoring frameworks for this part of the financial sector. This is particularly true with respect to the use of derivatives, as this can amplify systemic risks across the financial system.

To empirically investigate the determinants of derivative use by these entities, we employ a large and novel dataset which has detailed information on the characteristics of FVCs, their bank sponsors and the use of derivatives at a vehicle level over a period of nine quarters between 2015 and 2017. Conceptually, the decision to engage in derivative markets is dependent on whether the benefits of using these financial instruments are greater than the costs. Therefore, this decision can be influenced by a host of balance sheet factors which vary at the firm-level. Due to their importance, we also consider various characteristics of the bank sponsors. On this basis, our focus is to empirically examine the financial and balance sheet characteristics of the FVC and the bank sponsor which can influence FVCs' derivative usage.

The benefits and costs of the use of derivatives would be different for hedging and speculative transactions. We are not able to test this directly, although the structure of the exposure suggests that these are mainly used for hedging. Even assuming all these exposure are used for hedging, it is important to investigate the decision to hedge, as unhedged positions (i.e. the underlying interest rate risk) would behave differently in a financial shock than the hedged position (i.e. the counterparty risk from a derivative contract). Moreover, derivative users represent more complex vehicles, as they can have a greater number of counterparties compared to non-derivative users. Therefore, even if using derivatives to hedge, these entities can be exposed to a wider range of vulnerabilities such as credit risk, liquidity risk, and procyclical dynamics from their engagement in derivative markets. It is important to monitor such activities from a macroprudential perspective.

Indeed, European Systemic Risk Board (2017) highlights "procyclicality, leverage, and liquidity risk created through the use of derivatives and securities financing transactions" as a risk within the EU shadow banking system.

Our results suggest that larger vehicles (be it in terms of assets or debt securities issued), and those that have already overcome the fixed costs of engaging in international capital markets through the listing of debt securities, are more likely to use derivatives. Economies of scale have also been found to be relevant for other entities in the existing empirical literature (Nance et al., 1993; Geczy et al., 1997; Minton et al., 2009). Larger entities are typically better placed to manage a derivative portfolio, both through economies of scale (fixed costs spread over larger volumes) and economies of scope (risk management expertise shared between a larger portfolio). Similarly, vehicles that have engaged in international capital markets by listing their debt securities have already overcome market access and transaction related costs and thereby are more likely to use derivatives. We also find that bank sponsored vehicles and those sponsored by non-bank financial institutions are more likely to use derivatives over the sample period than vehicles sponsored by non-financial institutions. Moreover, we find that the characteristics of the bank sponsor (in particular capitalisation and profitability) have a significant effect on the likelihood that the vehicle would use derivatives. Finally, our results suggest that being bankruptcy remote w.r.t. the sponsor has no effect on the choice to hedge the risks, hinting at the weak nature of such remoteness (Acharya et al., 2013).

Our findings present useful stylised facts on securitisation vehicles, their interaction with banks, and their use of derivatives. The results have important policy implications, providing analytical insights which can inform the development of macroprudential policies for the non-bank financial sector. In particular, our findings provide new insights on the extent of the bank sponsor linkages and aid a mapping of the exposures between the banking and non-bank financial system in derivative markets. This is in line with the recommendations of the International Monetary Fund (2016) within the scope of their Financial Sector Assessment Program (FSAP) for Ireland.

The remainder of the paper is structured as follows. Section 2 provides an overview of the potential motives for derivative use, while Section 3 presents related literature on derivatives and SPEs. Section 4 describes the data and cleaning procedure used in our empirical analysis. Section 5 introduces the empirical approach. Section 6 presents the main results, while Section 7 concludes.

2. Derivative Use by Special Purpose Entities

The initial decision to engage in derivative markets is dependent on whether the benefits of using these financial instruments are greater than the costs. Therefore, this decision can be influenced by a host of balance sheet factors which vary at the firm-level. Given SPEs' tight connection with their sponsor organisation, characteristics of the sponsors can further influence this decision at the level of the entity.

Benefits of derivative use include enhanced risk management through hedging which can support revenues and help ensure that cash flows are sufficient to meet the payment of interest on the debt issued. As noted by Godfrey et al. (2015), SPEs can be funded through the issuance of different types of debt securities including, for example, profit participation notes, floating rate notes, and loan notes. They posit that the risks and characteristics associated with these types of debt securities can vary significantly while there can also be heterogeneity with respect to the number of investors. Therefore, for SPEs, the management of wider market and credit risks through the use of derivatives such as interest rate derivatives, foreign exchange, or credit derivatives can alleviate some of the risks associated with the issuance of these securities. Derivative use by SPEs can also reflect a sophisticated corporate structure which may be particularly appealing to institutional investors.

Nevertheless, the use of derivatives by SPEs can involve significant costs. At the vehicle level, the fixed costs of engaging in derivative markets include overcoming regulatory, tax and transaction-related costs. Further, an entity using derivatives would need to invest in enhanced risk management. An

additional potentially wider cost is that SPEs that use derivatives could take on excessive risk, including counterparty and liquidity risk. This could lead to losses and thus negative externalities for investors in the vehicle and the financial system more widely. As noted by Kenny et al. (2016), the financial crisis demonstrated how the interaction of non-bank financial institutions in derivative markets can have negative consequences and increase vulnerabilities within the financial system. Given that SPEs hold little equity capital, these concerns are particularly relevant for this type of non-bank financial institution.

The extraordinary growth in derivative activities in the run up to the financial crisis largely took place in the unregulated over-the-counter (OTC) market. A number of new regulatory initiatives have been introduced post-crisis in order to improve the transparency of OTC derivative markets. At the Pittsburgh summit in September 2009, G20 leaders agreed that all OTC derivative contracts should be reported to a trade repository and that all standardised OTC derivative contracts should be cleared through a central counterparty (CCP). Such data allow us to analyse derivative exposures of SPEs. Of note is the fact that very few entities in our study have centrally cleared their derivative contracts.

3. Related Literature

This section provides a brief overview of the literature pertaining to the use of derivatives by non-bank financial institutions and the literature on SPEs. Before the 2008 global financial crisis, derivative products were considered to have contributed to the resilience of the financial system by enhancing risk management practices. However, since the crisis, the more speculative aspects of some uses of derivatives have come into focus (Haldane and May, 2011) and therefore understanding the factors that influence derivative use can provide new insights for the macroprudential surveillance of the non-bank financial sector.

At the EU level, the European Market Infrastructure Regulation (EMIR), imposes a requirement for transaction-level data to be reported by counter-

parties of derivatives to trade repositories. Abad et al. (2016) provide an overview of the EMIR data reporting framework and present an overview of EU derivative markets, with a specific focus on interest rate, credit default swap (CDS) and foreign exchange markets. Their analysis shows that while these markets are mainly dominated by big derivative dealers, non-bank financial institutions are active players across the various asset classes of derivatives. While a number of empirical questions have been examined using the EMIR data (Aldasoro and Barth, 2017; D'Errico and Roukny, 2017; Hau et al., 2017; Bellia et al., 2017; Fiedor et al., 2018; Fiedor, 2018), we are aware of only one paper which has examined the role of SPEs in derivative markets using the EMIR data. The findings of Kenny et al. (2016) confirm that these vehicles are net sellers of CDS and have linkages to non-domestic banks. However, in contrast to our approach, they do not econometrically examine the vehicle and sponsor characteristics that affect derivative use.

There is a small stream of literature which examines the use of derivatives by non-bank financial institutions. Cici and Palacios (2015) examine the use of options by funds and explore the funds and manager characteristics that affect option use. They find that option use is positively related with expense ratios suggesting that the use of derivatives is resource intensive. In a related study, Koski and Pontiff (1999) find that the main characteristic determining derivative use is the membership in a family of funds. Aragon et al. (2018) examine the role of bond mutual funds in CDS markets and highlight a number of potential costs of greater liquidity provisions by these entities in credit derivatives markets. Regarding FVCs use of derivatives, Kenny et al. (2016) find that these types of entities have significant linkages to non-domestic monetary financial institutions in the CDS market.

Similar to derivative markets, shadow banking entities and activities have gained increasing attention on account of their role in propagating shocks during the global financial crisis. Monitoring derivative linkages between shadow banking entities and the traditional banking system is therefore of utmost importance to regulators and policymakers alike. A number of studies have examined the activities of FVCs in Ireland (Godfrey et al., 2015; Barrett et al., 2016; Golden and Hughes, 2018; Golden and Maqui,

2018). Godfrey et al. (2015) provide an overview of the FVC market. Similarly, Golden and Maqui (2018) describe the main activities of FVCs and non-securitisation SPEs including their main activities and sponsor linkages. In addition, they analyse the determinants of international banks' decisions to issue debt through Irish SPEs.

