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Non-Financial Corporate Debt in Advanced Economies, 2010–17

by Luiza Antoun de Almeida and Thierry Tresselt

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I N T E R N A T I O N A L M O N E T A R Y F U N D

**IMF Working Paper**

Monetary and Capital Markets Department

**Non-Financial Corporate Debt in Advanced Economies, 2010–17**

Luiza Antoun de Almeida and Thierry Tressel\*

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**Abstract**

This paper studies the evolution of non-financial corporate debt among publicly listed companies in major advanced economies between 2010 and 2017. Since 2010, firms have started to rely more on corporate bond markets and have used part of their debt to increase their holdings of cash. In our sample of some 5,000 firms, we find substantial differences across countries, industries, firms, and years in leverage and debt maturity, and we also identify time factors that are common drivers of capital structures. *Within countries*, loosening an index of financial conditions seems to be associated with lengthening debt maturity after controlling for firms' characteristics. *Across firms and countries*, leveraging and lengthening debt maturity have been greater where economic growth was stronger. Tighter financial conditions are positively associated with an increase in short-term debt financing. Quantile regressions suggest that there is substantial heterogeneity among firms on how they react to macro-financial conditions: large increases in long-term debt financing and large declines in short-term debt financing tend to be driven more by better macroeconomic performance, while large increases in short-term debt financing are more strongly impacted by tighter financial conditions. Since the paper uses data up to 2017, it does not reflect developments that occurred during the coronavirus pandemic. Nonetheless, sensitivity analysis shows that a significant amount of corporate debt, representing more than 5 percent of GDP, could be at risk in some countries, with an adverse spillover to the financial system if financial conditions tighten or economic growth slows down. This suggests that vulnerabilities should be closely monitored and policy action taken if warranted.

JEL Classification Numbers: G30; G01; E44; F65

Keywords: corporate debt; corporate vulnerability; bond issuance; macro-financial risks; firm-level data

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## I. INTRODUCTION

There is growing concern that the increase in non-financial corporation leverage in recent years has become a source of vulnerability in several advanced economies. Several central banks have identified risks related to non-financial corporation debt. For instance, the U.S. Federal Reserve identifies as a source of risk that non-financial corporation debt as a percentage of GDP is now higher than its pre-crisis peak and has significantly rebounded since 2010 (Kaplan 2019).<sup>1</sup> In 2018 in France, corporate vulnerabilities entailed a macroprudential policy response to contain bank exposures to large indebted non-financial corporates. While interest payments as a share of income have often declined, thanks to low interest rates, total debt service has remained stable or even increased in several advanced economies. As a result, a combined slow-down in growth and tightening of financial conditions could increase the “debt-at-risk”—the debt owned by vulnerable firms—to levels seen in the aftermath of the Global Financial Crisis (GFC) and cause losses to financial institutions while amplifying the downturn.<sup>2</sup>

Against this background, first we document the evolution of corporate debt using a sample of some 5,000 publicly listed companies in 10 advanced economies during the period 2010–17<sup>3</sup>. Because the paper relies on data only up until 2017, it does not reflect developments that occurred during the coronavirus pandemic, and it does not provide an assessment of related ongoing risks to the corporate sector. Stylized facts are established at both the macroeconomic and microeconomic levels for firms publicly listed on a stock market, documenting various indicators of debt leverage, debt maturity, ability to service debt, composition of debt by source of funds, and characteristics of bond financing, as well as use of funding.<sup>4</sup> Corporate debt increased in Belgium, Canada, France, the Netherlands, and the United States, and remained broadly stable in Germany, Japan, and the United Kingdom; and declined in Italy and Spain. A surge in the issuance of corporate bonds after the crisis was the main driver of the corporate debt increase, although bank loans also played a large role in Canada and the Netherlands. Corporate bond yields fell significantly, and the share of bond financing increased in every advanced economy analyzed. We find a high correlation between the incurrence of financial liabilities and the purchase of financial assets, particularly in Belgium, France, the Netherlands, and the United States. As a result of such accumulation of liquid financial assets, the increase in net corporate debt was in fact far less pronounced. The accumulation of cash buffers could reflect various considerations, including precautionary motives or intertemporal decisions in a low interest rate environment. The increase in corporate debt was driven mainly by large firms in several sectors.

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<sup>1</sup> See also recent issues of the Banque de France’s *Assessment of Risks to the French Financial System*: <https://publications.banque-france.fr/en/liste-chronologique/assessment-risks-french-financial-system>.

<sup>2</sup> See *Global Financial Stability Report* (IMF 2019).

<sup>3</sup> Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Spain, the UK, and the United States.

<sup>4</sup> National accounts and firm balance sheets report debt maturity on a remaining maturity basis, while corporate bond market data provide information on maturity at origination.

We next analyze empirically the determinants of firm leverage, debt maturity, and their evolution since 2010 among a sample of some 5000 publicly listed companies in advanced economies.<sup>5</sup> We first show that standard firm characteristics identified in the literature play an important role in explaining firm leverage, debt maturity, and their evolution over time. Second, we find that, after accounting for firms' characteristics, and country and industry fixed effects, there are time factors common to all firms that help explain corporate leverage and debt maturity since the GFC. Such factors may reflect the state of global monetary and financial conditions post crisis. We show that there was a trending increase in debt maturity.

Country and industry characteristics identified in the literature play a significant role in explaining corporate leverage and debt maturity and their change during the period studied. In particular, after netting out the effects of firms' characteristics and industries, we observe a leveraging relative to peers in the United States and Canada, and also in Italy, alongside a relative lengthening of debt maturity in the United States and Canada (and a shortening of debt maturity in Italy), and a relative deleveraging and shortening of debt maturities in Japan.

Financial conditions do not appear to have a clear and robust impact on firms' leverage on average, after we control for firms' characteristics as well as time invariant country and industry factors. Econometric results suggest that this could be the result of opposite effects offsetting each other: tighter financial conditions are associated with increased reliance on short-term debt financing and with reduced reliance on long-term debt financing, resulting in an overall reduction of debt maturity. Macroeconomic performance is not robustly associated with leverage and debt maturity *within countries* and industries.

However, differences in macroeconomic performance *across countries* do help explain the change in leverage and in debt maturity across firms during the period. Cross-sectional regressions show that, after controlling for firms' characteristics and industry effects, firms in countries with higher growth on average experienced a larger increase in leverage and long-term debt financing and a decrease in short-term debt financing. The reliance on short-term debt increased more in countries with tighter financial conditions.

We explore the potential heterogeneity in the response of leverage and debt maturity to the macrofinancial environment by performing a quantile regression analysis on the cross-section of changes in leverage and debt maturity. We find that macroeconomic performance has a clear, positive impact on both the increase of leverage and debt maturity, while the impact of financial conditions is more heterogeneous and appears to differ across firms that leverage and those that deleverage. Specifically, better macroeconomic performance tends to be significantly positively associated with changes in leverage or debt maturity at all quantiles of their distribution, but

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<sup>5</sup> The corporate debt of our sample of non-financial corporations accounts for between 30 percent and 50 percent of total non-financial corporation debt at the country level in eight out of 10 countries in our sample. In the two remaining countries (Italy and the Netherlands), it accounts for between 15 percent and 20 percent of total non-financial corporations.

economic growth has a stronger impact on leveraging and debt maturity among firms that experienced larger increases in the variable considered. Financial conditions tend to have a significant impact on changes in debt maturity at all quantiles of the distribution. However, tighter financial conditions are positively associated with increases in leverage and debt maturity for large increases in short-term debt financing and long-term debt financing, but negatively associated with changes in debt maturity for large declines in long-term debt financing.

All in all, these findings suggest that: (i) the cross-section of large increases in leverage are more likely to be explained by different macroeconomic performance than by differences in financial conditions; (ii) looser financial conditions have been associated with improved debt maturity mainly by reducing the decline in debt maturity (the left tail of the distribution of the change in debt maturity), and (iii) among large increases in debt maturity, there is no evidence that loosening financial conditions unambiguously resulted in extensions of maturity; in fact, we obtain the opposite result. These findings suggest that the extension of debt maturity and leveraging of recent years is more clearly related to cross-country differences in macroeconomic performance, than to disparities in financial conditions. This seems due to differences across firms in how they adjust their capital structures to financial conditions.

In the last part of the paper, we perform stress tests on the corporate debt-at-risk in our sample of publicly listed firms on the end of 2017 balance sheets. The downside scenarios entail different combinations of spread decompression and worsening macroeconomic performance, weakening firms' profits while raising debt service. We show that, during some of these scenarios, the corporate debt-at-risk could be substantial. This analysis suggests that corporate debt should be monitored closely and, if financial conditions tighten or economic growth slows down, policy actions should be considered. While offering specific policy recommendations is beyond the scope of this paper, we note that macroprudential policies to address nonbank and market corporate financing are not yet well established. In France, corporate vulnerabilities have necessitated a policy response to contain banks' exposure to large indebted corporates by tightening the large exposure limit of banks.<sup>6</sup>

The remainder of the paper is structured as follows: Section II presents an overview of the literature on corporate debt since the GFC. Section III documents stylized facts on the evolution of corporate debt in advanced economies. Section IV conducts a regression analysis to determine which factors influenced the evolution of corporate debt since the crisis. Section V presents a sensitivity analysis of combined shocks to interest rates and economic growth on the amount of debt-at-risk. Section VI concludes.

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<sup>6</sup> Haut Conseil de Stabilité Financière (2018).

## II. LITERATURE REVIEW

Several papers have studied how the GFC and the subsequent euro area crisis have affected firms' financing structures and how firms' characteristics, such as size, leverage, and profitability, influence their response to financial market distress. Firms' access to external financing determines their capacity to invest and hence support economic recovery.

Financial market distress is expected to affect credit through different channels. Banks are hit by adverse shocks to their funding and capital positions that weaken their balance sheets, making the extension of new credit less likely (Ivashina and Sharfstein 2010; Acharya and others 2018; Gambacorta and Marques-Ibanez 2011). In addition, economic downturns reduce the collateral value of borrowers and thus their creditworthiness, making banks unwilling to lend (Bernanke and Gertler 1995; Bernanke and Blinder 1988; Cerqueiro and others 2016). Finally, as uncertainty and risks rise, the expected returns on investment decline, making both banks and borrowers more reluctant to lock in capital in long-term investments.

The ultimate effect of a crisis on firms' leverage may be conditional on several firms' and country characteristics. These include size, being listed, market access, and countries' financial market and institutional development.

Listed large firms enjoy greater information availability, which should lead to a reduction of the information asymmetry faced by banks and also to greater market access, ultimately resulting in better access to credit (see Demirguc-Kunt and others (2020) for a review of the literature). Firms that have a higher share of fixed assets have a higher share of collateralizable, tangible assets and therefore better access to debt financing (Falato and others 2013; Adler and others 2019). Firms with higher growth opportunities (such as those with higher sales-to-asset ratios) tend to have lower leverage and shorter debt maturities to more fully internalize the returns from new investments (Fama and French 2002).<sup>7</sup> Firms with higher sales growth tend to have more cash and therefore easier access to debt finance.

Regarding country characteristics, theory suggests that shareholders in countries with high bankruptcy costs and weak rule of law will take more risks after an increase in uncertainty, which would in turn make banks less willing to lend to them and also reduce the maturity of debt (Diamond 2004; Jeanne 2009; Jensen and Meckling 1976). Recent experience also indicates that sovereign risk translates into a higher perceived corporate risk of decreasing firms' access to external financing (Antoun de Almeida and Masetti 2016; Augustin and others 2016). Demirguc-Kunt and others (2020) show that small unlisted firms and firms in countries with a shallower banking system and a weaker institutional environment experienced a more pronounced decline in their leverage after the GFC. By the same token, Buca and Vermeulen (2015), as well as Leary (2009) show that bank-dependent firms reduce their leverage and investment after a credit crunch more than firms with market access do. The depth of market financing in a country also influences the ability of firms to substitute bank financing during bank distress. As a result,

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<sup>7</sup> Arnold and others (2013) develop an intertemporal structural model and show that firms with growth options tend to have higher costs of debt than firms with real fixed assets.

output costs of financial crises tend to be higher in bank-based economies (Bats and Houben 2020; Chava and Purnanadam 2011; Chodorow-Reich 2014; and Gambacorta et al. 2014).

In response to the financial crisis, major central banks in advanced economies engaged in quantitative easing leading to portfolio rebalancing and even in direct corporate sector purchase programmes, both of which improved financing conditions for firms by decreasing bond yields (Abidi and Miquel-Flores 2018; Betz and De Santis 2019). Indeed, empirical studies find that large firms were able to substitute market financing for bank financing in response to the credit crunch during the crisis, leading to an increase in corporates' market debt share (Adrian and others 2013; Antoun de Almeida and Masetti 2016; Bats 2020; Becker and Ivashina 2014; and Betz and De Santis 2019).

