Measuring Non-Financial Corporate Sector Vulnerabilities in Canada

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Acknowledgements

Abstract

In this note, we use firm-level data from Statistics Canada's Quarterly Survey of Financial Statements to construct two sets of aggregate vulnerability indicators for the non-financial corporate sector in Canada. First, we measure debt at risk by tracking the share of outstanding debt associated with firms that are not generating enough income or have limited assets to make debt and interest payments. Second, we construct time-series measures of borrower quality by comparing the average credit quality of firms that have the largest increases in debt normalized by lagged total assets with those that have the smallest increases. Our results show that debt-at-risk has been above historical averages in recent years due to developments in some sectors that are related to commodities. We do not find evidence of a broad-based deterioration in borrower quality in recent years.

Bank topics: Business fluctuations and cycles; Credit and credit aggregates; Financial stability; Monetary and financial indicators; Recent economic and financial developments; Sectoral balance sheet
JEL codes: G, G0, G01, G3, G32

Résumé

Dans la présente note, nous utilisons des données sur les entreprises tirées du Relevé trimestriel des états financiers de Statistique Canada pour créer deux ensembles d'indicateurs globaux de vulnérabilité applicables au secteur canadien des sociétés non financières. Premièrement, nous mesurons la dette à risque en surveillant la part de l'encours des titres de créance qui est émise par des entreprises dont les recettes ou les actifs ne leur suffisent pas à rembourser l'emprunt et à payer les intérêts. Deuxièmement, nous créons, à partir de séries chronologiques, des mesures de la qualité des emprunteurs en comparant la qualité moyenne du crédit des entreprises dont la dette, normalisée selon la valeur retardée du total de l'actif, a le plus augmenté à celle des entreprises dont la dette a le moins augmenté. Nos résultats indiquent que la dette à risque a été supérieure aux moyennes historiques ces dernières années, en raison d'évolutions ayant touché certains secteurs liés aux produits de base. Nous ne constatons toutefois aucune détérioration généralisée de la qualité des emprunteurs au cours des dernières années.

Sujets : Cycles et fluctuations économiques; Crédit et agrégats du crédit; Stabilité financière; Indicateurs monétaires et financiers; Évolution économique et financière récente; Bilan sectoriel
Codes JEL : G, G0, G01, G3, G32

Introduction

The ratio of aggregate non-financial corporate debt to gross domestic product (GDP) in Canada has increased noticeably since 2011 and is currently at an all-time high (Chart 1). Considering this development, we look more closely at indebtedness in the Canadian non-financial corporate sector by combining unique firm-level data with tools recently developed in the literature to construct aggregate vulnerability indicators for the non-financial corporate sector.

We use firm-level data from Statistics Canada's Quarterly Survey of Financial Statistics (QSFS). The survey is designed to capture data from both publicly traded and private firms and measures their economic activity in Canada.[1] Because of these unique features, the QSFS is an input to National Balance Sheet Account (NBSA) data, which are used to measure Canada's aggregate non-financial corporate debt-to-GDP ratio.

We build two sets of aggregate vulnerability indicators. First, we follow Feyen et al. (2017) to measure debt at risk, which is defined as the proportion of outstanding debt issued by firms that are not generating enough income or have limited assets available to make debt-related payments. Second, we construct time-series measures of borrower quality by comparing the average credit quality of firms with the largest increases in debt normalized by lagged total assets relative to those with the smallest increases (Greenwood and Hanson 2013 and IMF 2018). This exercise helps us quantify whether lenders are predominantly extending credit to firms with weaker fundamentals. Overall, we find that debt at risk is above historical averages due to developments in some sectors related to commodities. We do not find evidence of a broad-based deterioration in the quality of borrowers in recent years.
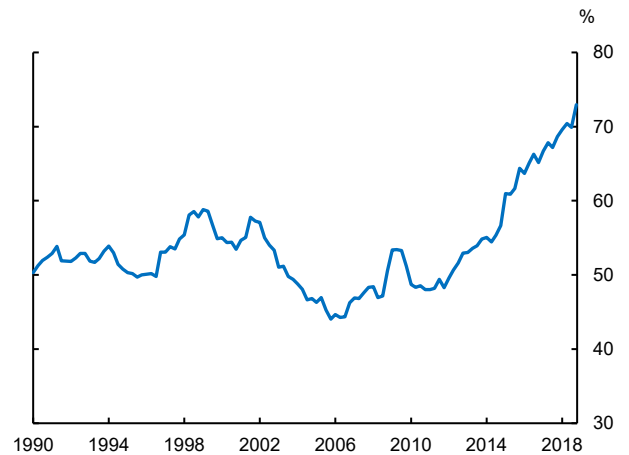
Our results complement the findings from previous work obtained using different datasets (Grieder and Lipsitz 2018). The authors use industry-level data from the QSFS to show that the aggregate non-financial corporate debt-to-income ratio was at elevated levels in 2017 due in part to developments in the oil and gas and mining industries. In addition, using firm-level data from Compustat for publicly traded companies, they show that firms in the oil and gas and mining industries had a noticeable impact on debt at risk during the oil price shock of 2014–15.