4. Data

This section describes the data used to examine the determinants of FVCs' derivative use, including firm and sponsor-level explanatory variables. We use granular quarterly balance sheet data on FVCs reported to the Central Bank of Ireland. Since the fourth quarter of 2009, the European Central Bank (ECB) and the Eurosystem is collecting quarterly data on FVCs. These data show that the total assets of euro area FVCs amount to approximately €1.8 trillion in the third quarter of 2017. FVCs domiciled in Ireland account for approximately €385 billion of this euro area amount representing 22% of the total euro area market. By assets, Ireland is the largest jurisdiction for the domicile of FVCs followed by Italy (€330 billion), the Netherlands (€260 billion), France and Luxembourg (with approximately €240 billion each).

[Fig. 1 about here.]

[Fig. 2 about here.]

[Fig. 3 about here.]

These data include information on the balance sheet characteristics of the vehicles along with a description of their engagement in capital markets. For example, we retrieve quarterly information on size (total assets), whether the vehicles' debt securities are listed on a stock exchange, whether the vehicle is part of a multi-vehicle structure and whether the vehicle is an orphan vehicle. Multi-vehicle structures are organisations comprising linked special purpose entities, often operating across borders. As noted by Bank

for International Settlements (2009), an orphan entity ownership structure implies that the entity is not owned by the sponsor but rather by a charitable trust. This structure facilitates bankruptcy remoteness and ensures that the entity should not be affected by the legal claims against the originator. There were 964 FVCs registered in Ireland over our sample period. However, as not all of the control variables of interest are populated for all FVCs we begin with an initial sample of 835 entities while the sample size varies between specifications. Where available, we hand collect and cross-check the legal entity identifier (LEI) for each FVC. This unique identifier allows us to obtain the derivative transactions for each FVC from EMIR (see below for details).

[Fig. 4 about here.]

In addition to balance sheet and other firm-level information, the FVC data includes the name, country of domicile and sector of the sponsor of the FVC. Where the sponsor is identified as a bank, we hand collect balance sheet information on the sponsor from SNL Financial and complement with data from Bloomberg using the sponsor name. As shown in Figure 1, almost half of the assets in our sample belong to FVCs sponsored by banks while over half of the assets are with FVCs sponsored by firms based in the UK or the US (Figure 2). In total we have data on over 60 individual sponsors from over twenty different EU and non-EU countries. We collect information on the size of the sponsor (total assets), equity capitalisation based on the CET1 ratio, the profitability of the sponsor based on net interest margin and merge this sponsor-level information with the FVC-level information described above. The economic rationale underpinning the inclusion of these explanatory variables is described in detail in Section 5, and a full list of variables is included in Annex A.

Regarding the nature of securitisation, the majority of assets are in traditional securitisation. "Other" types of vehicles, while holding a much smaller share of total assets, are much more likely to be using derivatives. In Figure 3 we show that the most common entities are engaged in corporate asset-backed securities (ABS), commercial mortgage-backed securities

(CMBS), residential mortgage-backed securities (RMBS), cash collateralised debt obligations (CDO), or are multi-issuance vehicles. Entities engaged in cash CDOs or with multiple issuances are more likely to use derivatives.

To obtain the derivative exposures of FVCs, we use transaction-level data established under the EMIR. These data contain all active derivative trades relevant to the Central Bank of Ireland, thus all derivative contracts of Irish counterparties. A standard data cleaning process was applied to the EMIR data as per Abad et al. (2016). We use trade state reports at the end of each quarter between the third quarter of 2015 and the third quarter of 2017, which comprise observations of all active derivatives trades in the purview of the Central Bank of Ireland. Based on the LEI of the FVC, we gather their derivative transactions from EMIR and merge with the FVC and sponsor-level explanatory variables. In Figure 4 we show the total gross notional by asset class and reporting date for Irish FVCs. We see that the main exposures of the Irish FVCs are towards interest rate derivatives, while credit, currency and equity derivatives are being used to a similar degree but almost an order of magnitude less than interest rate contracts. This is different from the situation for all Irish companies where both interest rate and foreign exchange derivative contracts dominate. Most of Irish FVCs' derivative exposures are below the clearing thresholds established under EMIR, thus they are not required to centrally clear these exposures. The exposures being mostly to interest rate derivative contracts suggests that derivatives are used by FVCs predominantly for hedging rather than speculative purposes.

5. Empirical Strategy

In a stylized illustrative example, an FVC has a choice of keeping the underlying risk (mostly interest rate risk) or swapping it for a hedge (exchanging the interest rate risk for a counterparty credit risk and fees). An FVC could also choose to centrally clear a hedge, thus swapping the counterparty credit risk for liquidity risk and some more fees. However, empirically we see that FVCs do not use central clearing, thus we abstract from this

aspect in our discussion.

The aim of our empirical strategy is to examine the factors that affect FVCs' choice to use derivatives. In line with the existing literature (Nance et al., 1993), the decision to use derivatives is assumed to be based on whether the benefits of employing these financial instruments (such as lower interest rate risk in the case of interest rate swaps) outweigh the costs (such as increased counterparty credit risk, regulatory or transaction related costs). The profits ($\Pi_{i,j,d}$) from FVC i sponsored by bank j employing derivatives d are:

$$\Pi_{i,j,d} = \text{revenues}_{i,j,d} - \text{costs}_{i,j,d} \tag{1}$$

However, the $\text{revenues}_{i,j,d}$ and $\text{costs}_{i,j,d}$ of employing derivatives in Equation 1 are not observable at the firm-level in our dataset. We therefore regress our dependent variable against a host of observable FVC-level and sponsor-level characteristics which are likely to influence the $\text{revenues}_{i,j,d}$ and $\text{costs}_{i,j,d}$ associated with derivative use. We outline how these control variables affect the model in Equation 1 in the following section. We base our empirical analysis on the following probit model:

$$\Pr\left(\text{FVC derivative use} = 1\right)_{i,j,t} = \Phi(\alpha + W_{i,t}\beta_1 + X_{j,t}\beta_2 + \gamma_t + \alpha_j) + \varepsilon_{ijt} \tag{2}$$

In this specification, our dependent variable (FVC derivative use) is a binary variable equal to one if the FVC i with a bank sponsor j uses derivatives in time t and zero otherwise. Therefore, if the FVC has a derivative exposure in any of the derivative asset classes such as credit, commodity, equity, foreign exchange or interest rate at the end of quarter, our dependent variable will take the value one. In addition to checking the EMIR data for the existence of derivative exposures for each FVC, we also cross-check for aggregate derivative exposures using statistical FVC data reported to the Central Bank of Ireland. On the whole, our main findings hold based on this robustness check. An important consideration when modeling the

decision to employ derivatives is the selection of control variables in this empirical setup. Following the existing literature, we include the following independent variables in our probit model.

$W_{i,t}$ is a vector of firm-level controls capturing characteristics of the FVC such as size, whether the FVC's debt securities are listed on an exchange, whether the FVC forms part of a wider multi-vehicle structure and whether the vehicle is an orphan entity. The economic rationale underpinning the inclusion of these factors is discussed in more detail under Hypothesis 1 below. In addition to FVC-level characteristics, the decision to use derivatives can also be influenced by the characteristics of the bank sponsor which vary at the firm-level in our dataset.

$X_{j,t}$ are bank sponsor explanatory variables such as size, equity capitalisation and net interest margin which are likely to affect the profitability and financial position of the bank-sponsor. The motivation for controlling for these bank sponsor controls are guided by the existing literature and discussed in detail under Hypothesis 2 below.

$\gamma_t + \alpha_j$ relate to time dummies and sponsor-sector dummies which capture unobserved time and sponsor sector characteristics while ε_{ijt} is an error term. In extended specifications, we also include sponsor-country dummies. The probit regression analyses based on this specification are presented as marginal effects. Marginal effects are calculated at the sample mean values of the explanatory variables. All time-varying explanatory variables are lagged by one period to mitigate potential endogeneity concerns.

In the following subsections we describe the main testable hypotheses of derivative use by FVCs. Guided by the existing literature, we analyse the role of a host of FVC and bank sponsor on the decision to employ derivatives.

Hypothesis 1: FVCs' characteristics

Larger, more complex and internationally active FVCs are more likely to use derivatives.

