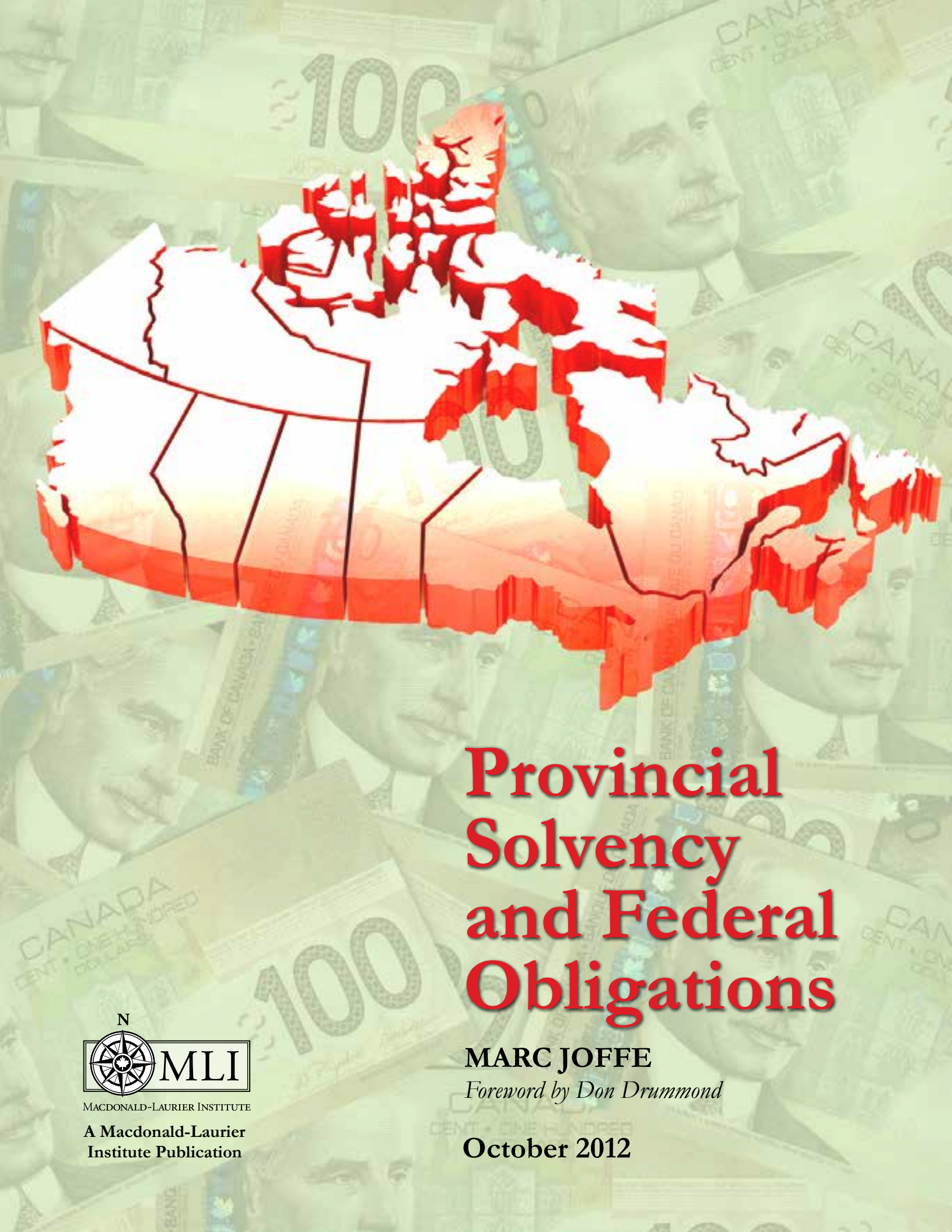

Provincial Solvency and Federal Obligations

MARC JOFFE

Foreword by Don Drummond

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Foreword by Don Drummond

The Macdonald-Laurier Institute publication "Provincial Solvency and Federal Obligations" by Marc Joffe provides a number of important lessons for Canadian fiscal policy authorities at the federal, provincial and territorial levels. The analysis suggests that the combination of future economic conditions, featuring more modest output increases than historically, and "status quo" policies, in particular the continuation of fairly rapid growth in health care spending, will put a number of provinces into debt positions that could lead to defaults. Interestingly, Alberta, despite its current net asset position, has the highest longer-term default probability. If credit rating agencies and markets share the perspectives from this report's analysis, then in theory the provinces should be facing higher interest rate spreads over federal rates. The author surmises that the relatively low spreads observable vis-a-vis federal rates are due to the assumption that the federal government will bail out any defaulting provincial government, as was done on several occasions in the 1930s. The complex analysis leading to this conclusion leaves a lot of room for question. Perhaps the agencies and markets believe provinces will act more responsibly to correct soaring debt than implied by the report's mechanical extrapolations. Perhaps they don't accept the study's definition of what debt burdens lead to high default risk. Nonetheless, the study does bring to our attention a number of very important issues that are highly relevant to current and future fiscal policy in Canada.

As is being recognized now in Europe, the study points out the difficulty of operating an economic and monetary union without some rules on the fiscal behaviour of its members. In Canada's case, with an implicit federal guarantee of provincial debt, the federal government may ultimately bear the fiscal consequences of any provincial default and in the meantime may be implicitly subsidizing inappropriate provincial policies. The federal government cleverly insulated itself from two of the strongest future cost drivers by capping its health transfers to the provinces to grow along with nominal GDP and raising the age of entitlement for seniors' pensions. Fiscally and policy-wise, the federal government may believe it has left the challenge of containing health care spending to the provinces. But as the MLI study points out, the risk could ultimately come back to the federal government if a province's debt gets so high it is in danger of defaulting. Federal fiscal protection may need to extend to a clarification of the conditions under which it will assist a province with its debt.

There is nothing inevitable about the rather mechanical spending projections contained in the report. But they do dramatically illustrate future dangers. Health care represents almost 50 per cent of program spending in every province now. In any plausible status quo projection it will grow much faster than incomes in every province. The MLI report illustrates one consequence of allowing this to happen, being a high probability of provincial debt defaults. Of course other outcomes are conceivable. Provinces could steadfastly raise tax rates although taxpayer fatigue would likely soon end that route. Provinces could squeeze virtually everything else but voters would soon express their displeasure at seeing their education, public safety and other interests eroded. Ultimately Governments will need to figure out how to do everything, especially health care, more efficiently so they don't risk bankrupty and don't raise taxes unacceptably.

The MLI study's focus on longer-term fiscal challenges provides a potent jolt that governments in Canada should not be myoptically focusing on their short-term fiscal challenge of returning to budget balance. That goal may be accomplished only to witness renewed and growing fiscal challenges as spending pressures exceed the economy's capacity to generate revenues at reasonable tax rates. Naturally there needs to be a focus on creating faster growth, especially through elevating Canada's anemic productivity record. Structural reforms, as opposed to simply cost-cutting, will be required to increase the effectiveness and efficiency of programs for the long haul.

Finally, the MLI study gives profile to a fiscal indicator, the interest bite, that deserves a lot more attention. This is the ratio of interest charges to revenues. The study uses it as a critical indicator of default risk, citing historical examples of default risk being quite high if more than 25 per cent of a province's revenue take is required to service debt. It is also a useful political barometer. Taxpayers understandably wish to feel they are getting their "money's worth" from government. It is hard to instill this sentiment if more than 25 per cent of the revenue take goes toward paying interest charges on services that have already been consumed. Fortunately all provinces are below 10 per cent currently. If they keep the ratio there we won't need to worry about which level of government ultimately bears a provincial debt default.

Executive Summary

Canadians may be too complacent if they think that the debt crisis wracking Europe cannot happen here. In the medium to long-term, public finances in several provinces are unsustainable, raising the spectre of debt crises, damaged credit ratings, and federal bailouts if corrective steps are not taken. If such crises occur, they will harm not only the provinces directly concerned, but could affect the entire economy. What is more, Canadians may be surprised to learn which provinces pose the greatest systemic risk to public finances in Canada.

As recent events in the Eurozone show, confederations of largely independent governing units contain a serious flaw: when an individual member encounters fiscal distress, the union and its more financially stable members face pressure to bail it out. Citizens in other parts of the confederation shoulder the costs of assisting the fiscally challenged government, yet have no influence over its policies. Since bondholders are aware that bailouts happen, there is a chance that bond yields for federation members reflect the possibility of a bail out. If this is the case, yields do not correctly signal the risks arising from each member's fiscal policies. Members can run large deficits without facing the wrath of the so-called "bond vigilantes".

The question this paper tackles is one of whether Canadian provincial interest rates include a subsidy arising from an expected federal bailout. Financial crises, defaults and bailouts all have precedents in Canadian provincial history. In fact, readers may be surprised to learn that half of the provinces received bailouts during the 1930s.

This study determines the existence of potential subsidies by estimating a theoretical interest rate that each province would pay in the absence of a potential bailout. It then compares these theoretical rates to market yields. To the extent that the theoretical rates exceed market yields, the approach suggests the expectation of a subsidy.

In theory, interest rates on risky bonds are primarily a function of default probability, so most of the analysis focuses on estimating each province's risk of failing to service its bonded debt over the next thirty years. After deriving default probabilities from agency ratings, a new approach for estimating government default risk is presented. This method employs a multi-year fiscal simulation with a default threshold stated in terms of an interest expense to total revenue ratio (or interest bite). Using evidence from our historical survey, the conclusion is that default is likely at a 25% interest bite, so the simulations simply estimate the probability of each province reaching that level. The simulation tool is open source and the fully transparent simulation models are available on line, so interested observers can substitute their own assumptions and rerun the analysis.

In the near term, no province has a material risk of reaching this 25% threshold and therefore each has essentially zero default risk.

At the long end of the maturity spectrum, this picture changes. Due to population aging, the provincial models forecast lower labor force participation, less economic growth and higher health spending in later years. Depending on how quickly interest rates revert to their post-World War II means, provinces are at risk of encountering solvency crises over the next 10-30 years if fiscal policies do not change.

Province default risks rise at different rates. The most vulnerable in the 10-20 year window is Ontario, due to its large annual deficits Alberta has the most risk at the 30 year threshold as its annual deficits swing its net financial position from a surplus to a large debt. Alberta's risk is attributable to high deficits, the fact that its population is expected by StatCan to age more rapidly than other provinces and because it is heavily exposed to volatile energy revenues. Quebec has the lowest statistical probability of default, but that risk is still nearly one in three.

Probability of Default in:	20 Year	30 Year
Newfoundland	18.6%	50.2%
Prince Edward Island	17.6%	57.1%
Nova Scotia	17.5%	53.6%
New Brunswick	23.4%	52.9%
Quebec	8.1%	28.2%
Ontario	42.9%	79.3%
Manitoba	33.7%	66.7%
Saskatchewan	15.3%	47.8%
Alberta	42.4%	84.0%
British Columbia	14.1%	53.6%

These dynamics do not appear to be reflected in long term provincial interest rates, which are relatively low and quite uniform across the nation. The fact that long term rates do not incorporate the solvency risks detailed in this report could show that (1) investors expect the federal government to rescue provinces down the road, or (2) they have confidence that provinces will take corrective action, or (3) they have not fully evaluated the long term credit picture.

Sommaire

Les Canadiens sont peut-être trop confiants s'ils croient que la crise de la dette qui ravage l'Europe ne peut pas se produire ici. À moyen et à long terme, les finances publiques dans plusieurs provinces ne sont pas viables, ce qui soulève le spectre de la crise de la dette, de décotes de crédit, et de plans de sauvetage par le gouvernement fédéral si des mesures correctives ne sont pas prises. Si de telles crises se produisent, elles pourraient nuire non seulement aux provinces directement concernées, mais pourraient affecter toute l'économie canadienne. Les Canadiens seraient étonnés des provinces qui présentent le plus grand risque systémique pour les finances publiques au Canada.

Comme les événements récents dans la zone euro le montrent, les confédérations de larges entités gouvernementales souveraines présentent un important inconvénient : quand un État membre se heurte à la détresse financière, l'union et les États membres les plus financièrement stables se voient dans l'obligation de le renflouer. Ainsi, les citoyens de partout ailleurs dans la confédération doivent apporter un appui financier au gouvernement en faute, sans pouvoir influer sur ses politiques. Puisque les détenteurs obligataires sont conscients de la possibilité de renflouements, les rendements obligataires des États membres de la fédération peuvent en tenir compte, et si c'est le cas, les rendements ne peuvent plus correctement signaler les risques découlant des politiques fiscales de chacun des États membres. Certains États membres peuvent donc accumuler des déficits importants sans faire face à la colère des soi-disant « justiciers *obligataires* ».

Cet article aborde la question de savoir si les taux d'intérêt provinciaux au Canada comprennent un subside découlant de l'anticipation d'un plan de sauvetage par le gouvernement fédéral. Les crises financières, les défauts de paiements et les sauvetages ont tous des précédents dans l'histoire des provinces au Canada. En fait, les lecteurs pourraient être étonnés d'apprendre que la moitié des provinces ont bénéficié de plans de sauvetage durant les années 1930.

Nous déterminons l'existence de subsides potentiels en estimant quel serait le taux d'intérêt théorique pour chaque province en l'absence de la possibilité d'un plan de sauvetage. Nous comparons ensuite ces taux théoriques aux rendements du marché. Selon cette approche, lorsque les taux théoriques dépassent les rendements du marché, il y a bel et bien présence d'un subside.

En théorie, les taux d'intérêt sur les obligations à risque sont principalement fonction du risque de défaillance. La plus grande partie de l'analyse porte donc sur l'estimation du risque qu'a chaque province de ne pas honorer le service de sa dette obligataire au cours des trente prochaines années. Après avoir dérivé les probabilités de défaillance des agences de notation, nous présentons une nouvelle approche pour estimer le risque de défaillance des gouvernements. Cette méthode utilise une simulation fiscale multi-exercices financiers qui fait appel à un seuil de défaillance établi en termes du ratio des dépenses d'intérêts au revenu total (ou la ponction du service de la dette). Utilisant les résultats de notre enquête historique, nous concluons que la défaillance est susceptible de se produire à un rapport de 25 %, de sorte que nos simulations estiment la probabilité pour chaque province d'atteindre ce rapport. L'outil de simulation est à code ouvert, et les modèles de simulation totalement transparents sont offerts en ligne. Les observateurs intéressés peuvent substituer leurs propres hypothèses et relancer l'analyse.

Nous constatons que, dans le court terme, aucune province n'a un risque important d'atteindre le seuil de 25 % et nous concluons qu'elles ont toutes un risque de défaillance pratiquement nul.

À l'autre extrémité de l'éventail des échéances, cette image change. En raison du vieillissement de la population, les modèles provinciaux de prévision prévoient un taux inférieur de participation au marché du travail, une croissance économique moindre et des dépenses de santé plus importantes au cours des dernières années de la période à l'étude. La rapidité à laquelle les taux d'intérêt reviendront à leur tendance de l'après-guerre déterminera lesquelles des provinces risquent de connaître des crises de solvabilité dans dix ans et durant les vingt années suivantes, si les politiques fiscales demeurent inchangées.

Les risques de défaillance s'élèvent par province à des rythmes différents. La plus vulnérable dans 10 ans et durant les dix années suivantes est l'Ontario, alors que l'Alberta court le plus grand risque dans 30 ans, puisque d'importants déficits annuels font passer sa position financière nette d'un excédent à une dette importante. Les risques de l'Alberta sont attribuables à des déficits élevés, au fait que sa population devrait, selon Statistique Canada, vieillir plus rapidement que celles des autres provinces et parce qu'elle est fortement exposée à la volatilité des revenus de l'énergie. Le Québec a le plus faible risque de défaillance, mais ce risque est néanmoins de près d'un sur trois.

Probabilité de défaillance	20 ans	30 ans
Terre-Neuve	18,6 %	50,2 %
Île-du-Prince-Édouard	17,6 %	57,1 %
Nouvelle-Écosse	17,5 %	53,6 %
Nouveau-Brunswick	23,4 %	52,9 %
Québec	8,1 %	28,3 %
Ontario	42,9 %	79,3 %
Manitoba	33,7 %	66,7 %
Saskatchewan	15,3 %	47,8 %
Alberta	42,4 %	84,1 %
Colombie-Britannique	14,1 %	53,6 %

Ces dynamiques ne semblent pas se refléter dans les taux d'intérêt provinciaux à long terme, qui sont relativement faibles et assez uniformes au pays. Le fait que les taux à long terme ne tiennent pas compte des risques de solvabilité détaillés dans ce rapport pourrait être un signe que les investisseurs anticipent des plans de sauvetage du gouvernement fédéral pour venir en aide aux provinces, ou que les provinces prendront des mesures pour corriger la situation.

Introduction

Under Canada's system of fiscal federalism, provinces receive a substantial portion of their revenues from the federal government. The degree of federal subsidy varies by province and over time. This system of intergovernmental support contains a moral hazard: individual provinces may be able to use the system to incur unsustainable debts on the assumption that they will be bailed out by the federal government in the event of a crisis. This moral hazard extends not only to provincial leaders, but to bondholders as well. Investors may finance spendthrift provinces at artificially low interest rates on the assumption that the federal government will step in. Indeed, as we will see later, this assumption has historical support: the Canadian government bailed out several provinces during the Great Depression. The same phenomenon is occurring in the Eurozone today. Greece, Ireland and Portugal have received substantial support from stronger countries in the European Union, with bondholders reaping some of the rewards. While private bondholders are suffering losses on Greek debt, their losses would have been larger in the absence of Eurozone intervention.