Several papers have documented the evolution and determinants of firms' leverage and vulnerabilities to funding shocks, but to our knowledge, few papers have undertaken a cross-country study among corporates of advanced economies, as this paper does. The IMF's October 2019 *Global Financial Stability Report* documents that debt at risk and other vulnerability indicators are already elevated in several major economies and may rise more, reaching or exceeding the GFC levels in several cases in a downside scenario. The report presents differences in the maturity of corporate and sovereign debt across advanced economies and emerging markets (EM) and across instruments (bonds and syndicated loans). Chow (2015) finds that in the aftermath of the GFC, emerging market corporates increased their borrowing, particularly in foreign currency, and notes that corporate debt-at-risk could rise significantly under a sensitivity analysis combining macroeconomic and financial shocks. Dao and Maggi (2018) find that some large firms have seized the opportunity of the low interest environment and reduced tax rates to incur debt and accumulate liquid assets, but without a commensurate increase in fixed real capital investment. Herwadkar (2017) determines that global financial market and macroeconomic conditions facilitated higher corporate leverage in EMs, while some traditional drivers like domestic growth and firm-specific factors have become less important in the post-crisis period. Moreno and Serena-Garralda (2018) show that the decline in the global price of risk has resulted in an increase in international bond borrowing by younger and smaller firms. This has made their funding costs more sensitive to changes in the global price of risk. Calomiris and others (2019) argue that the increase in bond market borrowing by EM firms since reflects a search for yield by institutional investors in higher risk securities. And it resulted, they state, in increased cash hoarding by EM corporates that were able to issue index-eligible bonds at a low cost. Abraham and others (2019) show that the rise in EM corporate borrowing was facilitated by the development in domestic capital markets.

The post-GFC leveraging may have been accompanied by a rise in debt vulnerabilities, which may become visible in a scenario of tightening financial conditions and reduced macroeconomic performance. Lessons from the pre-GFC period suggest that leveraging during periods of boom is not always well allocated. For instance, Bris and others (2014) studied capital structures of European firms before the global financial crisis and found that the creation of the euro considerably boosted debt financing in countries with previously weak currencies, particularly for large firms and firms dependent on external financing. Bruno and Shin (2016) point out that



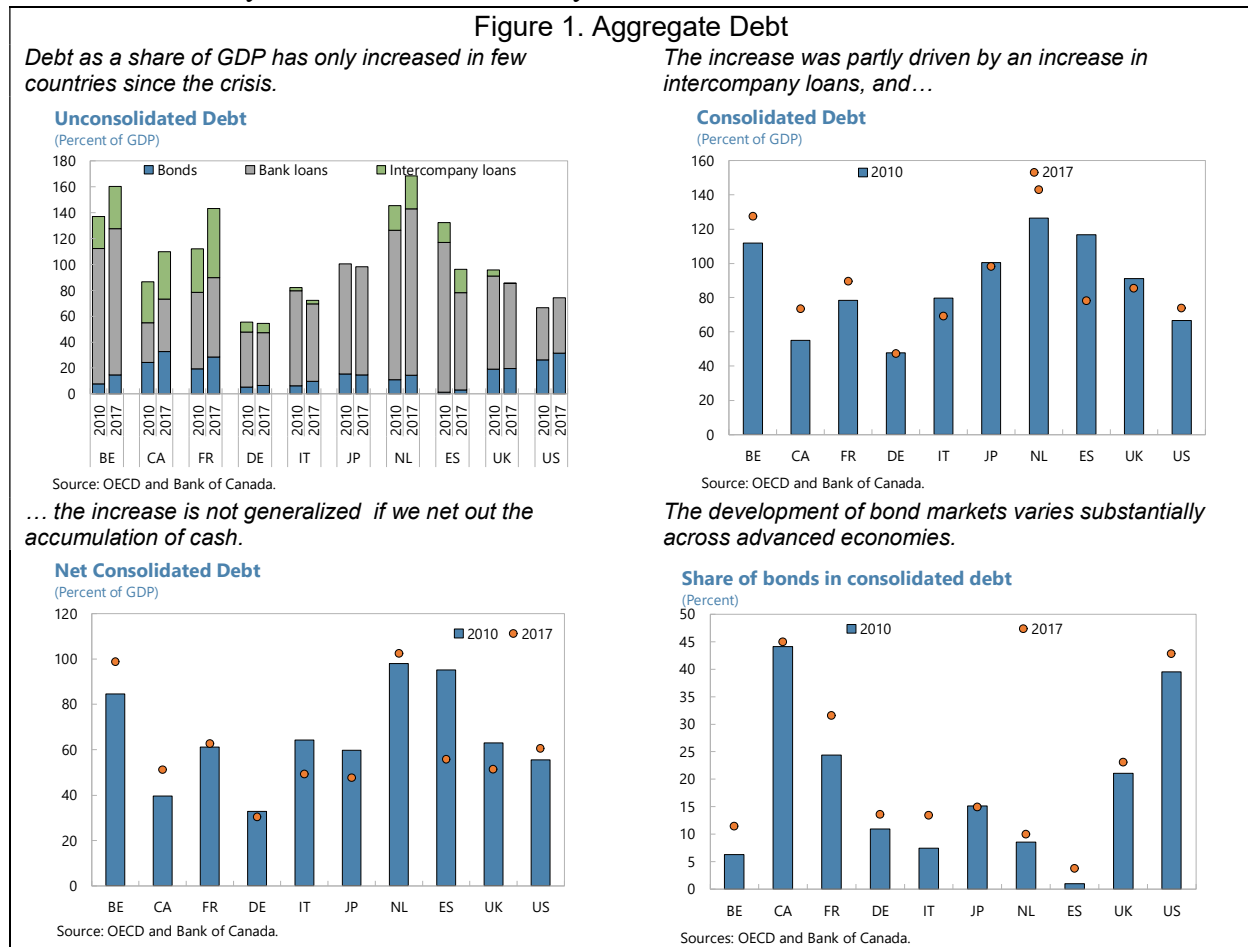
EM firms borrowing in U.S. dollars seem to add to cash holdings, and resemble carry trade rather than precautionary borrowing. Bruno and Shin (2018) show that dollar bond issuance by EM firms for the purpose of accumulating cash under carry trade-like transactions leaves the firms vulnerable to local currency depreciation. Falato and others (2013) and Adler and others (2019) present evidence consistent with the hypothesis that cash is accumulated to finance innovation and intangible assets. Banerjee and Hofmann (2018) focus on so-called “zombie firms” in advanced economies, for example, firms that cannot cover debt servicing costs over an extended period of time, and suggest that their increased incidence is linked to reduced financial pressure and, to some extent, low interest rates. Hackbarth and others (2006) characterize the countercyclicality of corporate leverage ratios and find that under boom conditions, firms should adjust their capital structure more often and more gradually than in recessions to avoid a rise in vulnerabilities. Moreno and Serena-Garralda (2018) find that, in a sample of advanced economies and EMs, reductions in global risk premium result in a larger increase of leverage from younger and smaller firms through international bond borrowing. This in turn links global risk appetite and the buildup of firm-level vulnerabilities. Budina and others (2015) show that, after the euro area crisis, Italian and Spanish corporate debt remained vulnerable to adverse shocks to profits and interest rates, due to low profitability and high leverage, with adverse effects on fixed investment (see also Bluedorn and Ebeke 2016). Chivakul and Lam (2016) stress the concentration of corporate debt among Chinese firms and find debt at risk to be macroeconomically relevant in the event of a shock to profits.

More generally, regarding the evolution of leverage over time, Graham and others (2015) study US firms’ capital structure over a long period and uncover significant increases in leverage over time. This seems to be explained mostly by macrofinancial considerations (such as fiscal policy, macroeconomic uncertainty, and the development of the financial sector, including the reduction in spreads) rather than firms’ characteristics. DeAngelo and Roll (2015) show that firms’ capital structure varies significantly over time and that cross-sections of leverage can be markedly different at various times, even a few years apart. Their analysis suggests that there can be substantial changes in firms’ capital structures over a given period, and that these changes are not well understood.

### III. STYLIZED FACTS

Corporate leverage has increased in percent of GDP in several advanced economies since 2010, exceeding 100 percent of GDP in some countries. Firms from Belgium, Canada, France, the Netherlands, and the US have increased their indebtedness. In the US, the increase in corporate debt as a share of GDP was mainly driven by an increase in bond issuance, while in Canada and the Netherlands, bank loans played a larger role than bond issuance, which was also strong. In France, the increase in debt was driven by bonds and intercompany loans. An increase in intercompany loans also played a large role in Belgium, although increases in bond and bank loans were also scant. In half of the largest advanced economies, corporate debt as a share of GDP has declined or stabilized since 2010, most notably in countries that have experienced a pre-crisis credit boom, such as Spain. Consolidated corporate debt levels (excluding

intercompany loans) exceed 100 percent of GDP in Belgium, Japan, the Netherlands, and Spain, while it is relatively low in Canada, Germany, and the United States.<sup>8</sup>



Intercompany loans may reflect intragroup loans due to centralized treasury operations and tax strategies. Once they are netted out, the increase in corporate debt is far less accentuated in Belgium and France.<sup>9</sup> After subtracting cash holdings from consolidated debt, debt is significantly lower in Belgium, France, Japan, the Netherlands, and the United Kingdom. Net consolidated debt has remained almost constant in France and the United States between 2010 and 2017, although unconsolidated and consolidated have increased. By contrast, net debt has also increased in Belgium, Canada, and the Netherlands.

Corporate bond issuance has played an important role in providing debt financing in advanced economies since the GFC amid scarce bank credit supply and central banks' quantitative easing. Central banks' purchase of government bonds and asset-backed securities (and ultimately corporate bonds in the case of the ECB) led investors to buy assets with similar characteristics

<sup>8</sup> Please note that data on intercompany loans are not available for Canada, Japan, and the US on the OECD website. Data on intercompany loans for Canada come from the Bank of Canada.

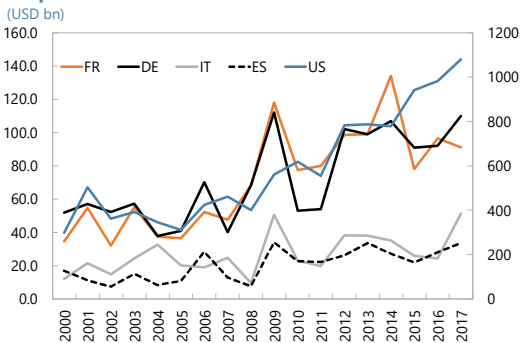
<sup>9</sup> Note that this consolidated debt only nets out resident intercompany loans, and because Belgium and the Netherlands are home to multinationals, their consolidated debt may still include a large amount of cross-border intercompany loans.

but higher yields, such as corporate bonds. The increased demand for corporate bonds in turn reduced their yields. The share of corporate bonds in total corporate debt has increased in every advanced economy analyzed for the period 2010–17. However, the development level of corporate bond markets varies substantially across countries, ranging from 3 percent of total debt in Spain to over 40 percent in Canada and the United States. In general, Anglo-Saxon countries enjoy a greater capital market development than European countries and Japan. One exception is France, where bonds represent roughly one third of corporate debt. Access to capital markets during the GFC may have alleviated the consequences of the bank credit crunch and may explain different corporate leverage developments across advanced economies.

Figure 2. Bond Issuance

Corporate bond issuance has surged in developed economies since 2009, while...

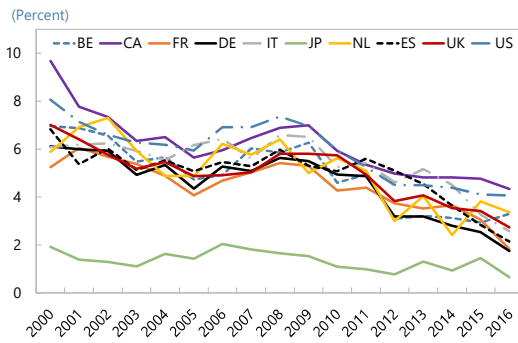
**Corporate Bond Gross Issuance Volume**



Source: Dealogic

... yields have declined, ...

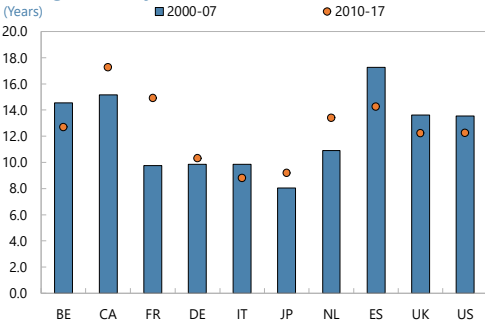
**Yield at Issuance**



Source: Dealogic

... and maturities in some countries have increased as well as...

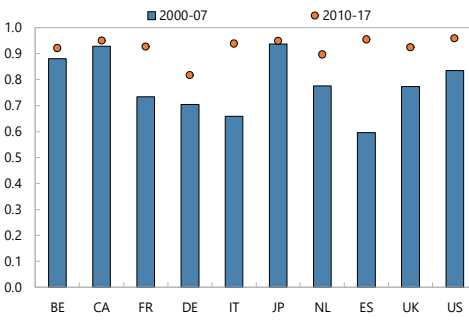
**Average Maturity**



Source: Dealogic

... the share of fixed rate bonds.

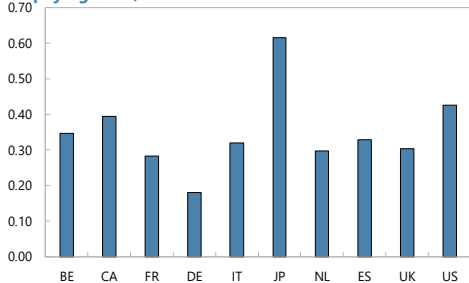
**Share of Fixed Rate Bonds**



Source: Dealogic

Bonds have been used to repay debt as well as to...

