3 CORPORATE FUNDING

OCTOBER 2020—GLOBAL FINANCIAL STABILITY REPORT

Liquidity Strains Cushioned by a Powerful Set of Policies — Online Annexes 3.1–3.6

CONTENTS

Online Annex 3.1. Data Sources

Online Annex Table 3.1.1. Data Sources

Variable	Description	Source
Aggregate Macrofinancial Indicators		
Consumer Price Index	Consumer price index	IMF, International Financial Statistics
Libor-OIS spread	Spread between Libor and the overnight index swap rates, bps	Thomson Reuters EIKON
VIX Index	Chicago Board Options Exchange Volatility Index, average and end-of-period	Haver Analytics
Overnight Index Swap Rate	Overnight index swap rate (1-month, 2-month, 3-month, 4-month, 5-month, 1-year, and 2-year maturities)	Thomson Reuters EIKON
Zero coupon yield	Zero coupon bond yield (3-year, 4-year, 5-year, 6-year, 7-year, 10-year, 12-year, 15-year, 20-year, 25-year, and 30-year maturities)	Thomson Reuters EIKON
Bank Lending Survey and Aggregate Bank Loan and Deposit Indicators		
Business lending standards	Business lending standards change, bank lending survey opinion balance, weighted and unweighted	Haver Analytics
Business loan demand	Business loan demand change, bank lending survey opinion balance, weighted and unweighted	Haver Analytics
Total nonfinancial corporate loans	Nonfinancial corporate loans by MFIs, amount outstanding, local currency unit, not seasonally adjusted	Haver Analytics
Total nonfinancial corporate deposits	Nonfinancial corporate deposits, amount outstanding, local currency unit, not seasonally adjusted	Haver Analytics
Corporate Loan and Bond Indicators		
Syndicated loan amount issued	Syndicated loan amount issued, gross, local currency unit	Dealogic
Syndicated loan grade	Indicates whether a syndicated loan is of investment grade or leveraged	Dealogic
Syndicated loan instrument type	Indicates the type (term loan or credit line) of a syndicated loan	Dealogic
Collateralized loan obligation issuance	Collateralized loan obligation (CLO) issuance, billion USD or euro	S&P LCD
Collateralized loan obligation credit rating	Collateralized loan obligation (CLO) credit rating	S&P Global Ratings
Commercial paper issuance	Nonfinancial commercial paper issuance in the US and the euro area, billion USD or Euro	Federal Reserve; European Central Bank; and Haver analytics.
Corporate bond amount issued	Nonfinancial corporate bond amount issued, gross, local currency unit	Dealogic
Corporate bond grade	Indicates whether a corporate bond is investment grade or high yield	Dealogic
Corporate bond outstanding	Outstanding amount of existing bond	Bloomberg, Thomson Reuters EIKON, DataStream
Corporate bond coupon rate	Bond coupon rate	Bloomberg, Thomson Reuters EIKON, DataStream
Corporate bond maturity	Years to maturity	Bloomberg, Thomson Reuters EIKON, DataStream
Corporate bond yield to maturity	Total yield anticipated if the bond is held to maturity, annual rate	Bloomberg, Thomson Reuters EIKON, DataStream
Excess bond premium (United States)	Corporate bond market credit spread not attributable to expected default risk, percent	Federal Reserve

Online Annex Table 3.1.1. Data Sources(continued)