Five of today's ten provinces actually received bailouts during the Great Depression.

This study endeavors to determine whether the provinces are receiving an implicit interest subsidy based on the assumption that they will be bailed out in the event of a fiscal crisis. To do this, it compares current spreads between provincial and federal bond yields with theoretical spreads based on the credit risk of each province. If a province is paying lower interest rates than it would on the basis of its own credit, it could be deemed to be receiving a subsidy.

The study begins with a survey of outstanding provincial debt. It considers different measures of debt and determine which is most appropriate for performing a solvency analysis. After presenting current bond yields, it generates two estimates of theoretical yields in the absence of federal support. Since interest rates are related to credit risk, the theoretical yields are based on estimates of provincial default probabilities. One of the estimation methods relies on bond ratings while the other uses multi-year budget simulations. After estimating theoretical spreads with these two methods, it compares the results to current spreads. The math behind converting default probabilities to theoretical spreads is briefly described in Appendix A.

A number of assumptions used in the estimation of theoretical yields are derived from historical analysis. Details of historical defaults by Canadian provinces and comparable entities are provided in Appendix B. The appendix shows that five of today's ten provinces actually received bailouts during the Great Depression. Given this historical precedent, concerns regarding future federal bailouts seem well placed. Although this material has been placed in an appendix to avoid disrupting the primary narrative, it is highly accessible and well worth the general reader's attention.

Outstanding Debt by Province

Measuring Debt

Government debt can be measured in a variety of ways. Debt metrics applied to Canadian governments vary with those used in other countries and have also evolved over time.

A particularly simple measure of a government's debt is the amount of bonds and other debt securities it has outstanding. This concept is sometimes called Gross Bonded Debt. Some governments maintain Sinking Funds, consisting of cash or cash equivalents (highly liquid securities) that are dedicated to repaying maturing bonds as they become due. Gross Bonded Debt less Sinking Fund Assets is called Net Bonded Debt.[1]

In Canada, the most commonly reported measure of government debt is Net Debt – which is quite different from Net Bonded Debt as defined above. Under Canadian Public Sector Accounting Board (PSAB) Standards, Net Debt refers to *all* of a government's liabilities (not just bonds) less its financial assets.[2]

1 Some provinces issue bonds in currencies other than Canadian dollars. Exchange rate movements change the Canadian dollar value of these foreign currency bonds. Net Bonded Debt, as defined in this study, also reflects these exchange rate movements.

2 This definition and other PSAB definitions that follow come from Office of the Auditor General of British Columbia, Summary Compar-

PSAB further defines financial assets as "assets that could be used to discharge existing liabilities or finance future operations and are not for consumption in the normal course of operations." Examples of financial assets include cash and cash equivalents, receivables, inventories and investments in government enterprises.

Net debt also includes a number of classes of liabilities other than bonds. These include accounts payable, liabilities for future employee benefits and loans from other governments.

Another value reported in Canadian Public Accounts is Accumulated Surplus or Deficit. This is simply the difference between all Assets (Financial and Non-Financial) and Liabilities.

Having identified a variety of debt measurements, we now turn to deciding which one is best for analyzing provincial solvency. Using a metric that includes Non-Financial Assets implicitly assumes that governments would be willing to liquidate these assets to pay bondholders. Generally, this assumption does not hold. As Reinhart and Rogoff[3] note, "Most country defaults happen long before a nation literally runs out of resources. … During Russia's financial crisis in 1998, no one contemplated for a moment the possibility that Moscow might part with art from the Hermitage museum simply to appease Western creditors." While limited asset sales to satisfy creditors are not unprecedented, they are the exception rather than the rule. Consequently, we disqualify Accumulated Surplus or Deficit as an option, leaving us with a choice between Net Bonded Debt and Net Debt.

Table 1 shows Net Bonded Debt and Net Debt, as well as some of their key components. In most provinces, these two values are similar, suggesting that the choice of one or the other would not significantly impact a default probability analysis.

TABLE 1 Components of Provincial Net Debt - March 31, 2011

	Gross Bonded Debt	Sinking Fund Assets	Foreign Exchange Rate Changes	Net Bonded Debt	Other Liabilities	Other Financial Assets	Net Debt
Newfoundland	6,630.92	716.64	218.36	5,695.93	7,406.93	4,973.55	8,129.30
Prince Edward Island	1,602.71	228.21	0.00	1,374.50	827.42	506.33	1,695.59
Nova Scotia	15,833.37	3,236.05	150.07	12,447.25	4,410.74	4,180.73	12,677.26
New Brunswick	11,961.60	4,341.40	0.00	7,620.20	3,937.50	2,077.30	9,480.40
Quebec	159,536.00	5,907.00	(850.00)	154,479.00	61,155.00	56,345.00	159,289.00
Ontario[1]	236,741.42	112.27	0.00	236,629.15	46,309.00	68,427.00	214,511.15
Manitoba	17,120.00	1,814.00	0.00	15,306.00	5,429.00	7,898.00	12,837.00
Saskatchewan[2]	6,896.54	2,010.77	5.23	4,880.55	9,172.86	10,270.06	3,783.35
Alberta	14,372.00	0.00	0.00	14,372.00	23,386.00	59,411.00	-21,653.00
British Columbia	47,553.00	1,410.00	0.00	46,143.00	18,518.00	34,024.00	30,637.00
Totals	518,247.56	19,776.33	(476.34)	498,947.57	180,552.44	248,112.97	431,387.04

Source: Public Accounts for Each Province as of March 31, 2011.
1 Ontario Sinking Fund Assets reflect School Debt Sinking Fund on Page 3-35 of the Public Accounts.
2 Saskatchewan bonded debt excludes 3,882.91 in GBE bonds and 421.05 in GBE sinking fund assets.

Net Debt, the most commonly discussed debt measure in Canada, also presents some analytical difficulties. While financial assets such as receivables and inventories intended for sale are supposed to be easy to liquidate, a government may not be able to sell them for anything near historical cost during a time of crisis.

ison of Canadian Public Sector Accounting Standards with the CICA Handbook Part V, Office of the Auditor General of British Columbia, February 2011. Available at http://www.bcauditor.com/files/imce/ComparisonDoc_Final.pdf.

3 Carmen M, Reinhart & Kevin S. Rogoff (2009), This Time is Different, Princeton: Princeton University Press, pp. 51-52.

Liabilities other than bonded debt should only be considered in solvency analysis if they must be paid before bond principal and interest. In financial market terminology, the order in which claims must be paid is referred to as seniority. Accounts payable are generally not senior to bonded indebtedness. Although the seniority of varying claims has not been tested recently in any Canadian province, we do have some evidence from the US state of California. During that state's recent budget crisis, bonds were serviced without delay while vendors received "IOU's" for their outstanding invoices.[4]

The decision to prioritize certain classes of creditors has both legal and political aspects. These considerations could impact the relative treatment of retirees and bondholders. Since pensioners are more numerous, are more likely to live (and thus vote) in the province and are more likely to attract sympathy than bondholders, political leaders will be tempted to honor their claims first in a financial emergency. Although pensioners have more political clout than bondholders, the latter could take their case to court. Since there have been no Canadian government defaults since World War II, bondholders have had no need to test their rights in the court system.[5]

Because provinces vary in size and economic strength, raw numbers offer little insight into the relative debt burdens each province faces. The tables below show Bonded Debt and Net Debt on a per capita basis and as a percentage of GDP.

TABLE 2 Bonded Debt Ratios - March 31, 2011

	Net Bonded Debt ($M)	Population	GDP ($M)	Bonded Debt Per Capita ($)	Bonded Debt/ GDP
Newfoundland	5,695.93	511,023	28,192	11,146	20.20%
Prince Edward Island	1,374.50	144,610	5,010	9,505	27.44%
Nova Scotia	12,447.25	945,834	36,352	13,160	34.24%
New Brunswick	7,620.20	754,641	29,448	10,098	25.88%
Quebec	154,479.00	7,940,218	319,348	19,455	48.37%
Ontario	236,629.15	13,299,242	612,494	17,793	38.63%
Manitoba	15,306.00	1,242,564	54,257	12,318	28.21%
Saskatchewan	4,880.55	1,050,548	63,557	4,646	7.68%
Alberta	14,372.00	3,742,193	263,537	3,841	5.45%
British Columbia	46,143.00	4,551,742	203,147	10,137	22.71%
Totals/Averages	**498,947.57**	**34,182,615**	**1,615,342**	**14,597**	**30.89%**

Sources: Net Bonded Debt from Provincial Public Accounts as of March 31, 2011.
Q1 2011 Population from StatCan table 051-0005; 2010 GDP from StatCan Table 384-0002.

4 A major difference between Canadian provinces and most US states is that the latter have constitutional balanced budget requirements. California's inability to pay vendors with cash arose from a failure to adopt a balanced annual budget, and did not reflect the state's solvency.

5 As of this writing, a partially relevant case was being tried by the Supreme Court. In Professional Institute of the Public Service of Canada, et al. v. Attorney General of Canada, et al., federal employee groups are trying to strike down a 1999 Canadian government decision to divert pension fund contributions to other accounts on the grounds that the funds were in surplus. See http://www.scc-csc.gc.ca/case-dossier/cms-sgd/sum-som-eng.aspx?cas=33968.

TABLE 3 Net Debt Ratios - March 31, 2011

	Net Debt ($M)	Population	GDP ($M)	Net Debt Per Capita ($)	Net Debt/GDP
Newfoundland	8,129.30	511,023	28,192	15,908	28.84%
Prince Edward Island	1,695.59	144,610	5,010	11,725	33.84%
Nova Scotia	12,677.26	945,834	36,352	13,403	34.87%
New Brunswick	9,480.40	754,641	29,448	12,563	32.19%
Quebec	159,289.00	7,940,218	319,348	20,061	49.88%
Ontario	214,511.15	13,299,242	612,494	16,130	35.02%
Manitoba	12,837.00	1,242,564	54,257	10,331	23.66%
Saskatchewan	3,783.35	1,050,548	63,557	3,601	5.95%
Alberta	-21,653.00	3,742,193	263,537	-5,786	-8.22%
British Columbia	30,637.00	4,551,742	203,147	6,731	15.08%
Totals/Averages	431,387.04	34,182,615	1,615,342	12,620	26.71%

Sources: Net Debt from Provincial Public Accounts as of March 31, 2011.
Q1 2011 Population from StatCan table 051-0005; 2010 GDP from StatCan Table 384-0002.

Both tables show that Alberta is in the strongest position, while Québec bears the heaviest burden. Alberta's net debt is actually negative because the province has large balances in its Heritage and Sustainability funds, although these funds are rapidly dwindling due to the province's large annual deficits.

Direct and Indirect Debt

In addition to considering which line item on the province's balance sheet best characterizes its debt, we may also wish to consider off balance sheet debt.

Hydro Quebec . . . had $38.66 billion in long term debt as of March 2011."

Most provinces own majority stakes in crown corporations. Perhaps the largest such corporation is Hydro-Québec, which had $38.66 billion in long term debt as of March 2011. According to the company's financial profile: "Hydro-Québec is a government-owned corporation whose sole shareholder is the Québec government, which guarantees most of its borrowings unconditionally."[6] While Hydro- Québec's long-term debt is shown in an Appendix to Québec's financial statements, it is not reported in the statements as either a liability or a contingent liability of the province.

The following table shows obligations listed in each province's public accounts that have not been incorporated into their respective Net Debt calculations.

6 Hydro Quebec Financial Profile, p. 21. Available at http://www.hydroquebec.com/publications/en/financial_profile/pdf/profile_2010-2011.pdf.

TABLE 4 Liabilities and Potential Liabilities Excluded from Net Debt Calculation - March 31, 2011

	Total ($M)	Description
Newfoundland	1,012.12	Newfoundland and Labrador Hydro ($976.612m); Municipalities ($0.474m); Fisheries($28.789m); Other Corporations ($6.241m)
Prince Edward Island	252.71	Loan Guarantees ($203.254m to Island Investment Development; $49.453 to all others)
Nova Scotia	131.30	Halifax Dartmouth Bridge Commission($51m); Highway 104 Western Alignment Corporation ($63.892m); Nova Scotia Gaming Corporation($15.24m); Nova Scotia Liquor Corporation($1.166m)
New Brunswick	5,393.60	New Brunswick Municipal Finance Corporation ($726.30m); New Brunswick Electric Finance Corporation ($4,667.30m)
Quebec	53,570.00	Hydro-Québec ($38,660m); Other Government Enterprises ($3,574m); Loan Guarantees ($11,336m)
Ontario	8,885.00	Ontario Power Corp. ($5,126m); Hydro One ($3,759m)
Manitoba	8,467.00	The Manitoba Hydro-Electric Board ($8,467m)
Saskatchewan	3,461.86	Saskatchewan Power Corporation ($2490.267m); SaskEnergy incorporates ($489.749m); Saskatchewan Telecommunication holding corporation ($369.928m); Municipal Financing Corp. of Saskatchewan ($97.330m); Saskatchewan Gaming Corp. ($14.585m)
Alberta	0.00	
British Columbia	405.00	Homeowner Protection Act loan guarantees ($375m); Financial Administration Act students and loans ($3m); School University College and Health organization (SUCH) loan guarantees ($1m); Columbia Basin Trust joint venture co- venturer debt ($5m); Feeder Association Loan Guarantee Program($10m); Home Mortgage Assistance Program Act mortgages ($1m); Total Self-supported guaranteed debt ($10m)
Total	81,578.58	18.9% of Provincial Net Debt

While holders of these debts do ultimately have a claim on provincial tax revenues, this claim only becomes relevant if the Crown Corporation or other borrowing entity becomes unable to generate sufficient cash to service the debt on its own. In the case of Hydro-Québec, the utility has been consistently profitable and provides an essential service. Thus, it is very unlikely that its obligations will become the responsibility of provincial taxpayers. Given these circumstances, it is hard to justify adding these liabilities to the province's Net Debt, especially if auditors have not objected to their exclusion in the province's financial statements.

In the budget simulations described later, I focus on Net Bonded Debt as derived from each province's public accounts and the interest thereon. This measure is best attuned to the concern of credit markets, i.e. whether provinces will continue to perform on their bond obligations. Further this measure is more consistent with traditional metrics used prior to the inception of PASB, and is thus more relevant to the historical default analysis presented in Appendix B.

Current Yields and Spreads on Provincial Debt

Table 5 shows yields on provincial bonds for various maturities. Yields are computed based on the bond's stated interest rate (known as the coupon rate) and its current trading price. Typically, a province does not have a bond maturing exactly five years or ten years from now, so interpolation may need to be performed to determine the appropriate yields. The yields below were computed by Bloomberg, a leading financial information provider.

TABLE 5 Provincial Bond Yields - March 27, 2012

	1 Year	5 Years	10 Years	15 Years	20 Years	30 Years
Newfoundland	1.39%	2.30%	3.34%	3.56%	3.70%	3.72%
Prince Edward Island	1.27%	2.41%	3.44%	3.71%	3.83%	3.81%
Nova Scotia	1.29%	2.27%	3.34%	3.59%	3.75%	3.72%
New Brunswick	1.22%	2.29%	3.24%	3.62%	3.81%	3.80%
Quebec	1.25%	2.25%	3.35%	3.63%	3.82%	3.76%
Ontario	1.24%	2.27%	3.29%	3.66%	3.68%	3.74%
Manitoba	1.24%	2.21%	3.14%	3.53%	3.71%	3.63%
Saskatchewan	1.23%	2.17%	3.21%	3.52%	3.56%	3.59%
Alberta	1.31%	2.11%	3.17%	3.42%	3.52%	3.58%
British Columbia	1.23%	2.22%	3.18%	3.52%	3.63%	3.63%

Source: Bloomberg Professional Terminal

A striking thing about these [bond] yields is their lack of variation across provinces.

By subtracting federal yields with equivalent maturities, we can derive yield spreads for each province at each of the selected maturities. Table 6 shows these spreads, along with minima and maxima across all provinces, and the federal yields used to compute the provincial spreads.

A striking thing about these yields is their lack of variation across provinces. Since no province is facing an imminent solvency crisis at the moment, the similarity amongst one year spreads seems appropriate. But even at the 20 and 30 year horizons, the range between the minimum and maximum yields is still only 30 and 23 basis points, respectively. This may suggest the presence of an implicit subsidy for bonds with longer maturities.[7]

7 Yields and spreads reported here are for a single day. A review of data on the Bloomberg Professional Terminal shows that spreads between provincial and federal spreads varied little on a day to day basis during early 2012.