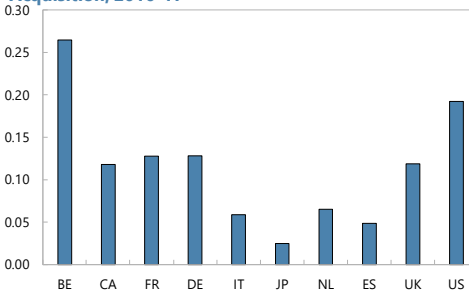
**Share of Bonds Issued with the Purpose of Repaying Debt, 2010-17**



Source: Dealogic

... finance acquisitions.

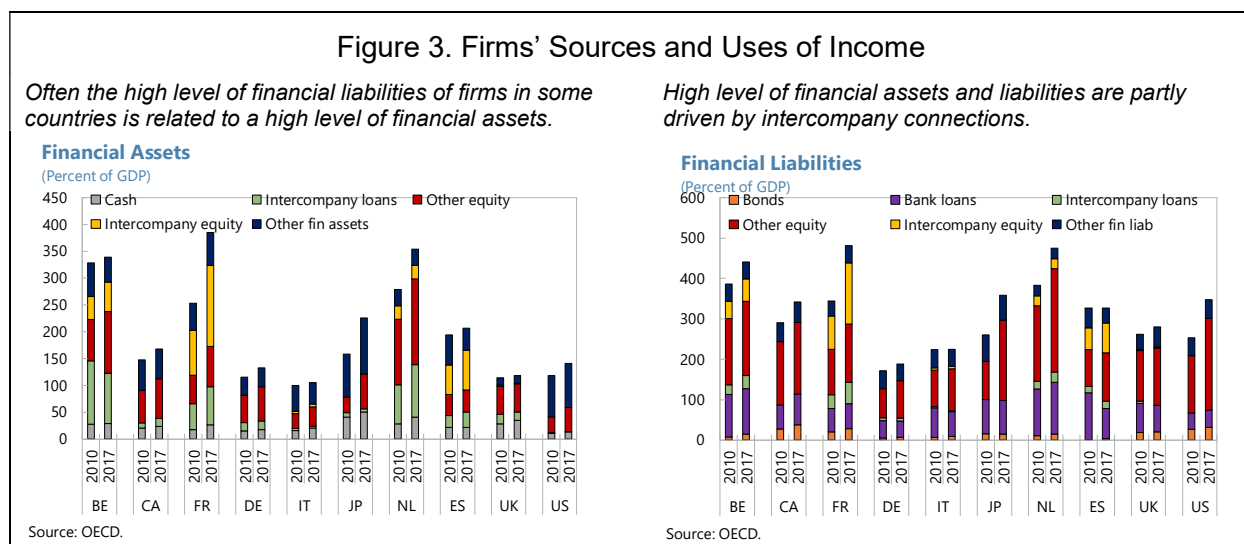
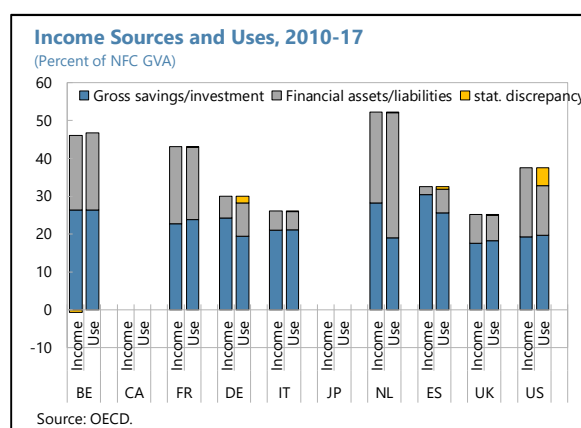
**Share of Bonds Issued with the Purpose of Acquisition, 2010-17**



Source: Dealogic

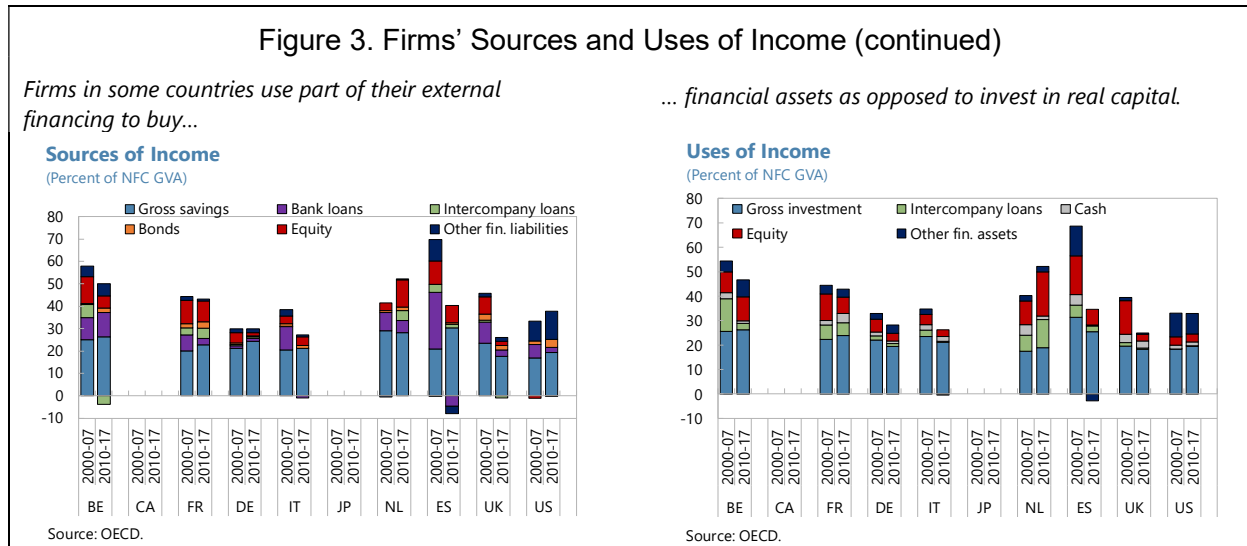
Bond issuance surged already in 2009 due to the GFC and continued to grow amid improved financing conditions. Average yields-at-issuance for developed countries' corporate bonds has declined from 5 percent before the crisis to 3 percent. Average bond maturity also increased in Canada, France, and the Netherlands. The share of corporate bonds with a fixed rate increased from 80 percent before the crisis to over 90 percent. In most countries, firms have used the proceedings of the bond issuance either to repay debt or to finance their acquisitions. One third of the bond issuance after the crisis was used to repay debt, while about 10 percent was used to finance acquisitions. In particular, Japanese firms used 60 percent of their bond issuance to refinance debt, while Belgian firms used over one fourth of their issuance to finance acquisitions.<sup>10</sup> In addition to Belgium, bond issuance to finance acquisitions was particularly high in Canada, France, Germany, the United Kingdom, and the United States.

It is interesting to analyze what firms are doing with their borrowed funds—whether they borrow to invest in real capital or in financial assets. In some countries (France, Italy, the United Kingdom, and the United States), firms' gross savings are not enough to finance real capital investment. However, there is a high correlation between the incurrence of financial liabilities and the purchase of financial assets, as firms borrow externally to invest in financial assets. For instance, while Belgian, Dutch, French, and U.S. firms acquire financial assets corresponding to over 10 percent of their gross value added (GVA) (for Dutch firms, it is over 33 percent), German, Italian, Spanish, and United Kingdom firms invest only about 6 percent of their GVA in financial assets.<sup>11</sup>



<sup>10</sup> The figure for Belgium is driven by the bond issuance of a single firm.

<sup>11</sup> Please note that data for Canada and Japan are not available on the OECD website.



The purchase of financial assets declined from about 21 percent of GVA prior to the GFC to 14 percent in the period 2010–17. Spanish firms reduced their purchase of financial assets from 37 percent of their GVA before the GFC to 6 percent after the GFC. After the GFC, firms invested in equity (7 percent of GVA), intercompany loans (3 percent of GVA), other financial assets such as trade credit (2 percent of GVA), and cash (1 percent of GVA). Dutch firms invested relatively more in equity and intercompany loans (18 and 12 percent of GVA, respectively), while French firms invested relatively more in cash (4 percent of GVA). Therefore, countries with high corporate debt liabilities tend to have high corporate assets. In the case of Belgium, France, and the Netherlands, high corporate liabilities and assets reflect corporate structures with intercompany connections, which give rise to a large amount of intercompany loans and assets. In particular, Belgium and the Netherlands are home to multinationals, which influence the statistics upwards.

We turn next to firm-level data to further understand the evolution of corporate debt among publicly listed firms in recent years and its potential concentration among specific firms or sectors. We use Worldscope, which has good coverage of publicly listed firms in advanced economies. Our sample contains firms from Belgium, Canada, Germany, Italy, Japan, the Netherlands, Spain, the United Kingdom, and the United States. After cleaning, our sample contains 2,800 firms for which we have observations on debt-related variables and a few key balance sheet indicators for the period 2010–17. The leverage variables include the debt-to-asset ratio, the debt-to-equity ratio, the long-term debt-to-asset ratio, the short-term debt-to-asset ratio, the long-term debt-to-total debt ratio, and the debt-to-income ratio. The balance sheet indicators considered include return on assets (ROA), the interest coverage ratio, total assets, the ratio of fixed assets to total assets, the ratio of sales to total assets, and the annual growth rate of sales, as in Demircuc-Kunt and others (2020). The cleaning process involves trimming the dataset from outliers by dropping observations that are within the 5<sup>th</sup> and the 95<sup>th</sup> percentile of the distribution of each of these variables.

Although the Worldscope dataset contains only publicly listed firms, it appears to account for a significant share of total debt and output at the country level. For the countries in our sample, it accounts on average for one third of total consolidated debt and of gross output. It accounts for about 40 percent or more of consolidated debt in France, Germany, Japan, and the United States, and over 45 percent of non-financial firms' gross output in France and Germany. Conversely, the sample is somewhat less representative of total consolidated debt in Italy and in the Netherlands.<sup>12</sup>

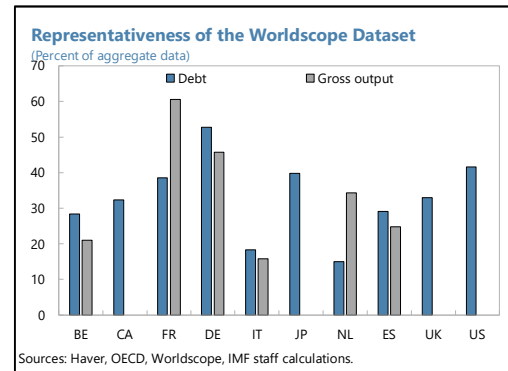


Table 1, at the end of the paper, reports descriptive statistics on the panel dataset. It shows that, in our sample, the average debt-to-asset ratio is 22 percent; the average debt-to-equity ratio, 58 percent; the average long-term debt-to-asset ratio, 66 percent; the average return on assets, 2 percent; and the average interest coverage ratio (ICR), 26 percent; the average dividend payout ratio is 24 percent. Table 1 also shows that there is a notable difference in characteristics among firms that are highly leveraged (defined as a debt-to-asset ratio in the 95<sup>th</sup> percentile of the distribution), firms that have little debt (a debt-to-asset ratio in the 5<sup>th</sup> percentile of the distribution), and the average. Firms that are highly leveraged are larger than the average; they are not profitable; and they have a higher debt service-to-income ratio. In contrast, firms that are in the bottom of the distribution are on average half the size of the long-term average of firms' assets; they hold little debt (0.4 percent of assets in average); and they have little debt service. Their profitability, however, is somewhat lower than the average (1.1 percent compared to 2 percent), while their dividend payout ratio of 18 percent is close to the average.

Table 3 presents descriptive statistics on the cross-section of firms based on 2010–17 averages, with a focus on the 5<sup>th</sup> percentile tails of the distribution of firms based on their change in leverage between 2010 and 2017. The descriptive statistics suggest that there is significant heterogeneity among firms regarding the evolution of leverage. Firms that belong to the top 95<sup>th</sup> percentile of the distribution of the change in leverage significantly increased their debt-to-asset ratio between 2010 and 2017—on average by 33 percentage points—while the average debt-to-asset ratio barely changed among all firms during this period. Firms in the 5<sup>th</sup> percentile of the distribution, in contrast, decreased their leverage on average by 27 percentage points during this period.

Table 3 shows that the large firm-level changes in leverage over 2010–17 are associated with higher levels of long-term debt but not of short-term debt, lower profitability, or lower ability to service debt. Firms in the top of the distribution of the change in leverage have a short-term debt-to-asset ratio that is broadly similar to the average firm or firms in the bottom of this distribution.

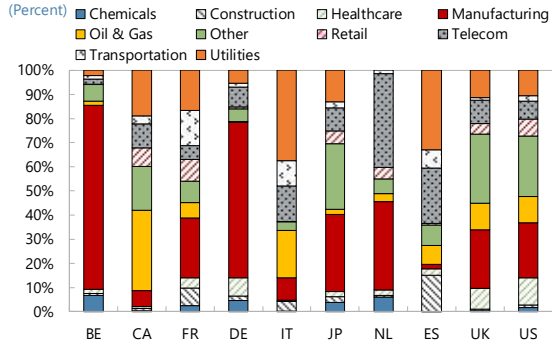
<sup>12</sup> Please note that the comparison between listed companies' global consolidated statements and national accounts statistics is not ideal because listed firms' statements include the debt of foreign subsidiaries. Foreign subsidiaries are typically separate legal entities and their debt is included in the national statistics of their country of residence rather than in the national statistics of the parent company's country.