Nonfinancial Firms Characteristics and Indicators		
Total assets (nominal terms)	Book value of total assets, local currency unit	S&P Capital IQ
Size	Log of total assets deflated by CPI	S&P Capital IQ; Haver; IMF staff calculation
Tobin's Q	Market capitalization of equity plus total debt, divided by book value of total assets	S&P Capital IQ; IMF staff calculation
Asset tangibility	Gross PP&E/total assets	S&P Capital IQ
Rating	Scaled indicator ranging from 1 (default) to 22 (AAA) of the S&P issuer rating.	S&P Capital IQ, IMF staff calculation
EBITDA	Earnings before interest, taxes, depreciation and amortization, local currency unit	S&P Capital IQ
Profitability	EBITDA divided by total assets	S&P Capital IQ, IMF staff calculation
Leverage	Short-term and long-term financial liabilities divided by total assets	S&P Capital IQ, IMF staff calculation
Liquidity gap	Short-term financing net of cash as a share of assets	S&P Capital IQ, IMF staff calculation
Cash flow from operations	Firm's cash flow from operations, local currency unit	S&P Capital IQ
Cash flow from investment	Firm's cash flow from investment, local currency unit	S&P Capital IQ
Cash flow from financing	Firm's cash flow from financing, local currency unit	S&P Capital IQ
Cash	Cash and short-term investments, local currency unit	S&P Capital IQ
Excess cash	Cash and short-term investments (in percent of total assets) relative to industry peers average, normalized by industry standard deviation	S&P Capital IQ; IMF staff calculation
Expected default frequency (EDF)	One-year expected default frequency of nonfinancial firms, percent	Moody's Analytics
Stock price	Daily stock price, local currency unit	Datastream
Credit lines drawdown (net)	Credit lines drawdown, local currency unit	S&P Capital IQ
Credit lines utilization rate	Listed nonfinancial corporates' credit lines drawdowns as a share of undrawn credit lines plus drawdowns, percent	S&P Capital IQ
Credit lines drawdowns for US firms (gross)	US nonfinancial corporates' gross credit line drawdowns, US dollars	S&P LCD
Total debt	Total debt, local currency unit	S&P Capital IQ
Bank Characteristics		
ROAE	Return on average shareholders' equity outstanding, percent	S&P Market Intelligence
Capital ratio	Ratio of capital to risk-weighted assets, percent	S&P Market Intelligence
Loan to asset ratio	Ratio of total loans outstanding to total assets, percent	S&P Market Intelligence
NPL ratio	Ratio of non-performing loans to total assets, percent	S&P Market Intelligence
Policy Indicators		
Policy announcements	Monetary, fiscal, and financial policy measures taken in response to COVID-19, and their announcement dates and times.	Yale Program on Financial Stability, IMF COVID Policy Tracker, press releases and press reports.

Online Annex 3.2. Firms' Choice of Debt Financing Instrument

This appendix provides information on the data and methodology used in the analysis of firms' choice of debt financing instrument.

This analysis exploits data on the quarterly issuance of syndicated loans and corporate bonds in Canada, the euro area, and the United States, where the euro area consists of France, Germany, and Italy. The sample period covers 2000:Q1 to 2020:Q2. Issuer information is matched with data from corresponding corporate financial statements. The number of firms included in the analysis is 163 for Canada, 285 for the euro area, and 1,516 for the United States. Pooled maximum likelihood estimation is separately carried out for each jurisdiction.

Choice Between Bond and Syndicated Loan Issuance

The analysis investigates the relative attractiveness of the corporate bond market and the syndicated loan market. The variables and estimation methodology are similar to that of Adrian, Colla, and Shin (2013).

A firm-quarter is included in the sample if the firm issued at least one syndicated loan or one corporate bond during that quarter.[1] An indicator variable indicates whether a firm issues a bond or a loan. Namely, if firm i issues only bonds in quarter t, the indicator variable $Bond\ Issuance_{it}$ is equal one, while if it issues only loans in that quarter , the indicator variable is equal to zero. If firm i issues both a bond and a syndicated loan in the same quarter, $Bond\ Issuance_{it}$ is equal to one if the outstanding amount of bonds issued in the quarter is larger than the amount of syndicated loans.

The estimated equation is the following.

$$P\left[Bond\ Issuance_{i,t} = 1 | Char_{i,t}, Credit\_Supply_t\right] = Logit\left(\alpha + \beta \cdot Char_{i,t} + \gamma \cdot Credit\_Supply_t\right)$$

Where $Logit(x) = \frac{exp(x)}{1+exp(x)}$.

$Char_{i,t}$ is a vector of firm characteristics that includes size, Tobin's Q, asset tangibility, rating, profitability, leverage, and liquidity gap.

$Credit\_Supply_t$ is a vector of variables that represents credit supply conditions and includes the LIBOR-OIS spread, the excess bond premium (EBP —see Online annex 3.4), and a Global Financial Crisis dummy (equal to 1 during 2007:Q3-2009:Q2), and two COVID-19 dummies (*dummy1* equal to 1 in 2020Q1, and *dummy2* equal to 1 in 2020:Q2)[2].

[1] Syndicated loans consist of loans labeled "Revolving/Term Credit Facility", "Revolving Credit", "Credit Facility", "L/C Facility", "Bridge Facility", "Swingline Facility", "Reducing Revolving Credit", "Overdraft Facility", "Commitment Line", and term loans labeled as "Term loan", and "Term loan A-H" in the Dealogic database.

[2] The number of quarter-firms during the first half of 2020 is 40, 70, and 552 for Canada, the euro area, and United States, respectively.

