

The Use of Microdata to Assess Risks in the Non-Financial Corporate Sector

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The objective of this report is to assess the use of individual-firm data (henceforth microdata) for the surveillance of risks in the non-financial corporate sector. The financial health of Canadian public non-financial companies (PNFCs) is important for financial system stability. Corporate loans, bonds, and equities make up a large part of the asset holdings of banks, insurance companies, and households (through pension plans and mutual funds). Hence, a rash of corporate failures could have widespread effects on the economy by eroding the capital of financial institutions and the wealth of households.

The analysis of financial accounts data is one way to assess corporate financial health. There is a large body of literature linking corporate financial health to three broad categories of financial ratios: profitability, liquidity, and leverage (Altman 1983; Scott 1981; Ohlson 1980; Bunn and Redwood 2003; and Vlieghe 2001). The following ratios from the above categories of financial ratios are selected to assess financial health: *leverage*, which is the ratio of total assets to total equity; *current ratio*, a measure of liquidity, is the ratio of current assets to current liabilities; and *net profit margin*, a measure of profitability, is the ratio of net income to total revenue.¹

This analysis of the financial health of PNFCs can be conducted with either aggregated data or microdata.² To date, aggregated data have been used most often because these data are easier to obtain. There are, however, a number of reasons to use microdata. Aggregated measures mask information about the underlying distributions,

whereas microdata can provide information about the “vulnerable tails” that are thought to be relevant for the analysis of financial stability (Benito and Vlieghe 2000). This masking is illustrated using the three ratios studied here.

Chart 1 shows part of the histogram for the inverse of the leverage ratio, the current ratio, and the net profit margin for the corporate sample used in this report.³ Vertical lines showing the ratio values calculated from the aggregated data for the same dataset are also included for comparison.⁴

The histograms reveal that the distributions for all three ratios are highly skewed (asymmetrical) and exhibit a large degree of kurtosis (fat tails). Note that the single value calculated for each ratio from the aggregated data masks the distributional information provided by the microdata.

Another reason to use microdata is the flexibility in the way that results can be combined to investigate a point of economic significance. In this case, microdata allow the calculation of the leverage ratio at the level of the individual company. Then, if company size is thought to be relevant for financial stability, the individual leverage values can be combined using asset weights. On the other hand, if debt or employment is of interest, then this analysis could be done using weights that emphasize the amount of debt or number of employees associated with each company in the sample. Hence, microdata allow the construction of various financial

1. These ratios are commonly used in accounting-based models of corporate financial health.
2. The December 2004 *Financial System Review* (pp. 5–7) highlighted an analysis of corporate financial structure using aggregated data.

3. The inverse of the leverage ratio is used here to provide a continuous ordering of companies, given that some of them have negative equity.
4. The ratios for the aggregated data are calculated by summing the numerator and denominator for all companies in the sample prior to calculation of the ratio.

health measures, depending upon the issue under consideration.

This report focuses on using financial accounting microdata at the company level to assess corporate financial health. In particular, we construct a microdata indicator using the “vulnerable tails” of the distributions for certain financial ratios. A preliminary comparison of this microdata indicator with other commonly used measures of financial vulnerability (bond spreads, ratings action, and leverage calculated from aggregated national accounts) shows that it is a good tool for assessing risks to financial stability in the non-financial corporate sector.

Using Microdata

The corporate data are from the *Financial Post's* database on public companies. It contains about 1,200 Canadian public companies from which a sample ranging from 106 to 1,191 companies was compiled annually for the period from 1994 to 2004.⁵ Companies indexed as financial companies were deleted from the sample. The assets covered in our sample represent, on average, 54 per cent of the total assets of non-financial corporations as reported in Statistics Canada's National Balance Sheet releases (ranging from 6 per cent to 68 per cent over the sample period).

The microdata indicator

Generally, increasing leverage, decreasing liquidity, and decreasing profitability are thought to increase corporate vulnerability. However, the interaction among these measures is also important.⁶ Hence, an indicator based on the microdata is constructed using the “vulnerable tails” of the distributions for each of the three financial ratios.