In contrast, their long-term debt-to-asset ratio (32 percent) is on average higher than that for all firms (18 percent) and for firms in the bottom of the distribution (17 percent). They are on average not profitable (average ROA of -1.1 percent) and have a weak ability to service their debt (ICR of 7 percent on average compared to 27 percent for the entire sample and 26 percent for firms in the bottom of the distribution).

Figure 4. Sectoral Decomposition of Debt

*Debt of listed firms is highly concentrated among a few sectors and...*

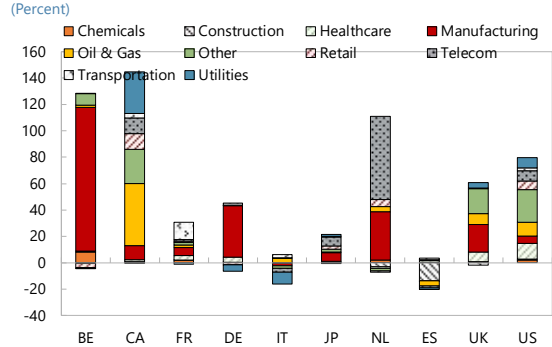
**Sectoral Composition of Corporate Debt, 2017**



Sources: Worldscope, and IMF staff calculations.

*... few sectors can explain the increase in debt since 2010.*

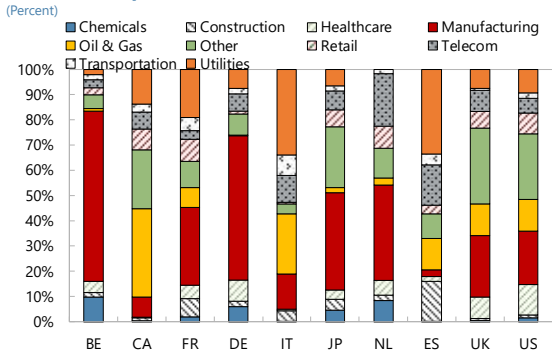
**Growth in Debt, 2010-17**



Sources: Worldscope and IMF staff calculations.

*Debt is more concentrated than assets and...*

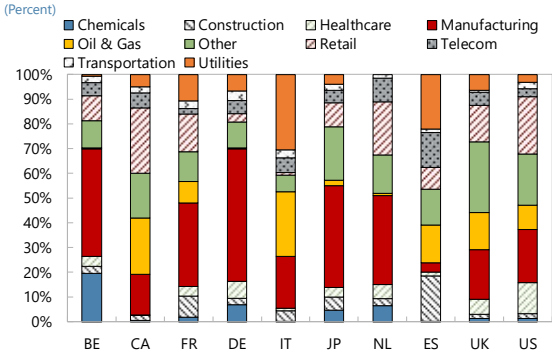
**Sectoral Composition of Total Assets, 2017**



Sources: Worldscope, and IMF staff calculations.

*... output in our sample of listed firms.*

**Sectoral Composition of Total Output, 2017**

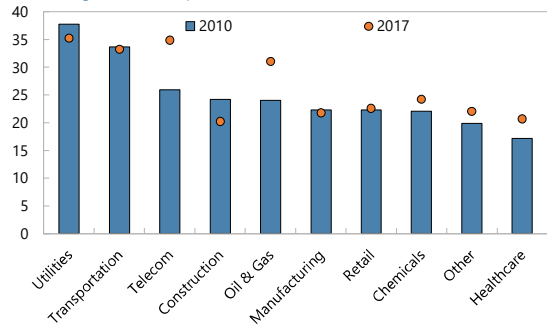


Sources: Worldscope, and IMF staff calculations.

*Network sectors are the most leveraged, while...*

**Debt to Assets**

(Percent, avg across developed countries)

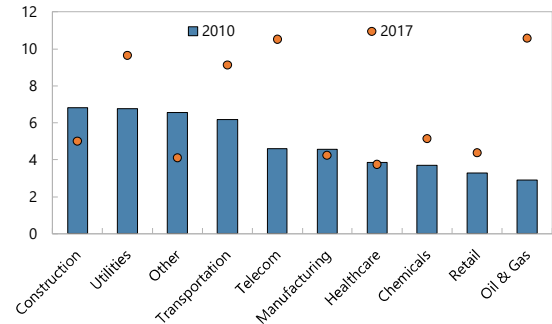


Sources: Worldscope, and IMF staff calculations.

*oil and gas, telecom, and utilities have the highest debt to income ratios.*

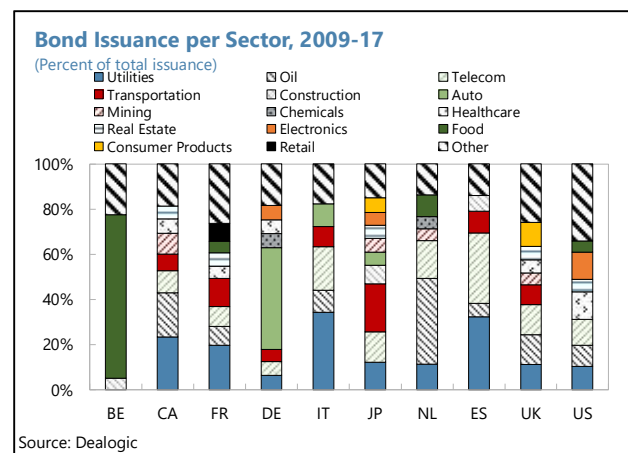
**Debt to Income Ratio**

(Percent, avg across developed countries)

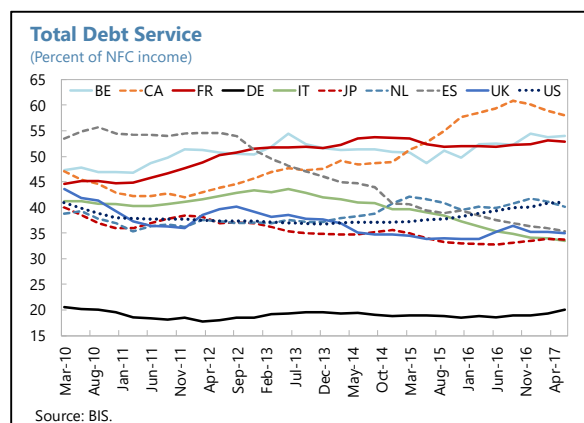


Sources: Worldscope, and IMF staff estimations.

Among listed firms, the consolidated debt stock, as well as the debt increase during the period studied, is concentrated in a few sectors. In Belgium and Germany, the manufacturing sector accounts for over 60 percent of the debt stock of listed firms, while network sectors (utilities, transportation, and telecommunications) account for over 60 percent of the debt stock in Italy and Spain. In Canada, the oil and gas sector and network sectors each accounts for 30 percent of the debt stock. In the Netherlands, the telecommunications sector alone accounts for over 35 percent of the debt of listed firms. The manufacturing sector accounts for about 25 percent of the debt stock of listed firms in France, and the utilities and transportation sector each for about 10 percent. Similarly, the debt increase was caused mainly by the manufacturing sector in Belgium and Germany, by the transportation sector in France, and by the telecommunications sector in the Netherlands. The construction and utilities sectors contributed to the decrease in debt in Spain, while the utilities sector contributed to the debt decrease in Italy. Network sectors are the most leveraged in terms of debt to assets, and leverage has increased the most in the telecommunications sector. Conversely, the oil and gas, telecommunications, and utility sectors have a high debt-to-income ratio, indicating a lower capacity to repay debt. Debt-to-income ratios have increased the most in the oil and gas sector between 2010 and 2017, due to low oil prices. The concentration of debt reflects to some extent the distribution of assets and output across sectors among listed firms. In most advanced economies, bond issuance was also highly concentrated in a few sectors, with bond issuance more diversified across sectors in countries where capital markets are more developed, such as in Canada, France, the United Kingdom, and the United States. With the exception of Belgium and Germany, network sectors are responsible for at least one fourth of the bond issuance in the period 2010–17. In Canada, Italy, the Netherlands, and Spain, network sectors are responsible for over 50 percent of the bond issuance. In Belgium, the food and beverage sector is responsible for over 70 percent of the bond issuance, while the automobile sector is responsible for almost half of the issuance in Germany.



Aggregate data show that financing costs have declined since the crisis, leading to a decrease in interest payments as a percent of income. Total debt service (including principal payments) has also decreased in most countries, notably in Italy, Japan, and Spain. In some few countries, notably Belgium, Canada, and France, total debt service as a share of GDP has increased due to the sheer amount of new debt.





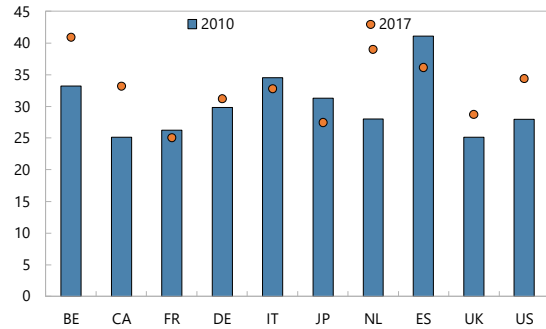
Our firm-level data are able to replicate most findings in the aggregate data. Debt-to-assets ratios of listed non-financial firms have increased above all in Belgium, Canada, and the Netherlands, and declined in Italy, Japan, and Spain. Conversely, total debt as a share of income has increased among listed firms of all advanced economies with the exception of Japan. Debt-to-income ratios are the highest in Belgium and in Canada. Although interest rates have declined, interest payments to income could have increased due to a rise in the amount of debt or due to a deterioration of income. Interest payments as a share of income have stayed stable or declined in France, Germany, and Japan, and they have increased in other countries. The highest interest payments as a share of income are in Belgium, Canada, and Spain. French, German, Italian, and Japanese listed firms have increased their cash-to-debt ratio during 2010–17, while firms in other countries have decreased it.

Figure 5. Debt Sustainability Indicators Among Listed Firms

*As firms have used their debt to buy assets, the increase in debt to assets is less accentuated than...*

**Debt to Assets**

(Percent)

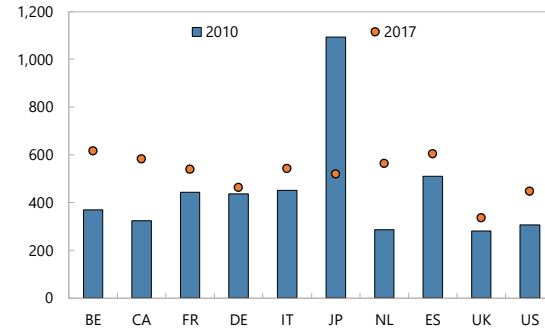


Sources: Worldscope, and IMF staff calculations.

*... the increase in debt to income.*

**Debt to EBIT**

(Percent)

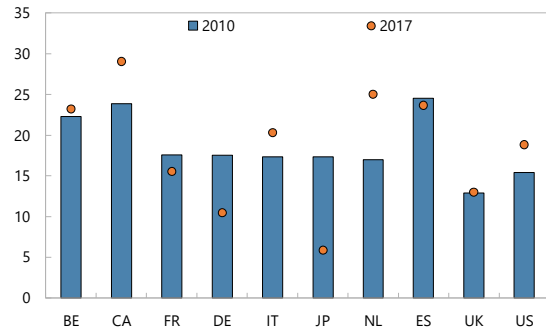


Sources: Worldscope, and IMF staff calculations.

*Due to lower interest rates, the increase in interest payments to income is less pronounced than the increase in debt to income.*

**Interest Payments to EBIT**

(Percent)

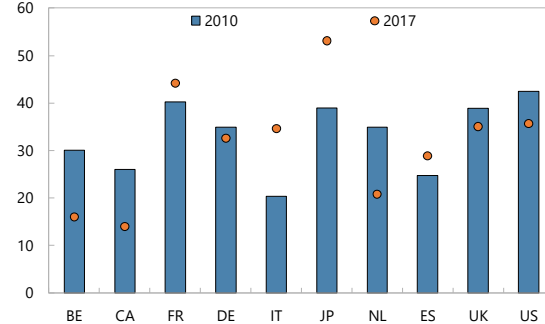


Sources: Worldscope, and IMF staff calculations.

*In some countries the increase in debt was mitigated by an increase in cash holdings.*

**Cash to Debt**

(Percent)



Sources: Worldscope, and IMF staff calculations.

## IV. DETERMINANTS OF FIRMS' LEVERAGE

### Econometric Specifications

First, we examine the short-term determinants of firms' capital structure to explain the differences in firms' leverage across firms and over time. For this purpose, we rely on a simple panel regression analysis explaining a measure of firms' capital structure ( $Y_{isj,t}$ ) of firm  $i$ , which belongs to country  $j$  and sector  $s$  at the end of year  $t$  by: (i) its lagged value; (ii) a set of firm-level control variables; and (iii) year fixed effects ( $D_t$ ), sector fixed effects ( $G_s$ ), and country fixed effects ( $F_j$ ) to account for unobserved characteristics. Indicators of firms' capital structure include the ratios of debt to assets, debt to equity, long-term debt to assets, short-term debt to assets and long-term debt to total debt. Firm-level observed control variables are lagged by one period (vector  $\mathbf{X}_{isj,t-1}$ ) and include profitability (return on assets), size (measured by total assets, relative to the average of all firms in a country), tangibility of assets (the ratio of fixed assets to total assets), availability of cash flows (the ratio of sales to total assets), and growth opportunities (the annual growth rate of sales). These variables are considered standard determinants of firms' indebtedness and maturity structure<sup>13</sup>. We consider the following panel specification for the period 2010–17 with standard errors robust to heteroscedasticity:

$$Y_{isj,t} = \alpha Y_{isj,t-1} + \sum \beta \mathbf{X}_{isj,t-1} + D_t + F_j + G_s + \varepsilon_{isj,t} \quad (1a)$$

In a variation of this model, we examine the role of macrofinancial conditions to explain firms' leverage. To fully capture this role, for example, the fact that macrofinancial conditions change over time and are partly determined by global factors, time fixed effects are dropped from the regression specification. However, we continue to control for time invariant country and industry effects that may affect leverage across countries and industries. The specification becomes, with robust standard errors clustered by country and year:

$$Y_{isj,t} = \alpha Y_{isj,t-1} + \sum \beta \mathbf{X}_{isj,t-1} + \gamma \cdot FCI + \delta \cdot real\_GDP + F_j + G_s + \varepsilon_{isj,t}, \quad (1b)$$

where FCI is a country-specific financial condition index and *real\_GDP* is annual real GDP growth<sup>14</sup>.

