MARKET RISK AND THE PROMINENCE OF PROJECT FINANCE

A CROSS-COUNTRY STUDY OF MARKET VOLATILITY AS A PREDICTOR OF THE CHOICE OF DEBT

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Abstract: The use of project finance has grown considerably in recent decades, both on a regional and industrial scale. This type of structured debt represents a specific investment vehicle associated with extensive risk mitigating features. In this study, we highlight the effects of market risk on the debt financing choice. The purpose of the study is to investigate the use of structured debt and determine how a firm can finance a project in an environment with higher market volatility and deteriorating credit market conditions. We conduct a cross-country study and identify significant effects of market volatility on the incidence of project finance using difference-in-difference tests. Our findings indicate that project finance loans are preferred in certain high-risk settings where credit conditions in the underlying market are negatively affected. Based on these findings, we argue that the project finance structure can help alleviate risks associated with financial instability in capital markets.

Keywords: Project Finance, Syndicated Loans, Debt Financing Choice, Risk Management, Market Volatility, Infrastructure Funding Gap

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Table of Contents

1. Introduction

1.1 Background

The global population has grown steadily for the past few hundred years, requiring significant infrastructure investments to sustain the growth. Most observers consider the investments as insufficient given certain parts of the world suffer due to an infrastructure funding gap (Ahmed and Fang, 1999), which in turn has fueled the considerable growth of project financing in recent decades (Kleimeier and Versteeg, 2010). The origin of project finance dates back to the 13th century, and prior to the 1990s was primarily used to finance large scale infrastructure projects. However, there has been a shift in recent decades where the financing technique has also been used for mid-sized projects (Kayser, 2013). Project finance is used all across the globe and across most sectors such as transport (airports, roads, railways, etc.), energy (generation and distribution), environment (e.g. water and waste treatment) and social infrastructure (e.g. hospitals, schools, government buildings) (Gatti, 2013). Also, when financing public-private-partnerships (PPP), project finance is the most commonly used instrument. Quoting the foreword in Gatti (2013) by Dario Scannapieco, Vice President of the European Investment Bank, project finance "ensures that risks are well managed within a project company, its sponsors and its financiers", meaning that structuring debt in this format could help mitigate uncertainties, both investment-specific or more general exogenous risks that parties involved in the project are exposed to.

Sponsors have two alternatives when selecting how to finance a new project: 1) financing the project *on*-balance sheet; or 2) financing the project *off*-balance sheet by creating a new economic entity where the project is incorporated. The first alternative is commonly referred to as *corporate finance* and the latter *project finance* (Gatti, 2013). In this study, we will use the terms "corporate finance" loans and "traditional syndicated" loans synonymously for the on-balance sheet debt in contrast to the term "project finance" loans. Project finance has traditionally been a method used to fund large scale projects requiring substantial fractions of debt (Ahmed and Fang, 1999). Since each project is unique in its structure, it is commonly referenced that there is no such thing as a "standard project finance deal" (Yescombe, 2002). Defining a modern project finance deal is becoming increasingly harder considering the market evolution during the two last decades. Shah and Thakor (1987) define project finance as "an arrangement whereby a

sponsor or group of sponsors incorporates a project as a legally separate entity, with project cash flows kept segregated for financing purposes from its sponsors, thereby permitting an appraisal independent of any direct support from the participants themselves". Another commonly cited definition of project finance is "the raising of funds on a limited-recourse or non-recourse basis to finance an economically separable capital investment project in which the providers of funds look primarily to the cash flow from the project as the source of funds to service their loans and provide the return of- and return on their equity invested in the project" (Finnerty, 2007). Four common characteristics to project finance agreements can be inferred from the above-mentioned definitions: 1) the borrower is a special purpose vehicle (SPV), 2) rights and obligations refer to the specially created entity, 3) creditors and sponsors rely on cash flow and the assets of the SPV and 4) they are typically highly leveraged transactions (Finnerty, 2007; Brealey et al., 1996; Kim, et al., 2011; Gatti, 2013).

Financing a project in a structured form can entail many benefits such as alleviating investment risk since the project is backed solely from the project's own operating cash flow and assets thus limiting additional guarantees provided by sponsors (Ahmed and Fang, 1999). Project finance has also been called "contractual finance" due to its organizational structure (Esty and Megginson, 2003). Contracts used within project finance are considered to be a complex set of linked agreements that can cover almost all aspects of the project's operations (Sawant, 2009). These are characteristics that allow project finance to be considered a beneficial form of financing in an asymmetric information setting. For example, with separately incorporated project cash flows creditor's screening is facilitated and thus the costs of screening lowered. In addition to these benefits, project finance can potentially mitigate contagion as a result of high debt levels on sponsors' solvency (Subramanian and Tung, 2016).

1.2 Purpose and Contribution

In this paper, we examine factors affecting the choice between the two financing alternatives, with one being project finance structured loans and the other being the issuance of traditional on-balance sheet debt. The objective is to understand why borrowers and lenders find one mode of financing more favorable than the other. We begin by descriptively presenting the development of the project finance market during the past two decades and capture the structural changes following the Great Recession.

Following this, we distinguish between the two types of financing, using a empirical approach. We examine deal-specific features that separate the transactions as well as underlying borrower- and macro-specific characteristics affecting the choice between them. Considering the development of project finance, as well as the limited academic work within the topic, we add to the existing literature by extending the research period and increasing the number of observations. This is done in order to capture both an entire economic cycle as well as the more recent developments of project finance as a special investment vehicle and the stakeholders involved. Using a comprehensive sample of loans, we aim to give an extensive and revived overview of the industrial- and geographical distribution, in addition, to financial characteristics of loans within this relatively unrecognized field of research.

Moreover, an empirical analysis aims to test the likelihood of a loan being structured as project finance debt based on features of the deal, to further understand the prominence in certain settings. Our main contribution is an extension of the research on the impact of country-level risk on the choice of debt financing by shedding light on market risk as a predictor of debt. This is based on the hypothesis that the project finance loan structure entails risk mitigating characteristics to country-specific risks. Previous research has focused on political risks as well as multiple law-related factors and we will add to this by examining the implications of financial market risk in the borrower's country. Our aim is to capture the choice of project finance as a response to country-specific credit conditions by studying capital markets, and the effect of stock market volatility on the debt financing choice in particular. The purpose is therefore to investigate the use of structured debt and determine how a firm can finance a project in higher market volatility environments with deteriorating credit market conditions restraining access to financing.

2. Literature & Theoretical Motivation

2.1 Project Finance Overview

Kayser (2013) summarized research within the field of project finance and identified four main areas; 1) contractual arrangements and legal framework of project finance, 2) project risk measurement and project selection methods, 3) globalization of project development and public sector cooperation and 4) projects under the Kyoto protocol and renewable energy projects. More relevant for this paper is previous research related to the first and second areas of studies.

Several studies examine project finance as a risk management tool. Gatti (2013) outlines three ways by which risk is treated and/or mitigated in a financial setting: 1) retaining the risk within the corporation, 2) transferring the risk to key counterparties within a transaction and 3) transferring the risk to professional risk agents, i.e. insurers. The first strategy is very common in a corporate finance setting whereas all three are present in the majority of project finance transactions. Financing several projects within the same corporation yields a contamination risk caused by all projects being dependent on the same source of financing (Gatti, 2013). According to the author, the second strategy is the cornerstone to every project finance transaction and constitutes the essence of the contractual arrangements of this type of structured financing. The strategy of extensive contracting thus enables project finance to be efficiently used as a risk management tool. In addition to contracting, separate incorporation of projects also contributes to mitigating contamination risk otherwise present in a corporate finance setting.

Kleimeier and Versteeg (2010) investigate the role of project finance as a driver of economic growth relating their findings to the financial instrument's risk mitigating benefits. Specifically, the authors show that project finance benefits the world's least developed countries by compensating for a lack of domestic financial development through its contractual structure which leads to better investment management and corporate governance. They conclude that project finance fosters economic growth and that its effects are the strongest in low-income countries.

Corielli et al. (2010) study the previously mentioned contractual arrangements and their effect on project specific factors. As mentioned, one of the most fundamental features of a project finance structure is the network of nonfinancial

contracts (NFCs) between the SPV and third parties which the authors conclude reduces agency costs and project risk. The network of contracts aims to mitigate cash flow volatility, which lowers the credit risk premium required by lenders and raises the amount of leverage used to finance the SPV (Corielli et al., 2010). Brealey et al. (1996) also examine the contractual structure of project finance. They show that project finance offers a comparative advantage to corporate finance via its ability to allocate project-specific risks, such as completion- and operating risk, revenue- and price risk, and the risk of political interference, to the actors that are best able to manage them.

Kleimeier and Megginson (2001) compare characteristics of project finance loans and non-project finance loans and how borrower and contract-specific factors affect the loan pricing. They add to previous literature by econometrically showing that the two types of credit are fundamentally different financial instruments. The authors demonstrate that project finance loans have lower spreads, justified by the features of project finance that facilitate effective monitoring and reduce agency costs such as cash flow transparency.

Sorge and Gadanecz (2008) focus on the term structure of spreads and identify both risk drivers and mitigants in project finance loans. The authors conclude that the relationship between maturity and credit spread in project finance loans is not linear, as in traditional loan pricing. This is explained by features of the loan structure, such as higher leverage and exclusive reliance on cash flows, which alleviate the perceived risk of loans with longer durations.