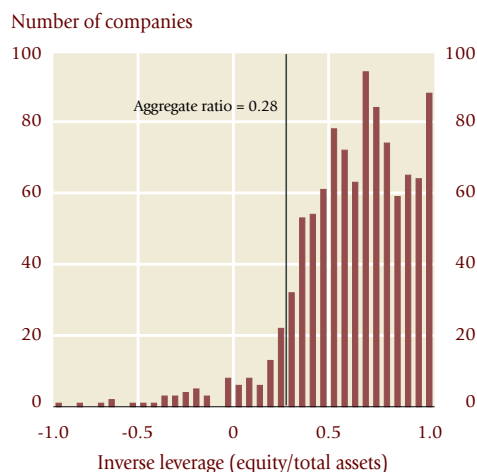
The construction of the indicator is straightforward. A threshold is chosen for each of the leverage ratio, the current ratio, and the net profit margin to define the “vulnerable tail” of the distribution for that ratio. In this case, the thresholds

5. The sample size of 106 companies was for 1994. The other years ranged between 675 and 1,191 companies. Excluding 1994 from the study did not change the conclusions reported here.
6. For example, high leverage by itself may not be a cause for concern if liquidity and profitability are high.

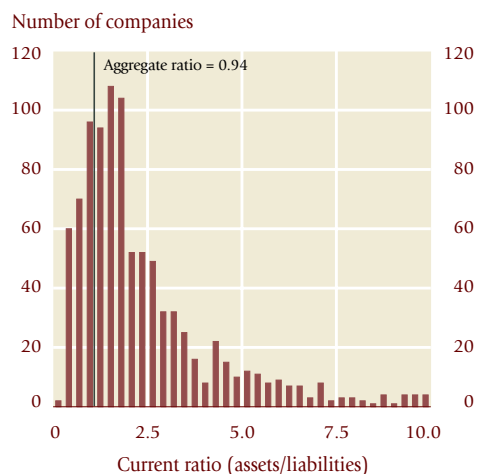
Chart 1 Distribution of Ratios (2004)

Sample size equals 1,049 companies

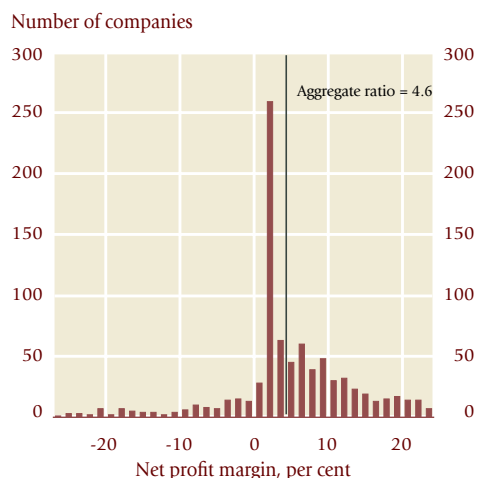
Inverse Leverage



Current Ratio



Net Profit Margin



are set at the average level of the 50th percentile over the entire sample period.⁷ A company is considered to be in the vulnerable tail of the distribution for a ratio if the value for that ratio for that company is “worse” than the value for the 50th-percentile threshold chosen here. Companies that appear in the vulnerable tails of all three ratios are identified, and the indicator is calculated as a percentage of the total sample assets held by these companies.⁸ A higher value indicates higher vulnerability for the sample as a whole.

The choice of the thresholds used to define the vulnerable tails is arbitrary, since there is no theoretical framework to determine these a priori. Sensitivity analysis showed that the indicator was relatively robust to the choice of thresholds ranging from the 25th to the 75th percentile for each ratio.⁹

For the purpose of financial system surveillance, it is useful to have an indicator with leading properties: the signal from the indicator anticipates vulnerability concerns. Here, the leading-indicator properties of this microdata indicator are evaluated using its correlation, one year ahead, with two financial-stress indicators of interest: bank gross impaired business loans and corporate bond defaults.¹⁰ It is also compared with other commonly used measures of corporate health: bond spreads (BBB over AA), ratings action (downgrades as a percentage of ratings actions), and the leverage ratio calculated from the *Quarterly Financial Statistics* for non-financial companies published by Statistics Canada (QFS leverage). Bond spreads reflect the additional return required by investors to compensate for the increased default risk of BBB-rated bonds

compared with the less-risky AA-rated bonds. Therefore, widening bond spreads reflect a higher risk of default and corporate vulnerability. Similarly, a rise in downgrades (changing the rating of a bond to a lower quality) as a percentage of ratings actions, is also taken as an indicator of increasing corporate vulnerability.

