

Towards a Financial Statement Based Approach to Modeling Systemic Risk in Insurance and Banking

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Outline

- Critique of SRISK as a measure of systemic risk
- Propose CRISK – an alternative financial statement-based measure of an institution’s vulnerability
- Case study: Prudential Financial, Inc.



Background

- CMSR studies systemic risk in several areas (e.g., chemical systems)
- SRISK has received significant attention recently, both academically and in the news
 - E.g. Danielsson et al (2014)
- This research is a cooperative project between CMSR and the B-school
 - Fundamental analysis is a focus area at the B-school
 - SRISK is predominantly stock market based measure of systemic risk
 - CRISK is an attempt to validate it with fundamentals

NYU Stern SRISK – Formulation

- “An estimate of the amount of capital that a financial institution would need to raise in order to function normally if we have another financial crisis”
- SRISK measures the *expected capital shortfall*, during a crisis (40% equity markets decline)

$$\text{SRISK}_{it} = E_t(\text{CS}_{it+h} | R_{m t+1:t+h} < C)$$

$$\text{CS}_{it} = kA_{it} - W_{it} = k(D_{it} + W_{it}) - W_{it}$$

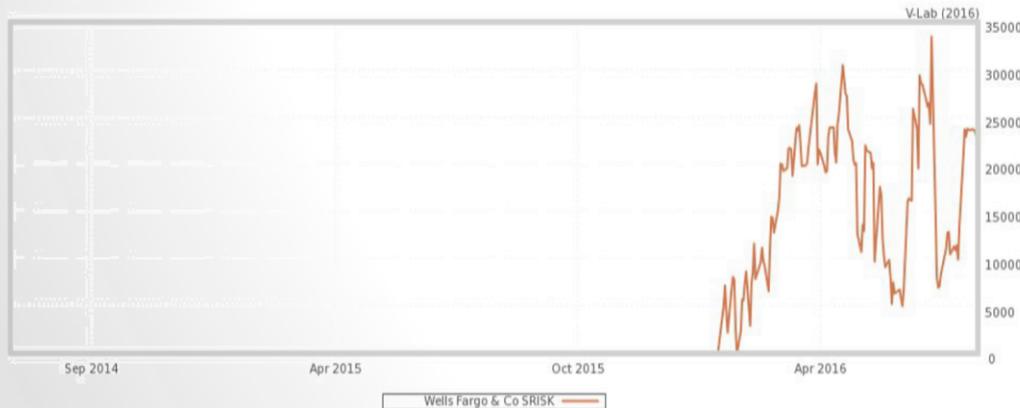
where W_{it} is the market value of equity; D_{it} is the book value of debt; A_{it} is value of “quasi assets”; k is prudential capital fraction, usually 8%.

Brownlees, C. T., & Engle, R. F. (2015). SRISK: A Conditional Capital Shortfall Measure of Systemic Risk. Available at SSRN 1611229.



NYU Stern SRISK – Too volatile

- SRISK prone to too much volatility



- Wells Fargo's SRISK has fluctuated dramatically between zero and \$36 billion in the first six months of 2016 (prior to the recent fake account scandal)
- Unlikely to reflect shortfalls in Wells Fargo's economic capital

NYU Stern SRISK – Critiques

- Capital shortfalls under SRISK represent a black box and are not tailored to specific business models
 - SRISK does not isolate “at risk” liabilities of each business model
 - “At risk” liabilities are those which are **callable at par value** and on which **the company bears the risk** (i.e. short term repos at a bank)
 - For a life insurer, consider **separate accounts, closed block, future policy benefits, and policyholders’ account balances**
 - 8% capital requirement is based on Basel capital standards and is not applicable to insurers (RBC)
 - Market risk may not be the most important systemic risk for an insurer
 - A hurricane, not a 40% decline in the market, could be a systemic event for a P&C insurer
 - A pandemic for a life insurer

