STATE OF ILLINOIS: CREDIT RISK AND BOND RATINGS

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Illinois Bonds: Perceived to be Risky

Ratings

- Moody's: A3 with Negative Outlook
- Standard and Poor's: A- with Negative Outlook
- These ratings are six notches below each agency's maximum

Spreads

- Long term Illinois bonds yield about 1.5% more than those issued by AAA-rated municipal bond issuers
- State is buying insurance from S&P AA-rated Assured Guaranty on selected maturities to reduce borrowing costs

Illinois credit risk generally attributed to pension underfunding

Some things to consider

- No default on state general obligation bonds since 1933.

- Investors obtained full recoveries on Depression-era defaulted bonds.

- Due to balanced budget requirements and borrowing restrictions, most states have low debt burdens. Illinois' Debt/GSP ratio is about 6% and interest expense accounts for less than 3% of total revenue.

- These levels are nowhere near those witnessed during Depression-era defaults by major sub-sovereigns. For example, Arkansas (1933) , Alberta (1936) and New South Wales (1931) all reached 30% interest/revenue ratios before defaulting. I (very roughly) estimate that Arkansas' debt/GSP ratio was 60% when it defaulted.

- Underfunded pension and defaults do not equate. Indiana's Teacher Pension Fund was fully pay-as-you-go between 1921 and 1996, with no adverse consequences to bondholders.

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Discriminatory State Bond Ratings?

Dodd Frank and new SEC Regulation 17g(8) require that ratings symbol have the same meaning (in terms of default risk) across asset classes.

However:

- Thousands of AAA/Aaa-rated mortgage backed securities defaulted during the financial crisis.

- AAA-rated Texaco filed for bankruptcy after an adverse legal decision in 1987. Illinois' ratings are equivalent to those of Worldcom in late 2000 – less than two years before it filed for bankruptcy. Finally, two AAA municipal bond insurers – Ambac and FGIC – went bankrupt during the financial crisis.

- The Canadian province of Ontario, with a 38% debt/GDP ratio, has higher ratings than Illinois (with a 6% debt/GDP ratio).

Thus, there is evidence that credit ratings for US states such as Illinois are harsher than those for other types of issuers – despite laws to the contrary.

An Alternative to Biased Ratings

- Use models to estimate default probabilities and then map default probabilities to letter ratings across asset classes
- Make model inputs and calculations transparent
- Transparent model-based rating approach has been pioneered for corporate bonds by the National University of Singapore's Risk Management Institute
- My challenge to the US public finance community is to develop and operate transparent rating models for state and local governments
- Because credit ratings are a public good requiring intellectual inputs, the academic community is well positioned to offer them

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An Alternative Approach to Rating States

Multi-year fiscal simulation

- Demographic, macroeconomic, policy variables and historic revenue, expenditure and debt levels as inputs

- Calculate revenue and expenditure distributions

- Then derive a distribution of deficits, debt levels and interest burdens

Establish a "default" point expressed as a fiscal ratio

- In my analysis I used interest expense *plus* pension contributions as a percentage of total revenues as the ratio

- My default threshold was 30% - on the basis of the Depression-era experience

- My pension contribution is not ARC – it is the amount needed to pay retirees minus a percentage of simulated pension fund assets

- Model can and does capture the possibility of pension fund exhaustion

Model Result for Illinois

Focus ratio was 9.76% in 2012

No trial reaches default threshold until 2030

In 2030, 4 trials of 1,000,000 have ratios > 30%

In 2044, about 17,000 trials have ratios > 30%

Conclusion: State should be rated AA or AAA depending on time period used

State of Illinois: Estimated Annual Default Probabilities
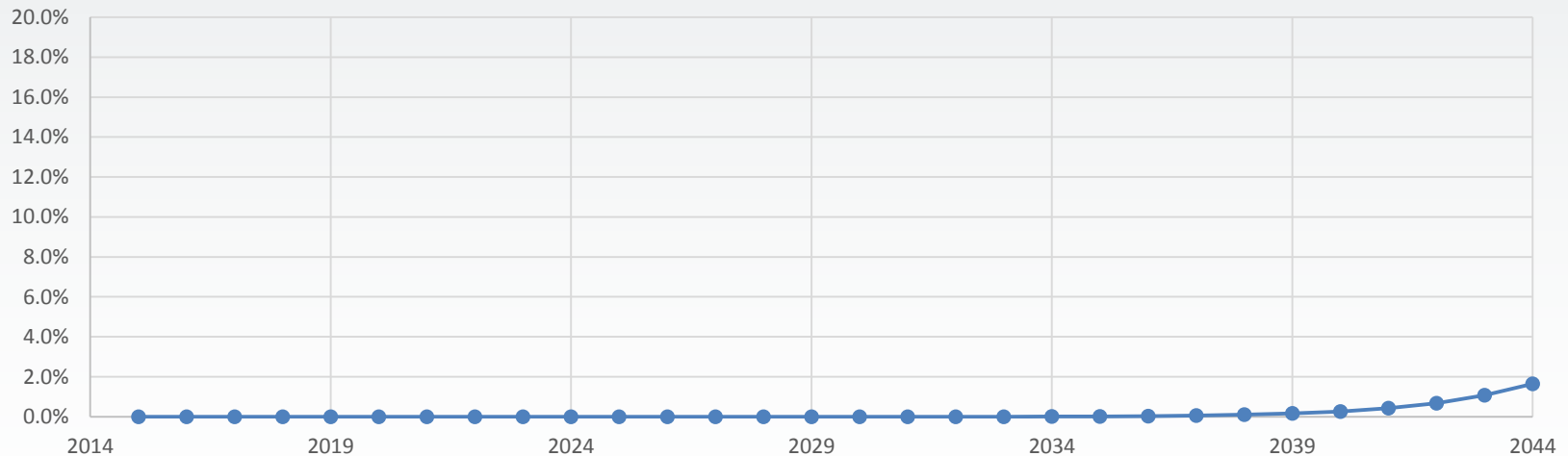
Further Information

Paper available at http://mercatus.org/publication/modeling-state-credit-risks-illinois-and-Indiana.

Related Bloomberg op-ed: http://www.bloombergview.com/articles/2013-06-20/relax-bondholders-illinois-won-t-default.

Open source simulation model framework:

- Excel add-in and C executable: http://www.publicsectorcredit.org/pscf.html

- Illinois model (Excel): http://www.publicsectorcredit.org/illinois_v2.xlsm

- All source code: http://www.github.com/joffemd/pscf.html

Public Sector Credit Framework

What's Wrong with Government Bond Ratings?

➢ Stale / Lagging the Market

➢ Pro-cyclical

➢ Subject to Bias

For more, see:

Gaillard, Norbert (2013). Credit rating agencies and the Eurozone Crisis: What is the value of sovereign ratings? *VoxEU*. http://www.voxeu.org/article/credit-rating-agencies-and-eurozone-crisis-what-value-sovereign-ratings

Gärtner, Manfred & Björn Griesbach & Florian Jung (2011). PIGS or Lambs? The European Sovereign Debt Crisis and the Role of Rating Agencies. *International Advances in Economic Research, 17*, 288-299.