A comparison of these indicators is shown in Chart 2. The associated correlations are presented in Table 1. This preliminary analysis shows that the microdata indicator appears to lead banks’ gross impaired business loans and corporate bond defaults by one year. Over the sample period, increases in the indicator in one period are generally followed by increases in impaired business loans and corporate bond defaults in the following period. The microdata indicator performed better than bond spreads in anticipating gross impaired business loans one period ahead. It appears to outperform the indicator from ratings actions, and the indicator using QFS leverage in anticipating both bank gross impaired loans and bond defaults one period ahead.¹¹ Note, however, that this is largely a qualitative assessment, since the limited number of yearly observations in this data set does not permit a more rigorous test.

Sector analysis

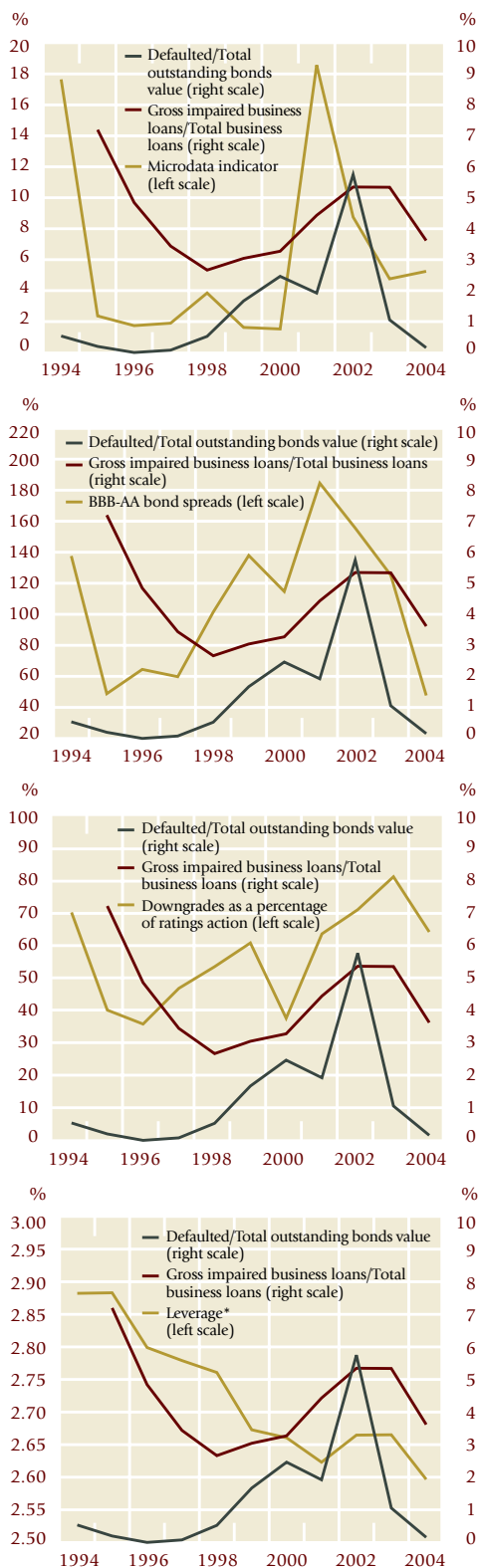
A further refinement is to extend the analysis to the sector level for PNFCs.

For this purpose, the companies identified as being in the vulnerable tails of all three financial ratios (as above) are categorized into eight sectors: consumer, energy, health care, industrials, information technology, materials, telecom, and utilities. The microdata indicator for a sector is calculated as the percentage of that sector’s assets held by the companies from that sector that are found in the vulnerable tails of all three ratios.