Hypothesis 1 investigates the FVC-level factors which may influence derivative use. These controls capture firm-specific factors such as size (mea-

sured by total assets), complexity (measured by whether the vehicle is part of a wider multi-vehicle structure), whether the vehicle has already overcome the fixed cost of engaging in international capital markets by listing their debt securities and the regulatory treatment of the FVC through the inclusion of a orphan dummy variable. Therefore, these explanatory variables capture different dimensions of the business model of these vehicles which are likely to effect the revenues and costs associated with derivative use.

The existing literature on derivative usage finds that larger financial and non-financial firms tend to use derivatives more (Geczy et al., 1997; Minton et al., 2009). In a related vein, the findings of El-Masry (2006); Bartram et al. (2009, 2011) lend support to the hypothesis that derivative usage is significantly related to important financial characteristics, such as firm size. For non-bank financial institutions, Johnson and Yu (2004) examine the use of derivatives by mutual funds in Canada. They find that fund characteristics such as fund size determine derivative use although the results vary by type of fund.

In terms of FVCs and in line with the existing literature, we expect that larger vehicles are more likely to employ derivatives. This is driven by the fact that larger FVCs can benefit from economies of scale related to costs which increases the likelihood of engaging in derivative activity (Geczy et al., 1997). On this basis, larger firms tend to have greater financial resources to meet the transaction, regulatory and other related costs of using derivatives. Overall, this is expected to lower the costs of derivative use for the FVC as in Equation 1 without obviously affecting revenues. Thus, this increases expected profits and increases the probability that the vehicle would use derivatives.

In addition, FVCs are by their business model dependent on external debt finance to obtain funding. We therefore find a strong correlation (0.9) between the size of the vehicle's total assets and the amount of debt securities issued.[1] In order to offset some of the risks related to market based financ-

[1]In alternative regressions, we include the log of total debt securities issued in place of total assets of the vehicle and obtain quantitatively similar results to those presented

ing, we would expect FVCs with larger debt liabilities to employ derivatives. Our expectation is that larger and thus more heavily debt financed vehicles are more likely to need to ensure that the volatility of cash flows are appropriately managed to safeguard the timely payment of interest. A key mechanism to manage the volatility of such cash flows is through hedging using derivatives such as interest rate and foreign exchange derivatives. The results of El-Masry (2006) support this expectation as he finds that one of the important reasons for hedging with derivatives is the management of cash flow volatility.

The dummy variable on whether the FVC has engaged in international capital markets through the listing of its debt securities captures financial market access. In this regard, the FVC has already overcome the costs related to regulation and transactions. Benefiting from these economies of scale related to costs, we expect FVCs that are already active on international capital markets to be more likely to use derivatives. Moreover, FVCs that list their debt securities on an exchange may point to a higher level of sophistication in business model compared to debt financing through private placements. By listing their debt securities, the FVC gains access to a wider array of investors, including institutional investors. While this increases the possible sources of funding for the FVC, it also entails increased market risks such as interest rate or foreign exchange risks which can be managed through the use of derivatives. In line with this, Broccardo et al. (2014) find that Italian listed banks are more likely to use credit derivatives. They posit that listed banks are more transparent from a financial market perspective which also instills market discipline.[2] In terms of Equation 1, we therefore expect listed entities to benefit from lower costs regarding derivative use compared to non-listed entities since these vehicles have already overcome some of the fixed costs of engaging in capital markets.

The dummy variable on whether the vehicle is an orphan entity aims

below.

[2]Listed companies must also meet increased regulatory transparency requirements. For example, listed companies in Europe must meet the requirements of the Prospectus and Transparency Directives.

to capture the regulatory treatment of the entity. Guided by the existing literature on SPEs, we expect those vehicles that are orphan entities and not subject to consolidated supervision of the parent to be more likely to use derivatives if regulatory arbitrage is an important motivation (Acharya et al., 2013). Our regulatory arbitrage hypothesis is guided by the fact that FVCs are not prudentially regulated and therefore do not have to meet the same burden of regulatory costs when compared to their bank sponsors. For example, under EMIR, bank sponsors are categorised as financial counterparties and therefore need to centrally clear some of their derivative exposures. By contrast, FVCs are categorised as non-financial counterparties under EMIR and therefore are not required to centrally clear their derivative transactions unless these transactions exceed certain thresholds.[3] The regulatory costs of engaging in derivatives can be reduced if the FVC employs derivatives rather than the bank sponsor. In line with this, we expect FVCs that are not subject to consolidated supervision and are therefore defined as orphan vehicles would benefit from lower costs for derivative use in Equation 1. As such, these reduced costs increase the likelihood that the vehicle will employ derivatives.

The dummy variable on whether the vehicle is part of a wider multi-vehicle structure is included to capture the complexity of the vehicle structure. Koski and Pontiff (1999) in a study on the use of derivatives by equity mutual funds, find that the most significant determinant of derivative use is membership of a family of funds. They suggest that membership of a wider family of funds helps to reduce the marginal costs of using derivatives and related governance arrangements within the family. Therefore, guided by this literature, we expect the more complex vehicles to be more likely to engage in derivatives in order to offset market and credit risks related to these more complex corporate structures. For example, as noted by Godfrey et al. (2015), in multi-vehicle structures the Irish domiciled FVC may be a creditor to another vehicle in the structure which requires careful coordination of cash flows to meet interest payments. Moreover, as proposed by Koski and Pontiff (1999), the marginal costs for multi-vehicle structures will be lower

[3]See ESMA website for further details.

which we expect would increase the likelihood of derivative use. Regarding Equation 1, we expect these types of vehicles to benefit from lower marginal costs related to derivative use and are therefore more likely to employ these types of financial instruments.

Hypothesis 2: Bank sponsor characteristics

Larger bank sponsors and those vulnerable to financial distress are more likely to engage in derivative transactions through FVCs.

In Hypothesis 2 we include bank sponsor level characteristics to test whether the size and financial position of the sponsor can influence the use of derivatives of the vehicle.[4] These bank sponsor level control variables capture information on the size of the bank sponsor (measured by total assets), the solvency of the bank sponsor (measured by the bank's CET1 ratio) and a measure of the profitability of the bank sponsor proxied by its net interest margin.

The focus on bank sponsors is driven by three considerations. First, as shown in Figure 1, almost half of the sponsors in our sample are banks. As previously mentioned, under EMIR, bank sponsors are categorised as financial counterparties which entails additional regulatory burden and costs compared to FVCs who are categorised as non-financial counterparties. In this respect, should regulatory arbitrage be a relevant consideration, the bank sponsor can circumvent some of the regulatory costs by employing an FVC to engage in derivatives. Second, the bank sponsor sector dummy in our initial specification is positive and statistically significant at the 1 per cent level suggesting that bank sponsored vehicles are more likely to use derivatives. Third, the experience from the financial crisis and the growing literature on the relationship between SPEs and their bank sponsors guide our specific focus on the financial characteristics of the bank sponsor. For

[4]In further extensions, we have also analysed a host of country-level characteristics, such as distance between Ireland and the country of the sponsor, common legal system between the two countries, and measures of financial development of the country of the bank sponsor. In the interest of brevity we do not report these results but they are available, upon request, from the authors.

example, Gorton and Souleles (2005) highlight that, although legal and accounting frameworks suggest a clear separation, SPE sponsors can bail out their SPEs if required to do so. Indeed, sponsor support provided to SPEs during the 2008 financial crisis reinforced the reputational linkages between SPEs and their banks sponsors and revealed how contagion can spread from the non-bank financial sector to the banking system.

As noted by Adrian and Ashcraft (2012), securitisation vehicles can be used to circumvent regulation, while empirical evidence from Acharya et al. (2013) confirms that regulatory arbitrage was an important motive for the establishment of asset-backed commercial paper conduits. Their analysis finds that conduits provide little risk transfer while losses from conduits remained with the banks.[5] In a related vein, the interaction of derivatives and securitisation activities can have a negative effect on financial institutions. For example, the findings of Trapp and Weiss (2016) suggest that US banks, which used financial derivatives and loan securitisation as a risk-transfer tool before the financial crisis, were highly vulnerable to the crisis and were more likely to experience extreme losses.

We are not aware of a study which has previously controlled for the importance of bank sponsor characteristics when examining the derivative use of their financial vehicles. Purnanandam (2007) analyses the effects of bank characteristics and macroeconomic shocks on the use of interest rate derivatives of commercial banks. He finds that larger banks are more likely to use derivatives while banks that face a higher likelihood of financial stress manage their interest rates more by engaging in higher derivative activities. Similarly, Minton et al. (2009) find that bank size is positively associated with the likelihood of hedging with credit derivatives.