TABLE 6 Provincial Spreads over Federal Yields - March 27, 2012

	1 Year	5 Years	10 Years	15 Years	20 Years	30 Years
Newfoundland	0.28%	0.62%	1.04%	0.95%	0.94%	1.00%
Prince Edward Island	0.16%	0.74%	1.14%	1.09%	1.06%	1.09%
Nova Scotia	0.18%	0.60%	1.04%	0.97%	0.98%	1.00%
New Brunswick	0.11%	0.62%	0.94%	1.00%	1.05%	1.08%
Quebec	0.14%	0.57%	1.05%	1.01%	1.06%	1.04%
Ontario	0.13%	0.59%	0.99%	1.04%	0.91%	1.02%
Manitoba	0.13%	0.53%	0.85%	0.91%	0.94%	0.91%
Saskatchewan	0.12%	0.49%	0.91%	0.91%	0.79%	0.87%
Alberta	0.20%	0.44%	0.88%	0.81%	0.76%	0.86%
British Columbia	0.12%	0.54%	0.89%	0.91%	0.87%	0.91%
Minimum	0.11%	0.44%	0.85%	0.81%	0.76%	0.86%
Maximum	0.28%	0.74%	1.14%	1.09%	1.06%	1.09%
Federal Yields	1.11%	1.68%	2.30%	2.61%	2.76%	2.72%

Source: Bloomberg Professional Terminal

While this lack of differentiation in long term provincial bond yields might be attributed to yield compression generally, it is worth noting that investment grade emerging market issuers like Brazil, Turkey, Russia and Mexico exhibit a wide range of 30-year bond yields. Recently, these yields ranged from 4.62% - 6.07%.[8] By contrast, Canadian provincial yields ranged from 3.48% to 3.72%. On the other hand, it is worth noting that while inflationary expectations are uniform across Canadian provinces, they can be expected to differ across sovereigns that issue their own currencies.

Theoretical Interest Rates in the Absence of Federal Support

Next I estimate fair spreads between provincial and federal interest rates in the absence of any expected or actual federal intervention. To be precise, I am not considering how interest rates would be impacted by the removal of federal equalization payments or support for program spending. I am specifically concerned with the level of interest rates in the absence of any future action to bail out a province in case it was about to default on coupon or principal payments.

To estimate bond yields, I need a model that explains the factors driving interest rates. I begin the estimation process by describing this model.

8 Bloomberg News, Putin Lures $24 Billion With Bond Yields Above Brazil, http://www.businessweek.com/news/2012-03-29/putin-lures-24-billion-with-bond-yields-above-brazil.

Interest Rate Drivers

Broadly speaking, an interest rate on a risky bond can be decomposed into four factors[9]:

- The risk free interest rate
- The default probability for the risky bond issuer
- Loss on the risky bonds in the event of default
- The degree of risk aversion on the part of investors

Under normal market conditions, an investor will demand some return even in the complete absence of risk because of time preference. Essentially, a dollar today is worth more than a dollar next year, because you can spend today's dollar now and thereby receive instant rather than delayed gratification. In recent years, this risk free interest rate fell to very low levels as price inflation remained minimal, Central Banks bought government debt instruments and investors worried about losing capital in riskier investments. It is worth noting that "risk free" in this context refers to freedom from default risk. Bondholders also face the risk of purchasing power from inflation. Under this credit oriented construct, inflationary expectations are included in the risk free rate.

The next three factors on the list above combine to create a risk premium: a margin that investors demand over the risk free rate to hold a risky instrument. Since investors face a risk of losing their principal, it is reasonable to expect that they will demand to be compensated in the form of higher interest rates for the risky bond.

Assuming that we had perfect information, markets were totally efficient and we were all unemotional, income maximizing automatons, the risk premium would simply be the product of the default probability and the loss given default.

A brief example can best prove this statement. To keep things simple, we will assume that the risk free rate is zero and that there are no transaction costs. An investor is given a choice of buying 100 risk free bonds or 100 risky bonds. Let's also assume that the face value of each bond is $1 and that they all mature or default in precisely one year. Due to perfect information, we know that 10 of the 100 risky bonds will default, and that half the principal on each of the defaulting bonds will be lost. In fixed income terminology, the default probability on these risky bonds is 10/100 = 10 percent and the loss given default is 50 percent (analysts also discuss the recovery rate which is 1 – loss given default, and thus also 50 percent in this simple case). If we multiply the 10 percent default rate by the 50 percent loss given default, we get an expected loss of 5 percent for the overall portfolio of risky bonds. If the investor is certain to lose 5 percent or $5 on the $100 risky bond portfolio, he would need to receive $5 in interest as an incentive to buy the risky bonds.

So, in this contrived example, the risky bonds would attract an interest rate of 5 percent. Now let's eliminate the contrivances. First we could remove the assumption of a zero risk free rate. Assuming a 1 percent risk free rate, the risky rate would have to be 6 percent, so that the investor would receive $101 at the end of the year in either case.

Next, let's remove the assumptions of perfect information and lack of emotion. While we have tools to estimate default rates and recovery rates, these are imprecise, so the $5 expected loss is not guaranteed. It could be more or it could be less. Economists have found over the years that people are generally risk averse. Most investors hate losing money more than they like making money. Recently, this idea has been reinforced by laboratory research conducted by behavioral economists[10].

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9 These factors are described in connection with corporate bonds by Agarwal, D., Arora, N. & Bohn, J. (2004). Parsimony in Practice: An EDF-Based Model of Credit Spreads, Moody's Analytics web site, http://www.moodysanalytics.com/~/media/Insight/Quantitative-Research/Credit-Valuation/04-29-04-Parsimony-in-Practice and an application is made to sovereigns by Remolona, E., Scatigna, M. & Wu, E. Interpreting Sovereign Spreads (March 2007), BIS Quarterly Review, http://www.bis.org/repofficepubl/arpresearch_fs_200703.02.pdf.

10 See, for example, Kahneman, Daniel. Maps of Bounded Rationality: Psychology for Behavioral Economics, American Economic Review, Vol. 93 No. 5 (Dec. 2003), pp. 1449-1475.

Consequently, the expected loss (default probability times loss given default) should be multiplied by a risk aversion factor. We can thus summarize our interest rate model with the following simple equation[11]:

Risky Interest Rate = Risk Free Rate + (Default Probability x Loss Given Default x Risk Aversion Factor)

With this equation, the next step is to estimate the various parameters that compose the risky (provincial) interest rates in the absence of a bailout.

First, we make the simplifying assumption that the federal government debt is risk free. There are a number of grounds for making this assumption. First, the federal government and its predecessor – the Dominion – have never missed a bond payment. Second, the federal government has strong fiscal ratios and carries the highest ratings from all western credit rating agencies.[12] Finally, since Canada has its own currency, it has the option of creating money to service its bonds.[13]

By making the assumption that federal interest rates are risk free rates, the equation becomes simpler. The premium on provincial bonds can be estimated by multiplying the Default Probability, the Loss Given Default and the Risk Aversion Factor. We now turn to estimating these three components.

Estimating Default Probabilities

We begin by considering default probabilities, using two methods. The first method derives these probabilities from bond ratings, while the second approach uses a multi-year budget simulation model.

The model approach is based on a review of historic defaults described in Appendix B. The primary purpose of this review is to evaluate a fiscal metric that can be used for predicting defaults, but, the review also includes a discussion of previous provincial bailouts. Appendix B also provides some historical data relevant to estimating loss given default.

Default Probabilities Implied By Ratings

Provincial debt is assessed by several rating agencies. These agencies assign letter grades to the bond issues of each province. The chart below shows the ratings assigned (as of the end of the 2011-2012 fiscal year) to the provinces by the three agencies that cover all ten. These rating agencies are Dominion Bond Rating Service (DBRS), Moody's and Standard & Poors (S&P).

11 In fact this equation is oversimplified as explained in Appendix A, which summarizes the Agarwal, Arora & Bohn model. The literature contains various functional forms. Some theorists include a liquidity premium to differentiate spreads on smaller volume issues, while others add a fixed risk aversion factor rather than treat it as a multiplier.

12 These ratings can be found on the web sites of the respective credit rating agencies. Ratings for Canada and other sovereigns are summarized on Wikipedia at http://en.wikipedia.org/wiki/List_of_countries_by_credit_rating.

13 Ronald Kneebone, Deficits in Debt in Canada, Canadian Public Policy, Vol. 20 No.2 (Jun. 1994), pp. 152-164 points out that the Bank of Canada could also create money to bail out provinces and may have reason to do so given fears of a default affecting the credit of other Canadian governments. His review of late 20th century fiscal history suggests that this factor was not in play during that time.

TABLE 7 Provincial Credit Ratings - March 2012

	DBRS	Moody's	S&P
Newfoundland	A	Aa2	A+
Prince Edward Island	A (low)	Aa2	A
Nova Scotia	A	Aa2	A+
New Brunswick	A (high)	Aa2	AA-
Quebec	A (high)	Aa2	A+
Ontario[1]	AA (low)	Aa1	AA-
Manitoba	A (high)	Aa1	AA
Saskatchewan	AA	Aa1	AAA
Alberta	AAA	Aaa	AAA
British Columbia	AA (high)	Aaa	AAA

Source: Bloomberg Professional Terminal
1 Moody's downgraded Ontario's rating to Aa2 on April 26, 2012.

As the chart suggests, each rating agency uses a different scale. To facilitate comparisons, we provide a second table that converts the ratings to ordinal numbers where 1 represents the agency's highest rating, 2 represents the second highest rating and so forth.

TABLE 8 Provincial Credit Ratings Transformed to Ordinal Numbers

	DBRS	Moody's	S&P	Simple Average
Newfoundland	6	3	5	4.67
Prince Edward Island	7	3	6	5.33
Nova Scotia	6	3	5	4.67
New Brunswick	5	3	4	4.00
Quebec	5	3	5	4.33
Ontario	4	2	4	3.33
Manitoba	5	2	3	3.33
Saskatchewan	3	2	1	2.00
Alberta	1	1	1	1.00
British Columbia	2	1	1	1.33

These ordinal values are reasonably comparable since each rating agency has roughly the same number of rating grades – they just label these grades differently. As the chart shows, rating agencies often take different views on the same province. Only Alberta receives the same rating from all three agencies.

Although rating agencies do not typically associate – or map - ratings to default probabilities, one can make such inferences by referring to long term historical default rates for each rating grade. It is necessary to consider long term default rates because defaults are highly cyclical. During a boom year, there may be few if any defaults in low ratings grades, while even top grades may suffer significant defaults during a severe recession.

Ideally, we would use public sector bond issuer default rates by ratings for this mapping. Fortunately for investors but unfortunately for our purposes, sovereign and sub-sovereign defaults by issuers rated single-A or higher have been so rare in recent decades that we cannot calculate meaningful default rates.[14] Consequently, we will consider corporate default rates.

14 For example, a 2010 S&P study showed no defaults post 1975 by sovereigns rated A or higher. See http://www.standardandpoors.com/ratings/articles/en/us/?articleType=HTML&assetID=1245302231824.

Each rating agency publishes studies that contain long term cumulative default rates by rating. The rates are shown on an annual basis for ten or more years. A ten year default rate of 2 percent for bonds rated single-A implies that 2 out of 100 single-A rated bonds defaulted over a ten year period. By definition, the default rates must remain the same or increase as the number of years increases, since the issuers in the rating category have more time default.

Also, one would expect the default rates to increase as the ratings become worse. For example, single-A issuers should have a higher default rate than double-A issuers over any given timeframe. Unfortunately, this relationship does not always prevail in the historic default tables (excerpted from rating agency default studies) that follow.

TABLE 9 DBRS Historic Default Rates

	1 Year	5 Years	10 Years
AAA	0.00%	0.00%	0.00%
AA (high)	0.33%	1.65%	2.64%
AA	0.11%	0.22%	0.22%
AA (low)	0.00%	1.25%	1.37%
A (high)	0.20%	0.50%	1.09%
A	0.23%	1.67%	2.77%
A (low)	0.12%	0.66%	0.97%

Source: 2010 DBRS Corporate Rating Transition and Default Study (http://www.dbrs.com/research/238830)

TABLE 10 Moody's Historic Default Rates

	1 Year	5 Years	10 Years	15 Years	20 Years
Aaa	0.000%	0.086%	0.186%	0.186%	0.186%
Aa1	0.000%	0.141%	0.158%	0.723%	0.806%
Aa2	0.000%	0.334%	0.718%	1.044%	2.328%
Aa3	0.048%	0.327%	0.502%	1.350%	3.849%
A1	0.061%	0.855%	1.468%	2.689%	4.382%
A2	0.065%	0.788%	2.642%	3.768%	7.343%
A3	0.058%	0.923%	2.500%	4.553%	8.332%

Source: Moody's Corporate Default and Recovery Rates, 1920-2010 (http://www.naic.org/documents/committees_e_capad_vos_c1_factor_review_sg_related_docs_moodys_corporate_default.pdf)

TABLE 11 S&P Historic Default Rates

	1 Years	5 Years	10 Years	15 Years
AAA	0.00%	0.38%	0.79%	1.09%
AA+	0.00%	0.19%	0.33%	0.33%
AA	0.02%	0.36%	0.89%	1.28%
AA-	0.04%	0.44%	0.92%	1.30%
A+	0.07%	0.61%	1.46%	2.63%
A	0.09%	0.64%	1.87%	2.77%
A-	0.08%	0.80%	2.17%	2.89%

Source: S&P 2010 Annual Global Corporate Default Study And Rating Transitions (http://www.standardandpoors.com/ratings/articles/en/us/?articleType=HTML&assetID=1245302234237)

An observer might be tempted to characterize this absence of a monotonic relationship between ratings and default rates as evidence of incompetence on the part of rating agencies. However, such criticism is not totally fair. Defaults on the part of "A" rated issuers are very rare: less than three percent over ten years for all categories shown in the accompanying tables. A few random factors can thus affect the ordering of default rates within the seven grades. Ratings for more speculative bonds in the "B" and "C" range exhibit more consistent default behavior.

Default rates that do not rise consistently with lower ratings restrict the usefulness of ratings for quantitative analysis of the type being performed in this study. In the 1990s Moody's addressed the issue by creating what it called "idealized default rates": statistically smoothing historic default rates so that they conformed to predicted relationships. Table 12 contains relevant Moody's idealized default rates.

TABLE 12 Moody's Corporate Idealized Default Probabilities

	1 Year	5 Years	10 Years	15 Years	20 Years	30 Years
Aaa	0.0001%	0.0029%	0.0100%	0.0221%	0.0377%	0.0754%
Aa1	0.0006%	0.0310%	0.1000%	0.2634%	0.4947%	1.1362%
Aa2	0.0014%	0.0680%	0.2000%	0.5046%	0.9518%	2.1971%
Aa3	0.0030%	0.1420%	0.4000%	1.1769%	2.0196%	4.0694%
A1	0.0058%	0.2610%	0.7000%	1.8490%	3.0871%	5.9412%
A2	0.0109%	0.4670%	1.2000%	2.5210%	4.1546%	7.8129%
A3	0.0389%	0.7300%	1.8000%	3.8053%	5.8619%	10.1153%

Sources: The U.S. Municipal Bond Rating Scale: Mapping to the Global Rating Scale And Assigning Global Scale Ratings to Municipal Obligations (http://www.moodys.com/sites/products/DefaultResearch/102249_RM.pdf)
And Moody's CDOROM available at http://www.moodysanalytics.com/Products-and-Solutions/Structured-Analytics-and-Valuation/Credit-Models-and-Forecasting/CDOROM.aspx

Unfortunately, these idealized rates appear to be too low when compared to default rates published in the recent rating agency default studies. Apparently, the decade of the 2000s had more "fallen angels" than the 1980s and 1990s (in the US, highly rated defaulters like Enron and Lehman come to mind). Moreover, these idealized rates do not appear to have been updated more recently.

Under the circumstances, the best option is to scale up the idealized default rates to take into account more recent history. We derived scaling factors for one year, five year and ten year terms. The factors were computed as follows. First, for each rating agency, find the highest default rate for each term among the seven ratings in our universe. For example, the worst one year default rate in the S&P table is 0.09%. We then computed a weighted average of the three agency specific maxima, attributing higher weightings to S&P and Moody's, because they have larger rated universes than DBRS. We then divided this result by the highest default rate in Moody's idealized default rate table. This approach led me to increase the idealized one year default rates by 329%, the five year default rates by 140% and the ten year default rates by 138%. We also applied this 138% scaling factor to 15, 20 and 30 year maturities, for which limited default rate data was available in the rating agency data presented above. The scaled default rates are shown in Table 13.

TABLE 13 Scaled Idealized Default Rates

	1 Year	5 Years	10 Years	15 Years	20 Years	30 Years
1	0.0003%	0.0041%	0.0138%	0.0306%	0.0520%	0.1040%
2	0.0020%	0.0434%	0.1380%	0.3635%	0.6827%	1.5680%
3	0.0046%	0.0952%	0.2760%	0.6964%	1.3134%	3.0320%
4	0.0099%	0.1988%	0.5520%	1.6241%	2.7870%	5.6158%
5	0.0191%	0.3654%	0.9660%	2.5516%	4.2602%	8.1988%
6	0.0359%	0.6538%	1.6560%	3.4790%	5.7333%	10.7819%
7	0.1280%	1.0220%	2.4840%	5.2514%	8.0894%	13.9591%
Scaling Factor	329%	140%	138%	138%	138%	138%

Finally, we can apply these rates to the provincial agency ratings shown earlier. Table 14 shows the rating implied default probabilities by province for various terms by rating agency. The table also includes simple averages of the three rating agency implied default probabilities for each province and term.