Nate Silver (2011), Why S.&P.'s Ratings Are Substandard and Porous. *New York Times Five Thirty Eight Blog*. http://fivethirtyeight.blogs.nytimes.com/2011/08/08/why-s-p-s-ratings-are-substandard-and-porous/

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Structured vs. Sovereign/Muni Ratings

➢ Sharpest criticism of rating agencies relates to mortgage backed securities, collateralized debt obligations and other structured assets.
➢ Observers should avoid generalizing criticisms of structured ratings to all rating activities; different critiques apply

Structured	Sovereign/Muni
High revenue	Minimal revenue
Substantial investment in technology and rating methodology development	Inadequate staffing; limited technology
Competition for rating assignments; rating shopping; rating inflation	Less competition and inflation; ratings depressed relative to those for structured

A New Sovereign/State Rating Approach
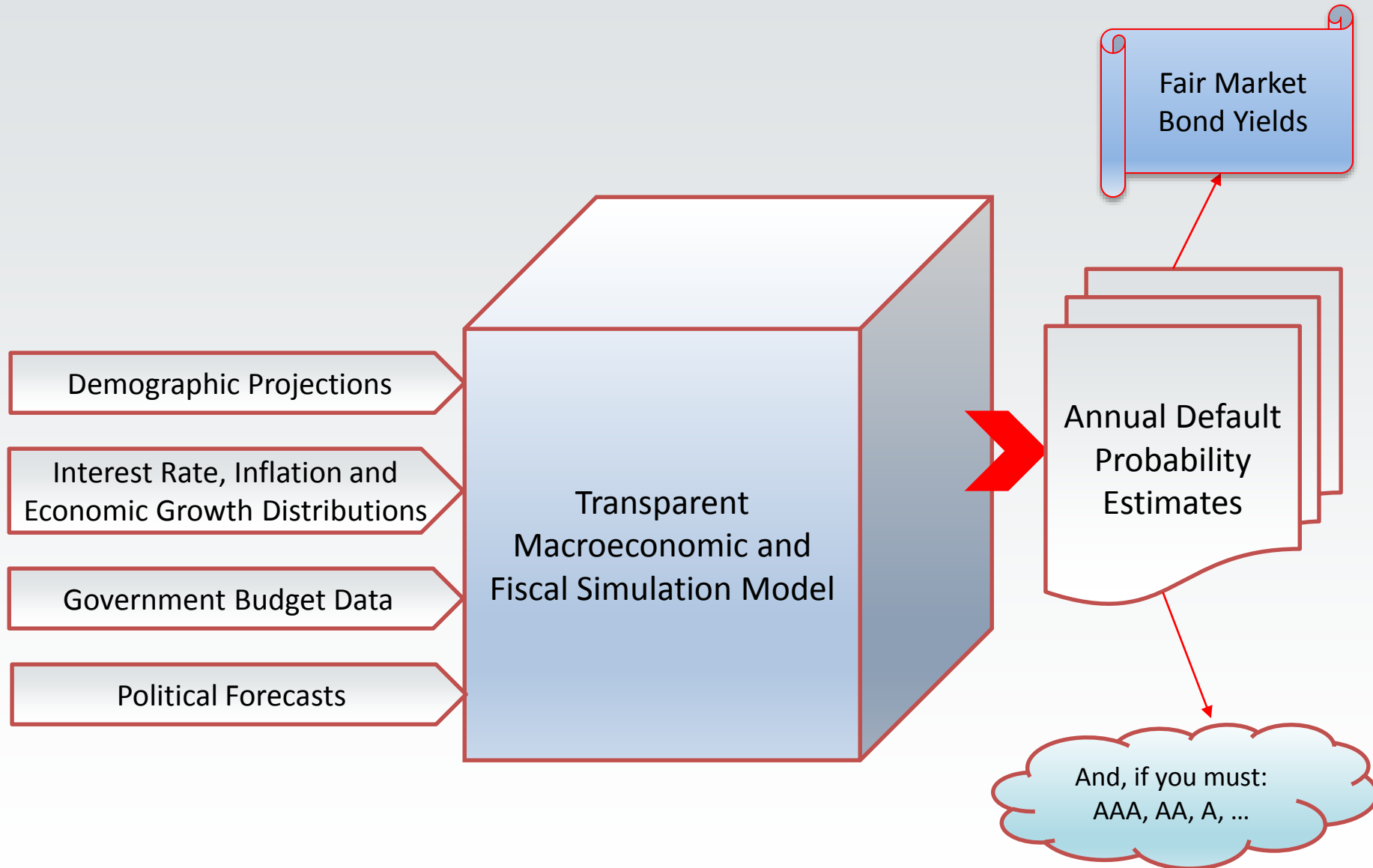
PSCF Principles

Public Sector Credit Framework is:

- ➢ <u>Quantitative</u> – To decrease the likelihood that unconscious biases will affect the analysis and to take advantage of the computer's ability to rapidly perform large numbers of calculations.

- ➢ <u>Transparent</u> – So that other analysts can examine and update assumptions.

- ➢ <u>Open Source</u> – In the hope that a community of developers will form to enhance the tool.

The open source release is only a framework. Users or vendors would have to build their own issuer-specific models.

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PSCF Solution Overview

Quantitative methodology based on:

- Multi-Year Budget Projections for Each Public Sector Issuer
  - Can rely in part on estimates published by the government itself
- Monte Carlo Simulation of economic variables such as GDP growth, inflation and interest rates
  - Forecasts and historical data are available from a number of vendors including IHS Global Research
- Default point stated in terms of a fiscal ratio
  - Debt to GDP
  - Interest Expense to Revenue
  - Debt to Assessed Valuation
  - Others?
- Annual default probabilities calculated as the percentage of simulation trials resulting in ratios surpassing the default point; DPs can be mapped to ratings within the framework

Technology Overview

- User interface implemented as an Excel add-in

- User enters simulation data in two tabs of the spreadsheet and then runs the simulation from a control panel

- Excel inputs are converted to a C program, the program is compiled and then executed. Results are written to text file(s) and loaded into Excel tab(s)

- C program is compiled with the GNU C++ compiler and is thus compatible with Linux and other operating systems. GNU compiler is installed with the framework

- We also install the Boost C++ library which we use for random number generation

- C language and compiling are used in order to maximize speed enabling the user to run complex simulations and large numbers of trials

- We hope that programmers participating in the open source community will port the capabilities to other environments

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Walkthrough Part 1: Model Sheet

Screenshot of Microsoft Excel spreadsheet "sample_usa" showing the model sheet:

	A	B	C	D	E
1	Parameter Name	Parameter Value			
2	Government Entity	United States			
3	Model Description	US Federal Budget Sample			
4	Currency	USD			
5	Initial Year	2012			
6	Projection Years	30			
7	Number of Trials	10			
8	Threshold Label	Default			
9	Show Projection Details	Y			
10					
11		Description	Expression	Threshold Level	Relation to Threshold Signifying Default
12	Metric 1	Interest Expense/Total Revenue	netinterest[y]/totrev[y]	0.3	>
13	Metric 2	Debt/GDP	debt[y]/GDP[y]		
14	Metric 3	Debt/Total Revenue	debt[y]/totrev[y]		
15	Metric 4	Absolute Increase in Debt	debt[y]-debt[y-1]		
16	Metric 5	Total Rev / Total Exp	totrev[y]/totexp[y]		
17					
18		Default Probability Code			
19					
20					
21		PSCF Control Panel			
22					
23					
24					

Sheet tabs: documentation, model, series, adjustments, ratingmap, projection, results

First metric used to establish the default point

Additional metrics can be calculated and viewed in Projection Details

Part 2: Series Sheet / Random Numbers

	A	B	C	D	E	F	G	H
1	Series Name	Series Description	Series Type	Type/Format	Minimum	Maximum	RandomMean	RandomStdDevOrSigma
2	normrandom_lfp	Random Draws for Labor Force Participation	Random Numbers	double(8,6)			0	0.5
3	normrandom_prod	Random Draws for Productivity	Random Numbers	double(8,6)			0	0.5
4	normrandom_infl	Random Draws for Inflation	Random Numbers	double(8,6)			0	0.5
5	normrandom_oil	Random Draws for Oil Prices	Random Numbers	double(8,6)			0	0.5
6	normrandom_int	Random Draws for Interest Rates	Random Numbers	double(8,6)			0	0.5
7	normrandomBirths	Random Draws for Births	Random Numbers	double(8,6)			0	0.5
8	normrandomDeathRates	Random Draws for Death Rates	Random Numbers	double(8,6)			0	0.5
9	unirandom_inctaxcuttop2	Random Draws for Extending Bush Tax Cuts for Top 2 Brackets	Random Numbers	double(8,6)	0	1		
10	unirandom_inctaxcutalloth	Random Draws for Extending Other Bush Tax Cuts and AMT Patch	Random Numbers	double(8,6)	0	1		
11	unirandom_estatetaxcut	Random Draws for Extending Lower Estate Taxes	Random Numbers	double(8,6)	0	1		
12	unirandom_docfix	Random Draws for Extending Medicare Doc Fix	Random Numbers	double(8,6)	0	1		

documentation / model / **series** / adjustments / ratingmap / projection / results

➢ Create any number of random series.

➢ One random number generated per series per trial.