Second, once we have characterized leverage and debt maturity in a standard firm-level panel dataset, we aim at uncovering the more medium-term determinants of the *change* in firms' leverage between 2010 and 2017 to determine the extent to which firm-level, industry, and country characteristics matter. For this purpose, a simple cross-sectional regression analysis

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<sup>13</sup> See, for instance, A. Demirguc-Kunt, M. Martinez-Peria, and T. Tressel, 2015. "The Impact of the Global Financial Crisis on Firms' Capital Structure," World Bank Policy Research Working Paper No. 7522.

<sup>14</sup> The index of financial conditions is constructed from various interest rates, spreads, equity market returns and volatility, exchange rates, and real house prices. For more details, see Chapter 3 of the IMF's October 2017 *Global Financial Stability Report*.

relates the change in leverage ( $\Delta Y_{isj}$ ) of firm  $i$  that belongs to sector  $s$  and country  $j$  between 2010 and 2017 to its initial debt-to-asset ratio in 2010 ( $Y_{isj,2010}$ ), a set of firm-level characteristics averaged over 2010–17 ( $\mathbf{X}_{isj}$ ), country fixed effects ( $F_j$ ), and sectoral fixed effects ( $G_s$ ). We consider two cross-sectional regression specifications, with robust standard errors clustered at the country level:

$$\Delta Y_{isj} = \alpha Y_{isj,2010} + \sum \beta \mathbf{X}_{isj} + F_j + G_s + \varepsilon_{isj} \quad (2a)$$

$$\Delta Y_{isj} = \alpha Y_{isj,2010} + \sum \beta \mathbf{X}_{isj} + \gamma \cdot Av\_FCI + \delta \cdot Av\_real\_GDP + G_s + \varepsilon_{isj}, \quad (2b)$$

where  $Av\_FCI$  and  $Av\_real\_GDP$  are the country-level averages over 2010–17 of the FCI index and real GDP growth, respectively.

Last, we consider quantile regressions to uncover potential differences in how country-specific macro-financial conditions impact the change in leverage across firms at different quantiles of their change in leverage. The specification is the following:

$$\Delta Y_{isj}^h = \alpha^h \cdot Y_{isj,2010} + \sum \beta^h \cdot \mathbf{X}_{isj} + \gamma^h \cdot Av\_FCI + \delta^h \cdot Av\_real\_GDP + G_s^h + \varepsilon_{isj}^h \quad (2c)$$

Where the subscript  $h$  accounts for the quantile of the distribution of the dependent variable ( $h=10^{\text{th}}$ ,  $25^{\text{th}}$ ,  $50^{\text{th}}$ ,  $75^{\text{th}}$ , and  $90^{\text{th}}$ ).

## Results

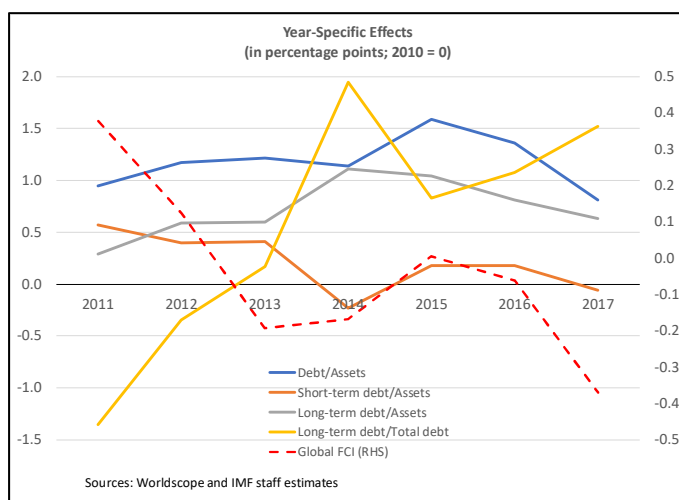
In Table 4, we show that firm-level variables, industry and country time invariant effects, and time effects common to all firms all matter in explaining the dynamics of firms' capital structure since 2010. There is a significant degree of persistence of capital structure from one year to the next. We find that, after controlling for country, industry, and common time effects, firms that are less profitable, larger in size, and have a higher proportion of fixed assets to total assets, lower turnover, and higher growth opportunities tend to be more indebted (column 1). The finding that firm-specific characteristics play an important role in explaining the choice of capital structure is well aligned with the conclusions of the corporate finance literature. There are, however, differences in the impact of these firms' characteristics on leverage depending on the maturity of debt. More profitable firms tend to have higher proportion of long-term debt to total assets and lower proportion of short-term debt to total assets (columns 3 and 4). Higher turnover (respectively higher growth opportunities) is associated with a lower (respectively higher) share of long-term debt to total assets, while the opposite is the case for the ratio of short-term debt to total assets (columns 3 and 4). These results are consistent with the findings that debt maturity is higher among more profitable firms, larger firms, and firms with higher proportion of fixed assets to total assets, lower turnover, and higher growth opportunities (column 6).

The estimates of Table 4 show that there have been strong common time effects that help explain the evolution of firms' capital structure in advanced economies since 2010. Time effects

common to all firms appear to be significant statistically and economically, as they imply that debt-to-asset ratios (respectively debt-to-equity ratios) are on average 0.8 percentage points (respectively 2.5 percentage points) higher in 2017 relative to 2010 (compared to an average debt-to-asset ratio of 22 percent and debt-to-equity ratio of 58.5 in our sample). Our estimations show that in 2017, debt ratios started to decline after the rising leveraging trend of the previous years. These time effects also appear to be driven by the portion of debt with a remaining maturity above one year, while short-term debt was higher in 2011–13 as a proportion of assets and then declined to levels not statistically different from 2010 levels on average.

A possible explanation for this phenomenon is that large firms' better access to financing since GFC could be related to the low interest rate environment and unconventional monetary policies of major central banks, in particular as the euro area crisis subsided after 2013. Indeed, the common time effects impacting the long-term debt-to-asset ratio seem to be inversely correlated to a global financial condition index, while the common effects impacting the short-term debt-to-asset ratio appear to be positively correlated with the same index. This suggests that, as financial conditions were loosening, firms were reducing their reliance on short-term debt while increasing their long-term debt initially, leading to an increase in debt maturity.

There appear to be significant differences of capital structures across countries, after controlling for firms' and industry characteristics (left chart of Figure 6). Firms in Canada, Spain, and the United States are on average more leveraged, particularly U.S. firms, which tend to have a debt-to-asset ratio 1.2 percentage points higher than French firms.<sup>15</sup> Firms in the United Kingdom and Japan tend to have the lowest leverage, 0.5 and 0.8 percentage points lower than French firms, respectively. There are even more notable differences of debt maturity across firms of different countries, after accounting for their individual and industry characteristics. In particular, firms in Belgium, Italy, Japan, and Spain are more reliant on short-term debt, while firms in the United States are more reliant on long-term debt. Cross-industry differences are also important, as retail, telecommunications, transportation, and utilities industries appear more leveraged and less reliant on short-term debt than other sectors (right chart of Figure 6).



<sup>15</sup> The omitted indicator variable is for France.

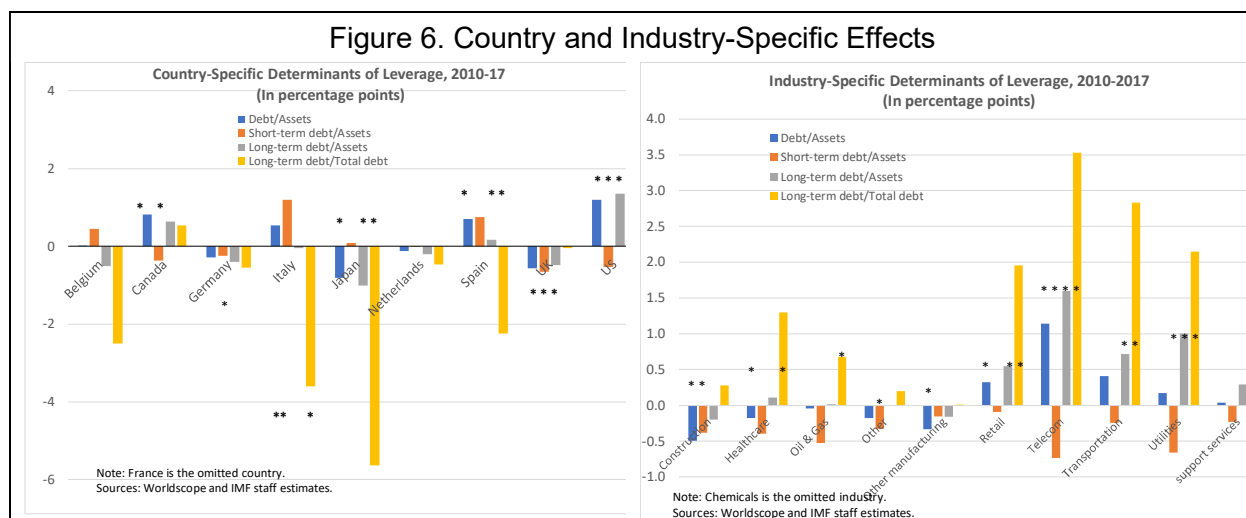


Table 5 confirms that the evolution of firms' leverage and debt maturity since 2010 is related to macrofinancial conditions that prevailed in our sample of advanced economies. In this set of empirical estimates, we include as additional control variables a financial condition index (constructed for the IMF *Global Financial Stability Report*) and real GDP growth for each country. We have dropped year dummies because the inclusion of such fixed effects would absorb the effect on firms' capital structures of changes in global financial conditions common to all countries; keeping year dummies in the regression would entail estimating the effect *within* each year of country-specific financial conditions, after netting out all global financial conditions, on capital structures. Instead, we are interested in assessing the effect of all financial conditions (global and domestic) on firms' capital structures. The caveat of our approach is that we cannot control for unobserved common sources of shocks that may impact capital structures independently than through financial conditions and real GDP growth. The inclusion of country fixed effects indicates that we are estimating the effect of changes in financial conditions within countries on capital structures. We find that during the period 2010–17: (i) there was no evidence that financial conditions and real GDP growth had a statistically significant impact on the debt-to-asset ratio;<sup>16</sup> (ii) tighter financial conditions resulted in a reduction in long-term debt financing (the long-term debt-to-asset ratio) and debt maturity (the long-term debt-to-total debt ratio); and (iii) tighter financial conditions resulted in an increased reliance on short-term debt financing. Findings 2 and 3 suggest that the effect of financial conditions on firms' leverage may not be straightforward and may be insignificant because of opposite effects on short-term debt and long-term debt financing. Further, financial conditions may primarily impact capital structures by modifying the debt maturity mix. The signs are consistent with economic intuition: when financial conditions loosen, firms may increase the maturity of their borrowing to take advantage of a flatter yield curve or may increase their long-term borrowing for precautionary reasons. Conversely, when financial conditions tighten and risk perception increases, long-term financing becomes relatively more expensive than short-term borrowing, which would result in a

<sup>16</sup> A similar result holds for the debt-to-equity ratio.

substitution of short-term debt for long-term debt, and, in the context of rising uncertainty, firms may also cut longer-term investments and related borrowing.

In Table 6, we turn to exploring what could explain the medium-term changes in capital structures during 2010–17. We investigate the firms’ level, country, and industry determinants of the change in firms’ capital structures between 2010 and 2017. First, firm-level characteristics play an important role in explaining cross-sectional differences in the change in leverage during this period. There is a significant mean reversion over seven years: firms with initially higher leverage (respectively debt maturity) experience higher decline in leverage (respectively debt maturity). More profitable firms have on average experienced more positive changes in debt maturity and more negative changes in short-term financing than other firms. Larger firms and firms with more fixed assets experienced an increase in their leverage as well as their debt maturity. Higher turnover on average is associated with more short-term debt and shorter debt maturity, while higher growth opportunities are associated with less debt financing and lower debt maturity. Second, it appears that, after controlling for firm-level determinants of changes in capital structures, there remain quite large and significant differences across countries as well as industries. In particular, United States and Canadian firms increased their leverage ratios by some 5 percentage points more than their French control peers, while Japanese firms reduced their leverage by some 5 percentage points (left chart of Figure 7). Country-specific changes in debt maturity are also large on the positive side for Canadian and U.S. firms, by 5 to 10 percentage points above French peers, respectively, and on the negative side for Italian, Japanese, and Spanish firms, by -5, -12, and -5 percentage points, respectively. Cross-industry differences are also noticeable (right chart of Figure 7).