TABLE 14

Rating Implied Default Probabilities - 1 Year

	DBRS	Moody's	S&P	Simple Average
Newfoundland	0.04%	0.00%	0.02%	0.02%
Prince Edward Island	0.13%	0.00%	0.04%	0.06%
Nova Scotia	0.04%	0.00%	0.02%	0.02%
New Brunswick	0.02%	0.00%	0.01%	0.01%
Quebec	0.02%	0.00%	0.02%	0.01%
Ontario	0.01%	0.00%	0.01%	0.01%
Manitoba	0.02%	0.00%	0.00%	0.01%
Saskatchewan	0.00%	0.00%	0.00%	0.00%
Alberta	0.00%	0.00%	0.00%	0.00%
British Columbia	0.00%	0.00%	0.00%	0.00%

Rating Implied Default Probabilities - 5 Years

	DBRS	Moody's	S&P	Simple Average
Newfoundland	0.65%	0.10%	0.37%	0.37%
Prince Edward Island	1.02%	0.10%	0.65%	0.59%
Nova Scotia	0.65%	0.10%	0.37%	0.37%
New Brunswick	0.37%	0.10%	0.20%	0.22%
Quebec	0.37%	0.10%	0.37%	0.28%
Ontario	0.20%	0.04%	0.20%	0.15%
Manitoba	0.37%	0.04%	0.10%	0.17%
Saskatchewan	0.10%	0.04%	0.00%	0.05%
Alberta	0.00%	0.00%	0.00%	0.00%
British Columbia	0.04%	0.00%	0.00%	0.02%

Rating Implied Default Probabilities - 10 Years

	DBRS	Moody's	S&P	Simple Average
Newfoundland	1.66%	0.28%	0.97%	0.97%
Prince Edward Island	2.48%	0.28%	1.66%	1.47%
Nova Scotia	1.66%	0.28%	0.97%	0.97%
New Brunswick	0.97%	0.28%	0.55%	0.60%
Quebec	0.97%	0.28%	0.97%	0.74%
Ontario	0.55%	0.14%	0.55%	0.41%
Manitoba	0.97%	0.14%	0.28%	0.46%
Saskatchewan	0.28%	0.14%	0.01%	0.14%
Alberta	0.01%	0.01%	0.01%	0.01%
British Columbia	0.14%	0.01%	0.01%	0.06%

Rating Implied Default Probabilities - 15 Years

	DBRS	Moody's	S&P	Simple Average
Newfoundland	3.48%	0.70%	2.55%	2.24%
Prince Edward Island	5.25%	0.70%	3.48%	3.14%
Nova Scotia	3.48%	0.70%	2.55%	2.24%
New Brunswick	2.55%	0.70%	1.62%	1.62%
Quebec	2.55%	0.70%	2.55%	1.93%
Ontario	1.62%	0.36%	1.62%	1.20%
Manitoba	2.55%	0.36%	0.70%	1.20%
Saskatchewan	0.70%	0.36%	0.03%	0.36%
Alberta	0.03%	0.03%	0.03%	0.03%
British Columbia	0.36%	0.03%	0.03%	0.14%

Rating Implied Default Probabilities - 20 Years

	DBRS	Moody's	S&P	Simple Average
Newfoundland	5.73%	1.31%	4.26%	3.77%
Prince Edward Island	8.09%	1.31%	5.73%	5.05%
Nova Scotia	5.73%	1.31%	4.26%	3.77%
New Brunswick	4.26%	1.31%	2.79%	2.79%
Quebec	4.26%	1.31%	4.26%	3.28%
Ontario	2.79%	0.68%	2.79%	2.09%
Manitoba	4.26%	0.68%	1.31%	2.09%
Saskatchewan	1.31%	0.68%	0.05%	0.68%
Alberta	0.05%	0.05%	0.05%	0.05%
British Columbia	0.68%	0.05%	0.05%	0.26%

Rating Implied Default Probabilities - 30 Years

	DBRS	Moody's	S&P	Simple Average
Newfoundland	10.78%	3.03%	8.20%	7.34%
Prince Edward Island	13.96%	3.03%	10.78%	9.26%
Nova Scotia	10.78%	3.03%	8.20%	7.34%
New Brunswick	8.20%	3.03%	5.62%	5.62%
Quebec	8.20%	3.03%	8.20%	6.48%
Ontario	5.62%	1.57%	5.62%	4.27%
Manitoba	8.20%	1.57%	3.03%	4.27%
Saskatchewan	3.03%	1.57%	0.10%	1.57%
Alberta	0.10%	0.10%	0.10%	0.10%
British Columbia	1.57%	0.10%	0.10%	0.59%

Rating Implied Default Probabilities - Summarized

	1 Year	5 Year	10 Year	15 Year	20 Year	30 Year
Newfoundland	0.02%	0.37%	0.97%	2.24%	3.77%	7.34%
Prince Edward Island	0.06%	0.59%	1.47%	3.14%	5.05%	9.26%
Nova Scotia	0.02%	0.37%	0.97%	2.24%	3.77%	7.34%
New Brunswick	0.01%	0.22%	0.60%	1.62%	2.79%	5.62%
Quebec	0.01%	0.28%	0.74%	1.93%	3.28%	6.48%
Ontario	0.01%	0.15%	0.41%	1.20%	2.09%	4.27%
Manitoba	0.01%	0.17%	0.46%	1.20%	2.09%	4.27%
Saskatchewan	0.00%	0.05%	0.14%	0.36%	0.68%	1.57%
Alberta	0.00%	0.00%	0.01%	0.03%	0.05%	0.10%
British Columbia	0.00%	0.02%	0.06%	0.14%	0.26%	0.59%

Default Probabilities Derived from a Model

As discussed above, this study used corporate default rates rather than government default rates in the foregoing analysis. By doing so, it implicitly assumes that credit ratings have the same meaning across asset classes. This assumption is open to debate, especially given the poor performance of triple-A ratings for mortgage backed securities and collateralized debt obligations during the recent financial crisis. Thus, rather than rely solely on ratings, we created models to compute default probabilities for each province for various terms. Before presenting the model results, we offer an explanation of the modeling approach chosen.

Both logic and empirical evidence suggest that government default is primarily caused by the accumulation of unsustainable amounts of debt. While this point may seem obvious, it is worth emphasizing, because rating agencies often give equal or higher weight to such other factors as per capita GDP and institutional stability. Although these factors may be applicable to developing nations, they appear to have little relevance to Canada or comparable countries such as the US and Australia. The record of the last century contains no instance in which a Canadian province or a US or Australian state defaulted simply because of conflicts within its legislature, so institutional considerations appear to be less significant.

Both logic and empirical evidence suggest that government default is primarily caused by the accumulation of unsustainable amounts of debt.

Setting aside other factors, we are then left with the question of how to measure the sustainability of a government's debt burden. The most common metric used in this regard is the debt-to-GDP ratio. Unfortunately, this ratio has a number of disadvantages for sustainability analysis. First, a sustainable sovereign debt-to-GDP ratio may not be applicable to sub-sovereigns. Typically, sovereigns raise much more revenue per capita than sub-sovereigns, so their capacity to carry debt is higher.

Another problem with applying debt-to-GDP ratios to provinces and other sub-sovereigns is that reliable historic GDP statistics are less available. GDP is a relatively recent innovation, and, although economists have estimated GDP for earlier periods at the national level, they have generally not computed estimates for provinces and other sub-sovereigns. Since most of the defaults in our relevant universe occurred during the 1930s, we lack reliable debt-to-GDP ratios for the majority of relevant defaults.

An interest expense to revenue ratio of 25 percent is likely to be unsustainable in a contemporary context.

Even at the sovereign level, there are some difficulties with measuring debt sustainability in terms of debt-to-GDP ratios. While many quote Reinhart and Rogoff's view that 90 percent is a critical threshold for the debt-to-GDP ratios[15], we have the examples of contemporary Japan and post-War Britain – both of which sustained ratios in excess of 200 percent without defaulting.

A common factor uniting these two cases is low interest rates. If a sovereign faces interest rates of 1-2 percent, because of high levels of domestic savings, financial repression or other reasons, it can service much more debt than a nation faced with rates closer to long term averages in the range of 4-5 percent.

A final issue with debt-to-GDP ratios, less relevant to the case of Canadian provinces, is the varying ability and willingness of comparable governments to extract revenue from their respective economies. For example, the Greek and US governments are much less able to realize revenue from a given amount of economic activity than a Scandinavian sovereign can. Widespread tax evasion (as in Greece) or political barriers to tax increases (as in the US) limit a government's ability to raise revenue.

Given these concerns, debt sustainability is best measured by a purely fiscal ratio – one based on public accounts – that is also influenced by interest rates. One metric that possesses these properties is the ratio between interest expense and total revenue. A variant of this metric is the debt service to total revenue ratio, which also takes principal payments into account. To the extent that a sophisticated borrower – like a Canadian province – effectively distributes its maturities across years, the conceptual difference between these two alternatives is not substantial.

Appendix B presents details of past defaults and fiscal crises in Canadian provinces and comparable entities. This analysis leads to the conclusion that an interest expense to revenue ratio of 25 percent is likely to be unsustainable in a contemporary context. Thus, we can estimate the probability of default by determining the likelihood that any given province will reach this ratio threshold.

Table 15 derives two measures of the interest expense to revenue ratio for each province as of fiscal year 2011. By either measure, all provinces are well below the 25 percent threshold and thus not in immediate jeopardy of defaulting. Our analysis uses interest on Net Bonded Debt for greater compatibility with the historical examples, but the difference between interest on Net Bonded Debt and overall debt charges is not large, and would not have greatly impacted the results.

15 It should be noted that Reinhart and Rogoff do not offer 90 percent as a default threshold. They simply note that a nation's growth is typically inhibited when its debt-to-GDP ratio reaches this level.

TABLE 15 Revenue, Debt Charges and Interest on Bonded Debt - Fiscal 2011

	Revenue ($m)	Debt Charges ($m)	Bond Interest ($m)	Debt Charges/ Revenue	Bond Interest/ Revenue
Newfoundland	8,137	837	436	10.29%	5.36%
Prince Edward Island	1,546	108	108	6.97%	6.97%
Nova Scotia	9,897	861	861	8.70%	8.70%
New Brunswick	7,497	643	643	8.57%	8.57%
Quebec	77,700	8,935	6,283	11.50%	8.09%
Ontario	107,715	9,480	9,480	8.80%	8.80%
Manitoba	13,205	773	773	5.85%	5.85%
Saskatchewan	13,298	709	709	5.33%	5.33%
Alberta[1]	38,802	295	704	0.76%	1.81%
British Columbia	39,926	2,253	2,253	5.64%	5.64%
Totals/Averages	317,722	24,894	22,250	7.84%	7.00%

Source: Provincial Public Accounts as of March 31, 2011 (Ontario data reflect 2011-12 Actuals in 2012 Budget).

1 Alberta's officially reported debt charges in 2011 exclude interest paid by the Alberta Capital Finance Authority. These are estimated and included in the Bond Interest column.

The approach the paper uses to determine the probability relies on simulation. The study assumes that various budget elements are functions of macroeconomic variables such as GDP, population, inflation and interest rates. We use computer generated random numbers to create one million scenarios for inflation, interest rates, labor force participation, productivity, unemployment on an annual basis for the next 30 years. The distributions of these randomly generated macroeconomic values are based on regression analysis of historical data collected from Statistics Canada and other sources. Annual GDP forecasts for each province are based on population forecasts (discussed below) as well as our randomly generated labor force participation, productivity, unemployment and inflation rates.[16] Next, we compute total revenues, expenditures, deficits (or surpluses), future debt levels and future debt service requirements for each scenario. The number of scenarios in which debt service exceeds 25 percent for a given year divided by the total number of scenarios evaluated gives us the default probability for that year.

The paper models most revenue items as functions of nominal GDP, but models natural resource revenue as a function of GDP growth and oil or gold prices, depending upon which commodity is dominant in the province. Health expenditures are specified as a function of senior population[17] and health cost inflation, while education spending is assumed to be a function of the number of school aged children and general inflation. In both cases, we add one percent to the inflation rate to better approximate expected wage inflation for these two labor-intensive service categories. Population forecasts by age cohort were obtained from Statistics Canada.[18] I adjusted these forecasts to reflect differences between actual and forecast 2011 population.

Health care cost inflation is assumed to be 0.5 percent greater than general price inflation. This is consistent with the difference between the annualized change in the health care price index and the general price index for the 30-year period ending December 2011.[19] Over the last ten years, the health and general price indices have changed at roughly the same rate, so this assumption may be overly pessimistic. On the other hand, increased utilization driven by population aging should be expected to affect relative prices as provincial health facilities need to increase compensation to attract medical staff.

16 We built up GDP from these components in order to capture the impact of declining labor force size arising from population aging.

17 Senior population rather than overall population is utilized, since seniors consume a disproportionate amount of health services.

18 We used scenario M1 (medium growth based on 1981-2008 historical changes) from StatCan series 52-0005. The 2010 StatCan study, entitled Population Projections for Canada, Provinces and Territories 2009 to 2036 is available in PDF form at http://www.statcan.gc.ca/pub/91-520-x/91-520-x2010001-eng.pdf. The report includes nationwide population forecasts through 2061. We used the nationwide figures to extrapolate provincial trends from 2036 to 2042.

19 As reported in CANSIM Table 326-0020.

Table 16 lists the major macroeconomic and budget assumptions used in our budget simulation models.

TABLE 16 Key Budget Forecasting Assumptions

Element	Estimation Assumptions
Population - Broken Down By Age Category	2011 Population Estimates with Annual Increases Based on StatCan's M1 Population Forecast
Labor Force Participation	Autoregressive function based on previous actuals in CANSIM table 282-0001 with random shocks
Unemployment	Autoregressive function based on previous actuals in CANSIM table 282-0001 with random shocks
Productivity	Autoregressive function based on previous actuals in CANSIM table 383-0005 with random shocks
Real GDP	Annual growth rate based on growth in employed population and productivity
Inflation	Autoregressive function based on previous actuals in CANSIM table 326-0021 with random shocks
Health Cost Inflation	Inflation plus 0.5%
Real Resource Prices	Autoregressive function based on previous actuals with random shocks. Only two resources were considered: oil (prices from http://inflationdata.com/inflation/inflation_rate/historical_oil_prices_table.asp) and gold (prices from http://www.nma.org/pdf/gold/his_gold_prices.pdf).
Coupon Rate on New Bond Issues	Transfer function based on previous year interest rate, simulated inflation rate and random shocks. This methodology does not routinely produce interest rate spikes during a fiscal crisis - as we have witnessed in the Eurozone. Since such spikes may be expected, actual default probabilities may be somewhat higher than those generated by the model.
Average Interest Rate Incurred by the Province	Weighted average of coupon on unmatured debt from prior year and coupon on new bond issues
Federal Assistance	Constant Percentage of GDP
Individual Income Tax	Constant Percentage of GDP
Corporate Income Tax	Constant Percentage of GDP
Sales Tax	Constant Percentage of GDP
Severance Tax	Annual change based on both change in GDP and change in nominal resource prices
Other Revenues	Constant Percentage of GDP
Health Expenditures	Annual change based on Health Cost Inflation and change in Senior Population
Education Expenditures	Annual change based on General Inflation and change in School Aged Population (decreases in this population are treated as no change)
Other Program Expenditures	Constant Percentage of GDP
Net Interest Expense	Average interest rate times prior year debt
Other Debt Charges	Constant Percentage of GDP
Terms	
Autoregressive process	The formula used in the simulation was derived by running a regression against historic time series data. The independent variable was the prior year's value. For example, this year's rate of inflation was assumed to be a function of last year's rate of inflation plus or minus some random amount.
Transfer function	The formula used in the simulation was derived by running a regression against historic time series data. The independent variables included prior year values of the same variable and curent year values of other variables. For example, this year's new issue coupon rate was assumed to be a function of last year's bond yields and of the current year's inflation rate plus or minus some random amount.
Random shocks	Normally distributed random numbers are generated and then scaled based on the standard deviation of historical data. As a result, data series that have been more volatile historically are assumed to be more volatile in the future.

We ran the simulation models in the Public Sector Credit Framework. PSCF is a free, open source budget simulation tool that can be launched from Microsoft Excel. The simulation models are available at http://www.publicsectorcredit.org/canadaprovinces.html. Readers are welcome to download the models and adjust them to reflect their own assumptions.

Summarized results of our simulation analysis are shown in Table 17.