7. The 50th-percentile thresholds were: inverse leverage less than 0.606; current ratio less than 1.6; net profit margin less than 0.1 per cent.
8. Although only the asset-based indicator is discussed here, indicators were constructed for each ratio and combinations of ratios on the basis of the percentage of debt and the percentage of companies in the tails, with similar conclusions.
9. The choice of thresholds did affect the level of the indicator and the width of the peaks.
10. Correlation is a measure of the similarity in how two series move together. Here, we mean the correlation between the value of the microdata indicator in one period with the financial-stress indicator in the next period. A high degree of correlation is evidence that the microdata indicator has some leading information about financial stress.

11. There is some overlap of the information contained in these indicators. The microdata indicator has a correlation of 0.65 and 0.54 with the bond spreads and ratings actions, respectively. Note also that the microdata indicator is using information from three financial ratios, whereas the QFS leverage uses information from only a single ratio. Ideally, a proper comparison would require an aggregate index that uses information from aggregated QFS data for the other ratios as well.

Chart 2 Indicators of Financial Health



* Statistics Canada, *Quarterly Financial Statistics*
Sources: Moody's, OSFI, Bank of Canada, Statistics Canada, *Financial Post*, and authors' calculations

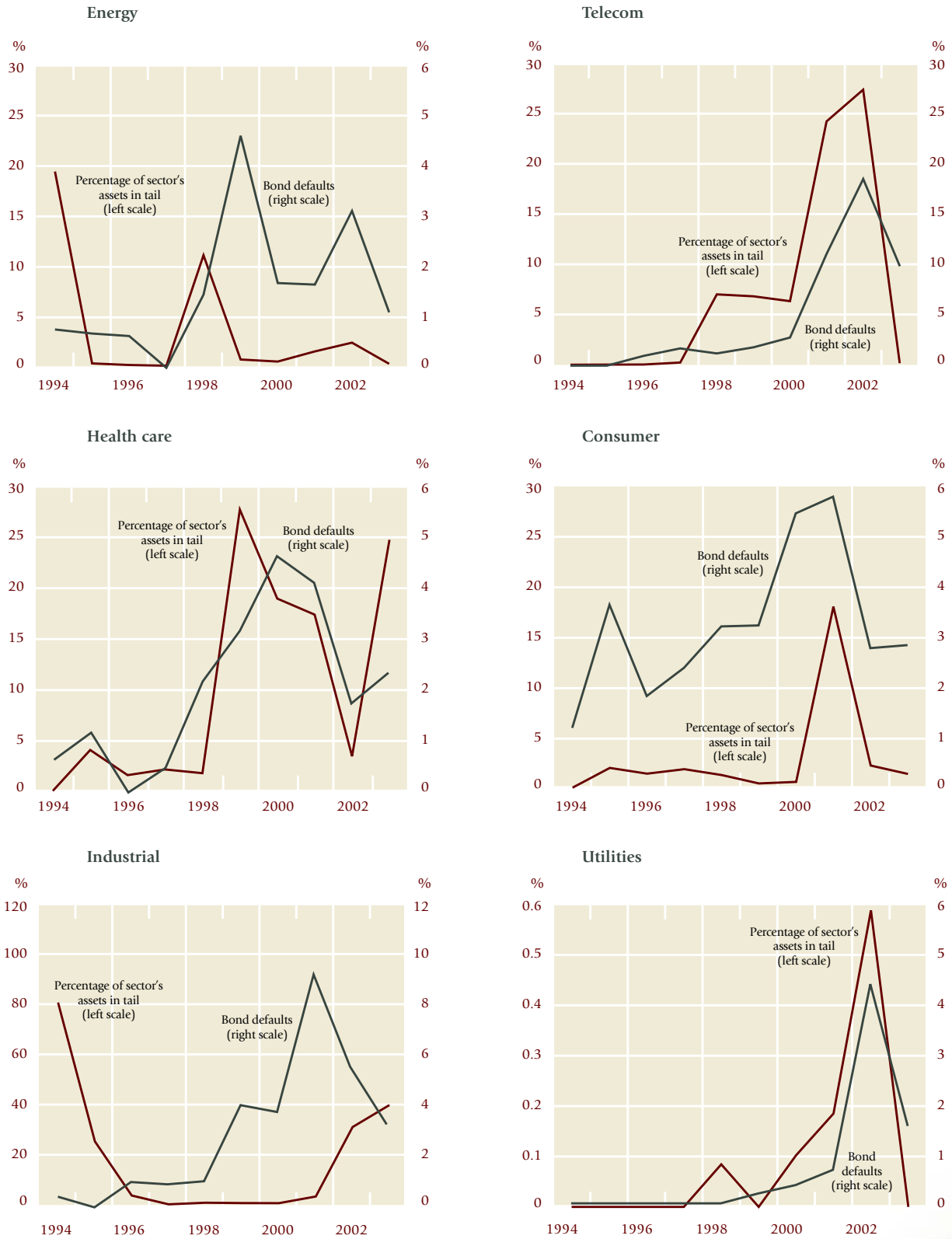
Table 1

Correlation Coefficients for Indicators*

	Microdata indicator	Bond spreads (BBB-AA)	Downgrades as a percentage of ratings actions	QFS leverage
	T-1	T-1	T-1	T-1
Gross impaired business loans	0.79	0.48	0.34	0.21
Corporate bond defaults as a percentage of bonds outstanding	0.46	0.68	0.13	-0.65

* T-1 refers to the indicator one year in the past.
Sources: Moody's, OSFI, Bank of Canada, *Financial Post*, Statistics Canada, and authors' calculations

Chart 3 Sector Analysis



Sources: Standard & Poor's, *Financial Post*, and authors' calculations

Chart 3 shows the relationship between the percentage of a sector's assets represented in the vulnerable tails and bond defaults for that sector.¹² For the telecom, energy, health care, and utilities sectors, the representation of the sector in the tails increases prior to a rise in bond defaults in these sectors. The results were less promising for the consumer and industrial sectors.

Nevertheless, this type of analysis has the potential to be of use to regulators of financial institutions who monitor sectoral exposures for these intermediaries.