Kim et al. (2011) investigate the capital structure decision in project finance and find that leverage is a critical feature in order to manage exposure to project-specific risks. They conclude that the parties in the syndicate take on a greater part of the exposure in exchange for greater control over the project's cash flows. They also discuss the high tangibility of assets present in most project finance deals which yields low costs of financial distress. Esty (2003) also finds that the high use of leverage in project finance entails that after interest and amortization there are limited amounts of available cash thereby reducing the temptation for the government to expropriate the project. Again, this statement is supported in research by Sawant (2009) who concludes that high leverage reduces free cash flow available for expropriation and also improves sponsors bargaining position in a renegotiation with local governments.

Additionally, there have been observed geographical differences in the use of project finance which has motivated cross-country studies focusing on the determinants of firms' debt choices. Esty and Megginson (2003) discuss the debt ownership structure of project finance loans and relate this structure to legal risks. The aim of their paper is to understand creditors' role with regard to enforcing governance within an entity. Examples where creditors enforce governance is via debt covenants that are considered to mitigate moral hazard issues through increased monitoring and the ability to control decisions made by management (Arrow, 1963; Smith and Warner, 1979). Esty and Megginson (2003) show that creditors structure the loan differently depending on the legal rights guaranteed. The authors conclude that in countries where legal risks are low, the debt ownership structure will be more concentrated which facilitates monitoring and thus lower debt costs.

Related to this topic, Subramanian and Tung (2016) argue that project finance via its contractual and organizational structure can be considered a substitute for weak investor protection laws. Through their study, they demonstrate that in countries with weaker insider theft and creditor rights laws, project finance is more often chosen as a substitute for corporate finance debt. With the same rationale, corporate finance debt will more often be chosen in countries with strong creditor protection. The authors argue that this is due to the fact that there is no need for a more costly and specialized form of financing, such as project finance, in order to monitor and control cash flows. The authors relate their findings to the fact that project finance is more frequent in asset-intensive industries due to the facilitated monitoring and default protection provided by collateral. Bae and Goyal (2009) also study differences in legal protection by focusing on the effect on spreads in project finance loans. They find that lenders will increase cost of financing, reduce the loan amount and lower the loan duration in countries with poor enforceability.

Furthermore, Hainz and Kleimeier (2012) contribute to the literature regarding country-level risk factors as predictors in the choice between project finance and corporate finance debt. They suggest that factors such as separate incorporation, extensive use of debt and strategic use of contracting make it a more likely form of financing in countries where the political risk is considered high since it reduces the expropriation risk. The related study by Sawant (2009) strengthens these findings by looking at why, in certain cases, foreign direct investments are structured in a project

finance form, instead of using corporate debt financing, attributable to the fact that corporate finance cannot sufficiently mitigate country risk threats.

2.2 Risk Definition and Analysis

In order to analyze the country-specific risk mitigating benefits of project finance, it is necessary to distinguish the general concept of risk. "Uncertainty in regard to cost, loss or damage" is one commonly cited definition of risk (Robertson, 1924). Using the taxonomy of risk developed by Christoffersen (2012), subcategories of risk can be specified as:

- *Market risk* defined as the risk to a financial portfolio caused by changes in equity prices, foreign exchange rates, interest rates, and commodity prices;
- *Liquidity risk* defined as the risk caused by attempting a transaction in a market characterized by low trading volumes and large bid-ask spreads;
- *Operational risk* encompasses the risk of loss due to a broad spectrum of events such as physical catastrophe, technical failure and failure of management;
- *Credit risk* depends on the likelihood that a counterparty in a transaction is not able to fulfill their obligation on the predefined date;
- *Business risk* can be categorized into quantifiable risks such as business cycle and demand equation risk or non-quantifiable risks such as changes in technology or the competitive landscape.

Understanding the different risks is necessary in order to implement appropriate risk management tools. Citing the World Bank's Development Report 2014, "risk management can be a powerful instrument for development" reflecting the importance of the right funding vehicles in developing countries and for closing the infrastructure funding gap. When analyzing financing alternatives, one might think credit risk is the most relevant parameter to capture. However, it is important to keep in mind that the different types of risks cannot always be analyzed independently, which, for example, is demonstrated by the relation between credit risk and market risk.

In 1974, Robert C. Merton laid the groundwork for modern credit risk analysis, resulting in what is known as the Merton Model. Several disadvantages have, however, been observed with this type of credit analysis, which was especially apparent during the Great Recession as it was largely caused by inaccurate credit risk pricing. Crouhy et al. (2000) conducted a comparative analysis of credit models, such as Merton's

Model, and concluded that market risk is not effectively captured since spreads fluctuate partially due to changes in capital markets. This is relevant since changes of the capital market equilibrium reflect variations in interest rates, stock market indices, exchange rates, unemployment rates, etc. This should in turn impact the overall profitability of firms and as such the overall regional credit condition, reflected in the fluctuation of spreads. To paraphrase the authors, "the ultimate framework to analyze credit risk calls for the full integration of market risk and credit risk". There have been attempts to capture this, most noteworthy by Barnhill and Maxwell (2002) who developed a model for correlating market risk, measured as financial market volatility, and firm specific credit risk, which are two risk measures commonly separated.

Covering the aforementioned risk factors, Standard & Poor's, an international credit rating agency, has developed five levels of analysis for assessing credit risk in project finance loans: 1) project level risks, 2) sovereign level risks, 3) institutional risks, 4) force majeure risks and 5) credit enhancement. Analyzing the prevailing risk levels in a loan transaction can shed light on which factors affect the choice between project finance and corporate debt finance due to the fact that a heightened risk factor level can be mitigated through the choice of financing, thus making one structure preferred.

The aim of this paper, and also previous research within the field, has been related to the first and second level of analysis, i.e. project- and sovereign-level risks. The first level covers factors such as contract structure, legal risks, counterparty risks and, most relevant for this study, market risk. Research related to project finance and sovereign level risk factors has covered how the choice between corporate debt financing and project financing is affected by sovereign level risks such as legal differences or political- and economic risks within countries (Ahmed and Fang, 1999; Subramanian and Tung, 2016).

2.3 Market Volatility and Project Finance

As mentioned previously, foreign direct investments can be structured as project finance loans in order to mitigate risks on a country level. There is however a research gap concerning financial market implications on foreign direct investment (Ahmad et al. 2010). Additional country-level risks can therefore be explored by studying variations in capital markets in order to capture the effect on the debt financing choice and the varying

prominence of project finance in particular. There has been extensive research on capital markets and the relationship between financial volatility and credit conditions with regards to uncertainty and risk aversion. For example, Chauvet et al. (2012) conclude that financial volatility effectively predicts future economic activity. Also, Gregoriou (2009) claims that stock market volatility mirrors change in economic, political and monetary fundamentals. Changing conditions in the aforementioned factors will consequently cause the position of the stock market equilibrium to shift, resulting in increased volatility. In addition, according to Bailey and Chung (1995), exchange rate and political risk are shown to be significantly priced in local equity markets. All these above-mentioned parameters are factors included in the credit risk assessment presented for analyzing project finance loans, making the study of market volatility as a predictor of debt issuance compelling.

Minton and Schrand (1999) study the relationship between cash flow volatility and cost of capital and conclude that higher volatility is associated with higher costs of financing in external capital markets. The authors explain their findings through the NPV rule, intuitively demonstrating that a firm able to achieve lower volatility than peers should also have a reduced cost of capital. Cash flow volatility can have several causes, one being uncertainty and volatility in the underlying market. Project finance should efficiently mitigate this type of uncertainty due to, for example, cash flow stability and transparency, as well as facilitated monitoring and thereby achieving a lower cost of financing. Volatile capital markets can cause additional concern for firms seeking financing as it has been shown that activity in credit markets contract significantly in unstable financial markets with higher credit risk premia (Ahmed and Fang, 1999). The design of a project finance loan, including large amounts of collateral and strategic allocation of risk, could have characteristics suitable to stimulate debt financing under high volatility settings.

Jiminez and Saurina (2003) showed that loans associated with higher risk also pledged larger amounts of collateral. Related to this, Fostel and Geanakoplos (2014) document by looking at two contrasting periods of volatility - one being the Great Moderation from the 1990s up through 2006 characterized by low volatility and high debt issuance, and the other being the Great Recession between 2007-2009 characterized by high volatility and low debt issuance - the existence of a collateral equilibrium. The authors conclude that lenders will require more collateral in volatile times. High collateral value is, as previously mentioned, a common characteristic of project finance. Altogether,

these theoretical foundations and research findings establish that there is substance to the research regarding a relationship between market volatility and lending activities and, thereupon, the debt financing choice.

2.4 Hypothesis Development

Given recent developments of project finance, with regards to both deal- and borrower-specific characteristics, we aim to examine the current market and descriptively present modern features of a project finance transaction. Since project finance loans and corporate debt can be regarded as alternative options (Kleimeier and Megginson, 2001), we aim to distinguish the funding vehicles. Taking the extensive progress of the project finance market during the two recent decades into consideration we still aim to draw similar conclusions and therefore expect that:

> **Hypothesis 1:** Project finance loans represent fundamentally different transactions than traditional syndicated loans when comparing deal characteristics as well as geographic- and industrial distributions.