In the remainder of this note, we describe the firm-level data from the QSFS and then construct our two sets of aggregate vulnerability indicators for the non-financial corporate sector.

Chart 1: Non-financial corporate debt-to-GDP is at an all-time high

Source: Statistics Canada's National Balance Sheet Account

Last observation: 2018Q4

Overview of the firm-level data from the QSFS

Statistics Canada's QSFS collects detailed income statement and balance sheet items from enterprises operating in Canada. An enterprise is a single corporation or a family of corporations under common ownership that produces financial statements. For simplicity we will refer to enterprises as firms throughout our note. A unique feature of the QSFS is that the data are measured at the highest level of consolidation in Canada, whereas other datasets (e.g., Compustat) consolidate the financial statements at the global level. This feature of the QSFS helps

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[1] In this note, a firm is classified as "publicly traded" if it has issued equity or debt to the public. It is classified as a private firm if it has not.

us more accurately measure economic and financial activity conducted by Canadian firms and is one of the reasons it is used as an input into the NBSA data (**Box 1**).

Another reason the QSFS is used as an input to the NBSA is that its sampling strategy is designed to make it representative of all firms operating in Canada in financial and non-financial industries.[2] In 2017, for example, there were roughly 2 million publicly traded and private firms operating in the Canadian economy. To approximate the quarterly activity of these firms, the following survey procedure is used for a given industry:

1. The largest firms, in terms of assets and revenues, are always surveyed and receive a sample weight of one.

2. Medium-sized firms are randomly surveyed and receive sample weights of more than one. Sample weights of more than one allow them to represent their own economic activity and that of similar firms that are not surveyed.

3. Smaller firms, below the industry threshold for assets and revenues, are not sampled, but their aggregate activity is estimated using administrative data from tax records.

Because we are building aggregate vulnerability indicators from firm-level data, we conduct our analysis using the financial statements of the firms surveyed as well as the sample weights (i.e., steps 1 and 2). We omit the aggregate activity of smaller firms estimated based on tax data (step 3).[3] Thus, the vulnerability indicators we build represent the 25,000 largest publicly traded and private firms operating in Canada.[4] Also, because our focus is vulnerabilities in the non-financial corporate sector, we exclude all firms in the finance and insurance industries (North American Industry Classification System [NAICS] code 52). **Chart 2** shows the proportion of firms sampled in 2018 by industry.[5]

Chart 2: Proportion of firms sampled by the Quarterly Survey of Financial Statements in 2018