TABLE 17 Annual Default Probabilities Generated by Budget Simulation Model

Fiscal Year	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
2013	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2014	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2015	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2016	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2017	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2018	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2019	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2020	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%
2021	0.01%	0.00%	0.00%	0.01%	0.00%	0.16%	0.01%	0.00%	0.00%	0.00%
2022	0.06%	0.00%	0.00%	0.05%	0.00%	0.58%	0.08%	0.00%	0.00%	0.00%
2023	0.21%	0.01%	0.03%	0.22%	0.01%	1.56%	0.38%	0.03%	0.08%	0.00%
2024	0.60%	0.07%	0.12%	0.62%	0.04%	3.32%	1.13%	0.14%	0.46%	0.02%
2025	1.31%	0.27%	0.36%	1.44%	0.14%	6.00%	2.66%	0.43%	1.63%	0.10%
2026	2.44%	0.74%	0.92%	2.84%	0.37%	9.65%	5.13%	1.03%	4.08%	0.34%
2027	4.09%	1.69%	1.98%	4.91%	0.83%	14.17%	8.59%	2.09%	8.15%	0.94%
2028	6.24%	3.34%	3.70%	7.67%	1.56%	19.36%	12.89%	3.69%	13.78%	2.11%
2029	8.82%	5.83%	6.21%	11.08%	2.66%	25.12%	17.85%	5.87%	20.50%	4.04%
2030	11.86%	9.19%	9.44%	14.94%	4.17%	31.09%	23.17%	8.61%	27.82%	6.73%
2031	15.14%	13.19%	13.25%	19.12%	6.01%	37.15%	28.52%	11.81%	35.26%	10.16%
2032	18.60%	17.63%	17.46%	23.38%	8.13%	42.96%	33.72%	15.27%	42.42%	14.14%
2033	22.20%	22.41%	21.89%	27.56%	10.40%	48.39%	38.63%	18.88%	49.11%	18.51%
2034	25.82%	27.25%	26.30%	31.56%	12.75%	53.43%	43.16%	22.58%	55.22%	23.04%
2035	29.33%	31.87%	30.68%	35.29%	15.11%	58.03%	47.30%	26.24%	60.70%	27.61%
2036	32.82%	36.32%	34.83%	38.76%	17.38%	62.18%	51.06%	29.84%	65.50%	32.01%
2037	36.14%	40.57%	38.70%	41.91%	19.57%	65.90%	54.45%	33.34%	69.72%	36.32%
2038	39.32%	44.54%	42.28%	44.73%	21.63%	69.26%	57.53%	36.64%	73.47%	40.36%
2039	42.32%	48.18%	45.60%	47.25%	23.56%	72.23%	60.28%	39.76%	76.71%	44.15%
2040	45.12%	51.47%	48.57%	49.44%	25.31%	74.92%	62.70%	42.65%	79.51%	47.59%
2041	47.72%	54.45%	51.25%	51.34%	26.86%	77.26%	64.82%	45.33%	81.94%	50.72%
2042	50.18%	57.11%	53.65%	52.99%	28.25%	79.32%	66.70%	47.79%	84.07%	53.56%

We do not attempt to model most discretionary fiscal changes, with one exception. Expenses for any given year are capped at 145% of revenues – slightly above the worst revenue to expense ratio found in a review of the Fiscal Reference tables dating back to 1981.[20] This cap reflects an assumption that provincial leaders will take steps to address extremely large deficits as they have in the past. Alberta is a major beneficiary of this cap and would have fared worse in the analysis had the cap not been imposed. It should be noted that Alberta is unique among the provinces in not currently imposing a sales tax, so it does have an added measure of fiscal flexibility. Table 18 presents the modeled default probabilities without the deficit cap.

20 The highest expense to revenue ratio since 1981 was 143.98%, recorded by Saskatchewan in fiscal 1986-1987.

TABLE 18 Annual Default Probabilities Generated by Budget Simulation Model without Deficit and Surplus Caps

Fiscal Year	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
2013	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2014	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2015	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2016	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2017	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2018	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2019	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2020	0.01%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%
2021	0.06%	0.00%	0.00%	0.01%	0.00%	0.16%	0.01%	0.00%	0.00%	0.00%
2022	0.27%	0.00%	0.00%	0.06%	0.00%	0.57%	0.09%	0.01%	0.08%	0.00%
2023	0.74%	0.02%	0.03%	0.24%	0.01%	1.53%	0.38%	0.05%	0.50%	0.00%
2024	1.65%	0.08%	0.11%	0.67%	0.04%	3.27%	1.15%	0.19%	1.87%	0.02%
2025	3.10%	0.30%	0.37%	1.53%	0.15%	5.95%	2.69%	0.54%	4.90%	0.11%
2026	5.15%	0.81%	0.96%	2.99%	0.40%	9.61%	5.21%	1.28%	9.92%	0.39%
2027	7.79%	1.84%	2.08%	5.12%	0.86%	14.18%	8.72%	2.51%	16.77%	1.05%
2028	10.89%	3.59%	3.89%	8.00%	1.63%	19.43%	13.09%	4.35%	25.01%	2.34%
2029	14.46%	6.23%	6.51%	11.51%	2.77%	25.26%	18.09%	6.79%	33.89%	4.41%
2030	18.38%	9.78%	9.93%	15.50%	4.32%	31.42%	23.48%	9.81%	42.74%	7.32%
2031	22.54%	13.89%	13.92%	19.75%	6.19%	37.58%	28.88%	13.21%	51.03%	10.98%
2032	26.71%	18.48%	18.30%	24.08%	8.32%	43.55%	34.12%	16.84%	58.44%	15.15%
2033	30.85%	23.32%	22.82%	28.29%	10.63%	49.11%	39.02%	20.60%	64.94%	19.64%
2034	34.87%	28.22%	27.25%	32.32%	13.00%	54.19%	43.54%	24.36%	70.46%	24.28%
2035	38.73%	32.79%	31.61%	36.03%	15.34%	58.75%	47.66%	28.10%	75.17%	28.85%
2036	42.41%	37.21%	35.73%	39.48%	17.63%	62.86%	51.36%	31.67%	79.12%	33.31%
2037	45.82%	41.41%	39.58%	42.60%	19.82%	66.52%	54.76%	35.08%	82.51%	37.57%
2038	49.01%	45.33%	43.15%	45.38%	21.88%	69.83%	57.82%	38.34%	85.38%	41.63%
2039	51.98%	48.95%	46.39%	47.84%	23.76%	72.80%	60.53%	41.41%	87.74%	45.32%
2040	54.71%	52.21%	49.32%	49.97%	25.47%	75.44%	62.93%	44.21%	89.71%	48.67%
2041	57.23%	55.12%	51.96%	51.85%	27.02%	77.73%	65.03%	46.82%	91.33%	51.73%
2042	59.54%	57.75%	54.33%	53.48%	28.38%	79.73%	66.88%	49.26%	92.68%	54.50%

While this additional set of probabilities are provided for comparative purposes, it is more accurate to anticipate a policy response to large deficits. We thus use the probabilities calculated with the cap (shown in Table 17) as the basis for further analysis below.

Since all provinces have interest expense to revenue ratios well below 25 percent at present, the model returns zero default probabilities for the first several years. Clearly a default probability of absolute zero is impossible. Some extreme event, like a natural disaster, could prevent a province from performing on its bonds. Consequently, we impose a floor of 0.00001 percent per year on the model outputs.[21] Default probabilities reflecting these floors are presented for 1, 5, 10, 15, 20 and 30 year terms in Table 19.

21 Of course, a cataclysm could also cause a federal default. Given the nation's greater size and diversity, it is fair to assume that a default arising from an extreme natural disaster would be more likely in a province. The 0.000001 percent annual floor is meant to capture this difference in disaster risk. The selected floor is significantly below the triple-A ratings implied default probabilities listed in Table 13 and was chosen to avoid creating the impression that subsidies were present in the absence of default risk measured by the simulation.

TABLE 19 Model Default Probabilities for Selected Terms
Results Subject to Annual 0.00001% Floor

	1 Year	5 Year	10 Year	15 Year	20 Year	30 Year
Newfoundland	0.00001%	0.00005%	0.05660%	4.08880%	18.59660%	50.17680%
Prince Edward Island	0.00001%	0.00005%	0.00110%	1.68660%	17.63200%	57.11220%
Nova Scotia	0.00001%	0.00005%	0.00260%	1.98180%	17.46440%	53.64520%
New Brunswick	0.00001%	0.00005%	0.05310%	4.90770%	23.38380%	52.98790%
Quebec	0.00001%	0.00005%	0.00110%	0.82600%	8.13260%	28.25250%
Ontario	0.00001%	0.00005%	0.58440%	14.16590%	42.95900%	79.31740%
Manitoba	0.00001%	0.00005%	0.08250%	8.58690%	33.71920%	66.70040%
Saskatchewan	0.00001%	0.00005%	0.00460%	2.08510%	15.27130%	47.78710%
Alberta	0.00001%	0.00005%	0.00470%	8.14500%	42.41700%	84.07010%
British Columbia	0.00001%	0.00005%	0.00010%	0.93810%	14.13620%	53.56130%

After several years, scenarios which have persistently low rates of GDP growth and/or high inflation generate default events in all provinces, as GDP-driven tax revenues fail to keep up with growing health care costs. Given declining fertility rates, education costs are less of a solvency concern under this approach. The model is also sensitive to interest rates since these directly affect debt service costs, but the impact of interest rate changes is initially blunted by the fact that most provincial debt is long term, carrying fixed rates of interest.[22] Thus, even in high interest rate scenarios, costly future debt issues are weighted against outstanding debt carrying lower rates.

By the end of the forecast period, all provinces have high default probabilities ranging up to 84 percent. At the thirty year threshold the benefits of low current interest rates are assumed to have disappeared, with provincial bond yields distributed around their post-World War II historical mean of roughly 7 percent.

The model assigns Ontario the highest default probabilities at the 10, 15 and 20 year terms. This is due to Ontario's relatively high stock of public debt (second to Quebec as a proportion of GDP) and high deficits. Since the model projects revenue and expenditure patterns on 2010-2011 actuals obtained from the public accounts and 2011-2012 projections in provincial budgets, Ontario's high deficits are assumed to persist.

At the 30-year threshold, the model assigns the highest default probability to Alberta, despite the fact that this province carries the highest bond ratings and is the only province that currently has no Net Debt. Alberta performs relatively poorly in the model analysis for two reasons. First, the province is running substantial budget deficits today. As with Ontario, these deficits are projected to persist. Second, StatCan projects that Alberta will experience more rapid growth in its senior citizen population than any other province. Since the size of the senior population is assumed to drive health costs, the implicit assumption is that Alberta will be driven further and further into the red.

By contrast, StatCan projects relatively less growth in the senior populations of Quebec and Saskatchewan, the provinces with the lowest estimated default probabilities at the thirty year horizon. Although Quebec is currently running deficits, it also has relatively little dependence on volatile resource revenues.

By the end of the forecast period, all provinces have high default probabilities ranging up to 84 percent.

The model may understate Newfoundland's default probabilities for two reasons. First, the projection of future non-resource revenues as a constant percentage of GDP based on 2011 proportions misses the reduction in federal assistance attendant to the expiration of the Atlantic Accord. Second, oil revenue projections assume that exploitation can continue through the forecast period, thus neglecting the possibility that the province's resources will be exhausted.

22 The annual rate at which each province's bonds mature and are replaced by new issues was estimated based on current maturity profile data gathered from the Bloomberg Professional terminal.

Loss Given Default

The historical survey of defaults and fiscal crises presented in Appendix B provides some evidence regarding potential recovery rates. However, in most of the cases cited, recoveries were enhanced due to intervention from a higher level of government. In the case of Alberta, federal funds were an integral part of the province's 1945 debt reorganization. In the US state of Arkansas, a federal agency refinanced debt that had previously been in default. In the case of New South Wales, the Australian Commonwealth almost immediately made up defaulted coupon payments, virtually eliminating realized losses in present value terms.

If the purpose is to understand what interest rates should be in the absence of federal intervention, we need to either gross up the losses identified in Appendix B or consider other cases in which a larger unit of government did not provide funds.

In a recent study, Moody's published recovery rates for 15 sovereign defaults between 1998 and 2010. The simple average recovery rate for this universe was 53 percent. The two largest defaults in the sample: those of Russia in 1998 and Argentina in 2001, had more dismal recovery rates of 18 percent and 27 percent respectively.[23]

Since all provinces have interest expense to revenue ratios well below 25 percent at present, the model returns zero default probabilities for the first several years.

Cruces and Trebesch reviewed a larger set of sovereign defaults dating back to 1978 and including cases that involved defaults on bank loans (as opposed defaults that only affected bonds), computing an average recovery rate of 60 percent.[24]

Most recently, private holders of Greek bonds agreed to accept a 70 percent reduction in the present value of their securities – a 53.5 percent reduction in principal with the remaining loss of value coming from lower rates of interest.[25] While it is true that government creditors are not taking a write-down, the impact on private bondholders would likely have been worse in the absence of the European Union rescue package Greece received.

The Argentina example seems especially relevant to what a Canadian provincial default might look like in the absence of federal intervention. Argentina is a relatively advanced country that has experienced repeated fiscal problems arising from high social welfare spending. Unlike Greece, it was not part of a larger currency union. As was the case with Argentina, an unsupported defaulting province should be expected to prioritize social services over making amends with creditors. In each case, beneficiaries of social services outnumber bondholders among the electorate. On the other hand, a defaulting province would likely face more pressure to rejoin the financial system than Argentina, which is not only a sovereign but one with a relatively contrarian stance.

Given these considerations, this study concludes that a recovery rate assumption somewhat above that of Argentina's 27 percent recovery seems reasonable. It will thus assume a 40 percent recovery rate equating to a 60 percent loss given default in our analysis.

Expected Loss

The expected loss on a risky bond is its default probability multiplied by its loss given default. It's the average amount you would lose if you invested in the bond a large number of times.

Earlier, we presented the concept of rating implied default probabilities and estimated these probabilities for highly rated bonds. Rating implied expected losses are simply rating implied default probabilities multiplied by a loss given default (LGD) assumption. Now that we have established a 60 percent LGD assumption, we can derive a set of rating

23 Moody's Investors Service (May 2011), Sovereign Default and Recovery, 1983-2010., http://www.naic.org/documents/committees_e_capad_vos_c1_factor_review_sg_related_docs_moodys_sovereign_default.pdf. Recovery rate quoted is based on the market price of the defaulted sovereign's bonds 30 days after default.

24 Cruces, Juan J. & Trebesch, Christoph (November 2010). Sovereign Defaults: The Price of Haircuts. CESinfo Working Paper No. 3604. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1943411. The average 60 percent recovery was based on market price of defaulted debt. They found a 63 percent average recovery rate based on the present value of realized versus contractual cashflows.

25 Reuters (February 21, 2011). Europe seals new Greek bailout but doubts remain. http://www.reuters.com/article/2012/02/21/us-greece-idUSTRE8120HI20120221.

implied expected losses. Similarly, we can apply the 60 percent LGD factor to the default probabilities calculated by our projection models to obtain modeled expected loss rates.

Expected loss rates derived from the rating implied default probabilities and modeled default probabilities are shown in Tables 20 and 21 respectively.

TABLE 20 Expected Losses Based on Rating Implied Default Probabilities

Assumes 60% Loss Given Default

	1 Year	5 Year	10 Year	15 Year	20 Year	30 Year
Newfoundland	0.01%	0.22%	0.58%	1.35%	2.26%	4.40%
Prince Edward Island	0.03%	0.35%	0.88%	1.89%	3.03%	5.55%
Nova Scotia	0.01%	0.22%	0.58%	1.35%	2.26%	4.40%
New Brunswick	0.01%	0.13%	0.36%	0.97%	1.67%	3.37%
Quebec	0.01%	0.17%	0.44%	1.16%	1.97%	3.89%
Ontario	0.00%	0.09%	0.25%	0.72%	1.25%	2.56%
Manitoba	0.01%	0.10%	0.28%	0.72%	1.25%	2.56%
Saskatchewan	0.00%	0.03%	0.09%	0.22%	0.41%	0.94%
Alberta	0.00%	0.00%	0.01%	0.02%	0.03%	0.06%
British Columbia	0.00%	0.01%	0.03%	0.08%	0.16%	0.36%

TABLE 21 Expected Losses Based on Model Default Probabilities

Assumes 60% Loss Given Default

	1 Year	5 Year	10 Year	15 Year	20 Year	30 Year
Newfoundland	0.00%	0.00%	0.03%	2.45%	11.16%	30.11%
Prince Edward Island	0.00%	0.00%	0.00%	1.01%	10.58%	34.27%
Nova Scotia	0.00%	0.00%	0.00%	1.19%	10.48%	32.19%
New Brunswick	0.00%	0.00%	0.03%	2.94%	14.03%	31.79%
Quebec	0.00%	0.00%	0.00%	0.50%	4.88%	16.95%
Ontario	0.00%	0.00%	0.35%	8.50%	25.78%	47.59%
Manitoba	0.00%	0.00%	0.05%	5.15%	20.23%	40.02%
Saskatchewan	0.00%	0.00%	0.00%	1.25%	9.16%	28.67%
Alberta	0.00%	0.00%	0.00%	4.89%	25.45%	50.44%
British Columbia	0.00%	0.00%	0.00%	0.56%	8.48%	32.14%

Risk Aversion Factor

Remolona, Scatigna, & Wu[26] estimated risk aversion factors based on rating implied expected losses. To do this, they compared a set of rating implied expected losses with sovereign credit default swap spreads. A credit default swap (CDS) is an insurance policy on a bond. If you buy a CDS and the bond defaults, you are entitled to give the insurer the bond in exchange for its face value in cash. Thus, CDS prices (which are known as spreads in the market), reflect the price of default risk on that bond.

26 Remolona, E., Scatigna, M. & Wu, E. Interpreting Sovereign Spreads (March 2007), BIS Quarterly Review, http://www.bis.org/repoffice-publ/arpresearch_fs_200703.02.pdf.

Remolona, Scatigna, & Wu found that the risk aversion factor (which they simply refer to as a multiple of the spread over the rating implied expected loss) varied with credit rating. Higher rated bonds had higher risk aversion factors. While their sample included mostly speculative grade bonds, they found that one investment grade issue – that of Korea – had a risk aversion factor of between 7 and 17. At the time, Korean bonds had CDS spreads of 0.55 percent, but rating implied expected losses estimated by the authors between roughly 0.03 percent and 0.09 percent

Risk aversion varies by individual, but is aggregated when individuals participate in a market. It is reasonable to think that the individuals who invest in provincial bonds are, on average, more risk averse than individuals who invest in stocks, which have both much greater risk and much greater potential reward. It is also reasonable to suppose that investors in higher rated bonds are more risk averse than investors in lower rated bonds. People who invest in the highest rated bonds do so because they want to know that their money is safe.

Bloomberg provides CDS spreads for 29 sovereign issuers whose average rating from four international rating agencies are in the first seven categories. The CDS contracts with the most liquidity are those with five and ten year terms, so we only considered those two contract lengths. We compared the CDS spreads with the rating implied expected loss rates to infer risk aversion factors by rating grade.