Based on this analysis, we continue with the objective to understand why, in comparable settings, one mode of financing is more likely than the other. Previous research related to project finance and sovereign level risk factors has covered the choice of financing related to factors such as legal differences or political- and economic risks within countries. In these cases, the project structure is proven to be a substitute for poor legal rights or lack of institutional development and stability.

Using the same logical reasoning, we predict that project finance can adjust to other country-specific risks resulting in market inefficiencies, such as asymmetric information and agency problems. As proven most recently by the Great Recession, financial market stability has a great impact on domestic credit market conditions. We therefore look to extend the research on the organizational choice by examining determinants and, in particular, the impact of domestic market risk on the choice of debt financing. We want to examine if the project finance structure can help alleviate risks associated with financial instability on capital markets, as investors become risk averse and capital becomes scarce. We aim to study the created need for credit risk management to assess financing alternatives as higher market volatility deteriorates credit conditions, restraining access to financing. Therefore, we expect that countries with higher market

risk, i.e. higher financial market volatility, will exhibit a larger prominence of project finance loans due to the risk mitigating characteristics previously mentioned. We therefore predict that:

Hypothesis 2: Ceteris paribus, project finance is more prominent than traditional syndicated on-balance sheet loans in countries with higher market volatility.

3. Data

3.1 Sample Description

In order to both descriptively analyze the project finance market and empirically test our hypotheses, the sample of syndicated loan transactions and project data was obtained from SDC Platinum, a database with a comprehensive record of transaction in many categories that is maintained by Refinitive (formerly Thomson Reuters).

3.1.1 Project Data

We first retrieved data on a project level for the period 2000-2019 from a sub-category within the SDC Platinum database called "Project Finance" in order to capture market attributes and developments. This sub-category contains data related to projects in various stages, including projects that have yet to be financed SPVs. We, therefore, screen out projects classified as "Canceled", "Inactive", "Defaulted" or "Rumored". Following Kim et al. (2011), we exclude a portion of the transactions from the sample by applying additional screens. In order to confirm that the loans are contracted on a non- or limited-recourse basis, we exclude the loans classified as "non-classic". The data includes information on a project level, such as financing break-down and sponsor details, which is useful for the descriptive analysis but not for empirically testing loan structures. This is why a different sub-category named "Syndicated Loans" containing detailed loan information is used for testing our hypotheses. After imposing these screens, our project sample is reduced from 9,510 projects to 9,409 projects across 175 countries.

Table 1. Distribution of the full sample of Projects by year

2000-2009				2010-2019			
Year	# of Loans	Total Value ($mil)	% of Total Deal Value	Year	# of Loans	Total Value ($mil)	% of Total Deal Value
2000	349	175653.8	4.24	2010	500	208799.2	5.04
2001	172	93405.1	2.25	2011	506	228200.6	5.51
2002	186	74244.5	1.79	2012	455	180755.6	4.36
2003	298	118700.7	2.86	2013	469	248518.2	6.00
2004	421	154408	3.73	2014	510	229633	5.54
2005	410	138147.8	3.33	2015	535	277398.7	6.69
2006	461	220138.9	5.31	2016	614	284010.5	6.85
2007	503	226618.2	5.47	2017	660	253123	6.11
2008	575	244773.2	5.91	2018	717	312020.9	7.53
2009	355	162478.5	3.92	2019	712	314028.4	7.58

This table shows deal count, aggregated deal value yearly deal-value fraction of the total amount during the entire sample period. Project sizes are presented are in $ million.

3.1.2 Syndicated Loan Data

In order to empirically test our hypotheses, we retrieve syndicated loans in two loan samples i.e. for project finance and corporate debt loans. Since multiple tranches from the same transaction are entered as separate observations in the database, we aggregate tranche-level data into the unit of observation in our study, which is the deal-data for each syndicated loan. We limit the scope to projects financed between 2009-2019 in order to capture the economic environment post the Great Recession (Aizenman and Pasricha, 2012). This is motivated by the fact that this event caused fundamental changes to the credit market, thus requiring an updated descriptive analysis to better understand the current characteristics of project finance. We choose to terminate our sample in 2019 to avoid the impact and market turmoil caused by the COVID-19 Pandemic.

We retrieve project finance loans from SDC's "Syndicated Loan" sub-category and filter based on the use of proceeds classified as "Project Finance". We only include projects financed on a limited or non-recourse basis. This is done by identifying the loans that can be matched with a SPV from the project data sub-set extracted from the "Project Finance" sub-category within SDC. The relatively narrow selection criteria is used in order to validate observations and filter out those loans obtained in the "Syndicated Loan" sub-category, classified as project finance but that are not associated with a SPV. The two primary reasons for doing this, first, is to ensure that the project finance loan is comparable to the corporate finance syndicated data with regards to variable definitions

and calculations, and secondly, to only retrieve syndicated loans that are compatible with the aforementioned definition of project finance.

The sample of traditional syndicated loans is also retrieved from the SDC Syndicated Loan sub-category for the same period of time as the project finance loan sample. This sub-set specifies the purpose of the loan and assigns it to a specific category. In line with Subramanian and Tung (2016), to ensure that we examine syndicated loans intended for investments in which the management is faced with the choice between traditional and structured debt, we only include asset-based loan categories such as "Capital Expenditures", "Real Estate" and "Infrastructure". For categories where the purpose is not necessarily asset-based, such as the broader category "Corporate Purposes", we add additional screens as imposed by Hainz and Kleimeier (2012) and only include loans classified as a "term loan". Additionally, we want to exclude extreme outliers, considering the long-tailed size distribution in our sample (see Appendix Figure A4), and include a size filter in order to rule out loans where the counterfactual choice of project finance is not easily plausible. Following Subramanian and Tung (2016), we exclude all corporate finance loans with proceeds less than the minimum loan amount for the project finance loan sample, which is $18 million after winsorizing at the 95% level. Finally, we only include deals arranged in sectors where both syndicated loans and project finance loans are commonly utilized. For example, an auto finance company issuing asset-backed securities based on auto loans is not a meaningful counterfactual compared to a company operating within the oil refining industry.

For both loan samples, we exclude observations where one or more variables are missing, where maturity is the most commonly missing variable. After imposing these screens, our sample consists of 20,379 corporate finance loans and 2,365 project finance loans across 144 countries worldwide.

Table 2. Distribution of the full sample of Syndicated Loans by type

Year	Project Finance Loans					Corporate Finance Loans				
	# of Loans	Mean Value	Total Value	% of Total PF Value	% of Total Value	# of Loans	Mean Value	Total Value	% of Total CF Value	% of Total Value
2009	152	206.32	31360.19	5.31	0.35	994	352.34	350221.30	4.15	3.88
2010	293	225.43	66050.69	11.19	0.73	1271	418.01	531288.14	6.30	5.89
2011	320	248.54	79531.85	13.47	0.88	1830	468.40	857168.59	10.17	9.50
2012	241	236.90	57093.56	9.67	0.63	1936	396.97	768541.46	9.12	8.52
2013	238	230.76	54920.79	9.30	0.61	2032	438.50	891030.30	10.57	9.88
2014	155	207.38	32143.35	5.45	0.36	1939	411.96	798795.60	9.47	8.85
2015	181	219.96	39813.11	6.74	0.44	2032	402.55	817990.87	9.70	9.07
2016	192	230.15	44189.63	7.49	0.49	2021	386.03	780161.41	9.25	8.65
2017	232	208.70	48419.15	8.20	0.54	2095	450.36	943500.38	11.19	10.46
2018	243	274.55	66716.43	11.30	0.74	2142	420.45	900613.91	10.68	9.98
2019	243	288.21	70035.66	11.86	0.78	2087	379.34	791688.81	9.39	8.78

This table shows deal statistics as well as the yearly deal-value fraction of 1) the loan specific total deal amount and 2) the total sample deal amount, during the period 2009-2019. Loan sizes are presented are in $ million.

3.2 Variable Description

3.2.1 Deal and Borrower Characteristics

For control variables on a loan- and contract-level, we retrieve information on the sampled transactions from the SDC database, while data for borrower- or industry characteristics are sourced from Compustat-Capital IQ from Standard & Poor's. Additionally, macro-level variables obtained on a country basis is collected from Refinitive Eikon with data provided by Morgan Stanley Capital International and Standard & Poor's.

Following Hainz and Kleimeier (2012), we include the investment characteristic variable loan *Size,* which is the total loan, aggregated of all tranches related to the syndicated loan, in USD. Similar to Kim et al. (2011), we exclude concession grants because they often come in the form of tax exemptions, land, infrastructure and other non-direct project costs and can therefore not be considered debt in the same essence. In addition to loan size, we include the total duration of each deal by obtaining the loan *Maturity* reported in the database for the tranche with the longest duration. Moreover, we want to explore additional aspects of the specific deals, and how they may differ. Therefore, we capture a transaction's potential *Currency risk* by including a dummy variable that is equal to 1 if the loan currency, i.e. the currency in which the cash flows are expected to be repaid, differs from the currency of the borrower's domestic country

reported in the SDC database. This will capture the repayment risk as a part of the overall credit risk of the issued debt. Also, we include *Syndicate size* in order to analyze how the number of lenders differs across loans in addition to *Number of tranches* reflecting the credit enhancement. Following Hainz and Kleimeier (2012), we create dummy variables to control for industry factors, which are based on the borrower's two-digit Standard Industrial Classification (SIC) codes, in order to control for different sectors' access to debt. We follow Corielli et al. (2010) and include a dummy variable indicating if the borrower, or sponsor in the case of project finance loans, is a public company, whereby they are under greater public scrutiny and may also benefit from reputational effects with regards to debt issuance.