➢ Three random number distributions supported:

➢ Uniform / Normal / Cauchy-Lorenz (allowing fat tails)

➢ User can impose maxima and minima on generated numbers

Part 3: Series Sheet / Macro Variables

	A	B	C	D	M
1	Series Name	Series Description	Series Type	Type/Format	Year 2
341	retiredpop	Population Eligible for Social Security	Macroeconomic	double(12,0)	seniorpop[y]
342	age16to64pop	Population Aged 16-64	Macroeconomic	double(12,0)	workingagepop[y] - seniorpop[y]
343	yr	Year Number	Macroeconomic	double(2,0)	65
344	age16to64participation	Aged 16-64 Labor Force Participation Rate	Macroeconomic	double(8,6)	0.017360 + 0.977893 * age16to64participation[y-1] + 0.051402 * normrandom_lfp[y]
345	seniorparticipation	Senior Labor Force Participation Rate	Macroeconomic	double(8,6)	-0.016204 + 0.000229 * yr[y] + 1.019063 * seniorparticipation[y-1] + 0.047795 * normrandom_lfp[y]
346	laborforcepart	Overall Labor Force Participation Rate	Macroeconomic	double(8,6)	(seniorparticipation[y]*seniorpop[y]+age16to64participation[y]*age16to64pop[y])/workingagepop[y]
347	laborforce	Size of Labor Force	Macroeconomic	double(12,0)	workingagepop[y] * laborforcepart[y]
348	productivitygrowth	Productivity Growth	Macroeconomic	double(8,6)	0.018880 - 0.153876 * productivitygrowth[y-1] + 0.029456 * normrandom_prod[y]
349	GDPgrowth	Real GDP Growth	Macroeconomic	double(8,6)	(laborforce[y] / laborforce[y-1] - 1) + productivitygrowth[y]
350	realGDP	Real GDP	Macroeconomic	double(20,0)	realGDP[y-1] * (1 + GDPgrowth[y])
351	inflation	General Inflation	Macroeconomic	double(8,6)	0.012515 + 0.640595 * inflation[y-1] + 0.029558 * normrandom_infl[y]
352	priceIndex	Consumer Price Index	Macroeconomic	double(10,6)	priceIndex[y-1] * (1 + inflation[y])
353	GDP	Nominal GDP	Macroeconomic	double(20,0)	realGDP[y] * priceIndex[y] * .01

- Inflation, GDP and interest rates can be modeled using any combination of constants, functions of random numbers and functions of other variables or prior year values
- Any C-compliant expression may be used
- Minima and maxima also supported
- Can use different formulae for different years

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Part 4: Series Sheet / Revs & Exps.

	A	B	C	D	W
1	Series Name	Series Description	Series Type	Type/Format	Year 12
395	indinctax	Individual Income Tax	Revenue	double(15,0)	GDP[y] * indinctax[11] / GDP[11]
396	socinscont	Social Insurance Contributions	Revenue	double(15,0)	GDP[y] * socinscont[11] / GDP[11]
397	corpinctax	Corporate Income Tax	Revenue	double(15,0)	GDP[y] * corpinctax[11] / GDP[11]
398	othrev	Other Revenues	Revenue	double(15,0)	GDP[y] * othrev[11] / GDP[11]
399	totrev	Total Revenues	Revenue	double(15,0)	indinctax[y] + socinscont[y] + corpinctax[y] + othrev[y]
400	socialsec	Social Security	Expenditure	double(15,0)	socialsec[y-1] * retiredpop[y]/retiredpop[y-1] * (1 + inflation[y])
401	medicare	Medicare	Expenditure	double(15,0)	medicare[y-1] * retiredpop[y]/retiredpop[y-1] * (1 + healthinflation[y])
402	medicaid	Medicaid	Expenditure	double(15,0)	medicaid[y-1] * totpop[y]/totpop[y-1] * (1 + healthinflation[y])
403	othermandatory	Other Mandatory	Expenditure	double(15,0)	GDP[y] * othermandatory[11] / GDP[11]
404	defense	Defense	Expenditure	double(15,0)	GDP[y] * defense[11] / GDP[11]
405	domesticdiscr	Domestic Discretionary	Expenditure	double(15,0)	domesticdiscr[y-1] * (1 + (inflation[y]))
406	netinterest	Net Interest Expense	Expenditure	double(15,0)	debt[y-1] * avgcpnrate[y]
407	totexp	Total Expenditures	Expenditure	double(15,0)	defense[y] + socialsec[y] + medicare[y] + medicaid[y] + othermandatory[y] + domesticdiscr[y] + netinterest[y]

➢ Revenue and expenditure items can also use any valid C expression

➢ Items may be linked to macroeconomic variables such as inflation or GDP.

➢ Annual surpluses or deficits can be computed from the revenue and expenditure series and then added to the previous year's debt.

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Walkthrough Part 5: Adjustments Sheet

	A	B	C	D	E	F
1	Adjustment Name	Expression to Evaluate	Relation to Threshold	Threshold Value	Series to Adjust if Threshold is Surpassed	Distribute Adjustment to Related Series
2	Expense Adjustment for Large Deficit	totrev[y]/totexp[y]	<	0.5	totexp[y]	defense[y]
3						medicaid[y]
4						othermandatory[y]
5						domesticdiscr[y]
6						

documentation / model / series / adjustments / ratingmap / results

- ➤ Legislative/executive decisions to reduce deficits (or spend large surpluses) can be simulated in the adjustments sheet.
- ➤ Revenue/Expenditure ratios can be bounded and changes to either revenues or expenditures can be distributed pro rata back to select budget lines.
- ➤ Would like to support more constraints in future releases.

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Walkthrough Part 6: Ratingmap Sheet

- ➢ Associate cumulative default probabilities with rating grades.
- ➢ Any rating system can be used.
- ➢ System returns a vector of annual ratings in recognition of the fact that bonds with different terms have different levels of risk.

Walkthrough Part 7: Results Sheet

	Clipboard	Font	Alignment	Number	Styles	Cells	Editing

K3

	A	B	C	D	E	F	G	H	I
1	PSCF Fiscal Projection								
2	Government Entity	United States							
3	Model Description	US Federal Budget Sample							
4	Currency Units in	USD							
5	Trials	10000							
6	Run Date/Time	Tue Apr 10 16:47:34 2012							
7									
8	Year	Default Count	Default Probability	Cumulative Default Count	Cumulative Default Probablilty	Rating Equivalent		Minimum Interest Expense/Total Revenue	Maximum Interest Expense/Total Revenue
9	2012	0	0.0000	0	0.0000	N/A		0.0961	0.0961
10	2013	0	0.0000	0	0.0000	AAA		0.0718	0.1593
11	2014	0	0.0000	0	0.0000	AAA		0.0536	0.2029
12	2015	0	0.0000	0	0.0000	AAA		0.0444	0.2465
13	2016	0	0.0000	0	0.0000	AAA		0.0399	0.2523
14	2017	0	0.0000	0	0.0000	AAA		0.0347	0.2911
15	2018	2	0.0002	2	0.0002	AA		0.0288	0.3344
16	2019	11	0.0011	11	0.0011	A+		0.0278	0.3868
17	2020	22	0.0022	23	0.0023	A		0.0195	0.4425
18	2021	45	0.0045	51	0.0051	A-		0.0119	0.4615
19	2022	90	0.0090	95	0.0095	BBB		-0.0185	0.4501
20	2023	131	0.0131	145	0.0145	BBB		-0.0503	0.5334
21	2024	192	0.0192	212	0.0212	BBB-		-0.0850	0.5724
22	2025	266	0.0266	299	0.0299	BBB-		-0.1125	0.5747
23	2026	374	0.0374	427	0.0427	BB+		-0.1425	0.6243
24	2027	473	0.0473	534	0.0534	BB+		-0.1734	0.6940
25	2028	555	0.0555	643	0.0643	BB+		-0.2171	0.7819

documentation / model / series / adjustments / ratingmap / **results**

Ready | 100%

Walkthrough Part 8: Projection Sheet

	A	OI	OP	OQ	OR	OT	OU	OV	OW	PA
8	Fiscal Year	Total Revenues	Net Interest Expense	Total Expenditures	Surplus or Deficit	Debt		Interest Expense/Total Revenue	Debt/GDP	Default Flag
290	Trial 9									
291										
292	2012	2,302,495,000,000	221,302,000,000	3,598,973,000,000	-1,296,478,000,000	10,167,912,418,920		0.0961	0.6799	0
293	2013	2,460,901,632,932	215,713,519,710	3,618,691,076,933	-1,157,789,444,001	11,372,823,862,921		0.0877	0.7298	0
294	2014	2,738,130,457,281	324,766,609,467	3,683,634,132,699	-945,503,675,418	12,427,759,442,339		0.1186	0.7888	0
295	2015	2,919,359,571,991	308,092,721,273	3,747,232,009,645	-827,872,437,654	13,358,776,174,729		0.1055	0.8239	0
307	2027	4,360,917,366,457	1,065,957,373,408	6,864,758,295,705	-2,503,840,929,249	30,797,778,502,871		0.2444	1.2912	0
308	2028	4,380,768,181,383	1,403,906,594,396	7,307,402,386,095	-2,926,634,204,711	33,803,186,110,445		0.3205	1.4108	1
309	2029	4,351,925,430,986	1,611,185,718,726	7,607,784,758,326	-3,255,859,327,340	37,138,434,721,290		0.3702	1.5603	1

➢ Optional projection tab shows trial-by-trial, year-by-year results for each variable you want to see.