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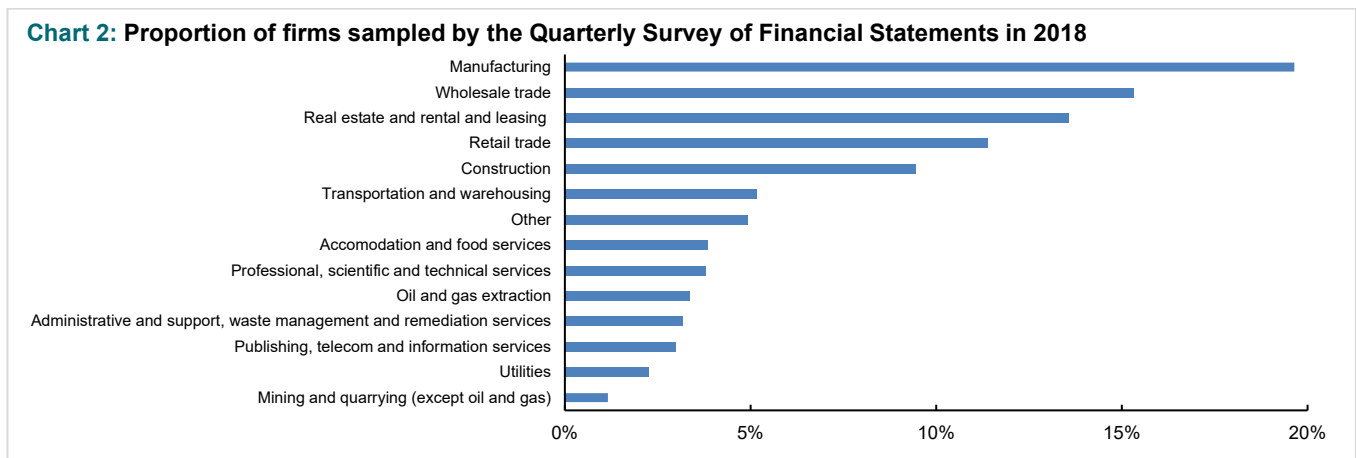
[2] The survey excludes non-profit firms and firms controlled by governments.

[3] The largest 25,000 firms capture more than 70 per cent of the assets, debt and revenue in the aggregate QSFS data.

[4] We cannot provide a breakdown of publicly traded versus private firms because the QSFS does not ask respondents to provide this information. Nevertheless, the QSFS likely contains many private firms because it represents 25,000 firms, whereas Compustat captured just under 2,000 publicly traded Canadian firms in 2017.

[5] Since a firm can have operations in one or several industries, it is ultimately assigned to the industry for which it provides the most value (value of output produced minus the value of inputs used in production). For example, a petroleum firm may be involved in exploration, mining, refining, shipping and retailing of petroleum products but gets assigned to manufacturing because its refining operations provide the most value.

Box 1: Measurement differences between the QSFS and other sources of firm-level data

Two aspects of the survey data differentiate it from typical data sources used to assess vulnerabilities in the non-financial corporate sector in Canada. First, the Quarterly Survey of Financial Statistics (QSFS) captures both publicly traded and private firms, while other data sources (e.g., Compustat) tend to capture firms that have publicly traded equity or debt.[1] Second, the level at which the financial statements are consolidated is different. The data in the QSFS are measured at the highest level of consolidation within Canada, while other data sources are consolidated at the global level. As a result, the financial statements in the QSFS measure economic activity in Canada, while the financial statements from other data sources measure a firms' global operations.

This measurement difference is important when a parent company owns subsidiaries (**Figure 1-A**). For instance, the economic and financial activity of a Canadian subsidiary linked to a parent in a foreign country would be in scope of the QSFS. However, it would be difficult to identify in other data sources because its financial statements are consolidated with the parent and not available at an individual level. These subsidiaries are active in the Canadian economy and should be accounted for when assessing financial stability in Canada.

In contrast, the activities of a foreign subsidiary linked to a Canadian parent are mostly outside the scope of the QSFS, and investment in foreign subsidiaries is reflected by only a couple of variables. First, any loans or borrowing from the parent to the subsidiary or vice versa appear as separate line items on the parent company's balance sheet. In addition, there is a line item that shows the parent company's share of the income earned by the subsidiary. In other data sources, there is no intercompany lending, and the entire income earned by the subsidiary would be included in the parent company's income because the financial statements are consolidated at the global level.

A potential limitation to using the QSFS for measuring vulnerabilities relates to the debt taken on by foreign subsidiaries of Canadian companies. Since any borrowing from banks or financial markets done by foreign subsidiaries is largely outside the scope of the QSFS, some vulnerabilities to the Canadian financial system could be missed. The extent to which financial difficulties of a foreign subsidiary matter for financial stability in Canada likely depends on (i) whether the parent company is legally required or has the incentive to pay off the debts of a bankrupt foreign subsidiary, (ii) the size of the foreign subsidiary relative to the parent, and (iii) the importance of the parent company to aggregate Canadian economic activity.