Guided by these findings, we expect vehicles that have larger bank sponsors are more likely to be active derivative users themselves. Larger bank

[5]In the post crisis period there have been a number of regulatory reforms of the securitisation market aimed at increasing 'skin in the game'. For example, originators and sponsors in the EU under the Capital Requirements Regulation (CRR) are now required to explicitly disclose that they will retain, on an ongoing basis, a material net economic interest in the securitisation for the life of the transaction. A material net economic interest shall not be less than 5 per cent.

sponsors have greater financial resources and knowledge which would be required in order to arrange derivative transactions through their vehicles. Larger bank sponsors can therefore benefit from economies of scale related to monitoring and transaction costs. As such, the costs in Equation 1 would be lower for FVCs sponsored by larger banks and this would increase the likelihood that they would employ derivatives. Similarly, larger bank sponsors are more likely to be sensitive to potential reputational concerns should one of their vehicles encounter financial distress and be unable to meet their debt obligations. Therefore, FVCs sponsored by larger banks are more likely to employ derivatives to manage their cash flows to ensure timely payment of interest.

Regarding the CET1 ratio, we expect to find a negative relationship between a bank sponsor's equity capital and the likelihood of their FVC using derivatives. For example, Minton et al. (2009) find a negative relationship between Tier 1 risk capital and credit derivative use while Thornton and di Tommaso (2018) indicate that EU banks that hold lower capital have a higher likelihood of using CDS. Regarding interest rate derivatives, Purnanandam (2007) finds that banks with a higher probability of distress manage their interest rate risk more aggressively. As noted by Hasan and Wu (2016); Aldasoro and Barth (2017), some types of derivatives such as CDS can be used for capital relief purposes. Aldasoro and Barth (2017) highlight how, under this hypothesis, banks that hold lower risk-weighted regulatory capital ratios have a greater incentive to engage in derivative use such as buying CDS protection on their credit risk exposures to lower their related capital requirements. In a related vein, Acharya et al. (2013) find that many banks set up off-balance sheet conduits to benefit from regulatory arbitrage. They note that the guarantees were structured in order to reduce regulatory capital requirements, in particular by banks with less capital, while still providing recourse to bank-sponsors balance sheets for outside investors. Guided by these streams of literature, we expect that FVCs that are sponsored by banks with lower equity capital are more likely to use derivatives (owing to higher expected revenues in Equation 1).

Turning to net interest margins as our proxy for bank sponsor profitabil-

ity, we expect that FVCs sponsored by less profitable banks are more likely to manage risks related to debt finance. Banks with tighter net interest margins are more likely to face financial distress and therefore are expected to hedge the volatility of their cash flows through derivatives. Empirical studies such as Minton et al. (2009) lend support to this hypothesis as they find that banks are less likely to employ credit derivatives if they are more profitable.

6. Results

Before proceeding to our empirical analysis, we begin by first examining differences in descriptive statistics for FVCs that are derivative users and non-derivative users. As shown in Table 1, on average, FVCs that are derivative users are larger than non-derivative users. We find that vehicles with assets greater than approximately €10bn are likely to engage in derivative markets. Further, derivative users, on average, list their debt securities on stock exchanges more than non-derivative users. On the whole, there does not appear to be significant differences in the characteristics of the sponsors for both groups. In the next section, we proceed by empirically examining the determinants of derivative use in a multivariate specification as outlined in Section 5. In Table 2 we present the sample sizes in specific subgroups given values of variables in our dataset and the percentage of derivative users within those subgroups. Of note is the finding that derivative users are more prevalent among orphan vehicles than non-orphan ones. Similarly, derivative exposures are more prevalent among listed vehicles, those sponsored by financial institutions, and those engaged in non-traditional securitisations.

[Table 1 about here.]

[Table 2 about here.]

Table 3 reports the results of the probit regressions (for last quarter and pooled). In unreported robustness checks, we have examined the determinants of derivative exposures of FVCs using all the other periods in

cross-sectional probit regressions. There, we find broadly similar results to our pooled probit results presented below. We have also checked for multicollinearity and found no issues. In columns (1) & (2) we present regressions using only the last quarter, while the other three specifications use all periods in a pooled regression. In all columns we include sponsor-sector dummies while in column (2) we employ sponsor country fixed effects, in column (3) we employ time fixed effects, in column (4) both time and sponsor country fixed effects, and finally in column (5) we employ a full set of sponsor country-time fixed effects.

The results show the larger FVCs are more likely to use derivatives, with a positive and significant effect across all specifications. This result is in line with most of the previous literature whereby larger firms and firms with more financial resources are more likely to benefit from economies of scale related to costs and thereby use derivatives. As noted above, firm size is also strongly correlated with the amount of debt liabilities of the vehicle and suggests that vehicles that are heavily reliant on debt finance are more likely to engage in derivative markets. This lends support to the hypothesis of hedging to manage the volatility of cash flows found in the existing literature. The sponsor sector dummies are also significant in this specification suggesting the bank and non-bank financial sponsored vehicles are more likely to use derivatives.

We also control for the engagement of the FVC in international capital markets. We do this by employing the listed dummy variable which captures whether the debt securities issued by the vehicle have been listed on an exchange. FVCs which have their debt securities listed have previously overcome the fixed costs of engaging in capital markets by meeting regulatory and other financial market access costs such as hiring a listing agent and preparing a prospectus for the listing of the debt securities. The listed dummy is positively and statistically significant at the 1 per cent level across all specifications suggesting that FVCs that have already engaged in international capital markets are more likely to use derivatives.

The dummy variable for orphan vehicles indicates whether the vehicle is set up as bankruptcy remote and can be used as an indication as to whether

the vehicle lies beyond the scope of consolidated regulation. We find that orphan vehicles are positively associated with derivative usage, although at a statistically significant level only in the third empirical setup. This result suggests bankruptcy remoteness between FVCs and their sponsors may not be as relevant. On this basis, there is scope for step-in risk (Acharya et al., 2013). Similarly, we include a dummy variable indicating if the vehicle is part of a wider multi-vehicle structure. This controls for the complexity of the corporate structure and a potential for mutual exposure insurance. We find that it is positively associated with derivative use only in the third empirical setup. Both those effects are not economically significant and can be explained with sponsor country fixed effects. Finally, we show that vehicles sponsored by banks (DTC) or non-bank financial institutions (FIN) are significantly more likely to use derivatives as compared with vehicles sponsored by non-financial companies.

[Table 3 about here.]

As probit is a non-linear model, the size of the effect of particular factors is not easy to discern from Table 3. In particular, the marginal effects of each variable are reported at the average of all other variables, but do not need to be the same for other combinations of these variables. For this reason, in Figure 5 we present the predicted probabilities that an FVC with specific characteristics would have derivative exposures. The differences between various parts of the chart, and between various points across the x-axis may be thought of as marginal effects that are not limited to the average of other variables. As can be seen, the main effect is between listed and non-listed vehicles, and ones sponsored by financial and non-financial companies. Of note is the non-linear dependence of the probability of a vehicle using derivatives and its size.

[Fig. 5 about here.]

Table 4 shows the results from our pooled probit regressions controlling for both FVC and bank sponsor characteristics. The number of observations

is lower than Table 3 as the focus in these specifications is on a subset of FVCs that are bank sponsored. As described in Section 2, contagion and step-in risk between banks and their off-balance sheet vehicles in derivative and securitisation markets are a key concern from a systemic risk perspective. We again find that the size of the vehicle and whether it lists its debt securities on an exchange are positively associated with derivative use (column 1). In contrast to Table 3, we find that the dummy variables for orphan and multivehicle are negative but insignificant.

Regarding the bank sponsor level control variables, we show that the size of the bank sponsor captured through the total assets of the bank is positively associated with derivative usage, albeit at the 10 per cent level of significance and the effect disappears for the results in columns (4) & (5) when we control for sponsor country fixed effects. We control for the solvency and equity position of the bank sponsor by including its CET1 ratio. We find that a higher CET1 ratio for the bank sponsor reduces that probability that the vehicle uses derivatives which is in line with the existing empirical literature. This effect is also washed away by sponsor country fixed effects. Finally, we control for the profitability of the bank sponsor employing its net interest margin. We find that this profitability measure for the bank sponsor is negatively associated with the likelihood of the FVC using derivatives. This finding is robust across all specifications. In an alternative specification (reported in Table 6 in the Annex) we use the notional of the interest rate derivative exposures as the dependent variable. The results are qualitatively broadly similar despite focusing on the intensive margin of derivative use rather than the extensive margin, with the exception of bank capitalisation where the results are inconclusive.