➢ Default flag is set whenever the first metric specified in the models sheet surpasses the default threshold.

Selected Media Coverage

FT Alphaville – Monte Carlo Simulated Credit Risk - http://ftalphaville.ft.com/2012/05/02/983041/monte-carlo-simulated-sovereign-credit/

Canadian Broadcasting Company – Rating Agency Rebellion - http://www.cbc.ca/player/News/Business/ID/2258963934/

Concord Coalition – Do Bond Markets Underestimate the True Riskiness of U.S. Treasuries? - http://www.concordcoalition.org/tabulation/do-bond-markets-underestimate-true-riskiness-us-treasuries

Global Treasury News – An Alternative to Sovereign Credit Ratings: PSCF http://www.gtnews.com/Articles/2013/An_Alternative_to_Sovereign_Credit_Ratings__PSCF.html (Gated)

Government Finance News, February 2013 (Hard Copy)

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Applications of PSCF

Provincial Solvency and Federal Obligations, Macdonald-Laurier Institute.

http://www.macdonaldlaurier.ca/files/pdf/Provincial-Solvency-October-2012.pdf

Italy Model – Covered in MF (Milano) – 26 July 2013 →

Modeling State Credit Risk in Illinois and Indiana, Mercatus Center.

http://mercatus.org/publication/modeling-state-credit-risks-illinois-and-indiana

LE PROBABILITÀ DI FALLIMENTO SECONDO UN'INDAGINE PSCS

Italia, rischio default al 2,6%

DI ÉSTER CORVI

Moody's ha abbassato il rating dell'Italia fino a Baa2, a un passo dal temuto livello junk bond, ma c'è chi, numeri alla mano, con questo giudizio non è d'accordo. Perché ritiene che sia del tutto ingiustificato per un Paese che non solo ha dimostrato in passato di saper convivere con ratio elevati debito-pil, ma che nei mesi scorsi ha anche imboccato con coraggio la via del risanamento. Lo sostengono gli esperti della società statunitense Public Sector Credit Solutions (Pscs) (fondata da Marc Joffe, ex direttore di Moody's Analytics), che hanno elaborato diverse proiezioni sull'evoluzione futura delle finanze pubbliche italiane, utilizzando un modello econometrico. E sono arrivati alla conclusione che le probabilità di default dei titoli di Stato italiani sono solo il 2,6%. Una percentuale risibile, che stride con la recente impennata del differenziale Btp-Bund oltre quota 500. Le ragioni principali sono quelle ricordate in precedenza: in primo luogo, l'Italia ha sostenuto nella metà degli anni Novanta spese per interessi maggiori di quelle attuali in percentuale sul debito senza fallire e, anche se il tasso di interesse medio sul debito pubblico raggiungesse il 7% (un processo che richiederebbe alcuni anni in funzione della struttura del nostro debito), il rapporto interessi/pil salirebbe, ma resterebbe comunque inferiore al livello sperimentato a metà degli anni Novanta. Il secondo aspetto che sostiene la valutazione degli analisti di Pscs è che l'Italia con la riforma pensionistica ha affrontato il problema dell'invecchiamento della popolazione, mentre il calo del tasso di fertilità si è stabilizzato negli ultimi anni.

Osservando l'esperienza del passato, si può notare che l'Italia dal momento della sua costituzione, nel 1861, non è mai fallita fino al 1932, a causa delle spese legate Prima guerra mondiale, è più tardi nel 1940, in conseguenza della dichiarazione di guerra alla Francia e alla Gran Bretagna. Un debito che non fu completamente onorato fino al 1952. Da allora l'Italia non è mai più stata insolvente, diversamente dalla Grecia ha registrato cinque default tra il 1862 e il 1964. Se si guarda alle prospettive future, gli esperti

fanno notare che il deficit dell'Italia (3,2% del pil nel 2011) è relativamente modesto e in decisa riduzione, visto che le stime del Fondo monetario internazionale lo indicano nel 2012 intorno al 2,6%, nonostante un calo del pil dell'1,9%, in un trend di graduale ma deciso miglioramento. In conclusione, in uno scenario a dieci anni, applicando il modello di Pscs e considerando le molte variabili in gioco, le probabilità di un default dell'Italia sono inferiori al 3%.

Un'elaborazione molto ardita, quella realizzata dalla Public Sector Credit Solutions, che ha pubblicato nel maggio scorso un'analisi per il calcolo delle probabilità annuali di default da parte dei governi. Il modello è stato elaborato al fine di effettuare una simulazione fiscale pluriennale, basata su numerosi scenari relativi al pil, all'inflazione e ai tassi di interesse. La relazione comprendeva anche un'analisi dettagliata dei conti pubblici italiani, che è stata in seguito aggiornata.

Joffe ha fondato la Pscs e divulgato il Public Sector Credit Framework open source allo scopo di elevare il livello di analisi del credito sovrano e sub-sovrano. «A causa dei disordini sociali che comportano, le crisi del credito sovrano possono trasformarsi in questioni di vita o di morte. Saperle prevedere con precisione è quindi una priorità sociale importante». La Pscs ha l'obiettivo, a detta dei fondatori, di produrre «ricerca destinata a tutti i principali emittenti sovrani e sub-sovrani, applicando tecniche trasparenti e quantitative e spera che la ricerca contribuisca alla creazione di un'agenzia di rating no-profit come quelle suggerite da Bertelsmann e Roland Berger». (riproduzione riservata)

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US Fiscal Crisis Probability