Figure 1-A: Comparing QSFS and Compustat
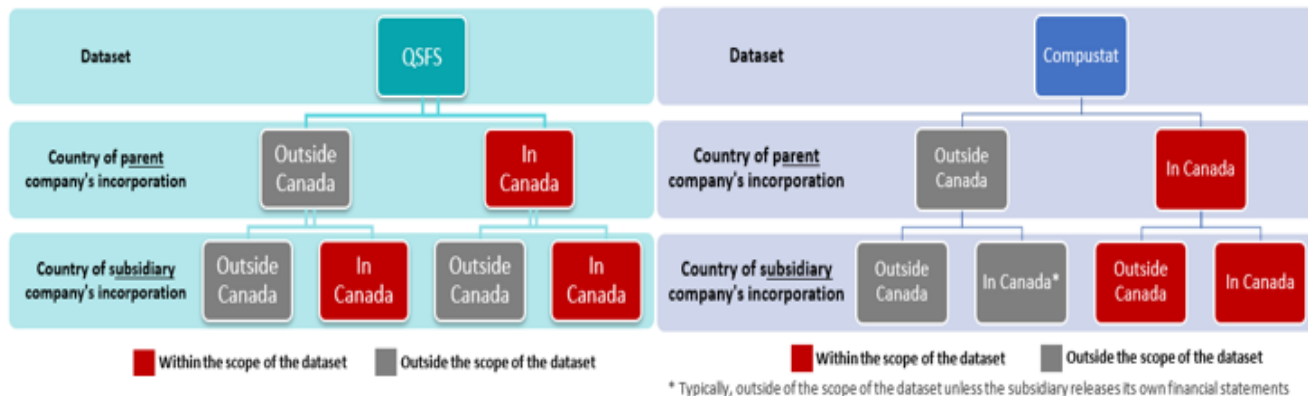
[1] Examples of vulnerability assessments using data for publicly traded firms include Grieder and Lipsitz 2018; Feyen et al. 2017; Greenwood and Hanson 2013; IMF 2018; Davydenko 2013; and Altman 1968.

Financial ratios used to construct aggregate vulnerability indicators

We build aggregate vulnerability indicators from firm-level financial ratios that we construct using the financial statements from the QSFS (**Table 1**). The data start in the first quarter of 2000 and end in the fourth quarter of 2018.

Table 1: Financial ratio definitions

Financial ratios	Formula
Debt-to-income ratio	$$\frac{\text{loans and other borrowings } + \text{ bankers' acceptances and paper } + \text{ bonds and debentures } + \text{ mortgages}}{\text{operating profits } + \text{ depreciation, depletion and amortization}}$$
Interest-coverage ratio	$$\frac{\text{operating profits} + \text{depreciation, depletion and amortization}}{\text{interest expense on borrowing}}$$
Current ratio	$$\frac{\text{current assets}}{\text{current liabilities}}$$
Leverage ratio	$$\frac{\text{loans and other borrowings } + \text{ bankers' acceptances and paper } + \text{ bonds and debentures } + \text{ mortgages}}{\text{total assets}}$$

Our primary concern is whether a firm is generating enough income to make debt-related payments. We measure income as operating profits plus depreciation, depletion and amortization to proxy for the cash earned from on-going operations. The main income-based indicators we use are the debt-to-income ratio and the interest-coverage ratio (income-to-interest expense). All else being equal, firms with a higher debt-to-income ratio or a lower interest-coverage ratio are less likely to be able to make interest and debt-related payments from their income.

Firms can also make debt-related payments by converting assets into cash.[6] Firms struggling to generate enough income will generally sell their most-liquid assets first. If their situation deteriorates further, they may also begin converting other assets to cash. Therefore, our secondary set of indicators is the current ratio (current assets to current liabilities, a measure of liquidity) and the leverage ratio (debt to total assets). All else being equal, the lower the current ratio or the higher the leverage ratio, the more likely it is a firm will have difficulty in converting assets into cash to make debt payments.