Following is the analysis presented step by step. First, we reproduce a portion of the rating implied default probability chart presented earlier.

TABLE 22 Selected Rating Implied Default Probabilities

Rating Grade	5 Years	10 Years
1	0.0041%	0.0138%
2	0.0434%	0.1380%
3	0.0952%	0.2760%
4	0.1988%	0.5520%
5	0.3654%	0.9660%
6	0.6538%	1.6560%
7	1.0220%	2.4840%

Multiplying these probabilities by our 60 percent loss given default assumption, I derive the following rating implied expected loss rates:

TABLE 23 Selected Rating Implied Expected Loss Rates

Rating Grade	5 Years	10 Years
1	0.0025%	0.0083%
2	0.0260%	0.0828%
3	0.0571%	0.1656%
4	0.1193%	0.3312%
5	0.2192%	0.5796%
6	0.3923%	0.9936%
7	0.6132%	1.4904%

The average sovereign CDS spreads are presented next. It is important to note that the spreads do not uniformly increase with rating category. In other words, more risky sovereign bonds appear to yield more income in certain cases. This could be an indication of lack of liquidity in certain CDS issues or the market's disagreement with certain rating assignments.

TABLE 24 Average Credit Default Swap Spreads by Rating Grade

Rating Grade	5 Years	10 Years
1	0.8073%	0.9803%
2	0.9218%	1.0948%
3	1.6305%	1.9339%
4	1.2044%	1.4290%
5	1.3475%	1.6338%
6	2.4108%	2.5555%
7	1.8910%	2.2343%

Source: Bloomberg Professional Terminal

We divide these spreads by the expected loss rates above to derive risk aversion factors, and then average the results for the two maturities and smooth these averages. Smoothing was performed to ensure that rating implied spreads (calculated below) move inversely with ratings. For example, we need to avoid a situation in which the rating implied spreads for triple-A bonds are higher than those for double-A bonds. Such an outcome would not persist, since it would be rational for investors holding double-A bonds to move into triple-A bonds, which would be both less risky and more lucrative.

TABLE 25 Implied Risk Aversion Factors
CDS Spreads Divided By Rating Implied Expected Loss Rates
Quotients of Values in Tables 24 and 23

Rating Grade	5 Years	10 Years	Average	Smoothed
1	328.17	118.39	223.28	125
2	35.40	13.22	24.31	35
3	28.55	11.68	20.11	17
4	10.10	4.31	7.21	10
5	6.15	2.82	4.48	7
6	6.15	2.57	4.36	5
7	3.08	1.50	2.29	3

So our risk aversion factors range from 3 for bonds rated A-/A1/A (low) all the way up to 125 for bonds rated AAA/Aaa.

Actual Versus Theoretical Interest Rates – Is There a Federal Subsidy?

Now that we have derived default probabilities, established an LGD assumption and inferred risk aversion factors from CDS spreads, we can estimate unsubsidized spreads for each province for each term. We can then compare these theoretical spreads to actual spreads to determine whether a subsidy exists, and, if so, how large it might be.

Earlier we presented rating expected loss rates by province using our two methodologies. We now transform these expected loss rates into spreads by incorporating the risk aversion factor, following an approach outlined in Appendix A. Our two estimates of theoretical spreads are as follows:

TABLE 26 Rating Implied Spreads

	1 Year	5 Year	10 Year	15 Year	20 Year	30 Year
Newfoundland	0.14%	1.64%	3.09%	4.28%	4.71%	4.68%
Prince Edward Island	0.30%	2.03%	3.50%	4.54%	4.85%	4.72%
Nova Scotia	0.14%	1.64%	3.09%	4.28%	4.71%	4.68%
New Brunswick	0.09%	1.26%	2.62%	3.97%	4.50%	4.59%
Quebec	0.11%	1.40%	2.79%	4.11%	4.59%	4.63%
Ontario	0.07%	1.19%	2.61%	4.04%	4.55%	4.61%
Manitoba	0.08%	1.29%	2.75%	4.05%	4.57%	4.63%
Saskatchewan	0.04%	0.87%	2.22%	3.44%	4.05%	4.27%
Alberta	0.01%	0.30%	1.16%	2.11%	2.83%	3.52%
British Columbia	0.02%	0.56%	1.70%	2.82%	3.49%	3.94%

TABLE 27 Model Implied Spreads

	1 Year	5 Year	10 Year	15 Year	20 Year	30 Year
Newfoundland	0.00%	0.01%	0.89%	5.34%	6.29%	5.26%
Prince Edward Island	0.00%	0.00%	0.10%	4.02%	6.23%	5.26%
Nova Scotia	0.00%	0.01%	0.18%	4.33%	6.25%	5.26%
New Brunswick	0.00%	0.01%	0.88%	5.64%	6.42%	5.26%
Quebec	0.00%	0.01%	0.11%	3.22%	5.65%	5.20%
Ontario	0.00%	0.01%	3.14%	7.34%	6.65%	5.27%
Manitoba	0.00%	0.01%	1.44%	6.90%	6.62%	5.27%
Saskatchewan	0.00%	0.02%	0.58%	5.93%	6.54%	5.27%
Alberta	0.00%	0.02%	0.73%	7.54%	6.68%	5.27%
British Columbia	0.00%	0.02%	0.11%	5.36%	6.57%	5.27%

The careful reader will notice some apparent oddities about the long term spreads at the right end of Table 27. Specifically, there is little variance in the 30 year spreads and they are lower than the 20-year spreads, despite the very high and varying default probabilities shown in Table 17. These are byproducts of the functional form described in Appendix A. The calculated spreads are affected by the fact that default is assumed to be far in the future and thus heavily discounted in present value terms. Further, the impact of default is offset by the large number of interest payments the investor receives prior to the payment failure.

Next we compare these theoretical spreads to the actual yield spreads presented earlier in Table 6. More precisely, we subtract the theoretical spreads from the actual spreads. Consequently, negative values reflect actual spreads below theoretical spreads, which would indicate a subsidy. For ease of understanding, the negative differences are highlighted in red.

TABLE 28 Difference Between Actual Spreads and Rating Implied Spreads

	1 Year	5 Year	10 Year	15 Year	20 Year	30 Year
Newfoundland	0.14%	-1.02%	-2.04%	-3.33%	-3.77%	-3.68%
Prince Edward Island	-0.15%	-1.29%	-2.36%	-3.44%	-3.79%	-3.63%
Nova Scotia	0.04%	-1.04%	-2.04%	-3.31%	-3.73%	-3.68%
New Brunswick	0.02%	-0.65%	-1.67%	-2.97%	-3.45%	-3.51%
Quebec	0.04%	-0.83%	-1.74%	-3.09%	-3.53%	-3.59%
Ontario	0.06%	-0.60%	-1.62%	-2.99%	-3.64%	-3.60%
Manitoba	0.05%	-0.76%	-1.90%	-3.13%	-3.63%	-3.72%
Saskatchewan	0.08%	-0.38%	-1.31%	-2.53%	-3.25%	-3.40%
Alberta	0.19%	0.14%	-0.28%	-1.31%	-2.07%	-2.65%
British Columbia	0.10%	-0.01%	-0.81%	-1.91%	-2.62%	-3.02%

TABLE 29 Difference Between Actual Spreads and Model Implied Spreads

	1 Year	5 Year	10 Year	15 Year	20 Year	30 Year
Newfoundland	0.28%	0.62%	0.16%	-4.39%	-5.35%	-4.26%
Prince Edward Island	0.16%	0.73%	1.04%	-2.93%	-5.17%	-4.17%
Nova Scotia	0.18%	0.59%	0.87%	-3.35%	-5.27%	-4.26%
New Brunswick	0.11%	0.61%	0.07%	-4.64%	-5.37%	-4.18%
Quebec	0.14%	0.56%	0.95%	-2.21%	-4.59%	-4.16%
Ontario	0.13%	0.58%	-2.15%	-6.30%	-5.74%	-4.25%
Manitoba	0.13%	0.52%	-0.60%	-5.99%	-5.68%	-4.35%
Saskatchewan	0.12%	0.48%	0.33%	-5.02%	-5.75%	-4.40%
Alberta	0.20%	0.42%	0.15%	-6.73%	-5.93%	-4.40%
British Columbia	0.12%	0.52%	0.77%	-4.45%	-5.70%	-4.36%

Most of the numbers in the leftmost columns of the two tables are positive or only somewhat negative. Under both analysis methods, we find that most provinces carry little or no near term default risk, so their theoretical spreads are low.

Toward the right end of the tables, we see more instances of negative numbers. This could reflect investor expectations of federal bailouts of provinces over the long term. It could also show that investors expect provinces to take corrective action. Or, it could reflect a failure on the part of investors to assess long term default risks given the complexity of performing long term provincial credit analysis.

Conclusion

The interest burden borne by Canadian provinces is well below levels historically associated with default. Under the current regime of low global interest rates, it is virtually impossible for the interest expense to revenue ratio to reach a critical threshold in any province in the near term. Provinces thus appear to have no material risk of defaulting within the next five years, and only a remote possibility of defaulting in ten years. The modest premia offered by provincial bonds maturing within ten years over comparable federal securities fairly - or even richly - rewards investors.

Under the current regime of low global interest rates, it is virtually impossible for the interest expense to revenue ratio to reach a critical threshold in any province in the near term.

Over the longer term, the aging population, persistent deficits and the possibility of lower commodity prices, introduce significant default risk, as estimated by the models introduced in this paper. Relatively low provincial bond yields at 15, 20 and 30 year maturities may indicate an expectation that the federal government will step in to prevent provincial defaults as it did during the Great Depression.

Appendix A: More on Interest Rate Decomposition

The interest rate decomposition discussion in the main text was simplified for the benefit of general readers. Here we remove some of those simplifications so that readers versed in fixed income concepts and terminology can better understand and replicate my calculations.

The simplified formula presented in the main text was:

Risky Interest Rate = Risk Free Rate + (Default Probability x Loss Given Default x Risk Aversion Factor)

This is oversimplified because Risk Aversion cannot be accurately expressed as a single value. The effect of risk aversion on a bond spread varies with the bond's term and its coupon rate. The full spread decomposition formula presented by Agrawal, Arora and Bohn is as follows:

Where: $Spread = \frac{-1}{Dur} \ln(1 - N\left[N^{-1}(DP) + \rho\lambda\sqrt{Dur}\right] x\ LGD$

Spread = The difference in yield between the risky bond and the risk-free bond

Dur = The bond's duration. As originally defined, duration refers to the amount of time it takes an investor to recoup his initial cash investment in a bond in present value terms. When coupons are paid, the duration is always shorter than the bond's term.

ln = Natural logarithm

N = The proportion of the standard normal distribution to the left of the bracketed expression that follows

N^{-1} = The inverse of the proportion of the standard normal distribution to the left of the parenthetical expression that follows

DP = Default Probability

ρ = Correlation between the bond and the overall market. I assume that this is 1 for Provincial bonds.

λ = The market price of risk

LGD = Loss Given Default

In the main text, we used the short hand concept of a risk aversion factor to capture all elements in this equation aside from DP and LGD. Since I fixed correlation (ρ) at 1, the main remaining factors are duration and the market price of risk (λ). To compute duration, I assumed a discount rate of 4 percent and a semiannual coupon of 4 percent. I then selected values of λ to achieve ratios of spread and expected loss broadly consistent with those shown in Table 25 in the main text.

We matched these ratios for the five year term only. Given the above equation's functional form, the ratio between spread and expected loss varies with term. The reasoning for choosing the five year term is as follows: the risk aversion factors were derived from Credit Default Swap spreads and the most liquid CDS contracts have five year terms. In fact, very little trading takes place for terms other than five and ten years.

Table A.1 repeats the ordinal ratings by province shown in the main text, along with their implied five year risk aversion factors and the values of λ (market price of risk) used to generate the rating implied and model spreads for all terms. Since the average ordinal ratings from the three agencies are not integers, the risk aversion factors have been interpolated from the values shown in Table 25.

Table A.1 Provincial Credit Ratings as Ordinal Numbers with Risk Aversion Factors and Values of Lambda (λ)

	DBRS	Moody's	S&P	Simple Average	Risk Aversion Factor (5 Year Maturity)	Market Price of Risk (λ)
Newfoundland	6	3	5	4.67	7.88	0.72
Prince Edward Island	7	3	6	5.33	6.26	0.71
Nova Scotia	6	3	5	4.67	7.88	0.72
New Brunswick	5	3	4	4.00	10.00	0.73
Quebec	5	3	5	4.33	8.88	0.72
Ontario	4	2	4	3.33	14.24	0.77
Manitoba	5	2	3	3.33	14.24	0.79
Saskatchewan	3	2	1	2.00	35.00	0.87
Alberta	1	1	1	1.00	125.00	0.91
British Columbia	2	1	1	1.33	65.00	0.91

Later in their article, Agrawal, Arora and Bohn also suggest the existence of an additional spread driver related to issuer size. The argument is that larger bond issuers pay lower interest rates than smaller issuers, all other things being equal. Other authors have suggested a liquidity premium, the idea that bonds that trade more frequently have lower spreads than infrequently traded bonds. This factor may help explain the relatively high yields on near term Alberta bonds despite their apparent lack of credit risk. It may also contribute to the elevated level of Prince Edward Island yields. These two provinces have relatively small volumes of bonds outstanding due to either a strong fiscal position (in the case of Alberta) or small absolute size (in the case of Prince Edward Island).[27]

27 For a discussion of liquidity effects on provincial bond yields see Lawrence Booth, George Georgopoulos & Walid Hejazi, "What Drives Provincial Bond Spreads", Canadian Journal of Economics, Vol. 40 No.3 (Aug. 2007), pp. 1008-1032.

Appendix B: Evidence from Past Defaults and Fiscal Crises

Canadian financial history records only one provincial default – that of Alberta in the mid-1930s. Since a single observation is a poor basis for estimating model parameters, we extended our analysis to consider provincial fiscal crises in which default was avoided, Canadian municipal defaults and state defaults in the US and Australia.

ALBERTA DEFAULT – 1935/1936

While the Great Depression affected public finances across Canada, the Western provinces were especially hard hit. In this era before widespread development of the nation's energy resources, the economies of these provinces were primarily based on agriculture. Declining food prices and tariff barriers imposed by the US cut deeply into agricultural incomes. Western provinces also entered the Great Depression with high levels of public debt.

This environment provided fertile ground for political change. In Alberta, the philosophy of Social Credit spread rapidly after being embraced by William Aberhart, an educator and religious leader who began promoting the philosophy during his radio sermons in 1932.[28] Three years later, the new Social Credit Party earned a landslide victory and Aberhart formed a majority government.

The Social Credit program was based on a belief that powerful financial interests were manipulating the availability of credit to the detriment of farmers and other producers. Social Credit proposed to remedy this situation by controlling the financial system and providing a monthly dividend to all adult citizens of the Province.

In August 1935, the outgoing government suspended redemption of Alberta Savings Certificates – small denomination bonds marketed to individuals. The new Social Credit government kept this moratorium in place. According to contemporary accounts, the government took this decision in response to a spike in redemptions just prior to and after the election. Speaking before Parliament in March 1936, Provincial Auditor James Thompson attributed the withdrawals to a "lack of confidence on the part of the investing public." He ascribed this lack of confidence to the fact that "the money markets are well aware that we have a very large public debt and they know that it takes a large portion of our revenue to meet the service charges on the debt that we already have."[29]

On April 1, 1936, the government defaulted on $3.2 million of maturing bond principal. It had only $550,000 in its sinking fund and was unable to secure a loan from the Dominion government for the remainder. The Dominion had offered to lend Alberta the funds required to avoid a default, but only on the condition that Alberta accept the imposition of a Loan Council, which would have supervised the Province's borrowing.[30]

On May 30, 1936, the Province unilaterally reduced interest rates on most of its outstanding bonds by up to half.[31] Negotiations with a committee representing bondholders were fruitless.

By 1945, Alberta had defaulted on $33.4 million in principal and $28.6 million in interest. Although Social Credit remained in office, William Aberhart had passed away – as had much of the party's radical program. The Dominion and the Province finally reached an agreement with each other and with bondholders to cure the default. Under the complex debt reorganization plan, different classes of bondholders received varying combinations of cash and new securities. The cash portion of the settlement came from a new $29.6 million bond issue, $9.4 million of Dominion subsidies and $8.3 million from the Province's reserves and appropriations.[32]

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28 John A. Irving, The Evolution of the Social Credit Movement. The Canadian Journal of Economics and Political Science, Vol. 14, No. 3 (Aug., 1948), pp. 321-341. This article explains the Social Credit philosophy and how it was applied in Alberta.

29 Lethbridge Herald, March 19, 1936, p. 3.

30 Lethbridge Herald, April 1, 1936, pp. 1-2.

31 Eric John Hanson, Paul Michael Boothe, Heather Edwards (2003). Eric J. Hanson's financial history of Alberta, 1905-1950. Calgary: University of Calgary Press.

32 Ascah, Robert L. Politics and the Public Debt: The Dominion, The Banks and Alberta's Social Credit. Edmonton: University of Alberta Press, pp. 129-131.

While bondholders ultimately received all unpaid principal and interest, owners of the defaulted 1936 bonds had to wait 9 years for their payout, producing a substantial loss in present value terms. Also, during this waiting period, they received only half of the contractually specified interest.