PSCF US analysis as shown on CBC and Concord Coalition video
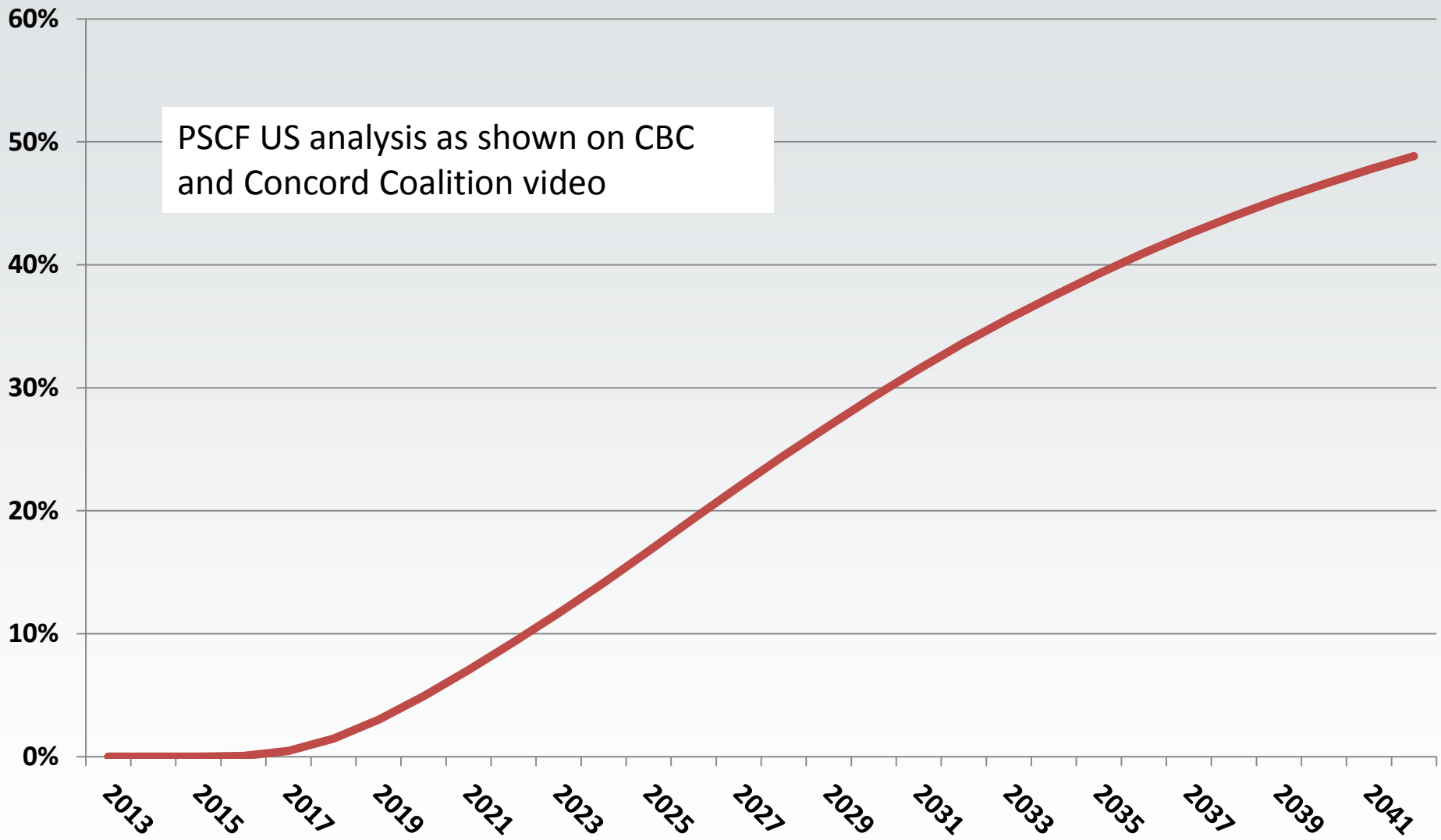
History of U.S. Municipal Ratings

Pre-1940

➢ 1918: Moody's begins publishing annual Municipal and Government Manual. The manuals include bond ratings and are purchased mostly by investors.

➢ 1929: 55% of US munis are rated Aaa and another 23% are rated Aa.

➢ 1933: Peak of muni default wave. Most defaults caused by over-bonding, poor revenue source diversification, property tax delinquencies and bank closures/bank holidays

  ➢ Over 4700 muni defaults during the 1930s.
  ➢ 10-Year default rate for 1929 Aaa rated munis is 10%.
  ➢ 10-Year default rate for 1929 Aa rated munis is 25%.
  ➢ Overall, munis *underperform* corporates in each rating category.

➢ 1939: 1% of US munis are rated Aaa and 14% Aa.

" … "

This shortcoming of inadequate analysis is natural, indeed, in view of the size of the task. For instance, the 1937 industrial manual of Moody lists 5,032 companies on which statistical information has been gathered and prepared; 691 bond issues of these companies have been rated. The utility staff of the same agency covered 1,986 companies "fully" and added short paragraphs on a further 347 units; 1,547 public utility bonds were selected for rating. As to railways, 1,597 roads are listed with 1,668 issues rated. ***The municipal manual discussed 14,711 taxing bodies and rated 4,816 securities of 3,704 issuing units. One cannot escape being impressed by the volume of expensive work involved - and by the conclusion that a uniform pattern of rating, making all these different issues comparable with one another in terms of some nine grades, handled by a large staff of moderately paid analysts with necessarily divergent experiences, biases, and opinions, can only be applied if based on none but obviously visible and easily comparable features.*** *The staggering cost of detailed study of some 23,000 issuing units, or even of the almost 9,000 rated issues, is prohibitive. Accordingly, the responsible agencies advise the customer not to rely upon the ratings alone but to use them together with the text of the manual and even to buy special investment advisory services which they are ready to supply. The candid observer cannot help wondering whether it would not be a still more responsible attitude to stop the publication of ratings altogether in the best interest of all concerned.*

*- **Melchior Palyi, Journal of Business of the University of Chicago, January 1938***

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Mid 20th Century

➢ 1949: S&P starts issuing muni ratings. Small issuers given the option to pay for a rating.

➢ 1963: Moody's and S&P rating levels remain near post-Depression lows despite two decades of minimal defaults.

➢ 1965: Moody's downgrades New York City from A to Baa; S&P follows in 1966. Resulting controversy triggers Congressional hearings, a book-length study by the 20th Century Fund and other investigations.

➢ 1968: S&P migrates to the issuer-pays model for all munis. Moody's follows shortly thereafter.

➢ 1971: Ambac pioneers the monoline insurance industry. MBIA formed in 1974.

"..."

[N]o one, including some of the analysts involved, with whom we have spoken, with whom others that we know have spoken at very great length indeed, are quite sure what a rating is based upon. The criteria are foggy. The rating services maintain a sort of an aloofness and are not too willing to discuss with the representatives in municipal offices of cities what it is about the city that occasions the upward or downward move in a rating.

*- **Roy Goodman, Director of Finance, New York City, In Congressional Testimony, Dec. 5, 1967***

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Recent History

- ➢ 1999: Fitch study finds that post-1979 default rates in most muni sectors were very low, suggesting that municipal ratings and corporate ratings are not comparable. Moody's reports similar results in 2002.

- ➢ 2002: Hedge fund manager Bill Ackman issues a research report on MBIA revealing that it is 139 times leveraged and thus not deserving of its AAA/Aaa rating

- ➢ 2008: California Treasurer Bill Lockyer reports that California paid $102 million for "unnecessary" municipal bond insurance; Moody's Laura Levenstein claims that the dual muni/global ratings scale dates from 1920; Connecticut Attorney General Richard Blumenthal sues rating agencies over inconsistencies between muni and corporate rating scales

" ... "

All three credit rating agencies systematically and intentionally gave lower credit ratings to bonds issued by states, municipalities and other public entities as compared to corporate and other forms of debt with similar or even worse rates of default, Blumenthal alleges.

As a result of these deceptive and unfairly low ratings, Connecticut's cities, towns, school districts, and sewer and water districts have been forced to spend millions of taxpayer dollars to purchase bond insurance to improve their credit rating, or pay higher interest costs on their lower rated bonds.

"We are holding the credit rating agencies accountable for a secret Wall Street tax on Main Street -- millions of dollars illegally exacted from Connecticut taxpayers," Blumenthal said. "Connecticut's cities and school districts have been forced to spend millions of dollars, unconscionably and unnecessarily, on bond insurance premiums and higher interest rates as a result of deceptive and deflated credit ratings. Their debt was rated much lower than corporate debt despite their much lower risk of default and higher credit worthiness.

–Connecticut Attorney General's Office Press Release, July 30, 2008

The Financial Crisis to Today

- Most monoline insurers go bankrupt or suffer multiple-notch downgrades (due to insuring toxic MBS and CDOs)

- Auction rate market freezes

- In April 2009, Moody's places the entire muni sector – i.e., all issuers – on negative outlook

- In December 2010, Meredith Whitney panics the muni market by incorrectly forecasting 50-100 or more sizeable defaults in 2011

- Connecticut lawsuit is settled for $900k of credits for future ratings services and no admission of guilt

- Annual muni bond default rates remain low. Default rates on rated munis and General Obligations remain even lower

Takeaways

- Municipal bond ratings performed poorly during the Depression.

- Rating agencies (over)-reacted by severely grading municipalities for the next 70 years, creating the so-called dual ratings scale.

- Severe municipal ratings gave rise to the monoline bond insurance industry, which received billions of taxpayer dollars and then blew itself up by using proceeds to insure toxic structured finance assets.

- Problems occurred under both the issuer-pays and investor-pays models. Issues with municipal bond rating quality are only partially explained by incentives; the real problem has been insufficient rigor.