[Table 4 about here.]

7. Conclusions

Despite recent data advances coupled with the systemic importance of derivatives markets, there is little empirical evidence on the determinants of

derivative use by non-bank financial institutions. In this paper, we document the derivative use of FVCs using transaction level data over the period from 2015 to 2017. We find that FVCs predominately use interest rate derivatives although they are also active players in commodity, credit and equity derivatives to a much lesser degree. Comparing descriptive statistics for both derivative users and non-derivative users, we find that users, on average, are larger.

Our findings suggest that FVC characteristics are the most important determinants which influence the likelihood of derivative use. On the whole, we find that larger FVCs, measured by their total assets, and those which already list their debt securities are more likely to use derivatives. In relation to the bank sponsor level controls, the evidence is not as strong. We find some evidence that larger bank-sponsors increase the likelihood of FVCs' using derivatives, while bank sponsors with higher CET1 ratios and net interest margins are negatively associated with FVCs' derivative use.

In terms of policy implications, our results indicate that the combination of large debt liabilities coupled with strong interconnectedness with bank sponsors increases the likelihood that these types of vehicles will engage in derivative markets. Large debt liabilities, interconnectedness with the banking system and derivatives were all found to be contributors to increased systemic risk during the financial crisis of 2008. The interconnectedness with the banking system through sponsor linkages may be an important potential contagion channel. This may not be limited to direct linkages, but may also include indirect linkages through common holdings or ex-ante legal uncertainty in times of crisis. Our findings therefore reinforce the importance of close monitoring and macroprudential surveillance of SPEs' derivative activities and their bank sponsors. Indeed, the IMF as part of the 2016 FSAP for Ireland recommended closing remaining data gaps on granular bilateral exposure data within and across the banking and non-banking sectors to improve surveillance. In this regard, our results lend support to recent calls for improved LEI reporting, needed for merging various regulatory datasets which can facilitate monitoring of cross-sector interconnectedness. Our findings also highlight the need for increased cross-

jurisdictional cooperation amongst central banks and regulators when monitoring risks in the SPE sector. Finally, our analysis highlights a number of areas for future research. While the focus of this analysis is on FVCs which are not prudentially regulated, the scope of non-bank financial institutions considered could be expanded in future work to examine the derivative use of non-securitisation SPEs and alternative investment funds such as hedge funds.

References

Abad, J., Aldasoro, I., Aymanns, C., D'Errico, M., Rousova, L. F., Hoffmann, P., Langfield, S., Neychev, M., and Roukny, T. (2016). Shedding light on dark markets: First insights from the new EU-wide OTC derivatives dataset. ESRB Occasional Paper 11.

Acharya, V., Schnabl, P., and Suarez, G. (2013). Securitization without risk transfer. *Journal of Financial Economics*, 107(3):515–536.

Adrian, T. and Ashcraft, A. (2012). Shadow Banking Regulation. *Annual Review of Financial Economics*, 4(1):99–140.

Aldasoro, I. and Barth, A. (2017). Syndicated loans and CDS positioning. ESRB Working Paper 58.

Aragon, G., Li, L., and Qian, J. (2018). The use of credit default swaps by bond mutual funds: Liquidity provision and counterparty risk. *Journal of Financial Economics*, tbc(tbc):tbc.

Bank for International Settlements (2009). The Joint Forum: Report on Special Purpose Entities. BIS Publication.

Barrett, D., Godfrey, B., and Golden, B. (2016). New Data Collection on Special Purpose Vehicles in Ireland: Initial Findings and Measuring Shadow Banking. Central Bank of Ireland Quarterly Bulletin Articles.

Bartram, S., Brown, G., and Conrad, J. (2011). The Effects of Derivatives on Firm Risk and Value. *Journal of Financial and Quantitative Analysis*, 46(4):967–999.

Bartram, S., Brown, G., and Fehle, F. (2009). International Evidence on Financial Derivatives Usage. *Financial Management*, 38(1):185–206.

Bellia, M., Panzica, R., Pelizzon, L., and Peltonen, T. (2017). The demand for central clearing: to clear or not to clear, that is the question. ESRB Working Paper 62.

Broccardo, E., Mazzuca, M., and Yaldiz, E. (2014). The use and determinants of credit derivatives in Italian banks. *Journal of Risk Finance*, 15(4):417–436.

Cici, G. and Palacios, L.-F. (2015). On the use of options by mutual funds: Do they know what they are doing? *Journal of Banking and Finance*, 50(C):157–168.

D'Errico, M. and Roukny, T. (2017). Compressing over-the-counter markets. ESRB Working Paper 44.

El-Masry, A. (2006). Derivatives use and risk management practices by UK nonfinancial companies. *Managerial Finance*, 32(2):137–159.

European Systemic Risk Board (2017). EU Shadow Banking Monitor 2. ESRB Report.

Fiedor, P. (2018). Clearinghouse-Five: determinants of voluntary clearing in European derivatives markets. ESRB Working Paper 72.

Fiedor, P., Lapschies, S., and Orszaghova, L. (2018). The centrally cleared interest rate derivatives market: how are clients changing the risk perspective? *Journal of Financial Market Infrastructures*, 7(2):1–28.

Geczy, C., Minton, B., and Schrand, C. (1997). Why Firms Use Currency Derivatives. *The Journal of Finance*, 52(4):1323–1354.

Godfrey, B., Killeen, N., and Moloney, K. (2015). Data Gaps and Shadow Banking: Profiling Special Purpose Vehicles' Activities in Ireland. Central Bank of Ireland Quarterly Bulletin Articles.

Golden, B. and Hughes, P. (2018). Shining a Light on Special Purpose Entities in Ireland. Central Bank of Ireland Economic Letter No.11.

Golden, B. and Maqui, E. (2018). How 'special' are international banks sponsoring Irish-resident SPEs? Central Bank of Ireland Research Technical Paper, No.14.

Gorton, G. and Souleles, N. (2005). Special Purpose Vehicles and Securitization. NBER Working Paper No. 11190.

Haldane, A. and May, R. (2011). Systemic risk in banking ecosystems. *Nature*, 469:351–355.

Hasan, I. and Wu, D. (2016). How large banks use CDS to manage risks: bank-firm-level evidence. Bank of Finland Research Discussion Paper 10.

Hau, H., Hoffmann, P., Langfield, S., and Timmer, Y. (2017). Discriminatory pricing of over-the-counter derivatives. ESRB Working Paper 61.

International Monetary Fund (2016). Ireland Financial Sector Assessment Program: Technical Note - Macroprudential Policy Framework. IMF Report.

Johnson, L. and Yu, W. (2004). An analysis of the use of derivatives by the Canadian mutual fund industry. *Journal of International Money and Finance*, 23(6):947–970.

Kenny, O., Killeen, N., and Moloney, K. (2016). Network analysis using EMIR credit default swap data: micro-level evidence from Irish-domiciled special purpose vehicles (SPVs). In Bank for International Settlements, editor, *Combining micro and macro data for financial stability analysis*, volume 41. Bank for International Settlements.

Koski, J. and Pontiff, J. (1999). How Are Derivatives Used? Evidence from the Mutual Fund Industry. *The Journal of Finance*, 54(2):791–816.

Lane, P. R. and Moloney, K. (2018). Market-based finance: Ireland as a host for international financial intermediation. In Banque de France, editor, *Financial Stability Review, Non-Bank Finance: Trends and Challenges*. Banque de France.

Minton, B., Stulz, R., and Williamson, R. (2009). How Much Do Banks Use Credit Derivatives to Hedge Loans? *Journal of Financial Services Research*, 35(1):1–31.

Nance, D., Jr., C. S., and Smithson, C. (1993). On the Determinants of Corporate Hedging. *The Journal of Finance*, 48(1):267–284.

Purnanandam, A. (2007). Interest rate derivatives at commercial banks: An empirical investigation. *Journal of Monetary Economics*, 54(6):1769–1808.

Thornton, J. and di Tommaso, C. (2018). Credit default swaps and regulatory capital relief: evidence from European banks. *Finance Research Letters*.

Trapp, R. and Weiss, G. (2016). Derivatives usage, securitization, and the crash sensitivity of bank stocks. *Journal of Banking and Finance*, 71(C):183–205.

Appendix A. Variable Definitions

[Table 5 about here.]