The present value loss can be estimated by comparing interest and principal payments investors actually received with those they would have received in the event of no default. In the latter case, it is appropriate to assume that investors would have re-invested their principal in similar bonds.

The defaulted 1936 bonds carried a coupon of 6 percent paid semiannually. At maturity on April 1, 1936 a holder of $100 of these bonds would have been entitled to receive $100 and an interest payment of $3 – half of the 6 percent coupon rate. Instead the investor just received the $3 coupon payment. Later in the year, after Alberta had unilaterally reduced its coupon rates by half, he would have only received $1.50. So the investor's total payout in 1936 was $4.50 instead of $103.00. From 1937 to 1944, he would have received 3 percent of his principal or $3 annually. Then, in 1945, he would have received all past due principal and interest amounting to $131.50.

In the alternative scenario in which Alberta had performed on its bonds, we assume that the investor received his full $103 on April 1, 1936, spent his $3 coupon and reinvested the $100 principal in another bond paying 6 percent. The table below shows the cashflows to the investor in both the no-default and default cases, discounting them at an annual rate of 6 percent. This calculation yields a loss given default in present value terms of 31 percent.

TABLE B.1 Maximum Present Value Loss on Alberta Defaulted Bonds Using 6% Reinvestment and Discount Rate

Year	Cash Received if No Default and Principal Reinvested at 6% Interest	Cash Actually Received	Discount Factor Based on 6% Rate	Present Value of Cash Received No Default	Default
1936	$106.00	$4.50	1.0000	$106.00	$4.50
1937	6.00	3.00	0.9434	5.66	2.83
1938	6.00	3.00	0.8900	5.34	2.67
1939	6.00	3.00	0.8396	5.04	2.52
1940	6.00	3.00	0.7921	4.75	2.38
1941	6.00	3.00	0.7473	4.48	2.24
1942	6.00	3.00	0.7050	4.23	2.11
1943	6.00	3.00	0.6651	3.99	2.00
1944	6.00	3.00	0.6274	3.76	1.88
1945	6.00	131.50	0.5919	3.55	77.83
Totals	**$160.00**	**$160.00**		**$146.81**	**$100.96**
				Loss	**$45.846**
				% Loss	**31.23%**

A problem with this estimation procedure is that it does not take into account the general reduction in interest rates that occurred during the Depression or the persistence of low interest rates during World War II. A more realistic reinvestment and discount rate under the circumstances would be 3 percent. If we substitute this rate into the analysis, the present value loss virtually disappears.

TABLE B.2 Maximum Present Value Loss on Alberta Defaulted Bonds Using 3% Reinvestment and Discount Rate

Year	Cash Received if No Default and Principal Reinvested at 3% Interest	Cash Actually Received	Discount Factor Based on 3% Rate	Present Value of Cash Received No Default	Default
1936	$103.00	$4.50	1.0000	$103.00	$4.50
1937	3.00	3.00	0.9709	2.91	2.91
1938	3.00	3.00	0.9426	2.83	2.83
1939	3.00	3.00	0.9151	2.75	2.75
1940	3.00	3.00	0.8885	2.67	2.67
1941	3.00	3.00	0.8626	2.59	2.59
1942	3.00	3.00	0.8375	2.51	2.51
1943	3.00	3.00	0.8131	2.44	2.44
1944	3.00	3.00	0.7894	2.37	2.37
1945	3.00	131.50	0.7664	2.30	100.78
Totals	**$130.00**	**$160.00**		**$126.36**	**$126.34**
				Loss	**$0.015**
				% Loss	**0.01%**

An alternative approach to measuring loss given default is to refer to the market value of defaulted bonds one month after the default occurs. The idea behind using a one month lag is that market participants may need some time to digest the fact that a default has occurred and properly assess its implications. Most bond markets are less liquid than equity markets, so they should not be expected to reach efficient, equilibrium prices as quickly. In the case of Alberta, the contemporary Moody's manual reports that during the week of April 29, 1936, Alberta bonds were quoted at 79 bid and 82 ask.[33] This means a bond dealer would have been willing to purchase $100 of Alberta bonds (in face value terms) for $79 and the dealer would have been willing to sell the same $100 of bonds for $82. This yields a mid-price (half way between the bid and ask) of $80.50, representing a loss given default of 19.50 percent.

In concluding our discussion of Alberta recoveries, it is worth noting that Alberta could not have cured the default without substantial assistance from the Dominion. Not only did the direct cash subsidy play a role, but we can safely assume that demand for the $29.6 million refunding issue would have been at best tepid in the absence of Dominion support for the debt reorganization. Thus, the realized Loss Given Default would have been higher in the absence of Dominion intervention.

Other Provinces during the Great Depression

As noted above, Alberta defaulted on a 1936 bond maturity after failing to obtain a loan from the Dominion. Alberta would likely have defaulted earlier in the absence of extraordinary Dominion support, as would other provinces. Ascah[34] reports that the Dominion provided substantial aid to both Manitoba and Saskatchewan in the late 1930s specifically to prevent them from defaulting. Dominion and Bank of Canada officials were concerned that multiple provincial defaults would negatively impact market opinions of Canada's credit at a time when it was hoping to refinance a large portion of its debt.

33 Moody's Municipal and Government Manual, 1937, p. a6.

34 Ascah, pp. 64-66.

According to MacGregor, the Dominion began making loans to Alberta, British Columbia, Manitoba and Saskatchewan in 1931.[35] By March 1936, loans outstanding to the four provinces amounted to $117 million with interest at 4-1/2 percent, of which $25 million had been lent to meet maturing obligations.[36] McGregor concludes that "All four western provinces would probably have defaulted on their interest payments if these loans had not been made."[37]

The table below shows the Dominion loans to the Western provinces in absolute dollar terms and as a percentage of Provincial debt for fiscal years 1932 to 1937.

TABLE B.3 Dominion Loans to Western Provinces
Dollars in Thousands

Fiscal Year	1932	1933	1934	1935	1936	1937
Manitoba	4,331	7,961	10,234	13,109	15,505	20,131
Saskatchewan	12,035	18,513	23,982	34,123	48,369	54,428
Alberta	5,143	6,000	10,051	11,977	25,081	25,886
British Columbia	5,784	5,726	7,048	15,014	27,573	31,545
Totals	$27,293	$38,199	$51,314	$74,223	$116,527	$131,990
As Percentage of Province's Outstanding Debt						
Fiscal Year	1932	1933	1934	1935	1936	1937
Manitoba	3.73%	6.80%	8.64%	10.84%	12.74%	16.10%
Saskatchewan	8.75%	12.68%	15.61%	19.68%	26.00%	30.15%
Alberta	3.33%	3.77%	6.35%	7.26%	14.60%	15.18%
British Columbia	3.93%	3.80%	4.57%	9.32%	16.15%	17.73%

Sources: Canada Public Accounts, Various Years and Royal Commission on Dominion-Provincial Relations, Public Accounts Inquiry, Appendices G, H, J & K, 1938.

In fiscal year 1938, the Dominion wrote off $18 million of the Saskatchewan loan, but outstanding balances continued to grow – reaching $157 million in aggregate by the early 1940s. In 1947, Parliament passed The Western Provinces Treasury Bills and Natural Resources Settlement Act which wrote off $55 million of the exposure and gave the four Provinces 30 years to pay off the remainder. In 1977, the loan balances finally disappeared from Canada's public accounts. Since a portion of each province's loan was written off by the 1947 Act, it is fair to say that all four provinces defaulted on a portion of their Depression-era debt.[38]

During the late 1930s, the staff of the Rowell-Sirois Royal Commission collected and standardized financial data from the nine provinces then in the Canadian Confederation. This data can be used to calculate a variety of fiscal ratios. The following table shows Net Debt Charges as a proportion of Revenue for each Province for various years. The commission reported various definitions of Revenue – we chose a definition that includes "Dominion Subventions and Grants in Aid", i.e. Dominion spending on behalf of Provinces for specific purposes. The commission's Net Interest figure includes interest on guaranteed bonds, sinking fund contributions and deducts interest income received by the Province. It is thus an imperfect measure of cash paid by each Province to meet interest requirements.

35 MacGregor, D. C. Federal-Provincial Financial Relations in Canada. The Economic Journal, Vol. 46, No. 181 (Mar., 1936), pp. 171-178.

36 Maxwell, J. A. The Adjustment of Federal-Provincial Financial Relations. The Canadian Journal of Economics and Political Science, Vol. 2, No. 3 (Aug., 1936), pp. 374-389.

37 MacGregor, p. 176.

38 This information was gathered from Canada Public Accounts, Various Years.

TABLE B.4 Net Debt Charges as a Percentage of Revenue (including Grants in Aid and Subventions) Instances of Federal Bailout Highlighted

	1913	1921	1929	1930	1931	1932	1933	1934	1935	1936
Prince Edward Island	6.90%	6.41%	10.13%	10.57%	10.97%	12.28%	14.21%	12.04%	11.30%	11.19%
Nova Scotia	18.95%	19.50%	25.42%	22.68%	20.73%	24.47%	29.93%	25.80%	21.33%	19.35%
New Brunswick	17.81%	37.52%	27.86%	30.45%	33.04%	42.43%	49.20%	45.32%	35.55%	33.32%
Quebec	11.13%	10.59%	4.67%	4.79%	7.55%	11.27%	13.98%	11.41%	11.77%	9.86%
Ontario	-1.30%	9.51%	16.36%	15.33%	16.27%	23.38%	24.48%	26.02%	21.29%	17.46%
Manitoba	14.75%	16.40%	16.67%	14.56%	23.02%	33.92%	27.52%	23.86%	21.77%	18.51%
Saskatchwean	7.88%	12.65%	13.72%	19.54%	22.94%	25.54%	31.94%	26.96%	28.29%	21.27%
Alberta	12.67%	31.98%	31.64%	30.17%	43.33%	37.03%	40.23%	37.01%	35.27%	17.20%
British Columbia	1.49%	19.13%	16.97%	20.20%	23.55%	26.79%	26.82%	23.57%	22.85%	19.73%

Source: Royal Commission on Dominion-Provincial Relations, Public Accounts Inquiry, 1938.

Provinces that defaulted or required a Dominion bailout reached peak Net Debt Charge to Revenue ratios in excess of 30 percent. Of the other five provinces, only New Brunswick exceeded the 30 percent threshold – but it surpassed this barrier by a substantial margin. The evidence would suggest that high debt service ratios are a necessary but not a sufficient condition for default.

The Roswell-Sirois report notes that "the self-subsistence nature of the [New Brunswick] economy reduced the necessity for extensive government relief."[39] Perhaps New Brunswick had not yet reached the point at which there were high expectations of government services, and could thus siphon away half of its revenue for debt service without fear of political upheaval. The Commission Report did characterize New Brunswick's debt buildup as "alarming" and said that "the Province's credit is now seriously threatened."[40]

NEWFOUNDLAND BAILOUT – 1932

Before becoming a Canadian province, Newfoundland enjoyed a long history as a self-governing colony and dominion within the British Empire. Parliament granted Newfoundland residents the franchise in 1832[41].

The colonial economy faced periodic crises, often resulting from disappointing fisheries. A particularly severe crisis followed a large fire that destroyed three-quarters of St. John's in 1892. In 1894, one of the island's major banks, The Commercial Bank, failed. This was followed by a run on other Newfoundland banks and worries that the colony would be unable to service its $11.2 million public debt. Annual revenues had fallen from $1.88 million in 1892 to $1.64 million in 1894, while public debt had risen from $6.4 million to $9.1 million, largely due to the costs of railway construction. The ratio of interest expense to revenues reached 27 percent at the height of the crisis in 1895.[42]

The Newfoundland government unsuccessfully sought aid from Great Britain. It then tried to negotiate a union with Canada, but was unable to obtain satisfactory debt relief from its larger sibling. After failing to raise private capital in both Montreal and New York, the Newfoundland government was able to successfully float a $2.8 million four percent issue in London, averting default.

The early 20th century witnessed some economic improvement, especially during World War I when the dominion benefited from high seafood prices. At the same time, public debt continued to increase, reaching $49 million by 1920.

39 Report of the Royal Commission on Dominion-Provincial Relations, 1940, p. 227.

40 Report of the Royal Commission on Dominion-Provincial Relations, 1940, p. 225.

41 The narrative that follows briefly summarizes the Amulree Report, available at http://www.heritage.nf.ca/law/amulree.

42 Revenue and debt figures from The Statesman's Yearbook, 1897, available on Google Books at http://books.google.com/books?id=JxM-NAAAAYAAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=falsehttp://books.google.com/books?id=-JxMNAAAAYAAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false.

During the 1920s, debt accumulation continued while revenues flattened. Fiscal year 1920 revenue of $10.6 million was not surpassed until fiscal 1930, when Newfoundland recorded $11.6 million in revenue. This was followed by a steep decline to $9.7 million in 1931 and $7.9 million in 1932. Volatile customs and excise duties accounted for over 70 percent of annual revenue throughout the period. Gross funded public debt reached $90 million by fiscal 1932 – 80 percent higher than it had been in fiscal 1920 and 1921.

As a result, Newfoundland's interest expense to revenue ratio exploded, rising from 20 percent in fiscal 1920 to 60 percent in fiscal 1932. In December 1932, the dominion was facing an imminent default on interest payments due January 1, 1933. The governments of Canada and the United Kingdom prevented the default by lending Newfoundland $1.25 million. The loan was to be serviced by a new royalty imposed on Imperial Oil, which had a petroleum monopoly offshore. Also, in consideration for the British-Canadian bailout, Newfoundland agreed to the appointment of a Royal Commission. The Amulree Commission, formed in 1933, terminated Newfoundland's century old parliament and imposed a government managed by six appointees – three of whom would not be from Newfoundland. This Commission form of government prevailed until Newfoundland and Labrador became the tenth Canadian province in 1949. At the time of its entry into the Canadian Dominion, the new Province was debt free.

Newfoundland reached an unusually high interest to revenue ratio prior to the British-Canadian bailout. It appears that the political system became able to accommodate very high interest burdens in the aftermath of the 1895 crisis. The dominion appears to have been finally done in by the sharp fall in revenues attendant to the onset of the Depression. In some cases, a high debt service burden may not be sufficient to trigger a default on its own, but it does leave the issuer much more vulnerable to insolvency if a financial reversal occurs.

SASKATCHEWAN FISCAL CRISIS – 1993

While there have been no provincial defaults since the Great Depression, a couple of fiscal crises do merit our attention. A review of these stress situations will help determine the upper bounds of sustainable interest expense to revenue ratios in a modern context.

As detailed in her book[43], *Minding the Public Purse*, Janice MacKinnon inherited a fiscal crisis when she was appointed Saskatchewan's Finance Minister in 1993. The crisis peaked when S&P lowered Saskatchewan's rating from A to BBB+, and the Province experienced difficulty selling new bond issues.

According to the Fiscal Reference Tables, the Province's Net Debt soared from -$1092 million (a surplus) in 1981-1982 to a peak of $7769 million in 1993-1994. Primary government bonded debt rose from $243 million to $8600 million according to Saskatchewan public accounts reports. During this period, the Province ran a deficit every year, with a peak shortfall in 1986-87 of $1232 million, or 7 percent of Saskatchewan's GDP.

MacKinnon criticizes the previous Conservative government for breaking the Province's long tradition of fiscal probity, seemingly unaware of Saskatchewan's insolvency in the 1930s and 1940s. That said, the 1980s experience clearly did constitute a departure from more judicious fiscal policies in the Post World War II era. Historical statistics show that Saskatchewan's Net Debt shrank after the Depression and did not return to its pre-War high in nominal terms until 1956. By 1975, Saskatchewan had the smallest Net Debt of any Province with the exception of Prince Edward Island.[44] Finally, as MacKinnon notes, the persistent deficits of the 1980s were attributable to low energy prices as well as poor fiscal management.

Forensic analysis of Saskatchewan's finances during the early 1990s crisis is complicated by accounting issues. After the New Democratic Party (NDP) replaced the Conservatives in 1991, the new government empaneled a special commission to review Provincial finances. The Financial Management Review Commission, more popularly known as the Gass Commission, identified a number of deficiencies in Saskatchewan's financial statements. It also noted that the Provincial Auditor had been criticizing Saskatchewan's financial reporting since 1984.[45] The Province's 1990-1991 Public Accounts include a qualified audit opinion citing concerns over unreported pension liabilities, assets reported

43 MacKinnon, Janice (2003). Minding the Public Purse. Montreal: McGill-Queen's University Press.

44 Bird, Richard M. (1999). Historical Statistics of Canada, Section H: Government Finance. Statistics Canada. http://www.statcan.gc.ca/pub/11-516-x/pdf/5500098-eng.pdf.

45 Gass, Don, et. al. (1992). Report of the Saskatchewan Financial Review Commission, p.17.

at amounts in excess of their value, and the failure to reflect all government activities in the financial statements of the consolidated fund. Subsequent official financial statements addressed these issues, producing a discontinuity in the time series data.

According to data from the Fiscal Tables – which are based on the Public Accounts – Debt Charges as a percentage of Revenues increased from 0.91 percent in Fiscal 1980-1981 to 10.20 percent in Fiscal 1990-1991. The Gass Commission published revised financial statements for Fiscal 1990-1991 that implied a much higher ratio of 17.16 percent. Most of the difference resulted from the Gass Commission attributing Crown Investment Corporation and Agriculture Credit Corporation debt to the primary government.

The ratio of Debt Charges to Total Revenues derived from Fiscal Revenue Tables data peaked at 18.65 percent in Fiscal 1993-1994. During this period, most Crown Investment Corporation debt but no Agriculture Credit Corporation debt had been transferred to the primary government.