Subsample Analysis: U.S. Investment Grade Market and High Yield Market

A similar analysis is performed for two United States subsamples: (A) investment grade loan issuance vs investment grade bond issuance, and (B) leveraged loan issuance vs high yield bond issuance.[3]

A firm-quarter is included in the sample for exercise (A), if the firm issued at least one investment grade loan or one investment grade bond during the quarter. Likewise, the sample for exercise (B) consists of the set of firm-quarters for which the firm issued at least one leveraged loan or one high-yield corporate bond during the quarter.

The Role of Firm Characteristics during Crisis Periods

To investigate the possibility that the choice of debt instrument is more sensitive to some firm characteristics during crisis times (including the COVID-19 crisis), the firm characteristics listed above are interacted with crisis dummies. A single COVID-19 dummy variable (equal to 1 during 2020:H1) is used instead of the two quarterly COVID-19 dummies mentioned above (*dummy1* and *dummy2*). This analysis is performed for the United States subsample only.

The estimated equation is as follows:

$$P\left[Bond\ Issuance_{i,t} = 1 | Char_{i,t}, Credit\_Supply_t\right] = Logit\left(\alpha + \beta \cdot Char_{i,t} + \gamma \cdot LIBOR\ OIS_t + \rho \cdot EBP_t + \psi \cdot GFC\ Dummy_t + \phi \cdot COVID19\ Dummy_t + \xi \cdot Firm_{i,t} \cdot GFC\ Dummy_t + \eta \cdot Firm_{i,t} \cdot COVID19\ Dummy_t\right)$$

[3] Investment grade loans are the deals labeled "Investment Grade", investment grade bonds are the deals labeled "Investment Grade Corporate Bond", leveraged loans are the deals labeled "Leveraged" or "Highly Leveraged", and high-yield bonds are deals labeled "High Yield" in the Dealogic database.

Online Annex 3.3. Identification of Aggregate Credit Supply Shocks

This annex describes the methodology used in the identification of aggregate credit supply shocks in the syndicated loans primary market.

The dataset is composed of syndicated loan issuance data in the euro area (consisting of France, Germany, and Italy), the United Kingdom, and the United States. The sample period covers 2010:Q1 to 2020:Q2 for the euro area and the United Kingdom, and 2005:Q1 to 2020:Q2 for the United States. The sample contains 5086 loans provided by 220 banks. The estimation is carried out separately for each jurisdiction.

Supply and Demand System of Equations

To identify the effect of credit supply shocks on the spread, accounting for the endogenous effect of the spread on issuance volume, the following supply-demand system is used:

$$\begin{pmatrix} 1 & -\phi_s \\ 1 & -\phi_d \end{pmatrix} \begin{pmatrix} \log(spread_{it}) \\ \log(volume_{it}) \end{pmatrix} = \begin{pmatrix} \alpha_i \\ \beta_i \end{pmatrix} + A \begin{pmatrix} \log(spread_{it-1}) \\ \log(volume_{it-1}) \end{pmatrix} + \gamma[Controls]_{it} + \begin{pmatrix} e_{it} \\ u_{it} \end{pmatrix}$$

where i refers to a bank, α_i and β_i are bank fixed effects, $spread_{it}$ is a weighted average of all the contractual spreads of loans made by bank i during quarter t, $volume_{it}$ is the weighted average of the volume of loans by bank i during quarter t, $[Controls]_{it}$ is a set of predetermined variables which could affect either credit demand or supply and which includes the weighted average of the logarithm of the maturity and of the tranche rating, and some bank characteristics (capital ratio, NPL ratio, loan-to-asset ratio, and ROAE).

[4]

Since the right-hand-side variables include the first lag of spread and volume, and the left-hand-side variables are contemporaneous, this system of equations can be characterized as a bank-level bivariate structural panel vector autoregression (VAR). The contemporaneous relationship between spread and volume is captured by the two price elasticities ϕ_s and ϕ_d. With a positive supply price elasticity ϕ_s and a negative demand price elasticity ϕ_d, the terms e_{it} and u_{it} are interpreted as supply and demand shocks, respectively.

Identification Through Heteroscedasticity

To identify the credit supply shocks, Rigobon's method of identification through heteroscedasticity is used (Rigobon 2003). The procedure is briefly explained below.

First, using a bank-level unbalanced panel dataset on loan volumes and associated spreads, the reduced form bivariate panel VAR model is estimated with ordinary least squares.