Appendix B. Alternative specifications

[Table 6 about here.]

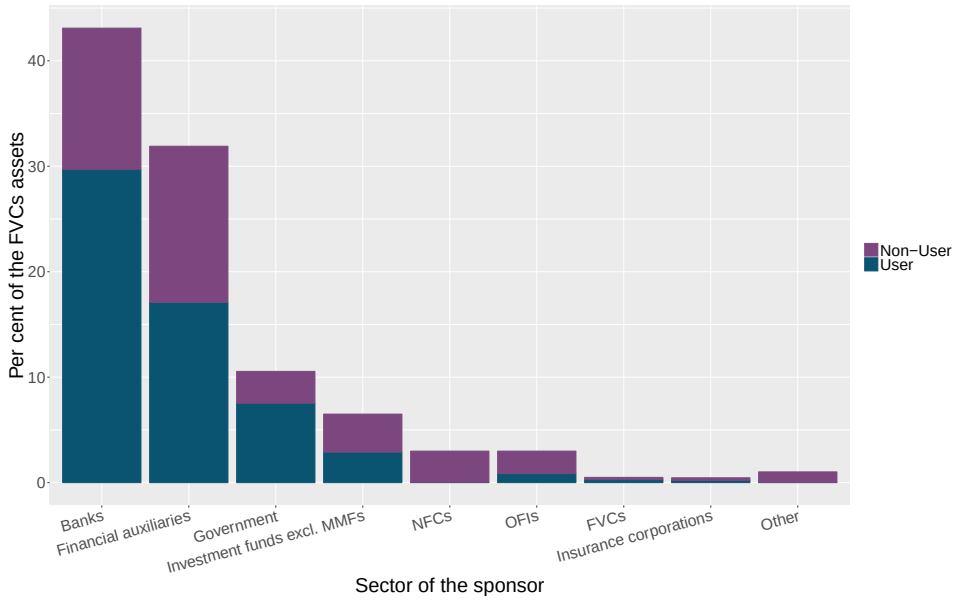

Fig. 1. Distribution of assets of financial vehicle corporations domiciled in Ireland by the sector of their sponsor (Q3 2017). The assets of FVCs are split into those vehicles that use derivatives at the end of Q3 2017 and those that do not.
Source: Central Bank of Ireland and authors' calculations.

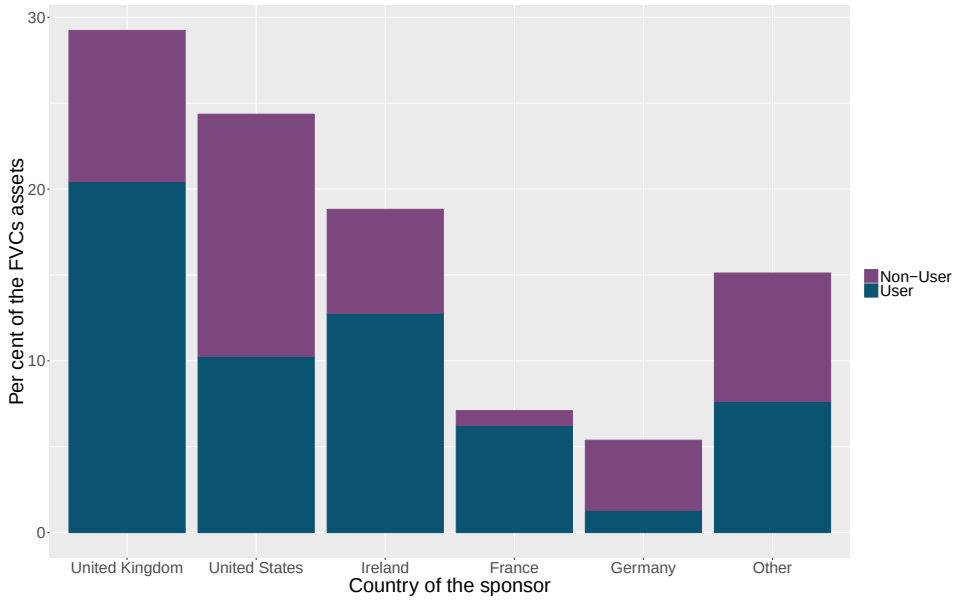

Fig. 2. Distribution of assets of financial vehicle corporations domiciled in Ireland by the country of domicile of their sponsor (Q3 2017). The assets of FVCs are split into those vehicles that use derivatives at the end of Q3 2017 and those that do not.
Source: Central Bank of Ireland and authors' calculations.

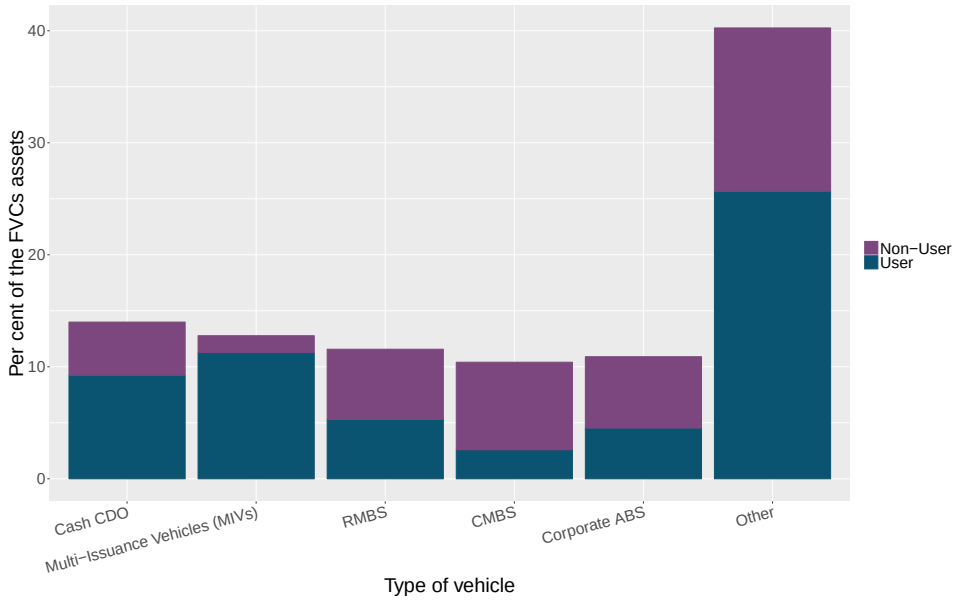

Fig. 3. Distribution of assets of financial vehicle corporations domiciled in Ireland by the type of securitisation they engage in (Q3 2017). The assets of FVCs are split to those vehicles that use derivatives at the end of Q3 2017 and those that do not. CDO refers to collateralised debt obligations, ABS to asset-backed securities, CMBS to commercial mortgage-backed securities, and RMBS to residential mortgage-backed securities.
Source: Central Bank of Ireland and authors' calculations.

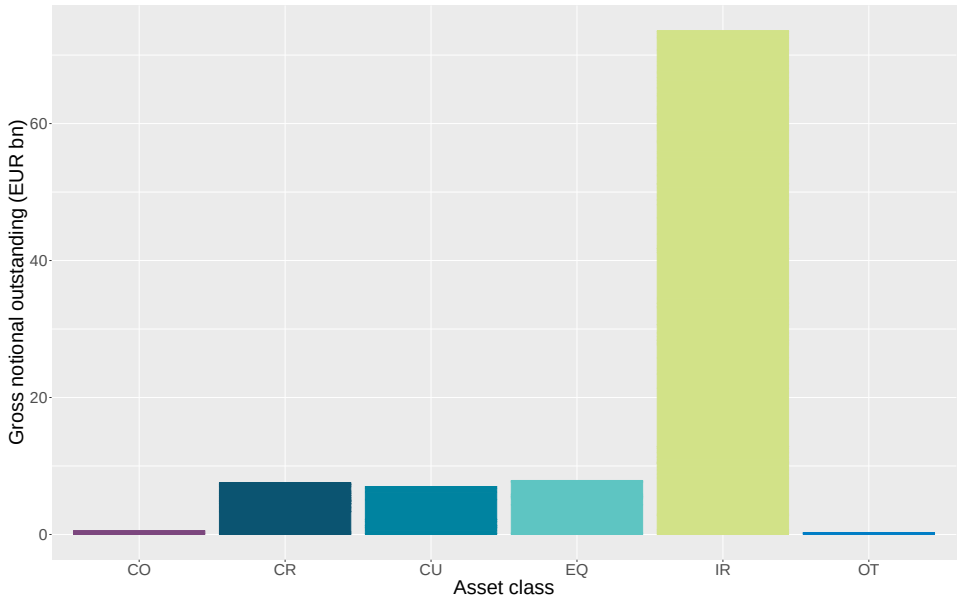

Fig. 4. Gross notional exposure of outstanding derivative contracts of all Irish FVCs divided by derivative asset class (CO — commodity, CR — credit, CU — currency/foreign exchange, EQ — equity, IR — interest rate, OT — other) at the end of Q3 2017.
Source: EMIR Trade State Reports and authors' calculations.