In addition to the deal- and borrower-specific variables we concentrate on industry attributes that affect the credit profile and thereof can provide a nuanced perspective to the comparative loan analysis. The data for these variables is gathered from Compustat on an average global industry level for the period 2009-2019. Inspired by Subramanian and Tung (2016), we include *Collateral* measured as the relation of net tangible fixed assets (or PP&E) to total assets for each two-digit SIC code. For project finance loans, this means the SIC code of the SPV. This reflects the amount of collateral available, an important aspect of the loan type choice. As previously discussed, higher collateral is referenced as a risk mitigating measure by lenders and is also an important aspect in any credit transaction as it mitigates moral hazard issues. Again, following Hainz and Kleimeier (2012), we include the median long-term debt divided by total assets for each two-digit SIC industry defined as *Leverage* ratio. Apart from contributing to the credit risk profile of the borrower, this is also a proxy for a potential debt-overhang problem within an industry. Firms suffering from a debt-overhang can mitigate this issue by structuring a transaction in a project finance form and thus shift assets and debt off the balance sheet (Myers, 1977). As a proxy for the operational risk, we use the average operational *Cash Flow Volatility* of the sector in which the borrower operates. Additionally, we calculate a variable for industry average *Return on Assets* measured as the relation of net income to total assets to account for an industry's average profitability. The industry specific variables are only used and included in the loan structure comparison given each variable's related marginal effect estimated in a logit regression would be distorted, due to fact that they are not assigned on a loan-level but rather over the entire period and on a sector-level.

3.2.2 Macro Characteristics

SDC states two types of nation codes for each project: the SPV nation code and the project nation code. This means that a project can operate in one country while the SPV is located in another. For example, a project may be located in Italy, while its project company is registered in Egypt. We treat the SPV country as the borrower country, which is reported in the syndicated loan database and exclude the small fraction of observations where the project is located elsewhere. This is used to match each observation with country-specific variables. When using time-varying variables, we use the observed attributes in the fiscal year which match the debt issuance.

In order to illustrate and observe country-level differences, we want to capture aspects of country risk that may help explain the credit conditions as well as the choice of debt, one of those aspects being sovereign risk. Following Corielli et al. (2010), we gather sovereign debt ratings from *S&P Global ratings* but reclassify them into 21 categories on a scale from 1-21, where 21 reflects AAA and 1 Sovereign Default.[1] This measure has shown to be highly correlated with alternative measures of country risk, and more specifically political risk; as estimated in the widely used data reported by the International Country Risk Guide (Bali and Cakici, 2010; Corielli et al., 2010).

Market Risk Proxy

There are two commonly used subcategories depending on how market members are exposed to risk, referred to as systematic and idiosyncratic risk. The World Bank (2014) defines systematic risk as "common to most members of the entire system" and idiosyncratic as "specific to some members of a system". In order to understand the choice between project finance and corporate debt finance, we want to capture total country market risk, i.e. systematic and idiosyncratic risk, with the hypothesis that this will better capture the borrower's credit environment and thereupon the prominence of project finance.

Harvey (1991) defines country risk as the conditional sensitivity of the country return to a world stock return. The global market can be considered as the accumulation of countries' capital markets i.e. the sum of all country-specific stock portfolios. Therefore, the cross-sectional variation in performance of each portfolio

[1] Our rating system is inspired by Corielli et al. (2010) but includes more scale levels to easier capture country differences and is as follows: 21 = AAA …. 1 = Sovereign Default, Unrated or Undisclosed.

should be reflected in the differences in countries' risk exposure, which is in line with traditional asset pricing theory (Harvey, 1991). Consequently, the differential expected returns in each country are related to the relative risk exposures to the world portfolio (Harvey and Zhou, 1993). However, this measure will not reflect the relative riskiness in each domestic market since the beta will be biased depending on the degree of integration with global markets. Remote markets that are less integrated with the world market will receive a low beta, indicating low risk which can be misleading in a cross-country comparison of domestic risk. This hypothesis is supported by Bali and Caksi (2010), who find no evidence for a significant relationship between world market risk and expected returns. Instead, they argue that country-specific total risk is significantly priced in an international CAPM framework. Since we want to capture total risk within countries that can be a comparable measure in our cross-country examination, we use Bali and Caksi (2010) definition of country specific total risk. This is measured as the one-year average monthly standard deviation of country i's market portfolio returns, i.e. the stock market index, as defined in equation (1), where the subscripts refer to country *i,* at time *t.*

$$VOL_{i,t} = \sqrt{\sum_{t=1}^{T}(R_{i,t}^{M} - \bar{R}_{i,t}^{M})^2} \qquad (1)$$

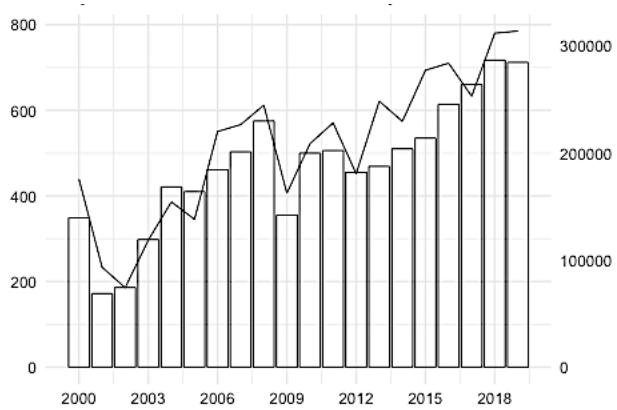
Based on the aforementioned material we define our key independent *Market Volatility* variable as the standard deviation of the past 12 month returns of each borrower's respective domestic stock index, in order to capture the prevailing level of risk influencing the borrowers' credit environment. All indexes are constructed by Morgan Stanley Capital International (MSCI) and retrieved from Refinitive Eikon. MSCI is a publicly listed global provider of fixed income-, equity-, hedge fund- and stock market indices. Stated in the company's Annual Report they as of December 31st, 2020 covered over 80 countries in developed, emerging, frontier and stand-alone markets in addition to providing regional indices. Assets under management benchmarked to an MSCI index in 2020 surpassed $1 trillion. In the case where MSCI does not cover a particular country in our sample or that data is not available for the entire sample period, a regional index has been used instead as a proxy. For example, MSCI does not construct a domestic index for Aruba for which an index covering Latin and Central America has been used instead. Given the geographical distribution, domestic indices are used for the majority of the observations. A regional proxy has been used for less than 4% of the observations in our sample.

4. Empirical Analysis

In order to test our hypotheses, we perform a stepwise empirical analysis to differentiate between the two debt structures, project finance and corporate debt finance, whereby we infer a relationship between domestic market risk and the choice between the two. First, we present descriptive statistics describing the market development during this century and describe the current market configuration. After providing a description of the current project finance market, we examine if the structure bears resemblance to the global syndicated loan market. When comparing the two sample populations, we conduct a preliminary empirical analysis to provide evidence in favor of our first hypothesis. Lastly, we present the results of the logit regressions where we study the effect of deal-, borrower- and macro-specific factors on the likeliness of a firm to take on debt through an SPV, including the effect of domestic market volatility. In order to support the previous findings and to further confirm the effect of market volatility on the likeliness of a structured project finance loan, we conduct additional difference-in-difference tests where we identify and utilize substantial shifts in domestic risk levels.

4.1 The Project Finance Market

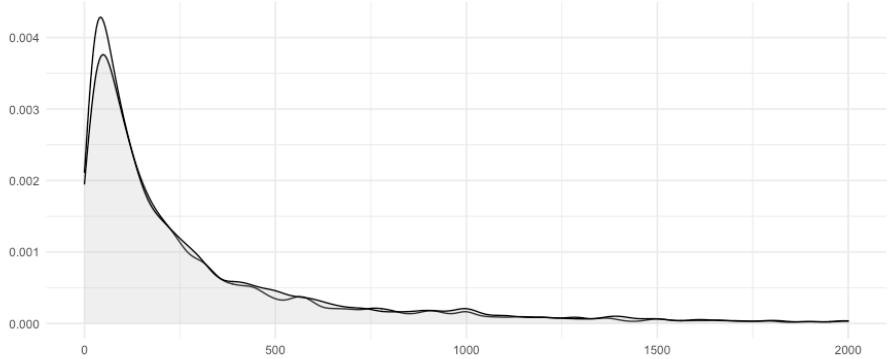
Figure 1. Number of deals and total project values by year
Note: Figure 1 shows the development during 2000-2019 of the number of deals (bar) and the total deal volume presented in million $ (line).



The market for project finance has expanded since the year 2000, both when considering aggregated deal- volume and count. As seen in Figure 1, the 2001 Tech Bubble and the Great Recession had a heavy impact on deal issuance. The total aggregated value of project finance deals reached a peak before the Great Recession in 2008, dropping in 2009 and has since then grown steadily. In 2019, a record high deal amount was reached of $314

billion completed project finance deal arrangements. This implies a 93% increase from the $162 billion reported following the financial recovery in 2009.