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What the Market Needs

Municipal bond assessments that:

➢ Are based on thorough research of historic credit performance and issuer-specific financial conditions rather than conjectures and generalizations

➢ Rely primarily on quantitative approaches (given the large number of issuers together with the expense and subjectivity of analytical talent)

➢ Are transparent and thus clearly understood by participants on both the buy and sell sides

These comments apply to sovereign ratings as well.

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Depression Era Default Research & Modeling

Municipal Credit Scoring

In December 2012, PSCS won a contract from the California State Treasurer's Office to calculate credit scores for 250 cities in the state with population > 25,000

Approach:

➢ Use a composite of financial statistics published in each city's Comprehensive Annual Financial Report

➢ Fully transparent methodology

➢ Score will take the form of a default probability

Benefits

➢ Easy to keep current

➢ Can be applied to *all* issuers – even those that don't purchase ratings

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Why a Default Probability?

Default probability scores would allow us to estimate "fair value" yields for municipal bonds

Other components of fair value include:

- ➢ Recovery rate
- ➢ Risk premium
- ➢ Tax treatment adjustments

Fair value (aka intrinsic value) calculations are common for corporate and structured bonds – we could improve transparency and liquidity by applying this technique to munis

A widely accepted system that translates fiscal changes to updated default probabilities and fair bond yields would assist issuers in analyzing the debt service impact of their policy choices

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Estimating Default Probabilities

- Different types of models have been developed for different asset classes.

- The most relevant asset class for our purpose is debt issued by private (i.e., unlisted) firms such as Moody's Riskcalc.

- The dominant methodology for estimating private firm default probability involves the following:

  ➢ Gather data points for a large set of firms that have defaulted and for comparable firms that have not defaulted

  ➢ Use theory and statistical analysis to determine a subset of variables that distinguish between defaulting and non-defaulting firms

  ➢ Use statistical software to fit a model on the selected variables. Data for current issuers can then be entered into the model to calculate their default probabilities

- George Hempel applied a similar approach to municipal bonds in a 1973 study, but only had access to a small data sample.

Applying this Approach

- Problem: Lack of recent defaults.
  - Income Securities Advisors' database contains fewer than 40 general obligation bond defaults between 1980 and mid-2011.

Annual Municipal Bond Default Rates By Number of Issuers
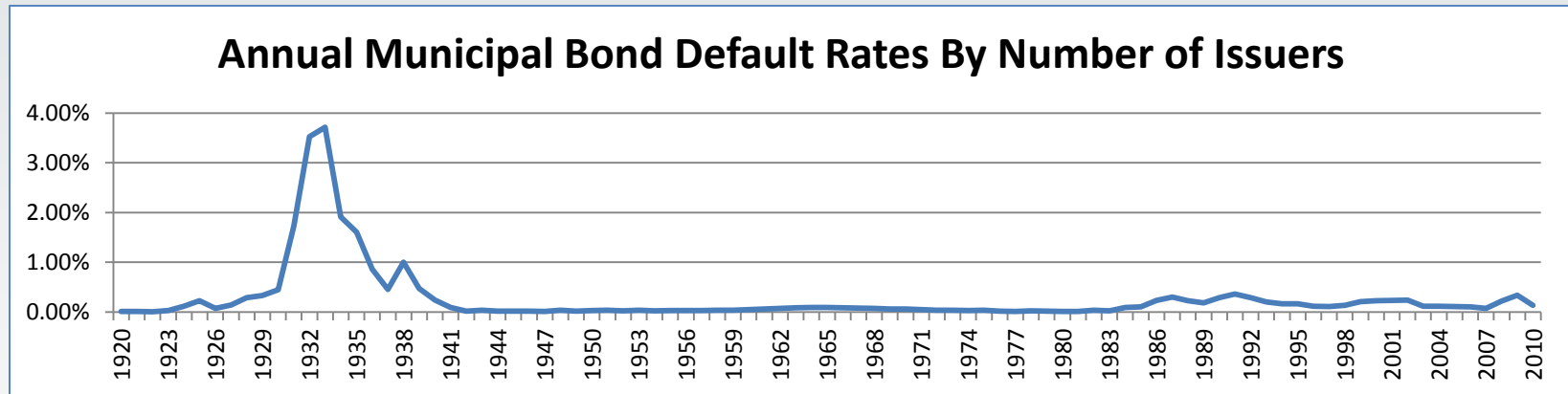
Source: Kroll Bond Rating Municipal Bond Study (2011). Public domain data collected by and in possession of PSCS.

- Solution: Follow the example of Reinhart & Rogoff (2009) by looking at older defaults.

Will the Depression Muni Experience Repeat?

Unlikely: We have not seen a buildup of municipal bond debt relative to GDP similar to the one that preceded the Depression. Municipal issuance surged after WW I as investors demanded tax free bonds and governments needed to build roads to accommodate newly popular automobiles.

State and Municipal Bonds Outstanding as a Percentage of GDP
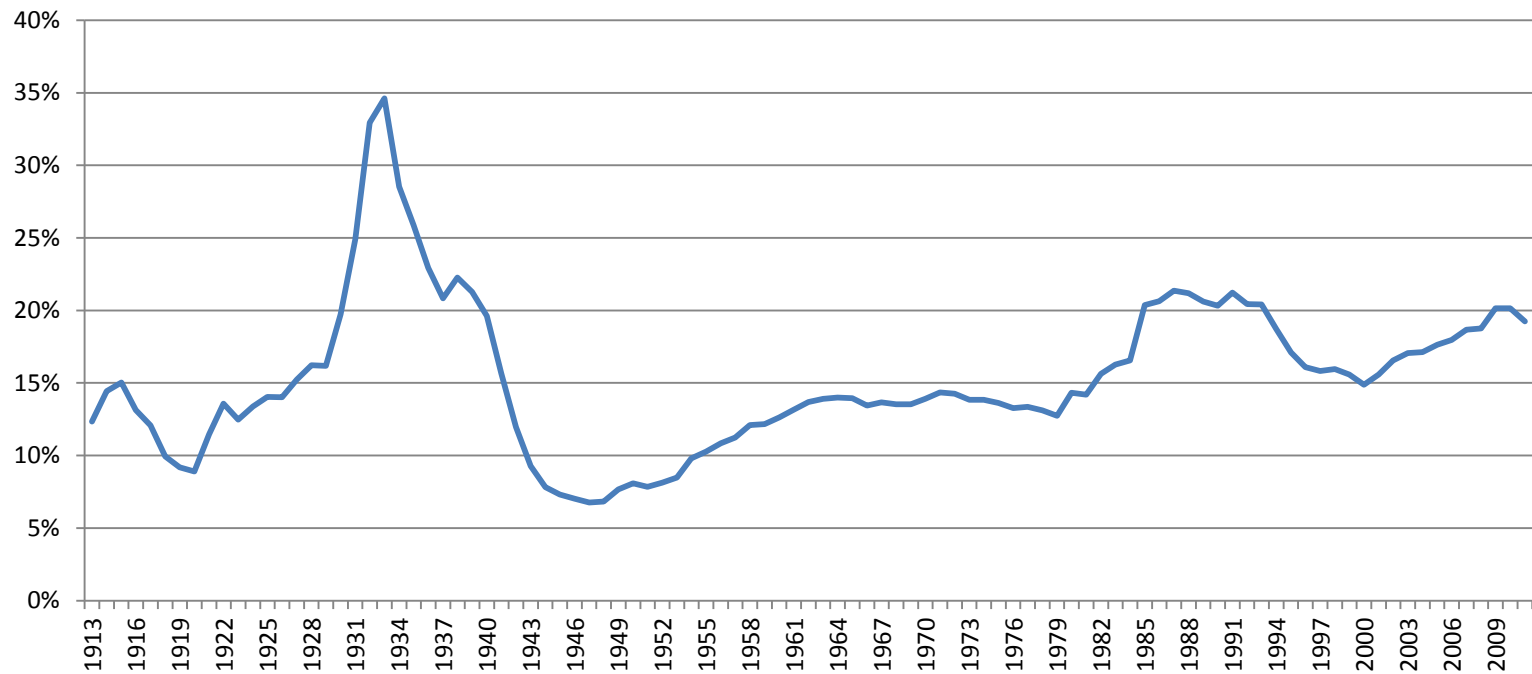
Source: Kroll Bond Rating Agency Municipal Default Study, 2011. Public domain data collected and in possession of PSCS.