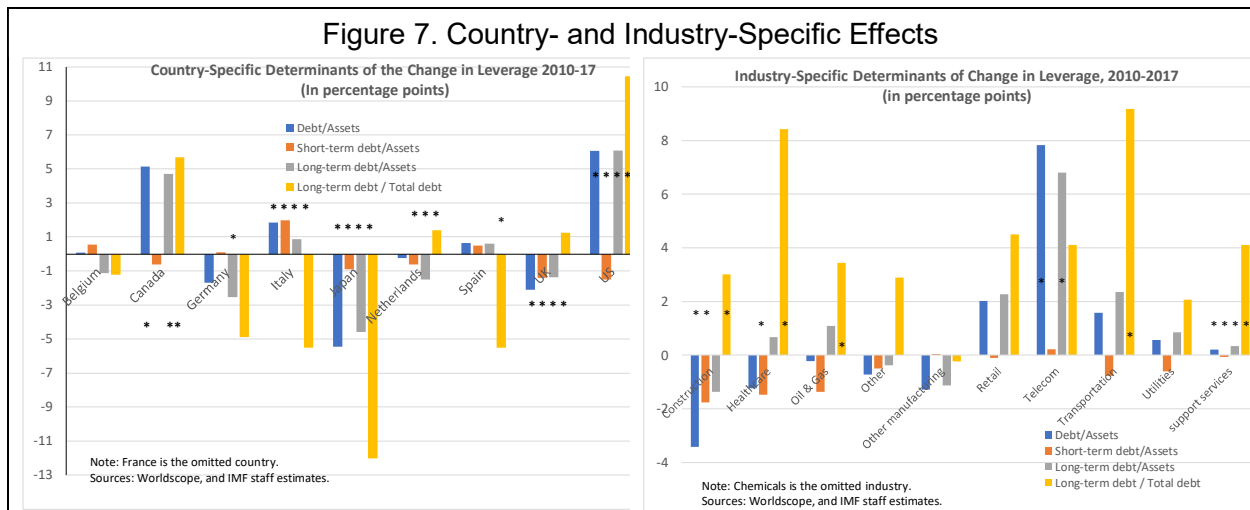
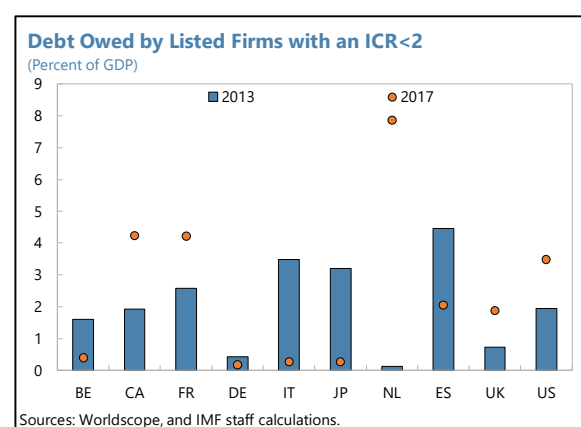
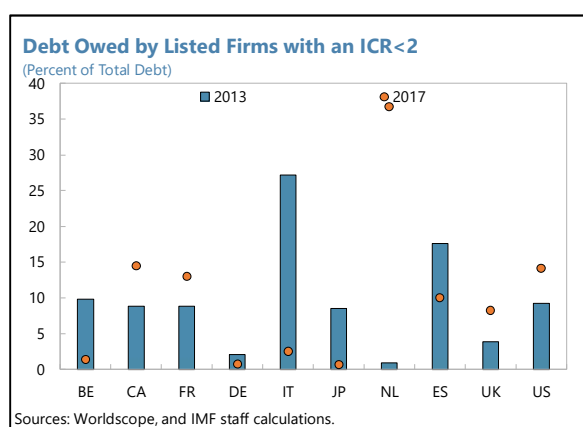


Table 7 panels A and B focus on the role of financial conditions and macroeconomic performance to explain the cross-section of capital structure changes. Panel A reports OLS regressions, while panel B reports quantile regressions. In panel A, it appears that in our sample of firms: (i) better macroeconomic performance is associated with a larger increase in leverage and in debt maturity (driven by an increase in long-term debt financing and a decline in short-

term financing); and (ii) differences in financial conditions across countries have no effect on overall leverage, but firms in countries with tighter financial conditions experienced an increase in short-term debt financing. Quantile regressions presented in panel B help further the analysis and allow us to identify interesting differences in how macrofinancial conditions impact the dynamics of firms' capital structures in our sample for different groups of firms. We find that, among firms that experienced large declines in the debt variable considered (defined at the 10<sup>th</sup> percentile of the distribution of the change in that variable): (i) tighter financial conditions are associated with a larger decline in long-term debt financing and debt maturity; and (ii) stronger macroeconomic performance is associated with a smaller decline in leverage, long-term debt financing and debt maturity, and a larger decline in short-term debt financing. At the other end of the spectrum, we find that, among firms that experienced a large positive increase in the debt variable considered (at the 90<sup>th</sup> percentile of the distribution): (i) stronger macroeconomic performance is associated with a larger increase in leverage and debt maturity, with no impact on short-term debt financing; and (ii) tighter financial conditions are associated with both an increase in short-term debt financing and an increase in long-term debt financing<sup>17</sup>. In the median regressions, tighter financial conditions and better macroeconomic performance appear to affect leverage and debt maturity positively. These findings, especially regarding the two tails of the distribution, suggest that there are notable differences in how financial conditions impact debt maturity choices for firms that deleverage (and decrease their debt maturity) and for firms that leverage (and increase their debt maturity): among firms that deleverage significantly, tighter financial conditions have been associated with reductions in long-term debt financing, while tighter financial conditions have been associated with longer-term maturities among firms that leverage significantly.

## V. CORPORATE DEBT AT RISK: SENSITIVITY ANALYSIS

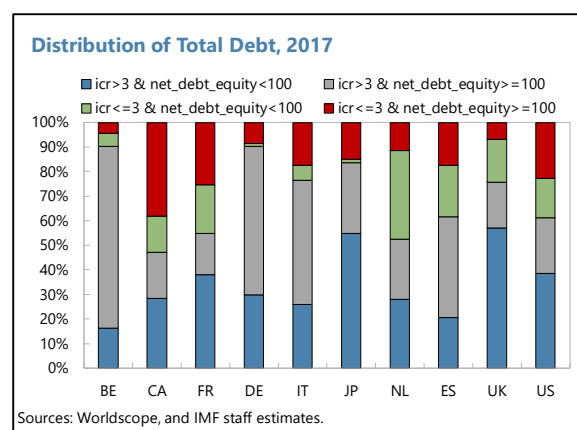
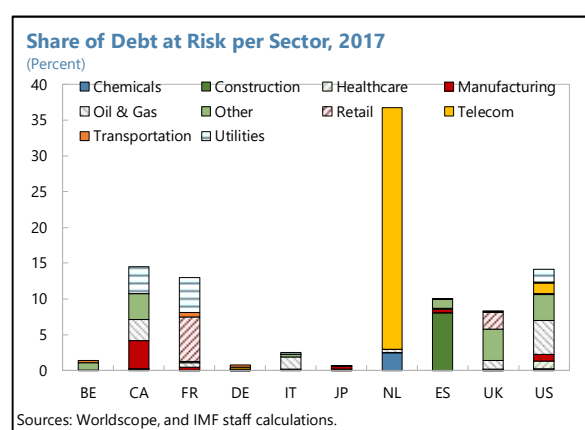
In this section, we analyze the risk of a firm's inability to service its debt amid a tightening of financial conditions reflected, in particular, in a decompression of spreads.



The share of debt at risk varied among our sample's countries in recent years (the vulnerable firms that own the debt are defined as those with an ICR below 2 for at least three consecutive

<sup>17</sup> Non-reported quantile regressions estimated at the 25<sup>th</sup> and 75<sup>th</sup> percentile of the distribution yield similar results.

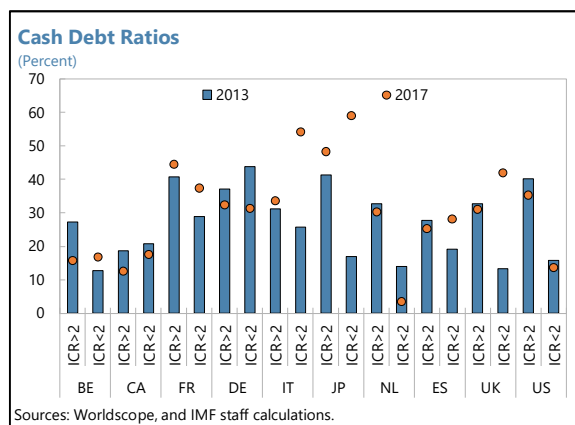
years). The share of debt-at-risk increased between 2013 and 2017 in Canada, France, the Netherlands, the United Kingdom, and the United States; the share of debt-at-risk declined in Belgium, Germany, Italy, Japan, and Spain during that period. In Canada, France, and the Netherlands, the amount of debt owned by vulnerable firms surpasses 4 percent of GDP. Since debt is concentrated among a few large firms, the share of debt-at-risk is often driven by a few large firms. In line with this observation, debt-at-risk is concentrated in the telecommunications sector in the Netherlands, in the utilities and retail sectors in France, in the construction sector in Spain, and in the manufacturing sector in Canada. The IMF 2019 *Global Financial Stability Report* estimates even higher shares in several advanced economies. The difference in estimates is due to different samples (some include public as well as private firms instead of only public firms, extrapolating to the entire economy) and a less strict threshold for debt-at-risk (ICR below 1 instead of 2).



A high net debt-to-equity ratio may be the consequence of the financing structure choice of large firms that have ample access to cheap borrowing, and does not necessarily reflect a risk-to-service debt. However, the combination of a high net debt-to-equity ratio and a low ICR signals that the firm has chosen a capital structure that is vulnerable to interest rate shocks. For instance, the share of debt from listed firms in Germany with a net debt-to-equity ratio above 100 is one of the highest, at 69 percent, but only a small part of these firms has a low ICR. By contrast, a large share of listed firms in Canada, France, Italy, Japan, Spain, and the United States have a net debt-to-equity ratio above 100 combined with a low ICR, which points to vulnerabilities.

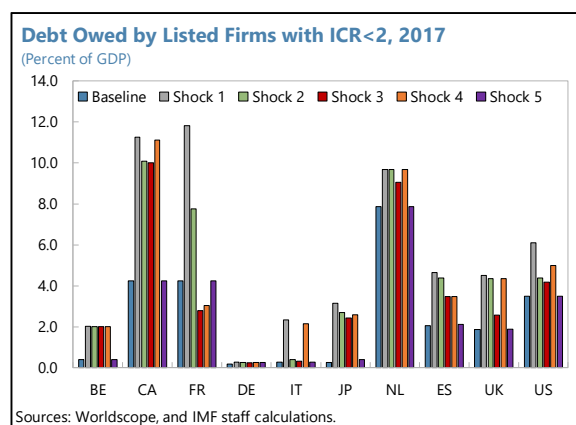
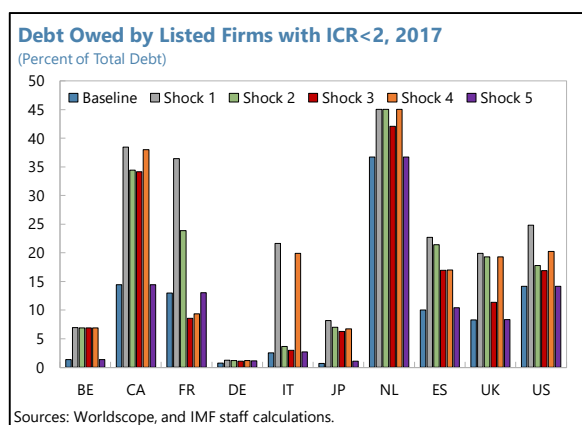


A risk mitigating factor is that firms in some countries have used their debt to increase cash holdings and cash-to-debt ratios have increased. Cash-to-debt ratios increased or remained constant in France, Italy, Japan, and Spain, while they have decreased in the other countries in the sample. However, cash holdings may be unevenly distributed among firms. For instance, although aggregate cash-to-debt ratios have declined in Belgium and in the United Kingdom, they have increased for vulnerable firms in these countries.



Using consolidated balance sheet data of listed firms from Worldscope, we simulate five scenarios of interest rate distress. We shock data from 2014 to 2017 and consider that a firm is vulnerable if its ICR falls below two in all three years.

- **Scenario 1:** A 200 bp increase in interest rate on total debt<sup>18, 19</sup>;
- **Scenario 2:** A 200 bp increase in interest rate on total debt and a 100 bp increase in interest on liquid assets;
- **Scenario 3:** A 200 bp increase in interest rate on total debt and on liquid assets;
- **Scenario 4:** A 200 bp increase in interest rate on total debt and on liquid assets, combined with a 10 percent decline in profits (if these are positive); and
- **Scenario 5:** A 200 bp increase in interest rate on short-term debt only.



Debt-at-risk can increase substantially and become macroeconomically relevant, but cash buffers and other liquid assets could significantly attenuate the extent of the shock. An increase in the interest rate on total debt of 200 bps (scenario 1) doubles or more than doubles the amount of

<sup>18</sup> These shocks represent an upper bound of the effect, as they do not take into account that part of the debt is under fixed rates.