Figure 2. Size distribution of projects in million dollars
Note: Figure 3 describes the frequency of project sizes for the two subsequent periods, 2000-2009 (shaded) and 2010-2019.



Although the average size has remained relatively unchanged, the market landscape seems to have changed portrayed by a smaller median and larger disparity in terms of size, as seen by the increased standard deviation of project size. Figure 2 provides some clarity to this observation as the skewed distribution indicates a high density of loans that are smaller in size for both periods, with a trend towards even more loans of smaller magnitude in the later period. However, there is a minority of very large unique projects initiated in both periods that raise the mean and creates a skewed distribution over the entire period.

Table 3: Summary Statistics – by Period

	Period 1: 2000 – 2009	Period 2: 2010 - 2019	Total Period: 2000 - 2019
Project Size			
median	162.6	148.25	151.8
mean (sd)	431.25 ± 916.41	446.72 ± 1390.45	440.59 ± 1224.63
Industry			
Transportation and Utilities: n (%)	1888 (50.6%)	3963 (69.8%)	5851 (62.2%)
Construction: n (%)	405 (10.9%)	399 (7.0%)	804 (8.5%)
Mining: n (%)	381 (10.2%)	453 (8.0%)	834 (8.9%)
Manufacturing: n (%)	328 (8.8%)	188 (3.3%)	516 (5.5%)
Other: n (%)	728 (19.5%)	675 (11.9%)	1403 (14.9%)
Project Type			
BOO: n (%)	2524 (67.7%)	4499 (79.2%)	7023 (74.6%)
Acquisition: n (%)	318 (8.5%)	459 (8.1%)	777 (8.3%)
PPP: n (%)	311 (8.3%)	414 (7.3%)	725 (7.7%)
BOT: n (%)	187 (5.0%)	84 (1.5%)	271 (2.9%)
Other			
Number of countries	138	156	175
With Grant: n (%)	53 (1.4%)	34 (0.6%)	87 (0.9%)

This table shows summary statistics for the whole project data sample over two subsequent periods, 2000-2009 and 2010-2019. Project sizes are presented are in $ million.

Apart from the development in deal amount, the market can be examined through the median of sector-specifications (see Appendix A1). As seen in Table 3, Transportation

and Utilities experienced the most noticeable increase of project finance funding during the two recent decades. One potential explanation for this development could be the effort to decrease the aforementioned infrastructure funding gap. Industries classified as "other", which are thought of as non-classic project finance industries, have increased when comparing the two periods. The increase of projects financed as BOO (Build Operate Own) and the corresponding decrease of BOT (Build Operate Transfer), which are different project types, could also be an indication of public efforts to incentivize private investment in infrastructure. A BOO project allows corporations to benefit from long term profits and thereby stimulates growth and innovation. Governments are also becoming less involved in projects as seen through the decreasing use of public grants to finance projects further shifting the picture of a typical project finance deal away from the classic infrastructure deals sponsored by public agencies, and towards a corporate instrument for the financing of new efforts and projects.

4.2 Debt Structure Comparison

In order to test our first hypothesis, we want to compare the two sample populations. By conducting an empirical analysis, we examine if project finance loans and traditional syndicated debt differ in terms of deal-characteristics as well as geographical- and industrial distributions.

Table 4: Summary Statistics – by Industry and Country

Panel A	Industry Categories				
	Construction (N = 1590)	Mining (N = 1984)	Manufacturing (N = 5409)	Transportation & Utilities (N = 5973)	Other (N = 7913)
Loan Amount: by type					
CF: Total value	456,957.60	1,051,032.90	2,430,368.10	2,398,439.10	2,094,203.00
(% of total CF)	(5.4%)	(12.5%)	(28.8%)	(28.4%)	(24.8%)
PF: Total value	53,728.89	72,872.69	28,911.34	367194.17	67,567.31
(% of total PF)	(9.1%)	(12.3%)	(4.9%)	(62.2%)	(11.4%)
Distribution: by type					
CF: n	1,387	1,795	5,320	4,288	7,589
(% of CF loans)	(6.8%)	(8.8%)	(26.1%)	(21.0%)	(37.2%)
PF: n	203	189	89	1,685	324
(% of PF loans)	(8.2%)	(7.6%)	(3.6%)	(67.7%)	(13.0%)
Project Size					
median	143.85	330.00	205.00	225.00	121.67
mean	321.19 ±	566.48 ±	454.66 ±	463.02 ±	273.19 ±
(sd)	432.29	575.45	556.15	556.35	395.42

This table shows summary statistics for the whole loan data sample by sector groups, based on SIC-codes described in Appendix A1, over the most frequent 20 countries by SPV domicile for the period 2009-2019. All aggregated values presented are in $ million.

As previously mentioned, Transportation and Utilities stand for a large number of project finance loans as seen in Table 4, covering projects during the entire

period 2009-2019. When looking at both types of loan structures, investments associated with the transportation- and utilities sector are large both by the number of issued loans, as well as loan amount. However, looking at the distribution of loan issuances, it is clear that the project finance loans are more concentrated around the four large sectors outlined in Table 4, where these loans capture 89% of the total deal amount, contrasted with a much smaller fraction of loans, categorized as 'other' for the purpose of financing investments.

When studying the emergence of project finance, we can see that the geographical distribution has widened. We recognize an expansion of regional coverage in both developed and developing countries. Table 5 provides the frequency of debt structures in different countries, sorted by the most common countries in terms of project finance loan issuances. The distribution of loans reveals striking differences between project finance issuance and corporate debt. The majority of traditional syndicated loans are concentrated in a few countries; e.g. borrowers located in the United States, Japan, China, Canada and India. The United States contributes the most to the total number of issued project finance loans. However, the fraction of project finance loans in relation to corporate finance loans is relatively low due to the fact that the American corporate debt market is the largest in the world. In contrast to corporate finance loans, project finance loans exhibit a much less concentrated pattern in terms of domicile, with a more evenly distributed number of deals in countries across the world.

Table 5: Distribution of debt types - by country

	Project Finance		**Corporate Finance**			
Country	Number of Loans	Total Value	Number of Loans	Total Value	Total Number of Loans	% PF
United States	425	121636.21	8740	3868430.59	9165	5%
India	340	75671.89	619	175262.86	959	35%
Spain	218	34949.01	609	213815.87	827	26%
Japan	207	30982:10	1782	280812.18	1989	10%
France	134	18366.81	508	241296.75	642	21%
United Kingdom	116	30216.71	433	290882.79	549	21%
Italy	101	13763.89	287	116673.33	388	26%
Australia	95	28821.11	368	164651.72	463	21%
South Korea	94	22770.96	114	36368.95	208	45%
Thailand	66	6341.77	53	19586.53	119	55%
Canada	54	12825.17	1097	470403.27	1151	5%
Brazil	44	13161.27	71	30461.29	115	38%

This table shows the deal count and value distribution for the whole loan data sample grouped by project finance loans and corporate debt financing, over the most frequent 12 countries by SPV domicile. All aggregated values presented are in $ million.

In addition to the geographic and industrial distribution, we test all variables previously described in order to distinguish in our sample which borrower-, deal- and

macro-specific characteristics are statistically different for project finance loans and traditional syndicated loans. We conduct our assessment for significant differences using a nonparametric test given we cannot assume that the variables are normally distributed with equal variance across the two samples (see Figure A4 in Appendix for variable distributions).

Table 6: Summary Statistics – by group

Panel A	**Corporate Finance Loans**			**Project Finance Loans**			
	Mean	Median	Min - Max	Mean	Median	Min - Max	p-value
Size	413.710	185.000	18.078 - 2000.000	237.058	144.584	18.072 - 981.690	< 0.001
Maturity	5.562	5.003	0.033 - 61.123	12.807	13.507	0.000 - 39.110	< 0.001
Tranches	1.591	1.000	1.000 - 15.000	2.035	2.000	1.000 - 11.000	< 0.001
Syndicate Size	5.879	4.000	1.000 - 97.000	4.334	3.000	1.000 - 33.000	< 0.001
Public	0.278	0.000	0.000 - 1.000	0.009	0.000	0.000 - 1.000	< 0.001
Currency Risk	0.159	0.000	0.000 - 1.000	0.183	0.000	0.000 - 1.000	0.002
Collateral	0.537	0.658	0.025 - 1.321	0.722	0.874	0.025 - 1.321	< 0.001
Leverage	0.155	0.173	0.023 - 0.505	0.205	0.233	0.023 - 0.292	< 0.001
CFO Volatility	0.686	0.689	0.218 - 1.610	0.615	0.586	0.218 - 1.610	< 0.001
ROA	0.022	0.024	-0.118 - 0.049	0.023	0.028	-0.118 - 0.049	< 0.001
Market Volatility	0.044	0.040	0.011 - 0.423	0.048	0.045	0.011 - 0.417	< 0.001
Sovereign Risk	17.873	20.000	1.000 - 20.000	15.776	17.000	1.000 - 20.000	< 0.001

This table shows summary statistics for the whole loan data sample, grouped by financing structure type. All variables are described in section 3.2. The p-value is reported for t-tests performed on group means.