Gathering Depression-era Default Data

- Sources
  - ➢ Old Moody's bond manuals
  - ➢ Old Census reports
  - ➢ Newspaper accounts
  - ➢ Records at state archives
- Technologies
  - ➢ Some resources on Google books
  - ➢ Library material needs to be photographed with proper lighting and a good camera
  - ➢ Photographs can be processed by Abbyy FineReader, which performs Optical Character Recognition and can convert inputs to PDFs or spreadsheets
  - ➢ Older material is usually too difficult to process automatically so offshore data entry personnel were used

(Techniques also apply to sovereigns)

← UN Statistical Yearbook 1955

FINANCES PUBLIQUES

166. Budget accounts and public debt (continued) — Comptes budgétaires et dette publique (suite)

Country and items	1939	1950	1951	1952	1953	1954	1955	Pays et postes
AMERICA, NORTH (continued)								AMERIQUE DU NORD (suite)
MEXICO (millions of pesos)			Calendar years — Années civiles					MEXIQUE (millions de pesos)
						D E	D E	
Expenditure								Dépenses:
Public debt service	82.0	554.0	770.9	895.3	805.9	651.6	799.5	Service de la dette
Education	69.1	314.0	367.9	459.0	507.8	606.6	711.8	Education
Other social services, etc.	36.7	136.8	153.9	172.9	185.0	208.9	249.0	Autres services sociaux, etc.
Defence	96.3	346.3	397.7	434.5	479.4	649.6	677.9	Défense
Other expenditure	336.2	2 112.2	3 303.6	4 502.5	3 512.3	2 711.0	3 242.8	Autres dépenses
Total	620.3	3 463.3	4 994.0	6 464.2	5 490.4	4 827.7	5 681.0	Total
Receipts:								
Direct taxes on income and wealth	50.2	770.8	1 193.9	1 448.1	1 145.3	1		
Customs duties	187.1	990.9	1 396.5	1 452.1	1 311.3	1		
Other indirect taxes	240.6	1 157.6	1 388.6	1 579.0	1 580.6	1		
Other receipts	87.8	525.2	983.9	1 624.5	985.9			
Total	565.7	3 444.5	4 962.9	6 103.7	5 023.1	4		
Balance (+) or (−)	−54.6	−18.8	−31.1	−360.5	−467.3	−		
Public debt (31 December):								
Domestic long-term	184.0	} 2 199.7	2 086.7	2 330.8	2 247.8 {			
: short-term	52.7							
Foreign	1 263.1	286.1	283.3	349.9	339.7			
Total	1 499.8	2 485.8	2 370.0	2 680.7	2 587.5			

UNITED STATES OF MEXICO   2579

British capital invested in Mexico during recent years was as follows:

	Govt. Bonds	Railways	Miscellaneous	Total
1925	£32,512,895	£107,875,103	£56,637,052	£197,025,049
1926	32,512,897	107 817,652	56,900,871	197,231,420
1927	33,784,430	107,475,721	53 677,910	199,938,061
1928	38,784,430	99,932,690	60,312,860	199,029 980
1929	38,784,430	97,711 535	64,274,915	200,770 880
1930	38,784 430	98 843,237	60 459,375	198,087,042
1931	38 597,130	98 731 977	57,698 016	195 027 083

American investments in Mexico have been estimated as follows: Mining and smelting, $230,421,000; petroleum, $205,868,000; communications and public utilities, $90,393,000, railways, $78,817,000; agriculture, fruit, etc., $58,873,000; other, $18,164,000; total, $682,536,000.

Governmental Finances

Revenues and Expenditures (in pesos):

Year	Revenue	Expenditure	Surplus	Year	Revenue	Expenditure	Surplus
1908	111,811,000	93,177,000	18,634,000	1927	306,872,516	340,231,614	*33,359,098
1913	120,958,902	110,781,871	10,177,031	1928	310,738,676	287,244,111	23,494,565
1918	146,749,283	145,711,651	1,037,632	1929	296,198,568	275,541,193	20,657,375
1920	256,734,091	201,714,221	55,019,870	1930	277,541,855	279,171,739	*1,629,884
1923	256,259,123	249,654,885	6,604,238	1931	227,689,969	231,054,495	*†3,364,526
1925	309,306,011	302,164,487	7,141,524	1932	227,690,000	226,573,546	1,116,454
1926	301,770,765	304,405,345	*2,634,580	1933 (budget)	215,050,000	215,014,754	35,246

* Deficit. † Certain obligations were not met, such as the national agrarian and banking debt and loans of the Bank of Mexico and advances on taxes payable in previous years, all of which amounted to 23,989,968 pesos or a total deficit in 1931 amounting to 27,913,646 pesos.

Details of revenues and expenditures (in pesos):

REVENUES*	1933 (Estim.)	1932 (Estim)	1931 (Actual)	EXPENDITURES*	1933 (Estim)	1932 (Actual)	1931 (Actual)
Import duties	47,250,000	52,150 000	54 195 104	Legislative	4,761,872	4 462,900	5,004 398
Export duties	4,600,000	3,600 225	4 067,831	Presidency	1,494 905	1 592,184	1 842,755
Taxes on industries	49 850 000	56,350 000	44 600 811	Judiciary	2,859,304	3,739,575	3,715,713
Income tax	18,500,000	13 500 000	33,090 148	Interior	2,442 577	3 561,178	2,509,450
Capital tax	1,000,000	900,000	1,166 905	State	4,257,241	4 678,407	4,506 073
Stamp tax revenues	11,000 000	29,750,000	29,179 996	Treasury	24,936,388	27 358,931	24 293,369
Immigration tax	140,000	125 000	112 901	War	55 286 900	54 854 338	59 682,226
Wholesale sales tax	5,100 000			Agriculture	13 145,845	15,721,549	18,108,723
Natural resources	11,500 000	15,390 500	10 505,231	Communications	26,131,774	31,791,294	37,693 913
10% additional	6,000,000	4,750,000	5,423,403	Industry	5 058,063	4 566 660	5 417,644
Public service concessions	16,400 000	22 247,000	22 633 602	Education	31,627,289	27,920 285	31,862,379
Other	42,460,000	13,131,500	22,719 937	Public health	6,499,987	6,415 176	7,407,953
				Government factories	6,000,000	6 132 234	8,820,922
				Comptroller's dept		3 550,806	3 412 958
				Statistical	900,665	1,749,986	2,077 555
				Attorney general	1,170,998	1,166,086	1,336 566
				Public debt	28,440,941	30 323 967	12 598 958
Total	209,800,000	*213,074,225	227,689,969	Total	215 014,754	*225,571 436	231 054 495

* As reported

Moody's 1934 Bond Manual →

US Municipal Bond Defaults: 1920 to 1939
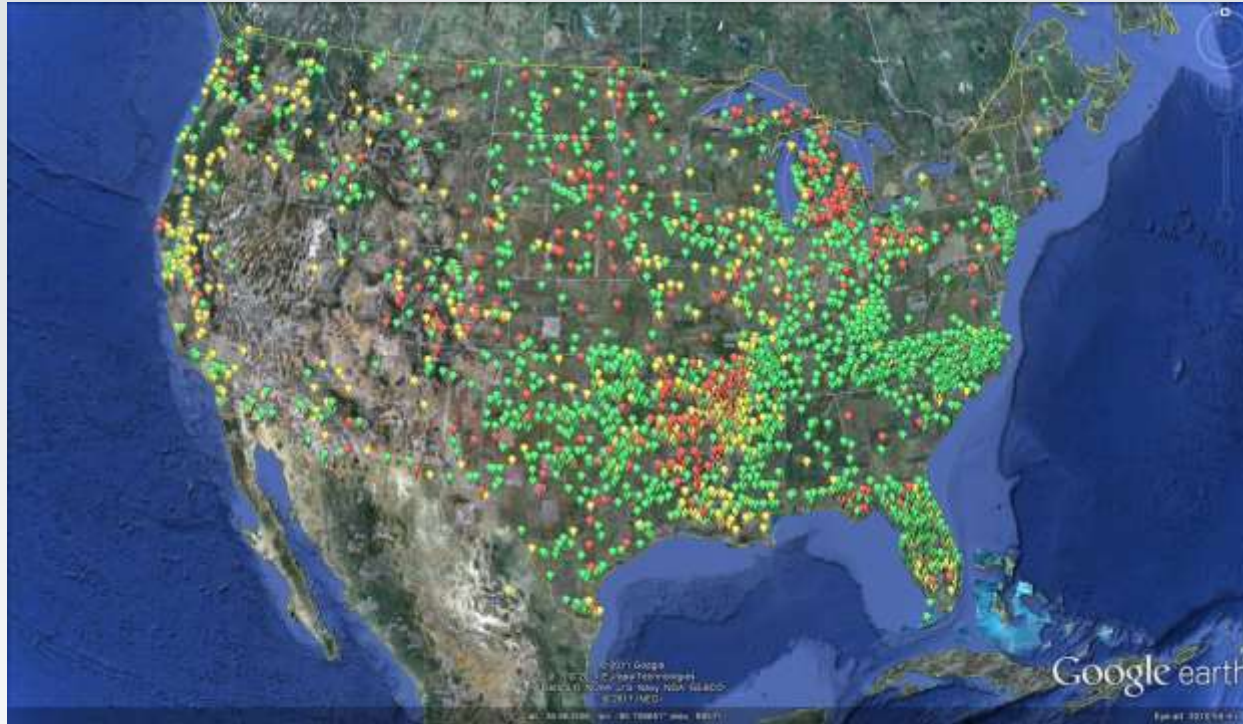
Yellow = Special Districts