<sup>19</sup> A 200 bp increase in interest rate corresponds to halving the decrease in interest rates since the onset of the GFC.

debt-at-risk in all countries except the Netherlands, which already has a high ratio under the baseline. On average, debt-at-risk increases from 3 percent of GDP under the baseline to 6 percent of GDP in scenario 1. Canada, France, and the Netherlands have debt-at-risk of over 10 percent of GDP in scenario 1. The consideration of liquid assets under scenarios 2 and 3 reduces substantially the share of debt-at-risk in France, Italy, and the United States. Adding a 10 percent decline in profits on top of scenario 3 (scenario 4) increases debt-at-risk mainly in Canada, Italy, the United Kingdom, and the United States. Finally, by considering that not all debt is subject to variable interest rates and shocking only short-term debt (scenario 5) on average more than halves the amount of debt-at-risk relative to scenario 1, in which total debt is shocked. Only for the Netherlands does it not make a difference.

## VI. CONCLUSION

This study shows that the evolution of corporate leverage in advanced economies between 2010 and 2017 can be explained by a combination of firms' characteristics, industry factors, and country characteristics, and has been boosted in part by strong corporate bond issuances. Since the analysis includes firms' balance sheets and financial statements until the end of 2017, it does not cover the ongoing coronavirus pandemic. We find that changes in leverage and debt maturity are related to differences in macroeconomic performance across countries, while loosening financial conditions had a larger impact on debt maturity than on leverage itself. There are important differences among firms in how their capital structures respond to macrofinancial shocks. Sensitivity analysis shows that, given the current low interest rate environment, a large adverse macrofinancial shock could result in significant amounts of corporate debt-at-risk, but existing stocks of cash would be important buffers. While the analysis predates the pandemic and does not assess policy responses to the crisis, it nonetheless suggests that it is important for policymakers to continue to closely monitor non-financial corporates balance sheets and consider policy actions as warranted.

We find that, on average, financial conditions do not appear to have had a clear and robust impact on firms' leverage, after we control for firms' characteristics as well as country and industry factors. This finding is explained by opposite effects that tend to offset each other at different maturities of debt: while tighter financial conditions are associated with increased reliance on short-term debt to finance assets, they are also associated with reduced reliance on long-term debt, and result in an overall reduction of debt maturity.

There is also important heterogeneity and asymmetry in how firms' capital structures adjust to differences in macrofinancial environment that quantile regressions help uncover. Cross-sectionally, firms headquartered in countries with higher growth during the period 2010–17 experienced a larger increase in leverage and debt maturity, while the reliance on short-term debt increased more in countries with tighter financial conditions. Quantile regressions show that better macroeconomic performance has a stronger impact on large increases in long-term debt financing, as well as on large declines in short-term debt financing. At the same time, tighter financial conditions have a stronger impact on large increases in short-term debt financing and large declines in long-term debt financing.

**Table 1. Description Statistics Panel Dataset, 2005–2017**

Variable (in percent) <sup>1/</sup>	Entire Sample			95 <sup>th</sup> Percentile of Debt/Assets			5 <sup>th</sup> Percentile of Debt/Assets		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Debt/ Assets	33,028	22.6	16.3	1,651	62.2	10.5	1,651	0.3	0.2
Debt/ Equity	31,180	58.5	59.2	624	189.7	94.6	1,651	0.4	0.9
Debt/ Income	28,252	461.0	575.1	912	666.8	717.3	1,354	6.0	18.2
Short-term debt / Assets	32,898	7.3	8.8	1,644	13.4	18.1	1,634	0.1	0.2
Long-term debt / Assets	32,898	15.3	14.8	1,644	48.7	21.1	1,634	0.1	0.1
Long-term debt / Debt	32,898	61.4	31.6	1,644	77.7	29.3	1,634	43.9	32.9
ROA	31,576	2.0	8.7	1,559	-2.0	14.4	1,555	1.1	11.2
ICR (ratio)	30,456	26.6	65.7	1,629	0.9	6.3	647	91.9	176.1
Fixed Assets / Assets	32,751	27.9	19.5	1,621	34.6	25.0	1,636	20.8	16.2
Sales / Assets	32,772	103.0	51.7	1,625	91.0	66.5	1,625	100.6	51.8
Dividend payout ratio	32,191	0.24	14.5	1,628	0.04	4.3	1,352	0.18	0.9
Total assets (as ratio of 2005-2017 country average)	33,028	2.1	8.2	1,651	3.0	14.4	1,651	0.5	1.6

<sup>1/</sup> Unless noted otherwise

Sources: Worldscope and IMF staff

**Table 2. Pairwise Correlations**

	Debt/ Assets	Debt/ Equity	Debt/ Income	Short-term debt / Assets	Long-term debt / Assets	Long-term debt / Debt	ROA	ICR	Fixed Assets / Assets	Sales / Assets	Dividend payout ratio	Total assets (ratio of country average)
Debt/Assets	1											
Debt/Equity	0.83	1										
Debt/Income	0.45	0.47	1									
Short-term debt / Assets	0.44	0.42	0.35	1								
Long-term debt / Assets	0.84	0.68	0.29	-0.12	1							
Long-term debt / Debt	0.28	0.19	0.02	-0.53	0.63	1						
ROA	-0.07	0.00	0.15	-0.15	0.01	0.11	1					
ICR	-0.37	-0.29	-0.18	-0.16	-0.30	-0.19	0.24	1				
Fixed Assets / Assets	0.22	0.16	0.17	0.04	0.22	0.14	0.04	-0.08	1			
Sales / Assets	-0.11	-0.05	-0.01	0.10	-0.18	-0.15	0.08	0.07	-0.19	1		
Dividend payout ratio	0.00	-0.01	0.02	0.001	-0.002	-0.003	0.003	-0.001	0.01	0.00	1	
Total assets (ratio of country average)	0.11	0.13	0.06	-0.04	0.14	0.14	0.06	-0.04	0.10	-0.14	0.002	1

Sources: Worldscope and IMF staff

**Table 3. Description Statistics Cross-Country Dataset**

Firm level averages 2010-17 (in percent)	Entire sample			95 <sup>th</sup> percentile of change in Debt/Assets			5 <sup>th</sup> percentile of change in Debt/Assets		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Change in Debt/Assets (2010-17) <sup>1/</sup>	2,824	-0.04	13.3	141	33.5	10.6	141	-26.9	6.2
Av. Debt/Assets	2,684	26.4	16.9	126	40.7	18.7	132	27.9	12.8
Av. Debt/Equity	2,520	64.0	55.6	82	78.5	43.8	120	69.6	42.2
Av. Debt/Income	1,580	510.0	437.1	36	328.8	363.8	79	556.5	334.9
Av. Short-term debt/Assets	2,654	8.1	8.1	126	6.4	7.9	129	11.3	8.4
Av. Long-term term debt/Assets	2,775	18.2	15.6	137	32.9	20.7	135	16.6	13.0
Av. Long-term term debt/Total debt	2,685	74.0	30.1	128	92.2	28.4	134	66.6	30.0
Av. ICR	2,386	27.6	49.8	116	7.1	16.7	128	26.0	35.9
Av. ROA	2,824	3.3	5.7	141	-1.1	11.6	141	3.0	7.2
Av. Total assets (as ratio of 2005-17 country av.)	2,824	2.7	10.0	141	2.1	6.1	141	2.5	18.8
Av. Dividend payout ratio	2,671	0.3	8.2	133	-0.01	0.9	132	0.03	0.7
Av. Fixed Assets/Assets	2,824	32.6	21.5	141	32.5	27.7	141	29.5	17.3
Av. Sales/Assets	2,824	120.4	54.9	141	103.9	61.2	141	133.3	56.7

<sup>1/</sup> This is the firm level change in leverage between 2010 and 2017.

Sources: Worldscope and IMF staff.

Table 4. Panel Regressions

Dependent variable:	Total debt / Assets	Total debt / Equity	Long-term debt / Assets	Short-term debt / Assets	Long-term debt / Total debt
	(1)	(2)	(3)	(4)	(5)
<b>Firm level variables (t-1)</b>					
Dependent variable	0.909***	0.871***	0.864***	0.763***	0.689***
ROA	-0.0189**	0.0452	0.0172**	-0.0499***	0.198***
Total assets	0.00755**	0.102***	0.0137***	0.00321	0.0731***
Fixed assets, % of total assets	0.00748***	0.0495***	0.0106***	0.00841***	0.0482***
Sales, % total assets	-0.00271***	-0.00102	-0.00456***	0.00348***	-0.0142***
Sales growth	0.000139***	0.000173	0.000207***	-8.97e-05***	0.00265***
<b>Year indicator variables <sup>1/</sup></b>					
2011	0.948***	3.699***	0.290*	0.569***	-1.353***
2012	1.175***	4.682***	0.591***	0.398***	-0.344
2013	1.214***	2.819***	0.600***	0.407***	0.169
2014	1.139***	4.936***	1.112***	-0.229*	1.945***
2015	1.588***	4.929***	1.042***	0.180	0.831*
2016	1.357***	5.585***	0.810***	0.178	1.078**
2017	0.812***	2.473***	0.635***	-0.0584	1.522***
<b>Country indicator variables <sup>2/</sup></b>					
Belgium	0.0215	-1.803	-0.509	0.444	-2.502*
Canada	0.823***	-1.681*	0.638**	-0.360*	0.542
Germany	-0.281	-1.853**	-0.403**	-0.246	-0.551
Italy	0.543**	4.407***	-0.0413	1.196***	-3.598***
Japan	-0.809***	-4.750***	-1.006***	0.0863	-5.636***
Netherlands	-0.118	-0.511	-0.198	-0.0153	-0.468
Spain	0.701**	4.195**	0.168	0.752**	-2.235**
UK	-0.556***	-3.661***	-0.478**	-0.652***	-0.0423
USA	1.200***	0.939	1.352***	-0.532***	3.942***
<b>Industry indicator variables <sup>3/</sup></b>					
Construction	-0.492***	-1.416**	-0.199	-0.378***	0.281
Healthcare	-0.179	0.499	0.109	-0.395**	1.300**
Oil and gas	-0.0423	0.328	0.0177	-0.523**	0.678
Other	-0.176	-0.649	-0.00986	-0.330**	0.200
Other manufacturing	-0.333**	-0.714	-0.161	-0.150	0.0132
Retail trade	0.323*	2.221***	0.547***	-0.0908	1.960***
Telecommunication	1.138***	5.086**	1.599***	-0.731***	3.529***
Transportation	0.407	2.677**	0.718***	-0.246	2.831***
Utilities	0.174	4.834***	1.007***	-0.663***	2.145***
Support Services	0.0389	2.009**	0.295	-0.232	1.585**
Constant	1.154***	3.529***	1.590***	1.273***	19.01***
Observations	33,028	31,953	34,625	32,864	33,358
R2	0.845	0.795	0.790	0.628	0.597
<b>F tests of joint significance</b>					
Firm level variables	15117.57***	6441.13***	6406.95***	1062.73***	2955.87***
Year indicator variables	23.08***	20.92***	11.78***	10.48***	11.94***
Country indicator variables	55.56***	33.02***	54.56***	9.66***	84.05***
industry indicator variables	5.24***	7.46***	6.57***	2.72**	6.68***

Robust standard errors in parentheses, observations clustered by country & year. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

1/ Period of observation is 2010-2017, dummy for 2010 omitted

2/ France is the country omitted

3/ Chemicals is the industry omitted

**Table 5. Panel Regressions: Impact of Macrofinancial Conditions**

<b>Dependent variable:</b>	Total debt / Assets	Long-term debt / Assets	Short-term debt /Assets	Long-term debt / Total debt
<b>Firm level variables (t-1)</b>				
Dependent variable	0.909***	0.864***	0.764***	0.690***
ROA	-0.0159	0.0188	-0.0496***	0.198***
Total assets	0.00803**	0.0141***	0.00283	0.0748***
Fixed assets, % of total assets	0.00698**	0.0102**	0.00839***	0.0476***
Sales, % total assets	-0.00279**	-0.00462***	0.00350***	-0.0143***
Sales growth	0.000150***	0.000212***	-8.81e-05***	0.00266***
<b>Macro financial conditions</b>				
<b>FCI</b>	<b>-0.434</b>	<b>-0.581**</b>	<b>0.345*</b>	<b>-2.542***</b>
Real GDP growth	-0.0291	0.00682	-0.0505	0.0567
Constant	2.238***	2.231***	1.511***	19.42***
Observations	33,028	34,625	32,864	33,358
R2	0.844	0.789	0.628	0.596
Country fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES

Robust standard errors in parentheses, observations clustered by country & year. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 6. Cross-Sectional Regressions**