Second, assuming the shock process is heteroscedastic because of multiple regimes, the variance-covariance matrix of volumes and spreads $V^{obs}$is computed. In this exercise, the following regimes are employed:

a. For the euro area and the United Kingdom, the sample period is divided into two regimes: (i) 2010:Q1-2019:Q4 (before the onset of COVID-19 crisis) and (ii) 2020:H1 (COVID-19 crisis).

[4] The tranche rating is captured by the Dealogic composite rating, which is based on the tranche ratings by Fitch Ratings, Moody's, and Standard & Poor's.

b. For the United States, data for the 2005:Q1-2009:Q4 period is also available. This period is divided into three subperiods (i) 2005:Q1-2007:Q2 (before the GFC), (ii) 2007:Q3-2009:Q1 (during the GFC)[5], (iii) 2009:Q2-2009:Q4 (recovery after the GFC). The other two regimes are the same are for the euro area and the United Kingdom. In total, five regimes are assumed for the United States.

Third, to ensure that the sign conditions regarding volatilities and price elasticities are satisfied, an exponential transformation is performed as follows: $\sigma_{demand}^{(regime\,n)} = \exp\left(s_{demand}^{regime\,n}\right), \sigma_{supply}^{(regime\,n)} = \exp\left(s_{supply}^{regime\,n}\right)$ for $n = 1,2$ for the euro area and the United Kingdom, $n = 1,2,\ldots,5$ for the United States, $\phi_d = -\exp(\psi_d)$, and $\phi_s = \exp(\psi_s)$.

Given a candidate vector of parameters of price elasticities and volatilities $\theta \equiv (\psi_d, \psi_s, s_{demand}^{(regime1)}, s_{supply}^{(regime1)}, s_{demand}^{(regime2)}, s_{supply}^{(regime2)}, \cdots)$, the matrix of theoretical moments $V(\theta)$ is computed using the general method of moments to find the vector of parameters θ^* that minimizes the following quantity[6].

$$M = \min_{\theta}((V(\theta) - V^{obs})(V(\theta) - V^{Obs})')$$

Finally, with the estimate of the price elasticities of credit supply $\widehat{\phi_s} = \exp(\hat{\psi}_s)$, one can compute the aggregate credit supply shock as the residual $\widehat{e_t}$ of the aggregate supply equation.

$$\overline{\log(spread_t)} = \alpha + \widehat{\phi_s}\,\overline{\log(volume_t)} + \hat{A}_{ds}\overline{\log(spread_{t-1})} + \hat{A}_{ss}\overline{\log(volume_{t-1})} + \hat{\gamma}\cdot\left[\overline{Controls_t}\right] + \widehat{e_t}$$

Where $[\cdot]$ is the operator that takes a simple average over all banks and α is the average bank fixed effect in the supply equation.

[5] This dating of the GFC period is identical to that in Adrian and others (2013).

[6] To improve the estimation accuracy, the weighting matrix could be introduced in the 2-step GMM to incorporate the magnitude of variance of the parameters. In this exercise, however, for the sake of computational simplicity, a one-step GMM with equal weighting scheme was employed.

Online Annex 3.4. Estimation of the Excess Bond Premium

This annex provides information on the data and methodology used to estimate the excess bond premium (EBP).

The dataset comprises monthly secondary market corporate bond yields in the euro area (defined as France, Germany, and Italy), Japan, and the United Kingdom. The sample period is 2005:M1 to 2020:M6. Estimation is carried out for each jurisdiction separately.

[7]

Following Gilchrist and Zakrajšek (2012), corporate bonds included in the sample are limited to unsecured straight bonds issued with a maturity shorter than 30 years. The number of bonds included in the analysis is 70 for the euro area, 1,286 for Japan, and 53 for the United Kingdom.

The estimation methodology is almost identical to Gilchrist and Zakrajšek (2012)[8]. The procedure is as follows:

a. First, a spread, called GZ spread, is constructed for each individual bond i issued by firm j. The GZ spread is defined as the spread against a hypothetical safe bond that would deliver exactly the same cash flows:

$$GZspread_{ijt} = Yield_{ijt} - SafeYield_{ijt}$$

b. To construct the safe yield, an OIS-based zero coupon rate curve is used. The cash flows are replicated based on the bond characteristics including coupon rate, coupon schedule, and maturity. Callability is controlled in the next step.