Finally, we also use a combination of ratios so that we can track firms that are not generating enough income and have limited assets to make debt-related payments. Combining income-based ratios with asset-based ratios when assessing vulnerabilities is useful for two interrelated reasons. First, a combination of financial ratios helps overcome the notion that firms with volatile income streams also tend to hold large liquidity buffers (Gryglewicz 2011). Second, the literature on corporate finance shows that firms tend to enter into default due to a combination of low income and limited assets relative to outstanding debt (Davydenko 2013 and Altman 1968).[7] Such firms are particularly vulnerable because their assets are likely not sufficiently large to buffer against sudden declines in income.

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[6] Firms may also reduce dividends, issue equity or issue additional debt to service their outstanding debts. We exclude these possibilities from our analysis. Note also there is some overlap in our income and asset ratios because any income earned during the year that is retained by the firm is reflected in value of assets shown on the balance sheet at the end of year.

[7] The market value of assets is often used to predict default because it represents financial market participants' views of the future profitability of a firm. We use the book value of assets in our analysis because we cannot infer the market value of assets for the firms in our sample with no publicly traded equity.

Measures of debt at risk are above historical averages due to developments in some commodity sectors

Debt at risk is defined as the proportion of the outstanding debt issued by vulnerable firms. A firm is judged to be vulnerable if it is not generating enough income or has limited assets to make debt-related payments. Feyen et al. (2017) propose using the 10th and 90th percentiles of the distributions of the firm-level financial ratios to identify vulnerable firms. We adopt a similar approach and use the following three steps to measure debt at risk:

1. Construct distributions for each financial ratio by combining all firm-year observations within a given industry.[8]

2. Establish thresholds beyond which firms are judged to be vulnerable:

   - For our income-based ratios, we first label all firms with negative income and some amounts of debt or interest expense as vulnerable. For firms with positive income, we also use the 90th percentile of the debt-to-income ratio and the 10th percentile of the interest-coverage ratio.[9]

   - We use the 90th percentile for the debt-to-asset ratio distribution and the 10th percentile for the current ratio distribution.

3. Measure the total debt held by these vulnerable firms each year as a proportion of the total debt outstanding in our sample of firms. This share of the total debt outstanding is said to be at risk.
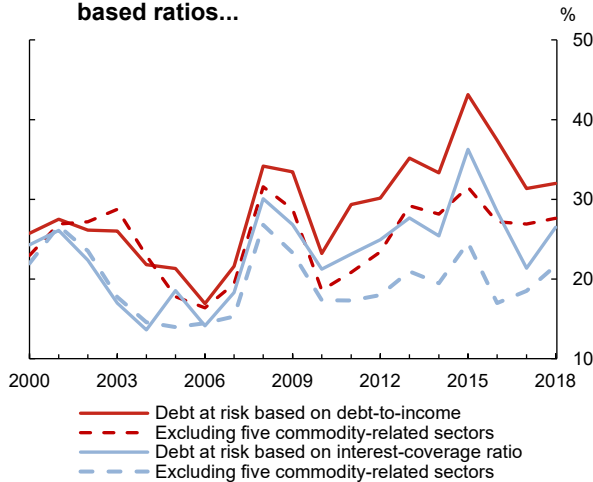
Debt at risk measured using the debt-to-income ratio and the interest-coverage ratio has been on an upward trend since 2006 and is currently above its historical average (Chart 3). In addition, these measures increased sharply due to large declines in income during the global financial crisis and the oil price shock. Unlike during the financial crisis, when the decline in income was broad-based, five sectors were the main contributors to the spike in debt at risk during the oil price shock: oil and gas extraction (NAICS 211); pipeline transportation (NAICS 486); petroleum and coal manufacturing (NAICS 324); chemical, plastics and rubber products manufacturing (NAICS 325 and 326); and wood and paper manufacturing (NAICS 321 and 322).[10] Since all five of these sectors are exposed to commodity prices, we label them as being "commodity-related." Once these five sectors are excluded from our analysis, the increase in debt at risk during the oil price shock is less pronounced, and the current level of debt at risk is below longer-term averages. Using the current ratio, the leverage ratio or a combination of income-based and asset-based ratios to measure debt at risk yields similar results to those obtained using the debt-to-income or interest-coverage ratio alone: debt-at-risk measures are currently above longer-term averages but fall to levels below their longer-term averages once the five commodity sectors are excluded (Chart 4 and Chart 5).