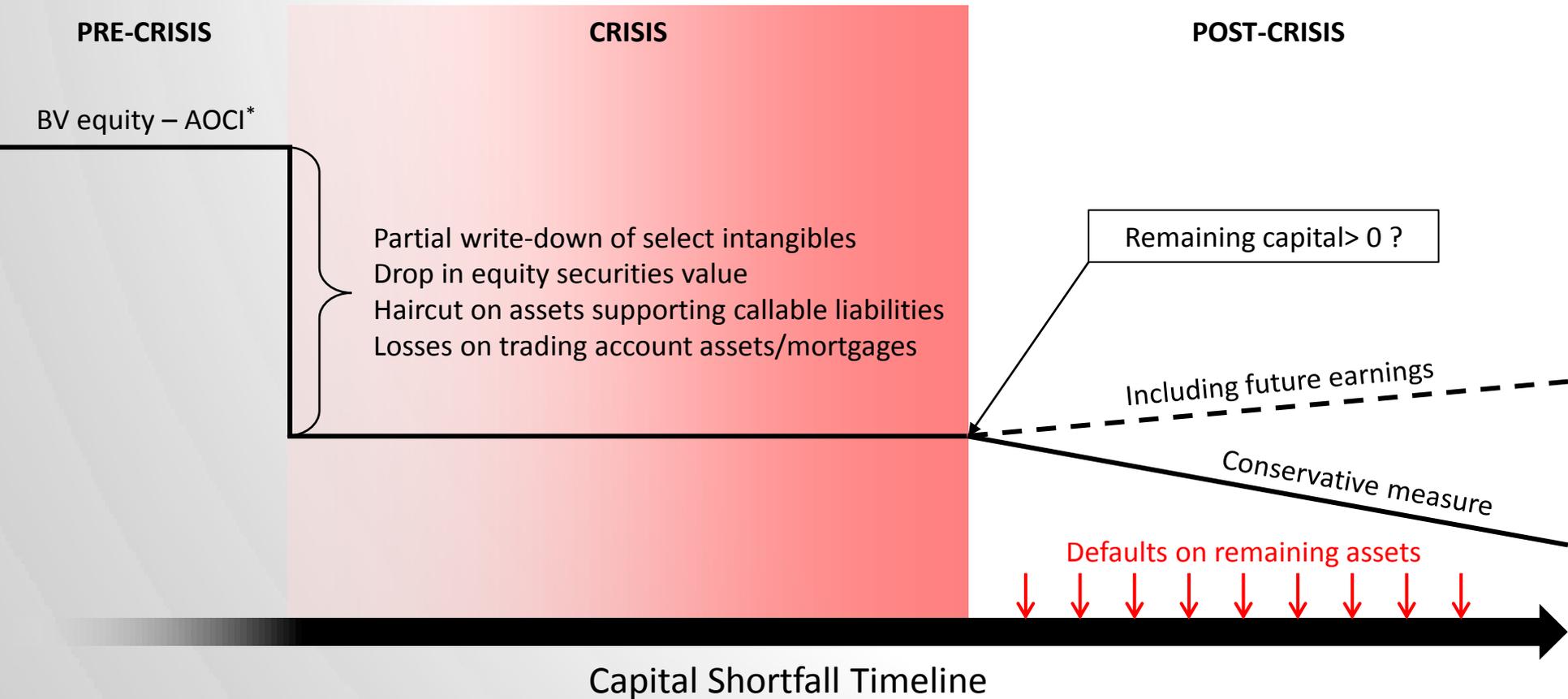
NYU Stern SRISK – Best for “at risk” liabilities

- Assumes the business liquidates and hence works best for callable liabilities on which the company bears the market risk (“at risk”)
 - Traditional banking liabilities such as deposits, repos or derivatives
- Market cap of equity is not “usable” in liquidation to pay off obligations, unlike book value of capital
- SRISK does not adequately capture the intuition that systemic risk ought to involve:
 - A forced unwinding of transactions big enough to materially impact the underlying market in that financial instrument
 - the contagion effect that such unwinding can cause

Columbia CRISK – Principles

- An ideal systemic risk measure should capture:
 - Callable liabilities on which the company bears the risk (“at risk”)
 - Financial vulnerability in the event of a crisis
 - Inter connectedness with the market
- We propose a financial statement approach to estimate systemic risk
 - Not as volatile or as much of a black box
 - Can accommodate variations in specific business models
- Two steps:
 - During crisis
 - Post crisis
 - Illustrated using Prudential Financial

Prudential: CRISK Two-Step Procedure



*Subtracting AOCI gains because (1) statutory accounting is book value based; (2) Life insurers generally hold bonds to maturity.

Columbia CRISK – During Crisis

1

- Review each liability (on or off-balance sheet) and evaluate whether that liability will be at risk in a crisis.