c. The EBP of individual bond i issued by firm j is computed as the residual of the following panel regression:

$$\begin{aligned}\log\left(GZspread_{ijt}\right) &= \alpha_j + \beta \cdot PD_{jt} + \gamma_1 \cdot \log\left(Outstanding_{ij}\right) + \gamma_2 \cdot \log\left(Coupon_{ijt}\right) + \gamma_3 \\ &\cdot \log\left(Maturity_{ijt}\right) + \gamma_4 \cdot \log\left(Age_{ijt}\right) + \gamma_5 \cdot I\left(Callable_{ijt}\right) + \gamma_6 \cdot Level_t + \gamma_7 \cdot Slope_t \\ &+ \gamma_8 \cdot Curvature_t + [Interactions\ with\ Level_t] + [Interactions\ with\ Slope_t] \\ &+ [Interactions\ with\ Curvature_t] + e_{ijt}.\end{aligned}$$

Where α_j is a firm fixed effect, PD is Moody's KMV 1-year expected default frequency, Age_{ijt} is the number of days past since the issuance, and $I(Callable)$ is a dummy variable equal to 1 when the bond is callable. $Slope$, $Level$, and $Curvature$ factors are extracted from the OIS-based zero-coupon rate curve by a dynamic factor model à la Diebold and Li (2006). Interaction terms named $[Interactions\ with\ Level]$,

[7] The EBP data for the United States used in the chapter is obtained from the Federal Reserve Board.

[8] Similar exercises have been conducted in the literature (e.g., Anderson and Cesa-Bianchi2020; De Santis 2016; Favara and others 2016; Suganuma and Ueno 2018; and Leboef and Hyun 2018).

$[Interactions\ with\ Slope]$, $[Interactions\ with\ Curvature]$ are interactions between all firm/bond-specific variables included in the equation (except the fixed effect) and the respective interest rate factors. This specification of the regression is almost identical to that used in Gilchrist and Zakrajšek (2012). The only difference is the inclusion of a firm fixed effect.

d. The economy-level EBP is defined as the median over firm j of the average of the individual EBP $\hat{e}_{ijt}$ over bond i during each quarter. Namely,

$$EBP_t \simeq median_t\left(\frac{1}{N_j}\sum_{i=1}^{N_j}\hat{e}_{ijt}\right)$$

where N_j is the number of bonds issued by firm j[9].

[9] In the original paper by Gilchrist and Zakrajšek (2012), EBP is defined as the average of the $\hat{e}_{ijt}$ rather than the median. In this exercise, however, the median is preferred becayse the sample size is smaller and the median is less affected by the effect of outliers than the average.

Online Annex 3.5. Firm-Level Stock Market Performance

This annex describes the analysis of the stock market performance of firms classified according to their degree of financial vulnerability at end-2019 during various phases of the pandemic. A standard event study methodology is used. The procedure for the analysis is as follows. First, the event start date is identified. Then, the event window is determined. Finally, daily abnormal returns are calculated based on a standard capital asset pricing model (CAPM) model. Daily abnormal returns are computed as follows:

$$Abnormal\ return_{i,t} = Stock\ Return_{i,t} - Alpha_i - Beta_i x\ Market\ Return_t$$

Where $Stock\ Return_{i,t}$ is firm *i's raw* return on date *t*, $Market\ Return_t$ is the domestic market return; and $Alpha_i$ and $Beta_i$ are parameters estimated from a regression of daily firm-level stock returns on daily domestic market returns during 2019.

Firm i's cumulative abnormal return (CAR) between days $T_1 and\ T_2$ is computed as follows:

$$CAR_i(T_1, T_2) = \sum_{t=T_1}^{T_2} Abnormal\ Return_{i,t}$$

CARs are computed for the periods from February 3, 2020 to March 31, 2020, and from Feb 3, 2020 to June 30, 2020.

For some exercises, firms are grouped into different portfolios based on their level of end-2019 vulnerability. Four main indicators of vulnerability are used: leverage, size, relative cash, and liquidity gap (see Online Annex 3.1 for definitions).

For other exercises, the cross-section of CARs is analyzed as follows:

$$CAR_i(T_1, T_2) = \beta\ High\ Vulnerability_i + \gamma Controls_i + \epsilon_i$$

Where $High\ Vulnerability_i$ is an indicator variable equal to one when a firm is identified as vulnerable. High vulnerability corresponds to size in the lowest tercile, relative cash in the lowest tercile, liquidity gap in the highest tercile, or leverage in the top half of the distribution at the end of 2019. Firm-level controls include the book-to-market ratio, Tobin's Q, and the EBITDA-to-total assets ratio (all as of end-2019), SIC2 industry dummy, and change in 12-months ahead sales forecast between 2019Q2 and 2020Q2. High-leverage (resp. small size) is also controlled for with an indicator variable equal to one when the total debt-to-asset ratio (resp. total assets) is above the median (resp. below the first tercile) of the end-2019 distribution in the relevant country. The specification is estimated separately for each G7 economies. The coefficient of interest is β, and represents the differential impact of developments between $T_1 and\ T_2$ on more vulnerable firms.