<b>Dependent variable:</b> change between 2010 and 2017	Total debt / Assets	Total debt / Equity	Long-term debt / Assets	Short-term debt / Assets	Long-term debt / Total debt
<b>Firm level variables</b>					
Dependent variable level 2010	-0.386***	-0.477***	-0.395***	-0.533***	-0.654***
ROA	-0.197***	-0.147	0.0339	-0.206***	0.603***
Total assets	0.00751	0.419***	-0.00758	0.0232**	0.0406*
Fixed assets, % of total assets	0.0333**	0.153***	0.0341**	0.0142**	0.0611***
Sales, % total assets	-0.0176***	-0.0288	-0.0206***	0.00842***	-0.0397***
Sales growth	-0.00449***	-0.00980***	-0.00462***	6.68e-05	-0.0211***
<b>Country indicator variables <sup>1/</sup></b>					
Belgium	0.0685	-10.12	-1.130	0.569	-1.211
Canada	5.152***	-3.444	4.708***	-0.615	5.694**
Germany	-1.701	-5.835	-2.542***	0.111	-4.891*
Italy	1.835	13.56	0.884	1.974**	-5.508*
Japan	-5.457***	-26.56***	-4.583***	-0.896**	-12.02***
Netherlands	-0.242	-0.162	-1.522	-0.612	1.376
Spain	0.624	3.595	0.612	0.501	-5.501
UK	-2.103*	-11.69**	-1.363	-1.394**	1.261
USA	6.059***	7.391*	6.093***	-1.508***	10.45***
<b>Industry indicator variables <sup>2/</sup></b>					
Construction	-3.419***	-9.501**	-1.365	-1.759***	3.012
Healthcare	-1.232	-1.307	0.673	-1.471**	8.427***
Oil and gas	-0.213	-7.425	1.095	-1.362*	3.439
Other	-0.708	-2.421	-0.370	-0.492	2.887
Other manufacturing	-1.276	-3.055	-1.133	0.0436	-0.238
Retail trade	2.027*	11.71**	2.277**	-0.0975	4.506*
Telecommunication	7.825***	34.59***	6.797***	0.220	4.102
Transportation	1.584	3.626	2.365	-0.759	9.179***
Utilities	0.570	8.284	0.850	-0.599	2.068
Support services	0.200	0.403	0.346	-0.0696	4.107
Constant	11.66***	35.33***	9.046***	2.921***	45.05***
Observations	2,824	2,669	2,886	2,790	2,813
R2	0.325	0.360	0.226	0.421	0.367
<b>F tests of joint significance</b>					
Firm level variables	109.84***	96.61***	69.92***	93.57***	524.26***
Country indicator variables	49.87***	30.46***	37.73***	3.37***	33.12***
industry indicator variables	5.26***	3.43***	3.47***	3.47***	3.42***
Robust standard errors in parentheses; observations are clustered by country. Explanatory variables are averages 2010-17, except the 2010 level of the dependent variable.					
*** p<0.01, ** p<0.05, * p<0.1					
1/ France is the country omitted.					
2/ Chemicals is the omitted .					

**Table 7. Panel A. Cross-Sectional Regressions: Impact of Macrofinancial Conditions**

<b>Dependent variable:</b> change between 2010 and 2017	Total debt / Assets	Long-term debt / Assets	Short-term debt / Assets	Long-term debt / Total debt
<b>Firm level variables</b>				
Dependent variable (level 2010)	-0.356***	-0.338***	-0.536***	-0.602***
ROA	-0.228*	-0.000960	-0.209**	0.525***
Total assets	0.00891	-0.00997	0.0241***	0.0328
Fixed assets, % of total assets	0.00752	0.00944	0.0141*	0.00602
Sales, % total assets	-0.0252**	-0.0266***	0.00765***	-0.0485***
Sales growth	-0.00405***	-0.00420***	0.000242	-0.0213***
<b>Macro financial conditions</b>				
FCI	0.219	-1.424	1.740**	1.646
Real GDP growth	5.414**	5.022**	-0.944**	10.67**
Constant	1.772	-0.551	4.284***	22.78**
Observations	2,824	2,886	2,790	2,813
R2	0.267	0.170	0.418	0.336
Industry FE	YES	YES	YES	YES

Robust standard errors in parenthesis; observations are clustered by country.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

All explanatory variables are averages across 2010-2017, except the 2010 level of the dependent variable.

**Table 7. Panel B. Cross-Sectional Quantile Regressions**

<b>Dependent variable:</b> change between 2010 and 2017	Total debt / Assets			Long-term debt / Total Debt		
	10 <sup>th</sup>	Median	90 <sup>th</sup>	10 <sup>th</sup>	Median	90 <sup>th</sup>
FCI	-0.915	2.855**	2.752	-15.86***	6.010***	9.096***
Real GDP growth	1.898***	5.143***	7.434***	10.74***	9.413***	8.145***
R2	0.25	0.14	0.17	0.12	0.12	0.47
Industry FE	YES	YES	YES	YES	YES	YES
<b>Dependent variable:</b> change between 2010 and 2017	Short-term debt / Assets			Long-term debt / Assets		
	10 <sup>th</sup>	Median	90 <sup>th</sup>	10 <sup>th</sup>	Median	90 <sup>th</sup>
FCI	0.242	0.833***	5.648***	-2.375**	0.638	2.661*
Real GDP growth	-0.483***	-0.624***	0.0664	1.379***	3.971***	7.091***
R2	0.60	0.24	0.10	0.28	0.06	0.12
Industry FE	YES	YES	YES	YES	YES	YES

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

All firm level control variables are included. Explanatory variables are averages across 2010-2017, except the 2010 level of the dependent variable.

## REFERENCES

- Abidi, N., and I. Miquel-Flores, 2018. "Who benefits from the corporate QE? A regression discontinuity design approach," ECB Working Paper No 2145.
- Acharya, V., T. Eisert, C. Eufinger, and C. Hirsch, 2018. "Real Effects of the Sovereign Debt Crisis in Europe: Evidence from Syndicated Loans," *The Review of Financial Studies*, 31(8), 2855-96.
- Adler, K., J. Ahn, and M. Dao, 2019. "Innovation and Corporate Cash Holdings in the Era of Globalization," IMF Working Paper 19/17.
- Adrian, T., P. Colla, and H.S. Shin. 2013. "Which Financial Frictions? Parsing the Evidence from the Financial Crisis of 2007 to 2009," in *NBER Macroeconomic Annual 2012*, edited by D. Acemoglu, J. Parker, and M. Woodford, 159-214.
- Antoun de Almeida, L., and O. Masetti, 2016. "Corporate Debt Substitutability and the Macroeconomy: Firm-Level Evidence from the Euro Area," *mimeo*.
- Arnold, M., A. Wagner, and R. Westermann, 2013. "Growth options, macroeconomic conditions and the cross-section of credit risk," *Journal of Financial Economics* 107 (2013) 350-85.
- Augustin, P., H. Boustanifar, J. Breckenfelder, and J. Schnitzler, 2016. "Sovereign to corporate risk spillovers," ECB Working Paper No. 1878.
- Banerjee, R., and B. Hofmann, 2018. "The Rise of Zombie Firms: Causes and Consequences," *BIS Quarterly Review*, September.
- Bats, J.V., 2020. "Corporates' dependence on banks: The impact of ECB corporate sector purchases," DNB working paper 667, De Nederlandsche Bank.
- Bats, J.V., and A.C.F.J. Houben, 2020. "Bank-based versus market-based financing: Implications for systemic risk," *Journal of Banking and Finance* 114, 105776.
- Becker, B., and V. Ivashina, 2014. "Cyclicality of Credit Supply: Firm Level Evidence," *Journal of Monetary Economics* 62, 76-93.
- Bernanke, B.S., and A.S. Blinder, 1988. "Credit, Money, and Aggregate Demand," *American Economic Review*, 78(2), 435-39.
- Bernanke, B.S., and M. Gertler, 1995. "Inside the Black Box: The Credit Channel of Monetary Policy Transmission," *Journal of Economic Perspectives*, 9(4), 27-48.
- Betz, F. and R.A. De Santis, 2019. "ECB corporate QE and the loan supply to bank-dependent firms," ECB working paper 2314.



Boyarchenko, N., and P. Mueller, 2019. “Corporate Credit Provision,” Federal Reserve Bank of New York Staff Reports No. 895, August.

Buca, A., and P. Vermeulen, 2015. “Corporate investment and bank-dependent borrowers during the recent financial crisis,” ECB Working Paper No. 1859.

Budina, N., S. Lanau, and P. Topalova, 2015. “The Italian and Spanish Corporate Sectors in the Aftermath of the Crisis,” IMF Country Report No. 15/267.

Bluedorn, J., and C. Ebeke, 2016. “Investment, Firm Size, and the Corporate Debt Burden: A Firm-Level Analysis of the Euro Area,” IMF Country Report No. 16/220.

Bris, A., Y. Koskinen, and M. Nilsson, 2014. “The Euro and Corporate Financing before the Crisis,” *Journal of Financial Economics*, 114 (2014) 554-75.

Bruno, V., and H.S. Shin, 2016. “Global Dollar Credit and Carry Trades: A Firm-Level Analysis,” *The Review of Financial Studies*, v.30 n.3.

Bruno, V., and H.S. Shin, 2018., “Currency Depreciation and Emerging Market Corporate Distress,” BIS Working Papers No.753.

Cerqueiro, G., S. Ongena, and K. Roszbach, 2016. “Collateral damage? On collateral, corporate financing and performance,” ECB Working Paper No. 1918.

Chan-Lau, J.A., W. Miao, K. Miyajima, and J. Shin, 2017. “Assessing Corporate Vulnerabilities in Indonesia: A Bottom-Up Default Analysis,” IMF Working Paper WP/17/97.

Chava, S., and A. Purnanandam, 2011. “The effect of banking crisis on bank-dependent borrowers,” *Journal of Financial Economics* 99, 116-135.

Chivakul, M., and W.R. Lam, 2016. “Assessing China’s Corporate Sector Vulnerabilities,” IMF Working Paper WP/15/72.

Chodorow-Reich, G., 2014. “The employment effects of credit market disruptions: firm-level evidence from the 2008-9 financial crisis,” *The Quarterly Journal of Economics*, 129 (1), 1-59.

Chow, J., 2015. “Stress Testing Corporate Balance Sheets in Emerging Economies,” IMF Working Paper 15/216.

Dao, M., and C. Maggi, 2018. “The Rise in Corporate Saving and Cash Holding in Advanced Economies: Aggregate and Firm-Level Trends,” IMF Working Paper WP/18/262.

DeAngelo, H., and R. Roll, 2015. “How Stable Are Corporate Capital Structures?” *The Journal of Finance*, Vol. LXX, No.1, February.

Demirguc-Kunt, A., M. Martinez-Peria, and T. Tressel, forthcoming in 2020. “The Impact of the Global Financial Crisis on Firms’ Capital Structure,” *Journal of Corporate Finance*.

- Diamond, D., 2004. "Presidential Address, Committing to Commit: Short-term Debt When Enforcement Is Costly," *Journal of Finance*, 59(4), 1447-79.
- Falato, A., D. Kadyrzhanova, and J. Sim, 2013. "Rising Intangible Capital, Shrinking Debt Capacity, and the U.S. Corporate Savings Glut," FEDS Discussion Paper 2013-67.
- Fama, E.F., and K.R. French, 2002. "Testing Trade-off and Pecking Order Predictions about Dividends and Debt," *Review of Financial Studies*, 15, 1-33.
- Gambacorta, L., and D. Marques-Ibanez, 2011. "The bank lending channel: lessons from the crisis," *Economic Policy*, 26(66), 132-82.
- Gambacorta, L., J. Yang, and K. Tsatsaronis, 2014. "Financial structure and growth," *BIS Quarterly Review*, 21-35.
- Graham, J., M. Leary, and M. Roberts, 2015. "A Century of Capital Structure: The Leveraging of Corporate America," *Journal of Financial Economics*, 118, 658-83.
- Hackbarth, D., J. Miao, and E. Morellec, 2006. "Capital Structure, Credit Risk, and Macroeconomic Conditions," *Journal of Financial Economics*, 82, 519-50.
- Haut Conseil de Stabilité Financière, 2018. Décision No. D-HCSF-2018-2 Relative aux Grands Risques des Institutions Systémiques, May 11.
- Herwadkar, S., 2017. "Corporate Leverage in EMEs: Did the Global Financial Crisis Change the Determinants?" BIS Working Papers No. 681, December.
- International Monetary Fund, 2019. "Institutional Investors: Falling Rates, Rising Risks," *Global Financial Stability Report*, Chapter 3, October 2019.
- International Monetary Fund, 2019, "Global Corporate Vulnerabilities: Riskier Business," *Global Financial Stability Report*, Chapter 2, October 2019.
- International Monetary Fund (IMF), 2019b, "Debt Maturity and the Use of Short-Term Debt: Evidence from Sovereigns and Firms, IMF Departmental Paper No.19/03.
- Ivashina, V., and D.S. Scharfstein, 2010. "Bank Lending in the Financial Crisis of 2008," *Journal of Financial Economics*, 97, 319-38.
- Jeanne, O., 2009. "Debt Maturity and the International Financial Architecture," *American Economic Review*, 76(2), 323-29.
- Jensen, M., and W. Meckling, 1976. "Theory of firm: Managerial behavior, agency cost and ownership structure," *Journal of Financial Economics*, 3(4), 305-60.

Jones, M.T., and M. Karasulu, 2006. “The Korean Crisis: What Did We Know and When Did We Know It? What Stress Tests of the Corporate Sector Reveal,” IMF Working Paper WP/06/114.

Kaplan, R., 2019. “Corporate debt as a potential amplifier in a slowdown,” Federal Reserve Bank of Dallas, March 5.

Kalemli-Özcan, S., L. Laeven, and D. Moreno, 2015. “Debt Overhang in Europe: Evidence from Firm-Bank-Sovereign Linkages,” unpublished manuscript.

Leary, M., 2009. “Bank Loan Supply, Lender Choice, and Corporate Capital Structure,” *Journal of Finance*, 64(3), 1143-85.

Manaresi, F., and N. Pierri, 2019. “Credit Supply and Productivity Growth,” IMF Working Paper, WP/19/107.

Moreno, R., and J.M. Serena-Garralda, 2018. “Firms’ Credit Risk and the Onshore Transmission of the Global Financial Cycle,” BIS Working Paper No.712.