As seen in Table 6, project finance loans are on average $177 million smaller compared to the traditional syndicated loans. Also, the median project finance loan is $40 million smaller. This demonstrates that SPVs are not in fact abnormally large financing vehicles but can rather be considered mainstream financing with regards to the syndicated loan market. One can also infer that project finance loans with regards to deal characteristics are shown to have longer maturities, more tranches and smaller syndicates in comparison to corporate finance loans. These variables are consistent with the financing of a loan, such as a project finance loan, that is embedded with other risk mitigating measures, such as an extensive contract network and higher degree of asset intensity. This is also supported by the industry specific variables which indicate that project finance borrowers are characterized by larger amounts of collateral, higher leverage and lower cash flow volatility. Public companies are more common in corporate debt deals which as previously mentioned, could be a result of reputational effects that facilitate this type of debt issuance.

The results for the whole sample period implies that there is substance to the research question given the debt types appear to differ significantly in terms of deal characteristics as well as sector- and regional coverage. The univariate findings are important first steps in order to accommodate the hypotheses. However, further analysis is required for an economic interpretation of the results. In the next section, we establish whether these preliminary findings can be corroborated with an analysis that allows for the interaction of factors that may drive the dynamics of the loan types simultaneously.

4.3 Market Volatility and the Choice of Debt Financing

4.3.1 Model and Specification

After conducting the univariate tests indicating structurally different loan types, we develop the analysis further and examine the determinants of a firm's debt choice. We aim to test our hypotheses, by analyzing the effect of deal and macro-specific characteristics, controlling for industry- and geographical differences. Specifically, we look to demonstrate how the choice between the two loan structures is dependent on the prevailing domestic market risk. We utilize an organizational choice model following Kleimeier and Megginson (2001) and Hainz and Kleimeier (2012). To model the probability of an issued project finance loan, we employ a logit regression to predict firms' debt financing choice. In the model, we use a binary dependent variable which is equal to 1 for project finance loans and 0 for corporate debt loans. The specification of the model is defined in equation (2), where the subscripts refer to loan *i,* at time *t,* in country *c.*

$$prob(y_{i,c,t} = 1) = \alpha_0 + \beta_1 \, Macro \, Variables_{c,t} + \beta_2 Deal \, Variables_{i,t} + \varepsilon_{i,t} \qquad (2)$$

The results of the logit model are presented with respect to the decision made regarding project finance loans and the effect of borrower-, deal- and macro-specific characteristics. All variables are presented and described in Section 4.3.2. and all specifications of the model are employed on the entire loan-sample described in section 3.1.2. To deal with potential endogeneity concerns and sample selection biases, we further develop the logit regression. Firstly, we include industry-level controls given the asset financing choice may be sector-specific. Additionally, there is a possibility that we obtain a relationship driven by unobserved country-level factors or that our selected sample could be biased towards higher market risk countries, resulting in a biased coefficient. Therefore, in order to infer a causal relationship between debt choice and stock market

volatility, we address these concerns by utilizing a difference-in-difference approach following other cross-country studies dealing with the same challenge in proving the relationship as causal in nature (Achary et al., 2013; Subramanian and Tung, 2016). We control for unobserved heterogeneity at the country level, by including country fixed effects as well as time trends and effects on a macro level, by including time fixed effects. We estimate the organizational choice model as a difference-in-differences test by including these fixed effects, meaning the before and after difference in a country and year, when there was a shift in market risk level on the issuance of project finance loans, compared to the before and after difference in a country and year where there was no such change.

4.3.2 Regression Variables

The regression variables are outlined in Table 7 and described in more detail in section 3.2. We examine the question of multicollinearity by presenting the correlation coefficients among variables in Panel B, which shows that our independent variables are not subject to high correlation. Correlation coefficients for each loan sample are provided in Table A2 (see Appendix). For robustness checks, we perform the logit regressions and let the variables with the highest correlation, syndicate size and loan size, alternately enter the analysis. When carrying out this procedure the results remain unchanged, with details reported in Table A3 (see Appendix).

Table 7: Regression Variables - Overview

Panel A	**Description of metric**	**Source**
Project Finance Loan (PF)	Dummy = 1 if syndicated loan is project financing, 0 if corporate debt financing	SDC Platinum
Domestic Market Volatility	1-year average lagged std of country *i's* domestic stock market index returns	MSCI
ln Size	The natural log of the total loan amount in $ million	SDC Platinum
Maturity	Total loan maturity in years	SDC Platinum
Currency Risk	Dummy variable = 1 loan currency differs from the borrower's home country currency, 0 otherwise	SDC Platinum
Syndicate Size	Number of lenders included in syndicate	SDC Platinum
Tranches	Number of tranches included in loan	SDC Platinum
Public	Dummy =1 if a borrower (or SPV Sponsor) is a listed company, 0 otherwise	SDC Platinum
Sovereign Risk	Numerical scale based on debt ratings	S&P's

Panel B	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
(1) Size								
(2) Maturity	-0.02							
(3) Tranches	0.15	0.09						
(4) Syndicate Size	0.57	-0.09	0.11					
(5) Public	0.30	-0.14	-0.04	0.30				
(6) Currency Risk	0.09	-0.05	-0.02	0.11	0.08			
(7) Market Volatility	-0.07	0.10	-0.05	0.01	-0.01	0.14		
(8) Sovereign Risk	0.10	-0.24	0.05	0.04	0.05	-0.39	-0.31	

4.3.3 Regression Results

The results of the logit models are presented with respect to the decision made regarding debt structure and the effect of borrower-, deal- and macro-specific characteristics. Column 1 presents the regression that solely includes our key independent variable as a determinant of the financing choice. Specification 2 adds all of our independent variables, while in column 3 and 4 we repeat the previous specification but include fixed effects to estimate the correlations as the difference-in-differences on a country and country-by-sector level. Lastly, we rule out any concerns that the results may be driven by shocks on an industry-level by including industry-by-time fixed effects. In the specifications with combined fixed effects we define industries as described in Table A1 (see Appendix). As mentioned, we include variables that do not change by loan observation, but rather vary with time and by country. Therefore, we adjust the regression and employ a strategy where we take into consideration a possible serial correlation of error terms within each country. However, this alone does not impose restrictions on the possible temporal serial correlation. Consequently, we incorporate two clusters when calculating the standard errors, country and time, and report more conservative estimates of the significance of the independent variables. This results in an additional layer of robustness, where we allow for arbitrary correlations across loan issuances belonging to the same cluster.

The reported pseudo R squared, calculated as the McFadden's likelihood ratio index, compares a model without any predictive factors to a model including such variables. As we systematically add on control variables and fixed effects, we can observe a relatively higher pseudo R squared, reflecting increasing predictive ability of the model.

Table 8. Logit Regressions

Dependent variable:	Project Finance (=1)				
Regression	(1)	(2)	(3)	(4)	(5)
Market Volatility	8.126***	0.201	7.960***	12.296***	10.508***
	(0.862)	(1.138)	(2.585)	(2.984)	(2.820)
ln Size		-0.475***	-0.438***	-0.446***	-0.453***
		(0.056)	(0.075)	(0.085)	(0.088)
Maturity		0.184***	0.232***	0.190***	0.206***
		(0.004)	(0.010)	(0.008)	(0.009)
Number of Tranches		0.419***	0.333***	0.418***	0.415***
		(0.022)	(0.031)	(0.034)	(0.037)
Syndicate Size		-0.020**	-0.059***	-0.068***	-0.068***
		(0.008)	(0.010)	(0.011)	(0.011)
Public		-4.424***	-3.867***	-3.879***	-3.485***
		(0.361)	(0.390)	(0.361)	(0.308)
Currency Risk		0.421***	0.076	0.254*	0.173
		(0.075)	(0.124)	(0.145)	(0.148)
Sovereign Risk		-0.079***	0.069*	0.025	-0.011
		(0.007)	(0.036)	(0.039)	(0.040)
Industry * Country and Time FE	-	-	Yes	-	-
Industry, Country and Time FE	-	-	-	Yes	-
Industry * Time FE and Country FE	-	-	-	-	Yes
Observations	22,869	22,869	22,869	22,869	22,869
Log Likelihood	-7,828.99	-5,458.37	-3,533.21	-2,848.60	-2,658.70
Pseudo R^2	0.0053	0.3065	0.5511	0.6381	0.6622

Table 8 displays logit regression results, relating deal- borrower- and macro characteristics to the choice between debt structures. Models (1) to (5) report logit results using the loan-level sample with various incorporated variables and fixed effects. The dependent variable equals 1 for a project finance loan and 0 for a corporate finance loan. We report estimated coefficients for each independent variable followed by heteroskedasticity-consistent standard errors clustered by country and time in parenthesis. McFadden R squared are presented for each model. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.