The results are robust to using abnormal returns calculated based on a three-factor Fama-French model instead of the CAPM model.

Online Annex 3.6. Policy Intervention Analysis

This annex describes the methodology used to analyze the impact of various policy announcements on firms' abnormal returns (see Online Annex 3.5 for the presentation of the computation of abnormal returns). The analysis investigates whether policy announcements had a stronger effect on firms that are more vulnerable to adverse credit supply shocks. The set of policy interventions includes monetary, fiscal, and financial policy measures and is provided in Annex Table 3.6.1. The policies can be grouped into twelve fine categories, and two coarse categories as follows:

Online Annex Table 3.6.1. Policy Announcements

Policy Categories	Examples
Policies providing indirect support to firms	
Monetary policy rate cut	A cut in the monetary policy rate
Asset purchases – government securities	Central bank government securities purchase programs
Other market liquidity	Central bank programs aimed at restoring liquidity in a specific market (excluding corporate funding markets)
Bank funding	Targeted Long-Term Refinancing Operations
Funding for lending (Central Bank)	Central bank liquidity provision to banks to encourage bank lending
Macroprudential	Easing of the macroprudential policy stance, easing of bank capital/liquidity requirements or policy guidance encouraging use of flexibility in regulation
Bank dividends	Policies limiting bank dividend distribution
Policies providing direct support to firms	
Guarantees	Government loan guarantees to nonfinancial businesses
Corporate collateral	Easing of central bank collateral requirements to include a wider scope of nonfinancial firm debt securities
Asset purchases – corporate securities	Corporate bond purchase programs
Corporate loans funding by the government	Government programs aimed at providing loans to the nonfinancial corporate sector
Fiscal relief	Government support through grants, tax holidays, payroll and employment support

Note: The classification of the policy measures is based on the Yale Program on Financial Stability (YPFS) COVID-19 Financial Response Tracker.

Within the set of policies considered, a distinction can be made between those that provide direct support to non-financial firms and those that provide indirect support. Measures taken by the European Central Bank or the European Union are considered for the three euro area economies. Pooling intervention days across countries in the period from February 3, 2020 to June 30, 2020, the following model is estimated:

$$Abnormal\ Return_{i,j,k,t} = \sum_{v=1}^{3} \beta_v High\ Vulnerability_{i,j,v} + \sum_{v=1}^{3} \sigma_v High\ Vulnerability_{i,j,v}\ X\ High\ VIX_t + \rho Controls_{i.j.k.t} + \lambda Controls_{i.j.k.t} X\ High\ VIX_t + \theta_{k,t} + \lambda_j + \epsilon_{i,j,k,t}.$$

where i is firm, j is sector, k is country, t is trading day, v is a type of vulnerability. Measures of vulnerabilities are the same as in Online Annex 3.5. Three vulnerabilities enter the regression simultaneously: either (low relative cash, small size, high leverage) or (high liquidity gap, small size, high leverage). The dependent variable is calculated by averaging firms' abnormal returns in the two-day period including the date of the policy announcement and the following day. Controls include the book-to-market ratio, Tobin's Q, cash-flow-to-total assets and a pandemic-related revenue shock proxy. $High\ VIX_t$ is a dummy variable equal to one whenever the daily level of VIX is above the 80th percentile of the VIX distribution in the period from February 2020 to June 2020. This variable captures the time-varying effect of extreme volatility on firms with different characteristics. $\theta_{k,t}$ are country-date fixed effects and λ_j are industry fixed effects (2-digits SIC). Standard errors are clustered at the industry and country-date levels. The coefficients of interest are the β_v coefficients.