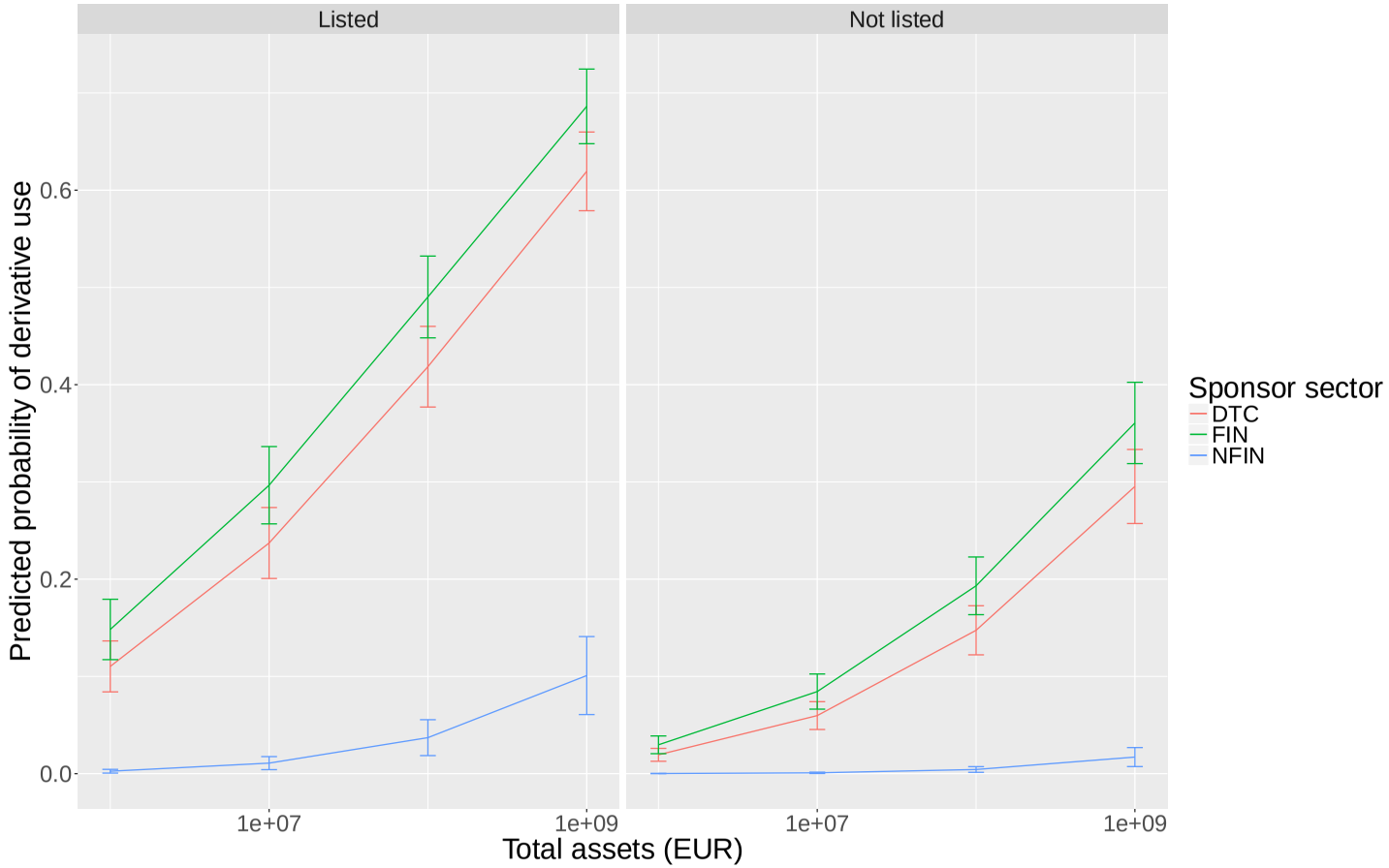

Fig. 5. Response rates (predicted probabilities of FVC using derivatives given a set of characteristics) for the model specified in the last column in Table 3. Probabilities calculated for the last quarter in the sample (Q3 2017) for an orphan multi-vehicle. Standard errors also presented. DTC — bank sponsor, FIN — non-bank financial sponsor, NFIN — non-financial corporate sponsor. Source: Authors' calculations.

Table 1: Summary statistics for financial vehicle corporations that are users of derivative contracts and those that are non-users of derivative contracts. Columns denote, respectively, the name of the variable, number of quarter-vehicle observations, average value, standard deviation, and 10th, 25th, 50th, 75th, and 90th percentiles.

Variable	N	Mean	sdev	10th	25th	50th	75th	90th
Derivative users								
Size (millions)	1,961	917.75	2,948.13	71.04	155.31	411.92	583.30	1,736.52
Listed	1,736	0.85	0.36	0.00	1.00	1.00	1.00	1.00
Orphan	1,753	0.95	0.22	1.00	1.00	1.00	1.00	1.00
Multivehicle	1,579	0.29	0.45	0.00	0.00	0.00	1.00	1.00
Sponsor size (millions)	975	1,105.48	762.65	49.05	349.96	984.62	1,745.58	2,101.20
Sponsor CET1 ratio	975	14.45	2.37	11.81	12.80	14.00	15.90	18.00
Sponsor NIM	975	1.50	1.23	0.40	0.86	1.17	2.23	2.56
Total Notional (EMIR, millions)	1,961	446.59	1,264.29	6.44	17.12	60.03	268.00	1,075.20
EMIR dummy	1,961	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Non derivative users								
Size (millions)	3,289	407.17	937.60	9.36	50.88	161.20	398.88	794.11
Listed	2,761	0.52	0.50	0.00	0.00	1.00	1.00	1.00
Orphan	2,823	0.88	0.33	0.00	1.00	1.00	1.00	1.00
Multivehicle	2,611	0.27	0.45	0.00	0.00	0.00	1.00	1.00
Sponsor size (millions)	1,241	1,112.74	2,341.48	60.02	386.87	835.81	1,593.20	1,973.40
Sponsor CET1 ratio	1,241	14.58	2.73	11.81	12.65	14.26	15.86	18.10
Sponsor NIM	1,241	1.60	2.58	0.53	0.90	1.34	2.18	2.63
Total Notional (EMIR, millions)	3,289	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 2: Number of (quarter-vehicle) observations for financial vehicle corporations that use or do not have derivative contracts at the end of a given quarter between Q3 2015 and Q3 2017. The last column presents the percentage of quarter-vehicle observations for a given category that are derivative users in all quarter-vehicle months in a given category. Rows denote specific subsets of the population of Irish FVCs. DTC — bank sponsor, FIN — financial non-bank sponsor, NFIN — non-financial corporate sponsor.

Variable	Derivative use		% users
	1	0	
Orphan	1,666	2,483	40.15%
Non-orphan	87	340	20.37%
Listed	1,477	1,438	50.67%
Non-listed	259	1,323	16.37%
Multi Vehicle	453	717	38.72%
Single Vehicle	1,126	1,894	37.28%
DTC sponsored	992	1,260	44.05%
FIN sponsored	944	1,644	36.48%
NFIN sponsored	16	251	5.99%
Traditional	1,050	2,703	27.98%
Synthetic	229	229	50.00%
Other	667	283	70.21%
Total	1,961	3,289	37.35%

Table 3: Average marginal effects of probit model regressions — FVC level characteristics. Time fixed effects included without reported coefficients. The dependent variable is equal to one if the FVC has any outstanding derivative contract at the end of a given quarter and zero otherwise. DTC — bank sponsor, FIN — non-bank financial sponsor. McFadden's pseudo R^2 reported. Robustness checks performed indicate that clustering standard errors on vehicle, sponsor, and sponsor country, and levels does not alter the results.