Our cross-country examination indicates that the issuance of a project finance loan is related to the level of market risk prevailing in the borrower's country as well as other observed characteristics of the deal and borrower. Table 8 shows the estimated coefficients of the deal characteristics which reflects the determinants of the borrower's choice of debt. In line with our first hypothesis, the factors affecting the likelihood of project finance are significant, indicating different predictors for the two loan types. In line with our second hypothesis, the market volatility is shown to be positively associated with the occurrence of a project finance loan. These tests indicate that market risk is a statistically significant predictor of project finance loan issuance. The magnitude of the marginal effect on probability, i.e. the incremental effect of a change in market volatility holding all other variables constant, will vary across subgroups within our sample which are incorporated conditional fixed effects, however, the odds-ratio will

not.[2] We therefore infer, from the estimated coefficients reporting log odds-ratios, a positive contribution of the market risk to the predicted probability of a project finance loan significant on a 1% level. This demonstrates evidence that project finance is more prominent than traditional syndicated on-balance sheet loans in a country and during periods exhibiting higher market risk and the evidence remains solid across the three model specifications incorporating conditional effects.

Furthermore, with the exceptions of the level of sovereign- and currency risks, we find evidence on deal- and borrower characteristics indicating that the two loan structures are different financial instruments. The results indicate how the likeliness of choosing the project finance mode of investment increases with longer maturities, as investors require more extensive credit enhancing, i.e. credit tranching, as well as when creditors lend capital denominated in a currency that differs from the borrower's domestic currency. The results also show how the likeliness of choosing the project finance mode of investment decreases with larger deal sizes when the loan risk is to be divided among a larger number of lenders in a syndicate and when the borrower, or the project-related sponsor, is a publicly listed firm.

Similar to the data set used by Subramanian and Tung (2016), we can conclude that we have a disproportionately large number of loan issuances in the United States and a potential concern is therefore that the results are driven by skewed observations in the loan sample. Therefore, in order to account for this possibility, we analyze a reduced sample that does not include borrowers domiciled in the United States and the results remain unchanged, see Table A3 in Appendix. We also address the concern that our results could be driven by unobserved effects related to the financial crisis and its aftermath during the start of the recovery period. Therefore, we perform additional analysis and exclude loans issued during 2009 to ensure the robustness of our results. The findings remain unchanged for this employment of the model and the regression details are reported in Table A3 in Appendix.

[2] Unlike regular linear regressions, coefficients from a fixed-effect logit regression lack consequential interpretation of magnitudes since marginal effects are conditional. Therefore, interpretations of the model-estimates regression are limited to relative odds-ratio effects of variables, which are dependent on the data and model specifications.

4.4 Market Risk Shifts and the Choice of Debt Financing

4.4.1 Model and Specification

In this section, we develop our analysis further in order to capture the eminence of project finance in country-specific credit conditions. Based on the previous differences-in-difference tests, which investigates the impact of market risk, we can infer that project finance is more prominent when market volatility is high. However, as opposed to other previously mentioned studies conducting difference-in-difference tests, our variable of interest does not exhibit a distinct shift as in for example a law change. In order to substantiate the results of the cross-country logit regressions presented in Table 8, we identify and exploit large and persistent changes in market risk within a domestic market to capture the prolonged effects of changed risk levels rather than the temporal changes. In the same way as we conducted a difference-in-difference test presented in Table 8, we exploit exogenous country-level changes in market risk.

Following the methodologies presented in Djankov et al. (2007) and Hainz and Kleimeier (2012), we identify countries and periods with substantial changes in our key explanatory variable, i.e. changes in the risk level for the domestic market. Instead of regressing the probability of a project finance loan against the absolute volatility, we construct and include a delta-variable, ΔMarketRisk, which marks periods exhibiting substantial and persistent changes in risk levels. The specification of the model is defined in equation (3), where the subscripts refer to loan *i,* at time *t,* in country *c.* We include country- and industry dummies to control for time-invariant unobserved country– and industry characteristics, in addition to time fixed effects to control for trends and effects on a macro level.

$$prob(y_{i,c,t} = 1) = \alpha_0 + \beta_1\ \Delta\text{Macro Variables}_{c,t} + \beta_2 Deal\ Variables_{i,t} + \varepsilon_{i,t} \qquad (3)$$

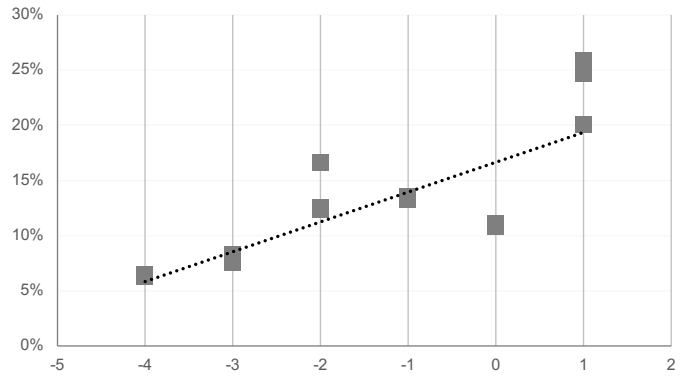
4.4.2 Constructing the Delta Variable

In order to construct the new variable, we first assign each stock index a "risk score" on a numerical scale between 1-7 depending on domestic volatility, where 1 represents the lowest volatility and 7 the highest. This method is inspired by the Synthetic Risk Reward Scale (SRRI) used for classifying UCIT funds (Committee of European Securities Regulators, 2010). The scale is applicable as country-level risk can be regarded as a

consolidated portfolio consisting of all domestic stocks, and as such, we follow the same volatility intervals for classifying risk.

Secondly, we calculate a differential value, which constitutes the delta-variable, based on changes in the risk score. In order for a change in risk score to be validated as a substantial shift and recognized in the ΔMarketRisk-variable, country *i*'s market risk score must 1) have been unchanged for a set number of consecutive months and 2) display a persistent change of risk score for a set number of consecutive months. We construct three ΔMarketRisk-variables with different degrees of validation, where the applied screening is carried out with the risk score persistence criteria of 6, 9 and 12 months respectively. Since the delta-variable is calculated on a country basis, the shifts are only relative to the country's risk score. For example, two countries can have the same absolute volatility but different assigned delta-values. The same is also true for two countries with different levels of absolute volatility but that exhibit the same delta-risk value. Therefore, the variable rules out the concern for unobserved heterogeneity at the country level.

Figure 4. Percentage of project finance loans versus ΔMarketRisk in the country at issuance
Note: Figure 4 shows the ratio of project finance loans and corporate finance loans, in each subsample based on the assigned ΔMarketRisk in the country and time of issuance. A ΔMarketRisk > 0, indicates that the country at the time had experienced an abnormal shift towards a higher risk level and vice versa.



As a preliminary test, and to examine the distribution of the assigned delta-values, we group the observations based on the magnitude of a confirmed risk deviation in all three degrees of validation, i.e. by the ΔMarketRisk-variables. Figure 4 plots the percentage of project finance loans in each group as well as in the control group, in which the loans are issued in a country and during a period where the risk level is considered uninterrupted, which serves as the relative benchmark in the comparison. The findings

are consistent with our second hypothesis, that a higher density of project finance loans is positively associated with an increase in market risk.

4.4.3 Regression Results

As seen in Table 9, the proxy for persistent market risk changes, i.e. the key independent variable ΔMarketRisk, is positively correlated with the occurrence of a project finance loan, providing additional strength to our second hypothesis.

Table 9. Logit Regression - Difference-in-difference test

Dependent variable:	Project Finance = 1		
	(1)	(2)	(3)
$\Delta MarketRisk_{6\ months}$	0.194**		
	(0.089)		
$\Delta MarketRisk_{9\ months}$		0.243***	
		(0.091)	
$\Delta MarketRisk_{12\ months}$			0.298***
			(0.109)
ln Size	-0.435***	-0.435***	-0.444***
	(0.083)	(0.083)	(0.083)
Maturity	0.183***	0.183***	0.184***
	(0.008)	(0.008)	(0.008)
Number of Tranches	0.401***	0.402***	0.403***
	(0.033)	(0.033)	(0.033)
Syndicate Size	-0.065***	-0.065***	-0.064***
	(0.011)	(0.011)	(0.011)
Public	-3.767***	-3.768***	-3.762***
	(0.352)	(0.352)	(0.351)
Currency Risk	0.199	0.200	0.199
	(0.141)	(0.141)	(0.141)
Sovereign Risk	0.033	0.035	0.030
	(0.038)	(0.038)	(0.038)
Industry, Country and Time FE	Yes	Yes	Yes
Observations	22,869	22,869	22,869
Log Likelihood	-2,940.54	-2,939.261	-2,938.901
Pseudo R^2	0.6264	0.6266	0.6266

Table 9 displays logit regression results, relating deal- borrower- and macro characteristics to the choice between debt structures. The dependent variable equals 1 for a project finance loan and 0 for a corporate finance loan. Models (1) to (3) report logit results using the loan-level sample and the independent variable delta market risk, employed in three modifications based on the persistence criteria set up to different degrees, with 12 months being the most stringent condition. We report estimated coefficients for each independent variable followed by heteroskedasticity-consistent standard errors clustered by country and time in parenthesis. McFadden R squared are presented for each model. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.

From the estimated coefficients reporting log odds-ratios, we document a positive contribution of a change in market risk to the predicted probability of a project finance loan significant on a 1% level. The findings suggest that countries experiencing a persistent increase (decrease) in market volatility are associated with a relatively higher (lower) issuance of project finance loans. These results are solid across all specifications

of the model, even in the strictest definition of a significant change in market volatility i.e. twelve months lagged and future persistence from the issuance date. This indicates that the market risk has an economically significant effect on the choice of debt structure and that the relation is strong.