The analysis is extended by studying the differential impact of different types of interventions on the abnormal returns of vulnerable firms. To this aim, the above model is enriched as follows:

$$Abnormal\ Return_{i,j,k,t} = \sum_{v=1}^{3} \beta_v High\ Vulnerability_{i,j,v} + \sum_{v=1}^{3} \sigma_v High\ Vulnerability_{i,j,v}\ X\ High\ VIX_t + \sum_{v=1}^{3} \eta_v High\ Vulnerability_{i,j,v}\ X\ Direct\ Policy_{k,t} + \sum_{v=1}^{3} \omega_v High\ Vulnerability_{i,j,v}\ X\ High\ VIX_t\ X\ Direct\ Policy_{k,t} + \rho Controls_{i.j.k.t} + \lambda Controls_{i.j.k.t} X\ High\ VIX_t + \theta_{k,t} + \lambda_j + \epsilon_{i,j,k,t}$$

Where $Direct\ Policy_{k,t}$ is a dummy variable equal to one for policy intervention days when the set of policy interventions included at least one that targeted the corporate sector directly. The coefficients of interest are the η_v and they measure the differential effect of policy announcements that included direct interventions on firms with high vulnerability relative to policy announcements that included only indirect interventions.

Online Annex Table 3.6.2. List of Announcement Dates and Policy Announcements Used in the Econometric Analysis of Chapter 3 [10]

Jurisdiction	Announcement Date	Main Policy Interventions
Canada	3/4/2020	Monetary policy rate cut
	3/12/2020	New term repo operations
	3/13/2020	Business Credit Availability Program (BCAP); Bankers Acceptance Purchase Facility (BAPF); Lowering domestic stability buffers
	3/16/2020	Swap Line with Fed; Monetary policy rate cut
	3/18/2020	Announcement of fiscal package
	3/20/2020	Contingent Term Repo Facility (CTRF)
	3/25/2020	Co-lending program for SME; Loan guarantee program for SME
	3/27/2020	Monetary policy rate cut; New Business Credit Availability Program Measures (CEBA); Government of Canada Bond Purchase Program (GBPP); Commercial Paper Purchase Program (CPPP); Encouragement to use bank regulatory buffers; Regulatory easing; Basel III delays; Additional fiscal stimulus
	4/9/2020	Relaxation of leverage ratio, of risk-weight floor factor; Other regulatory easing
	4/15/2020	Corporate bond purchase program; Provincial Bond Purchase Program (PBPP)
	5/11/2020	Large Employer Emergency Financing Facility (LEEFF)
United Kingdom	3/11/2020	Monetary policy rate cut; New Term Funding scheme; Release of Countercyclical Capital Buffer (CCyB); Encouragement to use bank prudential buffers
	3/16/2020	Swap Line with Fed
	3/17/2020	COVID Corporate Financing Facility (CCFF); New fiscal package announced
	3/19/2020	Corporate bonds and treasuries purchases expanded
	3/31/2020	Restrictions on bank dividend policies
	4/3/2020	Coronavirus Large Business Interruption Loan Scheme (CLBILS)
	4/16/2020	Expansion of Coronavirus Large Business Interruption Loan Scheme (CLBILS)
	6/18/2020	Easing of requirements for Asset Purchase Facility (APF)
Japan	2/28/2020	Japan Federation of Credit Guarantee Corporation (JGF) loan guarantees
	3/16/2020	Commercial paper and corporate bond purchases expansion; Introduction of the Special Funds-Supplying Operations to Facilitate Corporate Financing regarding the Novel Coronavirus (COVID-19); Swap Line with Fed; Increase in ETF/REIT Purchases
	3/17/2020	JFSA encourages use of bank regulatory buffers
	3/30/2020	Elements of Basel III delayed
	4/7/2020	New lending facilities and fiscal support announced
	4/8/2020	Easing leverage ratio exposure
	4/27/2020	Increase Corporate Bonds, Commercial Papers, and T-Bills Purchases; Additional monetary policy measures (SLF); Strengthening of the Special Funds-Supplying Operations
	5/22/2020	Extended the Special Funds-Supplying Operations
	5/27/2020	More fiscal and central bank support to SME
	6/16/2020	Expansion Special Program to Support Financing in Response to the Novel Coronavirus
United States	3/12/2020	1.5 tn USD repo operations are announced
	3/16/2020	Treasury purchases; Monetary policy rate cut; Encouragement to use capital buffers
	3/17/2020	Commercial Paper Funding Facility (CPFF) and Primary Dealer Credit Facility (PDCF); Adjustment to the definition of eligible income
	3/23/2020	Primary Market Corporate Credit Facility (PMCCF); Secondary Market Corporate Credit Facility (SMCCF); Term Asset-Backed Securities Loan Facility (TALF); Main Street Lending Program
	3/27/2020	Coronavirus Aid, Relief, and Economic Security (CARES) Act; Broad fiscal measures
	4/9/2020	Expansion of Primary Market Corporate Credit Facility (PMCCF); Secondary Market Corporate Credit Facility (SMCCF); Term Asset-Backed Securities Loan Facility (TALF); Modified capital rule to favour Paycheck Protection Program (PPP)
	4/30/2020	Expansion of Main Street Lending Program
	6/25/2020	Restrictions on bank dividend policies

[10] Announcement dates are associated with the following trading day if news releases occurred after the stock market close. In the table, only the description of the main interventions is reported.