It is worth noting that interest rates faced by Saskatchewan were much higher in the early 1990s than today. Most Province debentures paid rates of 9 percent or more. Since then, most of these high rate issues have matured or been called, resulting in a much lower interest burden at any level of debt.

Finally, it is worth emphasizing the Saskatchewan's fiscal crisis did not approximate a default. S&P's downgrade to BBB+ left the Province's debentures within the "investment grade" range as opposed to "speculative grade" territory and at least 11 notches above a default category. While MacKinnon says that the Province had difficulty selling new issues in Canada[46], it is unclear whether Saskatchewan could have found takers by offering an even higher rate of interest. On the other hand, MacKinnon reports that some ministers advocated default during a January 1993 cabinet meeting at which severe budget cuts and tax increases were debated. [47] In conclusion, it would appear that Saskatchewan's peak ratio of 18.65 percent is below the default threshold – but perhaps not too far below.

NEWFOUNDLAND AND LABRADOR FISCAL CRISES – EARLY 1990S AND EARLY 2000S

The only other province to have credit ratings in the "B" range in recent decades is Newfoundland and Labrador. S&P downgraded the province to BBB+ in 1994. Moody's rated Newfoundland Baa1 (which is equivalent to BBB+) from 1974 to 2002, while DBRS assigned the province an even more pessimistic rating - BBB (low) which is two notches lower – from 1993 to 2002.[48]

A 2003 report by Dave Norris[49] found that Newfoundland entered the Dominion with no debt in 1949, but then ran deficits in 51 of the next 54 years. Although many of these deficits were relatively small, there were occasional spikes – reaching a peak of 7 percent of GDP in the early 1970s. It is worth recalling that Newfoundland had run persistent deficits as an autonomous dominion prior to 1934 – resulting in a bail out and loss of home rule. It appears that this tendency toward fiscal imbalance re-established itself with the return of democratic rule in 1949.

In 1991, Finance Minister Hubert Kitchen declared that "we face a financial crisis which, if left unchecked, would impair permanently our ability to maintain public services at acceptable levels." A combination of layoffs, pay cuts, hospital bed closures and other service cuts enabled the province to balance its budget in Fiscal 1995-1996.[50]

Large deficits returned with the new millennium, reaching $914 million or 4.7 percent of GDP in fiscal 2003-2004. A new Progressive-Conservative government commissioned PriceWaterhouseCoopers to review the financial situation. The government then reduced public sector headcount, froze wages and cancelled a number of construction projects. It also raised tobacco taxes and eventually secured additional federal subsidies. Shortly thereafter, world oil prices rose substantially, increasing revenues and producing budget surpluses.[51]

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46 MacKinnon, p. 108.

47 MacKinnon, p. 121.

48 PriceWaterhouseCoopers (2003). Special Review – Financial Condition of the Province of Newfoundland & Labrador, Appendix 3. http://www.gov.nl.ca/financialsituation/pdf/Appendix%203%20Ratings.pdf.

49 Norris, Dave (2003). Royal Commission on Renewing and Strengthening Our Place in Canada: The Fiscal Position of Newfoundland and Labrador. http://www.gov.nl.ca/publicat/royalcomm/research/Norris.pdf.

50 Norris, p. 7.

51 This narrative based on the following news stories available on-line:

Fiscal Reference Tables data reflect peak Debt Charges to Revenue ratios of 27.91 percent in 1994-95 and 24.78 percent in 2002-2003. The first peak is misleading because it reflects an accounting change under which notional interest on pension underfunding was first added to Newfoundland's debt charge calculations. Public accounts documents show that Consolidated Fund Services – the unit that pays the Province's bond interest – had total expenditures of $538.69 million or 18.86 percent of revenues in Fiscal 1994-1995. At the second peak, the ratio between Consolidated Fund Service expenditures and Total Revenues in the public accounts is close to the ratio shown in the Fiscal Reference Tables. But, by this point, it appears that Consolidated Fund Services includes $270.2 million of notional interest on unfunded pension liabilities. Removing this notional amount reduces the 2002-2003 ratio to 16.95 percent.

Consolidated Fund Services in Newfoundland includes a variety of other non-interest expenses, so even the lower ratios reported above are overstated. According to estimates from DBRS reported by Norris, Newfoundland's interest expense to revenue ratio did not exceed 15 percent at either of the two peaks.[52]

AUSTRALIA AND NEW ZEALAND INTEREST ADJUSTMENTS – 1931 AND 1933

Given the limited record of historic provincial defaults, it is worth supplementing Canadian observations with data from peer nations. Although the Dominion of Canada came through the Great Depression with a clean payment record, the British Commonwealth of Australia and the Dominion of New Zealand were less fortunate.

Australia resolved a fiscal crisis in 1931 by increasing taxes, cutting spending and asking bondholders to participate in a conversion loan which reduced their coupon rates by 22.25 percent. The government promoted the conversion as a way for bondholders to voluntarily contribute to the Commonwealth's fiscal well-being. Most bondholders did voluntarily tender their holdings for conversion, but owners of about 3 percent of Australia's debt dissented. The government determined whether dissents were the result of personal hardship. In hardship cases, the Commonwealth redeemed the bonds for cash at full face value; otherwise the dissenter's bonds were converted on a compulsory basis.[53]

According to Moody's Bond Manual, interest represented 32.64 percent of revenues in Fiscal 1930-1931, when the Conversion Plan was authorized. The proportion fell to 23.22 percent in Fiscal 1931-1932 after the Plan was implemented.[54]

New Zealand implemented a similar conversion in March 1933. In this case, the interest reduction was 20 percent. As in the case of Australia, conversion was voluntary, but a 33 percent tax on interest was imposed on dissenters. Local authority interest rates were reduced by a similar proportion in May 1933. [55]

In fiscal 1932-1933, the year prior to the conversion, interest expense accounted for 37.66 percent of New Zealand's revenue. The proportion remained roughly the same in 1933-1934 as the conversion was effected, and then dropped to 30.71 percent in fiscal 1934-1935.[56]

The loss given default in present value terms on these conversions would depend on the initial coupon rate, the discount rate used and the time left to maturity. Assuming a 5 percent initial interest and discount rate, a holder of

"Premier vows public service wage freeze". Canadian Broadcasting Corporation. 5 January 2004. http://www.cbc.ca/news/canada/newfoundland-labrador/story/2004/01/05/nf_williams_20040105.html "Nfld. budget cuts projects, 4,000 jobs". Canadian Broadcasting Corporation. 30 March 2004. http://www.cbc.ca/news/canada/story/2004/03/30/nfld_bud040330.html "$2.6B deal sends Williams soaring in poll". Canadian Broadcasting Corporation. 8 March 2005. http://www.cbc.ca/news/canada/story/2005/03/08/williams-poll050308.html. "Oil-rich Newfoundland to post modest surplus". CTV. 3 November 2005. http://edmonton.ctv.ca/servlet/an/local/CTVNews/20051103/newfoundland_budget_051103?hub=SWOHome

52 Norris, p. 89.

53 Bland, F. A. & Mills, R. C. (November 1931). Financial Reconstruction: An Examination of the Plan Adopted at the Premier's Conference, 1931. The Economic Record, pp. 161-176.

54 Moody's 1934 Municipal and Government Manual, P. 2152. Interest expense excludes subsidies paid to Australian states to assist them with interest payments on their debt.

55 Moody's 1935 Municipal and Government Manual, p. 2267 and The New Zealand Official Yearbook, 1936. Available on-line from Statistics New Zealand at http://www3.stats.govt.nz/New_Zealand_Official_Yearbooks/1936/NZOYB_1936.html#idsect1_1_197134. The parliamentary act authorizing the conversion is also available on line at http://www.nzlii.org/nz/legis/hist_act/nzdca193223gv193233n37339/.

56 Calculations based on statistics in The New Zealand Official Yearbook, 1936.

Australia bonds with ten years remaining to maturity would have experienced an 8.59 percent loss in present value terms. A New Zealand creditor holding an analogous bond would have experienced a loss of 7.78 percent in present value terms.

NEW SOUTH WALES (AUSTRALIA) DEFAULT – 1931

The fiscal pressure affecting the Australian Commonwealth also affected member states. While five of the six states performed on their debts, New South Wales defaulted on an interest payment to overseas bondholders in April 1931. Prime Minister Jack Lang explained the decision to default in parliament as follows:

> Parliament in New South Wales was faced with an extremely awkward problem. It was committed to pay to oversea bondholders £700,000. The Government itself had not the money. It was informed, however, that this amount would be made available for shipment overseas if the Government needed it. Having in mind the reiterated statement that every £ of credit consumed by the Government meant a £ less for circulation among the primary and secondary industries, the Government was faced with a most difficult problem. If we took the £700,000 which the bank offered us, it meant that £700,000 worth of credit would have to be withdrawn from the primary and secondary industries of New South Wales. Default faced us on either hand. We could default, if we chose, to the farming community by withdrawing £700,000 from it, or we could default to our oversea creditors. Having to choose between our own people and those beyond our shores, we decided that the default should not be to our own citizens. Criticism of Parliament because of this action has been very clamant, because it is said we have broken a written contract, but very often the implied conditions of a contract are stronger than those which are written.[57]

While the default can be seen as an expression of Lang's progressive ideology, the size of the interest payment relative to other expenses facing the State was a likely contributor to the Prime Minister's decision. According to the 1932 Australia Yearbook, New South Wales' total revenue fell from £50.4 million in fiscal year 1929 to £40.9 million in fiscal year 1931.[58] Public debt service – which included both interest payments and contributions to sinking funds (used to retire bond principal) – totaled £15.7 million in fiscal 1931, or 38 percent of revenues[59].

It should be noted that other Australian states had similar or even higher interest expense to revenue ratios at the time. The most appropriate reading of the situation appears to be that, in the case of New South Wales, high debt servicing expenses and ideology combined to trigger the default.

Bondholders did not suffer any losses as a result of the default, as the Australian Commonwealth made payment on New South Wales' behalf. The state defaulted a number of other times later in 1931 and in 1932, with the Commonwealth covering the missed payment in each instance – although bondholders did suffer a 20-day delay in one case.[60]

The Commonwealth addressed New South Wales' repeated interest defaults by enacting the Financial Enforcement Act of 1932, which gave Australia the authority to seize New South Wales' revenues in order to compensate for the defaulted interest. In April 1932, Australian High Court upheld the law, and, in May, the Governor of New South Wales removed Lang from office.[61]

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57 The Sydney Morning Herald, 2 April 1931, page 11.

58 The Public Finance chapter of the 1932 Australia Year Book is available at http://www.abs.gov.au/AUSSTATS/free.nsf/log?openagent&13010_1932%20section%208.pdf&1301.0&Publication&D322790C90D90A42CA2573AD00200664&0&1932&01.01.1932&Latest. Amounts quoted are on page 316.

59 1932 Australia Year Book, Page 324.

60 Moody's 1933 Bond Manual, Pages 464-467.

61 Australian Dictionary of Biography: John Thomas (Jack) Lang. Available at http://adb.anu.edu.au/biography/lang-john-thomas-jack-7027.

ARKANSAS (US) DEFAULT – 1933[62]

In 1927, the Arkansas state legislature assumed highway construction debts incurred by local governments across the state. This action, together with other borrowing initiatives, increased the state's debt from $1.6 million to $160 million between 1927 and 1932. Meanwhile tax revenues peaked in 1930 and then began to decline.

As a result, the state government's debt ratios became unmanageable. By 1932, Arkansas' ratio of Interest Expense to Revenue was 29.68 percent, the highest among the 48 states then in the union. The state with the second highest ratio, South Carolina[63], devoted 18.83 percent of revenue to interest payments. [64]

In March 1933, the State defaulted on highway bond interest payments. The following year, the legislature restructured the highway debt, rolling defaulted interest into new bonds and deferring principal maturities by ten years. In 1941, the highway debt was replaced by a US federal loan (issued by the Reconstruction Finance Corporation), lowering the state's interest rate by 1.20 percent. Ultimately, bondholders recovered all principal and interest on a delayed basis, thus suffering a present value loss. According to Moody's 1934 bond manual, Arkansas bonds traded at 40 bid and 44 ask one month after the default, representing a 58 percent loss given default.

CANADIAN MUNICIPAL DEFAULTS – 1930S

The author is unaware of any Canadian municipal bond defaults since the former city of Jacques Cartier in Québec failed to service its bonds in the 1950s[65]. However, municipal defaults were quite common in the years prior to World War II. According to statistics published by A.M. Hillhouse[66], 163 of Canada's 4286 taxing units were in default in 1934. Most of the defaulting entities were school districts and small towns, so their experience is less applicable to large, diversified taxing entities like provinces. Contemporary Moody's bond manuals listed five Canadian cities with more than 25,000 residents that defaulted on either principal or interest during the 1930s. These relatively sizable entities may have some relevance to future defaults by larger governmental units. Table B-5 contains a list of these Depression-era municipal defaults with interest expense to revenue ratios, which range from 18% to 26%.

TABLE B.5 Depression-Era Canadian Municipal Defaults for Cities Over 25,000 Population

City	Province	Year of Default	Population	Interest/Revenue Ratio
York	ON	1933	70000	26%
Windsor	ON	1932	63108	23%
North York	ON	1933	32363	18%
East York	ON	1933	30555	24%
Burnaby	BC	1932	25564	24%

Source: Moody's Government and Municipal Bond Manuals, Various Years.

62 This account is based on research previously published by the author as part of Kroll Bond Rating Agency's US municipal bond study. That study is available upon registration at http://www.krollbondratings.com/research/public-finance.

63 South Carolina also defaulted, but only briefly.

64 North Carolina, a state which did not default, had the third highest ratio of 18.30 percent. These ratios were calculated from data in US Census Bureau, Financial Statistics of State and Local Governments: 1932, Washington, Government Printing Office.

65 Moody's Municipal and Government Bond Manual 1958, p. 2095, Fort Mill, SC, USA: Mergent Corporation. According to the manual, the Quebec Municipal Commission assumed payments, so there was no loss to bondholders. The city of Jacques Cartier was later dissolved and merged into Longueuil.

66 Hillhouse, A. M. (1936). Municipal Bonds: A Century of Experience. New York: Prentice Hall. Page 218.

Conclusion

During the Great Depression, Canadian provinces and American states were generally able to avoid default if their interest expenses accounted for less than 30 percent of revenue. Many, but not all of these sub-sovereigns – along with selected counterparts in Oceania - became insolvent when the 30 percent threshold was reached. Five Canadian municipalities defaulted at ratios below 30 percent.

More recent fiscal crises in Saskatchewan and Newfoundland occurred at levels below 20 percent, but these situations did not result in default. Given the increased social service responsibilities of Canadian provinces in recent decades – especially in the area of health – the 30 percent threshold appears too high in the modern context. It is hard to believe that the voting public would tolerate cuts to health services when three out of ten tax dollars were going to bondholders. Consequently, we believe that a 25 percent threshold is more appropriate in the current context.

The evidence related to loss given default in this historical record is limited. States and provinces described above either avoided default entirely, received an immediate bailout or ultimately resolved their defaults with assistance from a higher level of government. The Australia and New Zealand loan conversions do not appear to have been cushioned by a subsidy from the United Kingdom, so their loss rates, both of which were below 10 percent are worth considering. On the other hand, Arkansas bondholders suffered a 58 percent market value loss before it became clear that the US government would step in. Alberta's 19.5 percent market value loss may be somewhat less indicative because it occurred in an atmosphere of Canadian dominion support for all western provinces.

About the Author

Marc Joffe is principal consultant at Public Sector Credit Solutions in San Francisco. Until 2011, Joffe was a Senior Director at Moody's Analytics, where he worked for nine years. He researched and coauthored Kroll Bond Rating Agency's 2011 U.S. Municipal Bond Default Study, and he recently published an open-source Public Sector Credit Framework for estimating government bond default probabilities. Prior to joining Moody's, Marc held management and consulting positions at several money center banks in New York and London, including CIBC. He earned his B.A. and MBA from New York University, and he is completing his MPA at San Francisco State University. His email address is marc@publicsectorcredit.org.

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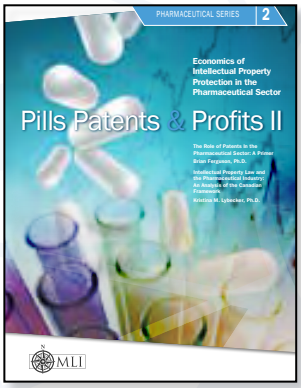

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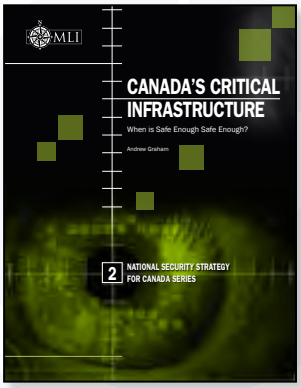

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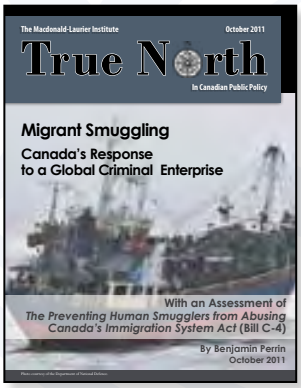

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CONTACT US: Macdonald-Laurier Institute
8 York Street, Suite 200
Ottawa, Ontario, Canada K1N 5S6

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