Conclusion

This report has focused on the ways that microdata can be used for the surveillance of potential risks to the financial system originating from PNFCs.

Microdata analysis can augment analysis based on aggregated data by utilizing the information about the underlying distributions of vulnerability measures. Microdata also allow flexibility in the way that information can be combined to emphasize a point of economic significance. As such, this type of analysis could prove to be a useful addition to the other tools currently available for assessing financial stability.

The type of analyses presented here can be used for the surveillance of financial stability on a regular basis. At the moment, this is being done annually. However, given that public companies report quarterly, the analysis could be updated more frequently. One concern with financial data is the three- to six-month delay between a company's year-end and the availability of the data for analysis. This delay may largely mitigate the value of the leading-indicator properties described above.

Further work is required to refine the microdata indicators. For instance, a data set for a longer time period is being constructed to allow a more rigorous investigation of the statistical properties of the microdata indicator. A company-level study using panel data will also be conducted to extend this line of research by investigating the relationship between corporate financial health and macroeconomic factors such as output growth.

References

- Altman, E. 1983. *Corporate Financial Distress: A Complete Guide to Predicting, Avoiding, and Dealing with Bankruptcy*. New York: John Wiley & Sons.
- Benito, A. and G. Vlieghe. 2000. "Stylised Facts on UK Corporate Financial Health: Evidence from Micro-Data." *Bank of England Financial Stability Review* (June): 83–93.
- Bunn, P. and V. Redwood. 2003. "Company Accounts Based Modelling of Business Failures and the Implications for Financial Stability." Bank of England Working Paper No. 210.
- Ohlson, J.A. 1980. "Financial Ratios and the Probabilistic Prediction of Bankruptcy." *Journal of Accounting Research* 18: 109–31.
- Scott, J. 1981. "The Probability of Bankruptcy: A Comparison of Empirical Predictions and Theoretical Models." *Journal of Banking and Finance* 5: 317–44.
- Vlieghe, G. 2001. "Indicators of Fragility in the UK Corporate Sector." Bank of England Working Paper No. 146.

12. Data on bond defaults were not available for the materials and information technology sectors.