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[8] Firm-year observations include each yearly firm-level observation over the entire sample period. For instance, if a firm appears every year, each yearly observation is included as part of the industry's total number of observations over the full sample period.

[9] We obtained qualitatively similar results when the 25th and 75th percentiles for each financial ratio distribution and, as we show in the appendix, when we focus on firms with an interest-coverage ratio or current ratio of less than one.
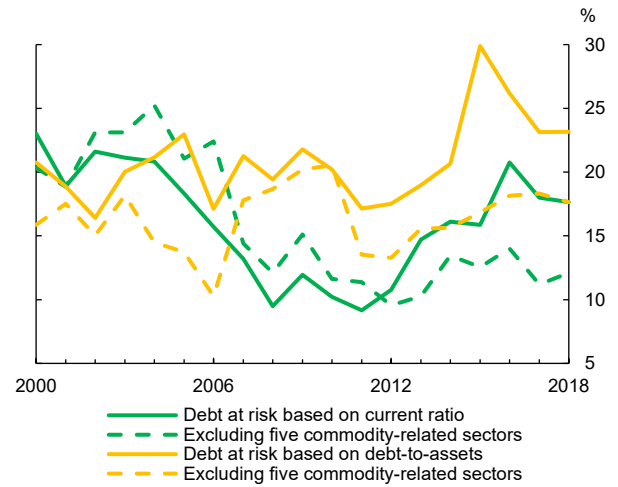
[10] The chemical, plastics and rubber products manufacturing industry contains a diverse set of sub-industries, including petrochemical manufacturing, pesticide, fertilizer and other agricultural chemical manufacturing, and pharmaceutical and medicine manufacturing.

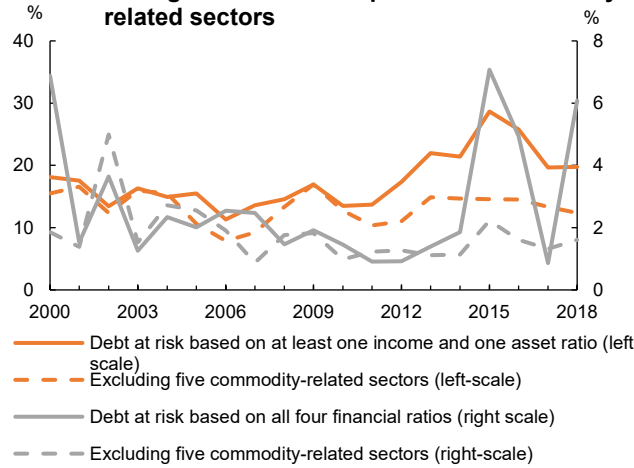**Chart 3: Commodity-related sectors had a large impact on debt at risk constructed from income based ratios...**

%

—— Debt at risk based on debt-to-income
- - - Excluding five commodity-related sectors
—— Debt at risk based on interest-coverage ratio
- - - Excluding five commodity-related sectors

Sources: Statistics Canada's Quarterly Financial Statistics for
Enterprises and Bank of Canada calculations
Last observation: 2018

Chart 4: ...and on debt at risk constructed from asset-based ratios.

%

—— Debt at risk based on current ratio
- - - Excluding five commodity-related sectors
—— Debt at risk based on debt-to-assets
- - - Excluding five commodity-related sectors

Sources: Statistics Canada's Quarterly Financial Statistics for
Enterprises and Bank of Canada calculations
Last observation: 2018

Chart 5: Debt at risk associated with firms with limited income and assets is above longer-term averages due to developments in commodity-related sectors

%   %

—— Debt at risk based on at least one income and one asset ratio (left scale)
- - - Excluding five commodity-related sectors (left-scale)
—— Debt at risk based on all four financial ratios (right scale)
- - - Excluding five commodity-related sectors (right-scale)