As in the previous test, we address the concern that our results could be driven by structural changes and market conditions related to the financial crisis. Therefore, as a robustness test, we exclude loan observations issued in 2009 and calculate a new delta-variable. The results remain unchanged for the shorter time period and the regression details are reported in Table A3 in Appendix.

5. Discussion & Implications

5.1 Concluding Discussion

This study has drawn particular attention to differentiating project finance from corporate debt finance as two distinctive funding vehicles with regard to deal characteristics, in addition to geographical- and industrial distributions. Our main contribution is the effects of country-level risks on the choice of debt finance; more specifically, our second hypothesis aimed to conclude countries with higher market risk will tend to issue relatively more project finance loans given the risk mitigating characteristics of this loan structure.

When examining the project finance market, we can observe significant changes in the landscape during the past two decades, with a trend towards a smaller-scale corporate instrument used to finance new efforts and projects. With that in mind, we found it important to examine how the project finance structure bears resemblance to the syndicated loan market, and, more importantly, how it may differ and thereby lead to a preferred mode of financing. By comparing deal characteristics and examining determinants that increase the likelihood of financing through an SPV, we conclude that although the financing choices are alternative options for a firm seeking funding, the deals and determinants are significantly different.

When looking at exogenous macro factors affecting domestic credit market conditions, we identify an effect of market volatility on the incidence of project finance. We conclude that the likelihood of a project finance loan increases with financial instability, proxied by the volatility in domestic capital markets. This implies that project finance loans are more favorable in certain high-risk settings where the credit conditions in the underlying market are negatively affected.

These findings can be supported by financial concepts linking volatility to the cost of capital (Minton and Schrand, 1999). A firm facing a higher cost of capital due to increased volatility in the underlying market may be able to lower financing costs to finance a new investment by taking on the additional project off-balance sheet, as this structure mitigates issues related to debt overhang and contamination. The costs incurred by extensive contracting within a project finance transaction can then be offset by a decreased cost of off-balance sheet debt. A high volatility setting may inhibit a firm from contending with additional debt, thereby foregoing additional investments. This indicates

that project finance, i.e. off-balance sheet debt, is an effective tool that can be used in order to mitigate underinvestment issues, which suppress economic growth and innovation, leading to, for example, the global infrastructure funding gap.

Our findings document a higher use of project finance loans in financially unstable settings, induced by high market risk. The network of contracts in a project transaction results in cash flow *stability,* and the separate incorporation results in cash flow *transparency* (Corielli et al., 2010; Gatti, 2013). The contractual structure helps mitigate the increased agency costs of debt and asymmetric information problems in high volatility settings, thereby effectively lowering the credit risk premia (Corielli et al., 2010; Kleimeier and Megginson, 2001; Sorge and Gadanecz, 2008). Also, the network of contracts allocate risk to those actors best able to manage them, reducing the risk, and thereby the cost of debt (Brealey et al., 1996). As a result, the use of a project finance structure mitigates issues related to the heightened market risk factors.

Market instability also creates stringent credit market conditions resulting in low debt issuances and high demand for collateral (Fostel and Geanakoplos, 2014). Based on our findings, we reason that project finance is able to alleviate these loan issuance limitations due to pronounced characteristics such as large amounts of collateral and control over the project's assets and subsequent cash flows. Also, building on the findings presented by Kleimeier and Versteeg (2010), project finance facilitates in meeting funding needs. We reason that project finance becomes the preferred choice of debt when sources of financing are more scarce or expensive due to increased market uncertainties. The structure contains appropriate features that alleviate risk factors associated with financial instability, thereby stimulating lending activities.

Our findings also suggest that a less volatile market, also characterized by higher financial stability, decreases the likelihood of the use of project finance loans to mitigate risk. We reason the occurrence is due to the costs incurred when structuring the debt, such as set-up costs and contracting costs, outweigh the benefits in this market setting. This is reflected in our results through the chosen period since it constitutes a time of economic recovery where a generally reduced level of market risk is captured. This finding is consistent with Subramanian and Tung (2016) that conclude firms will not look to incur expensive set-up costs if it is not deemed to be beneficial.

The conclusion of this study is that although project finance cannot fully mitigate the risk associated with high volatility in financial markets, or that the set-up

costs of doing so are too high, it can at least reduce these associated risks. The significance of our findings revolves around economic growth and innovation that can be stimulated by allocating capital and avoiding underinvestment during times, and in places, where it is needed.

5.2 Further Research

As previously mentioned, Gregoriou (2009) concludes that stock market volatility mirrors changes in economic, political and monetary fundamentals. Market volatility as such captures a wide range of societal events, such as currency risk and economic activity, that together create prevalent credit conditions. However, an area of future research could be to isolate one or more of these elements in order to yield a deeper understanding of both the factors most affecting credit conditions and the specific project finance characteristics mitigating these issues. Such research can also benefit society at large in order to distinguish market mechanisms inhibiting economic growth and development.

An additional area of future research could be to conduct the same study but during a period of increasing volatility and uncertainty. By studying the period after the Great Recession, most countries across the globe have experienced decreasing volatility, economic recovery and improved credit conditions. The economy has historically gone in cycles where, for the purpose of this area of research, the recent Covid-19 Pandemic, could prove to be an interesting period to study that can be regarded as a recession even though the stock market effects were brief.

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Appendix

Table A1. Sector Groups – by SIC code

Sector	SIC Code	Description
Mining	10 ≤ SIC ≤ 14	Metal Mining, Coal Mining, Oil and Gas Extraction
Construction	15 ≤ SIC ≤ 19	Building Construction, Heavy Construction and Construction activity by other special trade contractors
Manufacturing	20 ≤ SIC ≤ 39	Mechanical or chemical transformation of materials into new products including agriculture, forestry, fishing, mining, quarrying and other
Transportation and Utilities	40 ≤ SIC ≤ 49	Passenger and freight transportation as well as electricity-, gas-, steam-, water- and sanitary services
Other	10 < SIC or 49 > SIC	Other sectors

Table A2. Correlation Matrices – by sample

Corporate Finance Loans	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
(1) Size								
(2) Maturity	0.03							
(3) Tranches	0.16	0.01						
(4) Syndicate Size	0.56	-0.05	0.13					
(5) Public	0.29	-0.07	-0.01	0.29				
(6) Currency Risk	0.09	-0.06	-0.02	0.12	0.09			
(7) Market Volatility	-0.06	0.08	-0.06	0.01	-0.00	0.14		
(8) Sovereign Risk	0.09	-0.20	0.05	0.03	0.02	-0.40	-0.32	
Project Finance Loans	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
(1) Size								
(2) Maturity	-0.02							
(3) Tranches	0.15	0.09						
(4) Syndicate Size	0.57	-0.09	0.11					
(5) Public	0.30	-0.14	-0.04	0.30				
(6) Currency Risk	0.09	-0.05	-0.02	0.11	0.08			
(7) Market Volatility	-0.07	0.10	-0.05	0.01	-0.01	0.14		
(8) Sovereign Risk	0.10	-0.24	0.05	0.04	0.05	-0.39	-0.31	

Table A3. Robustness Checks – all specifications of the regression model

Dependent variable:	Project Finance = 1				
Regression	(1)	(2)	(3)	(4)	(5)
ΔMarketRisk$_{12\ months}$	0.261**				
	(0.119)				
Market Volatility		10.986***	9.483***	12.386***	12.142***
		(3.738)	(2.978)	(3.008)	(2.949)
ln Size	-0.431***	-0.421***	-0.616***		-0.714***
	(0.086)	(0.088)	(0.098)		(0.074)
Maturity	0.185***	0.191***	0.185***	0.187***	0.194***

	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)
Number of Tranches	0.414***	0.426***	0.327***	0.390***	0.416***
	(0.035)	(0.036)	(0.038)	(0.033)	(0.035)
Syndicate Size	-0.064***	-0.068***	-0.047***	-0.097***	
	(0.011)	(0.012)	(0.013)	(0.010)	
Public	-3.907***	-4.021***	-3.747***	-4.004***	-3.916***
	(0.390)	(0.404)	(0.410)	(0.371)	(0.351)
Currency Risk	0.163	0.208	0.163	0.185	0.268*
	(0.148)	(0.153)	(0.144)	(0.143)	(0.144)
Sovereign Risk	0.029	0.014	-0.028	0.021	0.024
	(0.043)	(0.045)	(0.038)	(0.039)	(0.039)
Industry, Country and Time FE	Yes	Yes	Yes	Yes	Yes
Observations	21,723	21,723	13,704	22,869	22,869
Log Likelihood	-2732.119	-2649.201	-2144.903	-2861.62	-2867.153
Pseudo R^2	0.6529	0.6634	0.7275	0.6364	0.6357

Table A3 displays marginal effects calculated at the sample means, which predict borrowers' choice between debt structures. The dependent variable equals 1 for a project finance loan and 0 for a corporate finance loan. Model (1) and (2) excludes observations during 2009, model (3) excludes observations with US borrowers and model (4) and (5) deals with potential multicollinearity by alternately entering variables. We report estimated coefficients for each independent variable followed by heteroskedasticity-consistent standard errors clustered by country and time in parenthesis. McFadden R squared are presented for each model. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively

Figure A4. Variable Distributions – Loan Sample