Red = School districts

Green = Cities, States and Counties

Source: Public Sector Credit Solutions Default Database

- Over 5000 defaults in all
- Defaults heavily concentrated in specific states, esp. Florida, the Carolinas, Arkansas, Louisiana, Texas, New Jersey, Michigan, Ohio and California
- No defaults reported in Maryland, Delaware, Connecticut, Vermont and Rhode Island

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Drivers of Depression-Era Defaults

- Poor control of municipal bond issuance in certain states such as Florida (which had outlawed state debt), Michigan, New Jersey and North Carolina.

- Many defaults stemmed from bank failures and bank holidays. When banks holding sinking funds and other municipal deposits were not open, issuers could not access cash needed to perform on their obligations.

- Prohibition had eliminated alcohol taxes as a revenue source; local income and sales taxes had yet to become common. Cities were thus heavily reliant on real estate taxes. When real estate values fell and property tax delinquencies spiked, many issuers became unable to perform.

- Many defaults occurred in drainage, irrigation and levee districts. Bonds funding these agricultural infrastructure projects were serviced by taxes paid by a small number of farmers or farming companies. A single delinquency could thus trigger a default.

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Analysis and Modeling of Large City Defaults

- Strongest predictor was ratio of **Interest to Total Revenue**.
- Mean ratio for defaulting cities was 16.1% versus 11.0% for non-defaulters.
- High ratio non-default observations were concentrated in **Virginia** – which has a unique law requiring the State to cover municipal bond defaults. A dummy was added to address this state-specific attribute
- **Change in Annual Revenue** was also significant
- Population changes and cash balances were *not* significant

Interest as a Percentage of Revenue
Defaulting and Non-Defaulting Cities
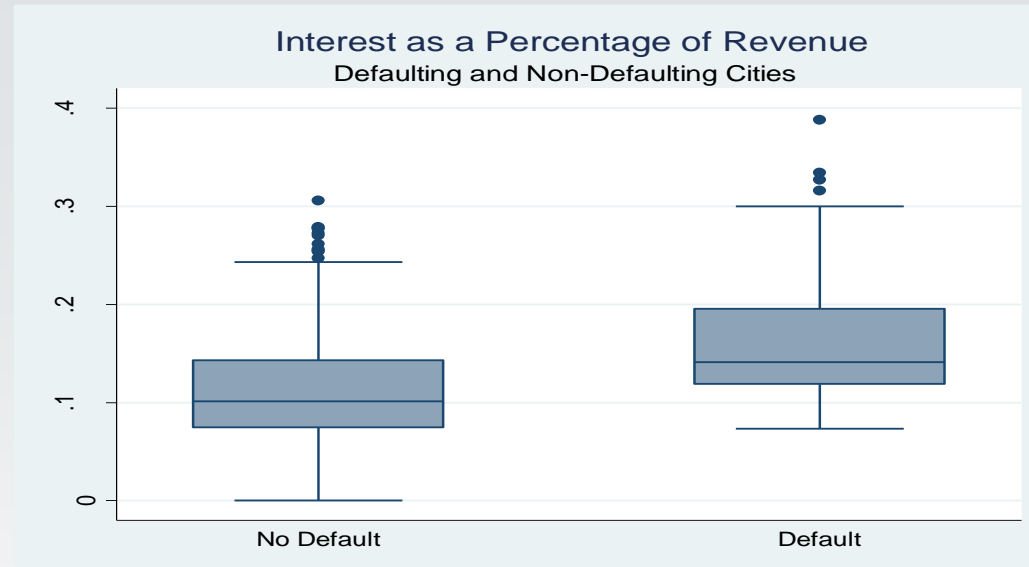
Variable	Coefficient	Standard Error	p
Interest/Revenue	17.41951	1.99172	0.000
Virginia Dummy	-3.695301	1.471739	0.012
Δ Revenue	-1.964635	-1.964635	0.042
Constant	-4.13551	0.3037248	0.000

$$dp = \exp(-4.14 + 17.42\text{IR} - 3.70\text{VA} - 1.96\Delta\text{R})$$
$$/(1 + (-4.14 + 17.42\mathit{IR} - 3.70\mathit{VA} - 1.96\Delta\text{R}))$$

Some Other Observations

- Pensions and Other Post Employment Benefits (OPEB) are a threat to certain issuers, but we should consider the following:
  - ➤ Underfunded pensions are nothing new
  - ➤ Discussion around the issue is often distorted by political considerations. In particular, comparisons between a government's annual budget (a flow) and its unfunded liabilities (a stock reported in present value terms) are not meaningful
  - ➤ Future pension and OPEB expenditures should be estimated and compared to projected revenues
- Recoveries on municipal bond defaults have been quite high both during the Depression and more recently. New York City (1975) and Orange County (1994) both had full recoveries. Jefferson County, Stockton and San Bernardino creditors may not be as fortunate, however.

Toward an Alternative Business Model

Some Concerns with Current Model

Current business and billing practices can jeopardize the quality and independence of municipal bond ratings:

- ➢ Billing based on the size of a bond issue may cause a rating agency to place less emphasis on an issuer's total indebtedness, which (relative to capacity) is the strongest contributor to default risk.

- ➢ Because rating agencies realize less revenue from public sector bonds than other asset classes, they may under-invest in methodology research and technology.

- ➢ Rating agencies may have an incentive to "under rate" municipal issuers to create space for bond insurers, which may be expected to pay higher rates.

- ➢ Rating agencies' monitoring performance has been comparatively weak. When they receive monitoring fees, payment is not based on quality of service provided.

An Example of Failing to Monitor

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Incumbent Firms and Transparency

US Government accounting standards require a high degree of transparency, and most large units of government provide substantial amounts of public disclosure.

Since the rating process does not really require any "secret sauce" it, too, could be transparent, but isn't.

For example, rating agencies could collect, aggregate and report publicly available issuer statistics – but don't

Instead these data must be collected on PDFs scattered across the web and to subscribers of proprietary data services such as Merritt Research

A new firm can provide an important service to investors and the general public simply by publishing these data

An Alternative Business Model: 3 Levels

Level 1: Open data / Open model

Publish key financial statistics and municipal credit scores on a widely accessible web site. Business benefit: Creates public awareness by providing a useful service.

Level 2: Certified Scores

Work with local governments to ensure that model inputs are accurate and properly interpreted. Annual flat or hourly fee billed to the government regardless of issuance size. Score could be DP itself or an implied rating like AA(m).

Level 3: Traditional Rating Service

Incorporates qualitative and issue specific factors.

Advantages of this Business Model

The "freemium" model – providing a compelling free service to build traffic and then charge for enhancements – is common among internet firms

Publishing standardized data and scores on a large number of issuers should create significant media attention and thus awareness among local government officials – our potential customers

This high level of awareness could result in calls from issuers asking to be rated, and should also ease the sales process

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