Sources: Statistics Canada's Quarterly Financial Statistics
for Enterprises and Bank of Canada calculations
Last observation: 2018

Borrower quality does not appear to have declined extensively in recent years

We construct time-series measures of borrower quality by comparing the average credit quality of firms with the largest increases in debt normalized by lagged total assets relative to those with the smallest increases. (Green-wood and Hanson 2013 and IMF 2018). This exercise helps quantify whether lenders are predominantly extending credit to firms with weaker fundamentals.
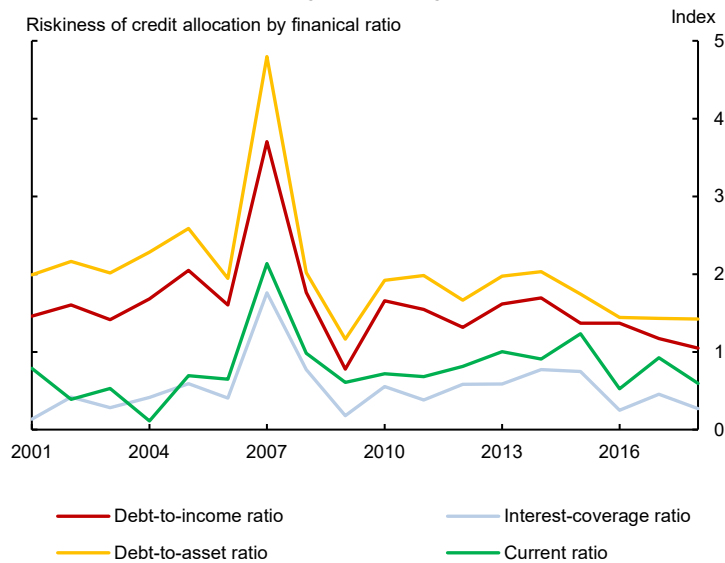
We follow the same steps as those described in Box 2.1 of the IMF's April 2018 *Global Financial Stability Report* (IMF 2018) to construct indicators of borrower quality. For each year:

1. We sort firms into five bins based on the changes in debt normalized by lagged total assets. Those firms with the largest change are labelled as top borrowers, and those with the smallest change are labelled as the bottom borrowers (or firms that are repaying their debts the most rapidly).

2. By industry, we sort firms into deciles based on their financial ratios. The bottom decile represents relatively stronger firms, and the top decile represents the most vulnerable firms.

3. For each financial ratio, we measure borrower quality, which is the difference between the average decile for the top borrowers and the average decile for the bottom borrowers. Increases in these indicators over time suggest that the top borrowers are becoming more vulnerable than those taking on the least amount of debt (or repaying their debt).

Chart 6 shows the results of constructing the borrower quality indicators using our financial ratios. Overall, we do not find evidence of a broad-based deterioration in borrower quality in recent years because our indicators have been stable since 2010 and are below longer-term averages.

Chart 6: Borrower quality does not appear to have declined extensively in recent years

Riskiness of credit allocation by finanical ratio

Index

| Debt-to-income ratio | Interest-coverage ratio |
| Debt-to-asset ratio | Current ratio |

Sources: Statistics Canada's Quarterly Financial Statistics for Enterprises and Bank of Canada calculations

Last observation: 2018

Although we do not find evidence of a widespread decline in the quality of borrowers, there may nevertheless be areas of growing vulnerabilities that we cannot identify in our dataset. For example, we are unable to quantify the extent to which Canadian non-financial corporate firms are exposed to potentially fragile funding sources, such as the US high-yield bond or leveraged loan markets.

Conclusion

In this note, we use firm-level financial statements from the QSFS to measure the amount of debt at risk and to quantify how the quality of borrowers have evolved over time. Our results suggest that debt at risk is above long-term averages due to developments in some sectors related to commodities. We do not find evidence of a broad-based deterioration in the quality borrowers in recent years

There are several caveats associated with our results. First, our results do not include potential vulnerabilities related to the activities of foreign subsidiaries with a Canadian parent company. Second, smaller firms that do not meet the revenue and asset thresholds to be included in the QSFS and government-sponsored firms are excluded from our results. Third, our data exclude details regarding the hedging or speculating activities firms may be doing

with derivative securities.[11] Fourth, our data do not capture granular information related to a firm's debt, such as its maturity, currency of issuance, whether it has fixed or floating rate, its credit rating, or whether there are any associated covenants. Last, our results exclude information from financial markets, such as market-based indicators of default and stock market investors' perceptions of future profitability.