Online Annex Table 3.6.2. List of Announcement Dates and Policy Announcements Used in the Econometric Analysis of the Chapter 3 (concluded)

Jurisdiction	Announcement Date	Main Policy Interventions
Germany	3/13/2020	Protective Shield for Businesses
	3/18/2020	Release of Countercyclical Capital Buffer (CCyB)
	3/23/2020	Economic stabilization fund; fiscal stimulus package
	4/6/2020	Quick Loan Program
	6/3/2020	Fiscal stimulus package
France	3/12/2020	Bpifrance guarantees
	3/16/2020	Government guarantees
	3/17/2020	Announcement of $384 Billion fiscal bill
	3/18/2020	Release of the counter-cyclical bank capital buffer
	4/15/2020	Announcent of second fiscal package
Italy	3/16/2020	Heal Italy Decree
	4/6/2020	Liquidity Decree
	5/14/2020	Relaunch Decree
	6/4/2020	Changes in minimum requirements for own funds and eligibile liabilities (MREL)
Euro area / European Union	3/12/2020	Targeted Long-Term Refinancing Operations expanded
	3/16/2020	Swap Line with Fed
	3/19/2020	Pandemic Emergency Purchase Programme (PEPP) and corporate sector purchase programme (CSPP) expansion; Collateral requirements include non-financial corporations
	3/20/2020	Capital requirements relaxation. Increase in swap lines operations frequency
	3/26/2020	Removed purchase limits and lowered maturity minimums from Pandemic Eemergency Purchase Programme (PEPP)
	3/27/2020	Recommendation on bank dividend distribution
	4/7/2020	Collateral easing measures for Pandemic Emergency Purchase Programme (PEPP) and Targeted Longer-Term Refinancing Operations (TLTROs)
	4/16/2020	Temporary reduction of capital requirements for market risk
	4/22/2020	Grandfathering of the eligibility of marketable assets used as collateral in eurosystem credit operations (including fallen angels)
	4/30/2020	Pandemic emergency longer-term refining operations (PELTROs)
	6/4/2020	Pandemic emergency purchase programme (PEPP) expanded
	6/24/2020	Temporarily adapted banking rules for banks

References

Adrian, Tobias, Paolo Colla, and Hyun Song Shin. 2013. "Which Financial Frictions? Parsing the Evidence from the Financial Crisis of 2007 to 2009." NBER Macroeconomics Annual 27 (1): 159-214.

Anderson, Gareth and Cesa-Bianchi, Ambrogio. 2020. "Crossing the Credit Channel: Credit Spreads and Firm Heterogeneity." Bank of England Working Paper 854, London.

De Santis, Roberto A. 2016. "Credit Spreads Economic Activity and Fragmentation." Working Paper Series 1930, European Central Bank.

Diebold, Francis X., and Canlin Li. 2006. "Forecasting the Term Structure of Government Bond Yields." *Journal of Econometrics* 130 (2): 337-364.

Favara, Giovanni, Simon Gilchrist, Kurt F. Lewis, and Egon Zakrajšek. 2016. "Recession Risk and the Excess Bond Premium." FEDS Notes, Board of Governors of the Federal Reserve System, Washington DC.

Gilchrist, Simon, and Egon Zakrajšek. 2012. "Credit Spreads and Business Cycle Fluctuations." *American Economic Review* 102 (4): 1692-1720.

Moody's Analytics. 2020. "Ample Liquidity Shores Up Investment-Grade Credits." April.

Rigobon, Roberto. 2003. "Identification Through Heteroscedasticity. " *Review of Economics and Statistics* 85 (4): 777-792.

Suganuma, Kenji, and Yoichi Ueno. 2018. "The Effects of the Bank of Japan's Corporate and Government Bond Purchases on Credit Spreads." IMES Discussion Paper Series 18-E-04, Institute for Monetary and Economic Studies, Bank of Japan.