	FVC derivative use				
	(1)	(2)	(3)	(4)	(5)
Log FVC size$_{t-1}$	0.038***	0.033***	0.066***	0.063***	0.063***
	(0.008)	(0.008)	(0.004)	(0.004)	(0.004)
Listed	0.284***	0.223***	0.301***	0.247***	0.241***
	(0.035)	(0.036)	(0.014)	(0.015)	(0.015)
Orphan	0.054	0.026	0.076***	0.041	0.041
	(0.060)	(0.060)	(0.027)	(0.029)	(0.028)
Multivehicle	0.019	−0.041	0.049***	−0.017	−0.020
	(0.039)	(0.040)	(0.016)	(0.018)	(0.017)
DTC sponsor	0.319***	0.265***	0.335***	0.302***	0.299***
	(0.061)	(0.071)	(0.017)	(0.021)	(0.020)
FIN sponsor	0.241***	0.208**	0.372***	0.354***	0.352***
	(0.057)	(0.070)	(0.016)	(0.022)	(0.020)
Period	2017Q3	2017Q3	All	All	All
Observations	684	684	4,071	4,071	4,071
Firms	684	684	684	684	684
Sponsors	202	202	202	202	202
Pseudo R^2	0.146	0.214	0.177	0.227	0.243
Time FE	No	No	Yes	Yes	Yes
Sponsor country FE	No	Yes	No	Yes	Yes
Time-country FE	No	No	No	No	Yes

Notes: ***Significant at the 1 per cent level.
**Significant at the 5 per cent level.
*Significant at the 10 per cent level.

Table 4: Average marginal effects of probit model regressions — FVC and bank sponsor level characteristics. Time fixed effects included without reported coefficients. The dependent variable is equal to one if the FVC has any outstanding derivative contract at the end of a given quarter and zero otherwise. CET1 — Core Equity Tier 1, NIM — net interest margin. McFadden's pseudo R^2 reported. Robustness checks performed indicate that clustering standard errors on vehicle, sponsor, and sponsor country, and levels does not alter the results.

	FVC derivative use				
	(1)	(2)	(3)	(4)	(5)
Log FVC size$_{t-1}$	0.031**	0.034***	0.048***	0.061***	0.062***
	(0.012)	(0.013)	(0.007)	(0.007)	(0.007)
Listed	0.440***	0.396***	0.376***	0.306***	0.304***
	(0.066)	(0.080)	(0.029)	(0.033)	(0.032)
Orphan	−0.171	−0.048	−0.058	0.041	0.044
	(0.150)	(0.166)	(0.062)	(0.074)	(0.073)
Multivehicle	−0.049	−0.029	−0.054	−0.103***	−0.104***
	(0.082)	(0.099)	(0.033)	(0.039)	(0.039)
Sponsor size$_{t-1}$	0.038*	0.069*	0.014*	0.012	0.017
	(0.019)	(0.040)	(0.007)	(0.012)	(0.012)
Sponsor CET1 ratio$_{t-1}$	−0.046***	−0.048**	−0.022***	−0.006	−0.008
	(0.011)	(0.019)	(0.005)	(0.006)	(0.007)
Sponsor NIM$_{t-1}$	−0.111***	−0.128**	−0.069***	−0.073***	−0.083***
	(0.037)	(0.059)	(0.015)	(0.022)	(0.022)
Period	2017Q3	2017Q3	All	All	All
Observations	220	220	1,494	1,494	1,494
Firms	220	220	220	220	220
Sponsors	52	52	52	52	52
Pseudo R^2	0.199	0.265	0.140	0.228	0.254
Time FE	No	No	Yes	Yes	Yes
Sponsor country FE	No	Yes	No	Yes	Yes
Time-country FE	No	No	No	No	Yes

Notes: ***Significant at the 1 per cent level.
**Significant at the 5 per cent level.
*Significant at the 10 per cent level.

Table 5: Variable definitions and data sources

Variable	**Description**	**Data Source**
Derivative user	Dummy variable equal to 1 if FVC uses derivatives and 0 otherwise	EMIR and authors' calculations
FVC size	Log of total assets of FVC in EUR million	Central Bank of Ireland and authors' calculations
Listed	Dummy variable equal to 1 if FVCs' debt securities are listed on stock exchange and 0 otherwise	Central Bank of Ireland and authors' calculations
Orphan	Dummy variable equal to 1 if FVC is an orphan entity and 0 otherwise	Central Bank of Ireland and authors' calculations
Multivehicle	Dummy variable equal to 1 if FVC is a multivehicle and 0 otherwise	Central Bank of Ireland and authors' calculations
Sponsor size	Log of total assets of bank sponsor of FVC in EUR million	Bloomberg, SNL Financial and authors' calculations
Tier 1 ratio	Common Equity Tier 1 ratio of bank sponsor as defined by the latest regulatory and supervisory guidelines	Bloomberg, SNL Financial and authors' calculations
NIM	Net interest margin of bank sponsor defined as net interest income on a fully taxable basis as a percentage of average earning assets	Bloomberg, SNL Financial and authors' calculations

Table 6: Results of OLS regressions — FVC and bank sponsor level characteristics. Time fixed effects included without reported coefficients. The dependent variable is the logarithm of the notional of all outstanding interest rate derivative contract at the end of a given quarter. CET1 — Core Equity Tier 1, NIM — net interest margin. Robust standard errors reported. Robustness checks performed indicate that clustering standard errors on vehicle, sponsor, and sponsor country, and levels does not alter the results.

	log(1 + OTC Interest Rate notional)				
	(1)	(2)	(3)	(4)	(5)
Log FVC size$_{t-1}$	0.336	0.336	0.703***	0.632***	0.653***
	(0.223)	(0.233)	(0.103)	(0.102)	(0.106)
Listed	3.977**	3.689**	3.111***	2.844***	2.794***
	(1.592)	(1.791)	(0.577)	(0.619)	(0.637)
Orphan	−1.778	0.990	−0.311	1.993	1.821
	(3.170)	(3.434)	(1.134)	(1.252)	(1.296)
Multivehicle	−2.489	−1.162	−1.616***	−0.966	−1.176*
	(1.619)	(1.912)	(0.589)	(0.676)	(0.701)
Sponsor size$_{t-1}$	0.447	0.400	0.093	0.110	0.052
	(0.383)	(0.679)	(0.140)	(0.217)	(0.241)
Sponsor CET1 ratio$_{t-1}$	−0.590**	−0.144	−0.245***	0.317***	0.389***
	(0.230)	(0.310)	(0.094)	(0.121)	(0.134)
Sponsor NIM$_{t-1}$	−0.836	−1.175	−0.161	−0.685*	−0.576
	(0.750)	(1.085)	(0.281)	(0.379)	(0.403)
Period	2017Q3	2017Q3	All	All	All
Observations	220	220	1,494	1,494	1,494
Firms	220	220	220	220	220
Sponsors	52	52	52	52	52
R^2	0.094	0.230	0.082	0.223	0.245
Adjusted R^2	0.064	0.140	0.074	0.207	0.168
Time FE	No	No	Yes	Yes	Yes
Sponsor country FE	No	Yes	No	Yes	Yes
Time-country FE	No	No	No	No	Yes

Notes: ***Significant at the 1 per cent level.
**Significant at the 5 per cent level.
*Significant at the 10 per cent level.

Imprint and acknowledgements

The views expressed in this paper are those of the authors and do not necessarily reflect those of the Central Bank of Ireland or the European System of Central Banks (ESCB). The authors would like to thank Simone Cima, Ron Davies, Peter Dunne, Edward Gaffney, Klaus Grobys (discussant), Christoph Herpfer (discussant), Philip Lane, Fergal McCann, Peter McQuade, Kitty Moloney, Parth Venkat and participants at the 2019 RiskLab/BoF/ESRB Conference on Systemic Risk Analytics, 2019 Irish Economic Association Conference, 2019 Annual International Conference on Macroeconomic Analysis and International Finance, 2019 CONSOB-ESMA-Bocconi Conference “Securities markets: trends, risks and policies”, 2018 Irish Academy of Finance conference, the Central Bank of Ireland-Financial Stability Board (FSB) Workshop on Non-Bank Financial Intermediation, the Central Bank of Ireland's International Financial Data Working Group (IFDWG) internal seminar and internal Economics seminar, and the European Systemic Risk Board's Joint Expert Group on Interconnectedness for helpful comments on earlier drafts. The authors also thank Simone Cima for excellent research assistance. Any remaining errors are our own.

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ISSN 2467-0677 (pdf)
ISBN 978-92-9472-113-6 (pdf)
DOI 10.2849/163120 (pdf)
EU catalogue No DT-AD-19-013-EN-N (pdf)