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[11] Approximately one-third of Canadian publicly traded firms use derivatives to reduce the volatility of their income by hedging exposures to risks related to interest rates, exchange rates and commodity prices (Paligorova and Statskow 2014).
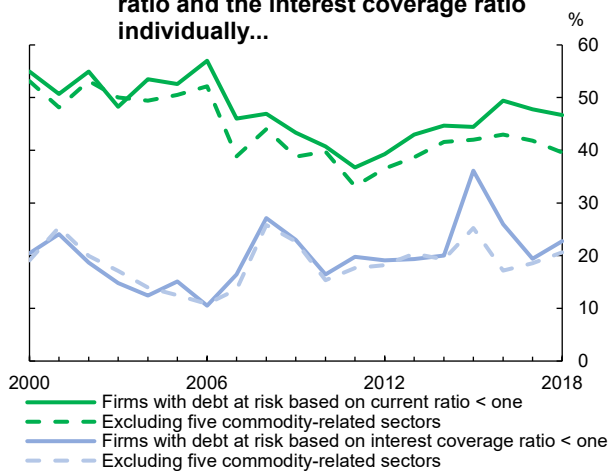
Appendix

Measuring debt at risk using rule-of-thumb thresholds

Another technique used to identify vulnerable firms when measuring debt at risk is to apply rule-of-thumb thresholds to the interest-coverage ratio and the current ratio (Grieder and Lipsitz 2018 and IMF 2014). Firms with an interest-coverage ratio of less than one can be viewed as vulnerable because they are not earning enough income to make their required interest payments. Similarly, firms with a current ratio of less than one could also be considered vulnerable because they do not have enough liquid assets to pay back all liabilities coming due within one year. Firms with both an interest-coverage ratio and a current ratio of less than one may be especially vulnerable because they are not generating enough income and do not have enough liquid assets to make all short-term debt-related payments.
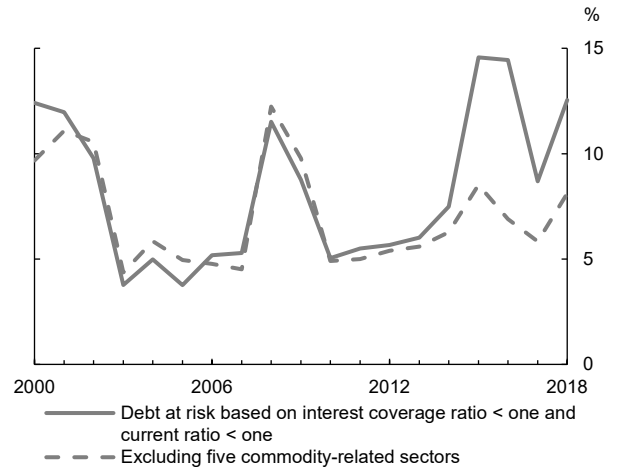
Debt at risk using rule-of-thumb thresholds leads to similar results as those obtained using thresholds estimated from the firm-level data: measures are slightly above longer-term averages due to developments in the commodity sectors, whether examining debt at risk on one or multiple financial ratios (**Chart A-1** and **Chart A-2**).

Chart A-1: Commodity-related sectors had a noticeable impact on debt at risk using the current ratio and the interest coverage ratio individually...

Firms with debt at risk based on current ratio < one
Excluding five commodity-related sectors
Firms with debt at risk based on interest coverage ratio < one
Excluding five commodity-related sectors

Sources: Statistics Canada's Quarterly Financial Statistics for Enterprises and Bank of Canada calculations

Last observation: 2018

Chart A-2: ... and when the two ratios are combined

Debt at risk based on interest coverage ratio < one and current ratio < one
Excluding five commodity-related sectors

Sources: Statistics Canada's Quarterly Financial Statistics for Enterprises and Bank of Canada calculations

Last observation: 2018