2

- If a liability is at risk, consider whether the firm has earmarked specific assets to pay off that liability.

3

- If no earmarked assets, assume the higher quality assets will be sold first to pay off the liability. If these assets are not cash, assume that the assets will be sold at a haircut.

4

- The extent of the expected sale of securities will provide an indication of the potential impact of such a sale on the market for that security.

5

- Charge any losses from sales of securities against the firm's book value of equity.

6

- Assume goodwill and select intangibles will be worthless, should a systemic event occur, and hence reduce the book value of equity accordingly.

Columbia CRISK – Post Crisis

7

- The assets left over will represent less-liquid or even lower quality claims.
- Now compute 8% of the left over assets and designate that number as the institution's required loss absorption capacity after the crisis has passed.

8

- Calculate the required loss absorption capacity of the institution. That is, apply “defaults” to these assets based on approximate loss default rates that apply to these assets based on their credit ratings.
- Evaluate whether capital need is in excess of available capital.

Case Study – Prudential



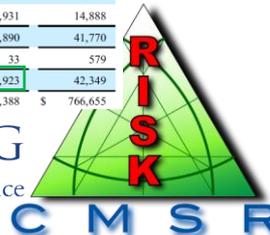
PRUDENTIAL FINANCIAL, INC.
 Consolidated Statements of Financial Position
 December 31, 2015 and 2014 (in millions, except share amounts)

	2015	2014
ASSETS		
Fixed maturities, available-for-sale, at fair value (amortized cost: 2015 – \$265,416; 2014 – \$265,116)	\$ 290,323	\$ 299,090
Fixed maturities, held-to-maturity, at amortized cost (fair value: 2015 – \$2,624; 2014 – \$2,002)(1)	2,624	2,002
Trading account assets supporting insurance liabilities, at fair value(1)		
Other trading account assets, at fair value(1)		
Equity securities, available-for-sale, at fair value (cost: 2015 – \$6,847; 2014 – \$6,847)		
Commercial mortgage and other loans (includes \$274 and \$380 measured at fair value at December 31, 2014, respectively)(1)		
Policy loans		
Other long-term investments (includes \$1,322 and \$1,082 measured at fair value at December 31, 2014, respectively)(1)		
Short-term investments		
Total investments		
Cash and cash equivalents(1)		
Accrued investment income(1)		
Deferred policy acquisition costs		
Value of business acquired	2,828	2,836
Other assets(1)	14,358	13,379
Separate account assets	285,570	296,435
TOTAL ASSETS	\$ 757,388	\$ 766,655
LIABILITIES AND EQUITY		
LIABILITIES		
Future policy benefits	\$ 224,384	\$ 217,766
Policyholders' account balances(1)	136,784	136,150
Policyholders' dividends	5,578	7,661
Securities sold under agreements to repurchase		
Cash collateral for loaned securities		
Income taxes		
Short-term debt		
Long-term debt		
Other liabilities(1)		
Notes issued by consolidated variable interest entities (includes \$8,597 and \$6,033 measured at fair value under the fair value option at December 31, 2015 and December 31, 2014, respectively)(1)		
Separate account liabilities		
Total liabilities		
COMMITMENTS AND CONTINGENT LIABILITIES (See Note 23)		
EQUITY		
Preferred Stock (\$.01 par value; 10,000,000 shares authorized; none issued)		
Common Stock (\$.01 par value; 1,500,000,000 shares authorized; 660,111,339 shares issued at both December 31, 2015 and December 31, 2014)		
Class B Stock (\$.01 par value; 0 shares authorized and issued at December 31, 2015; 10,000,000 shares authorized and 2,000,000 shares issued at December 31, 2014)		
Additional paid-in capital		
Common Stock held in treasury, at cost (213,009,970 and 205,277,862 shares at December 31, 2015 and December 31, 2014, respectively)		
Class B Stock held in treasury, at cost (0 and 2,000,000 shares at December 31, 2015 and December 31, 2014, respectively)	0	(651)
Accumulated other comprehensive income (loss)	12,285	16,050
Retained earnings	18,931	14,888
Total Prudential Financial, Inc. equity	41,890	41,770
Noncontrolling interests	33	579
Total equity	41,923	42,349
TOTAL LIABILITIES AND EQUITY	\$ 757,388	\$ 766,655

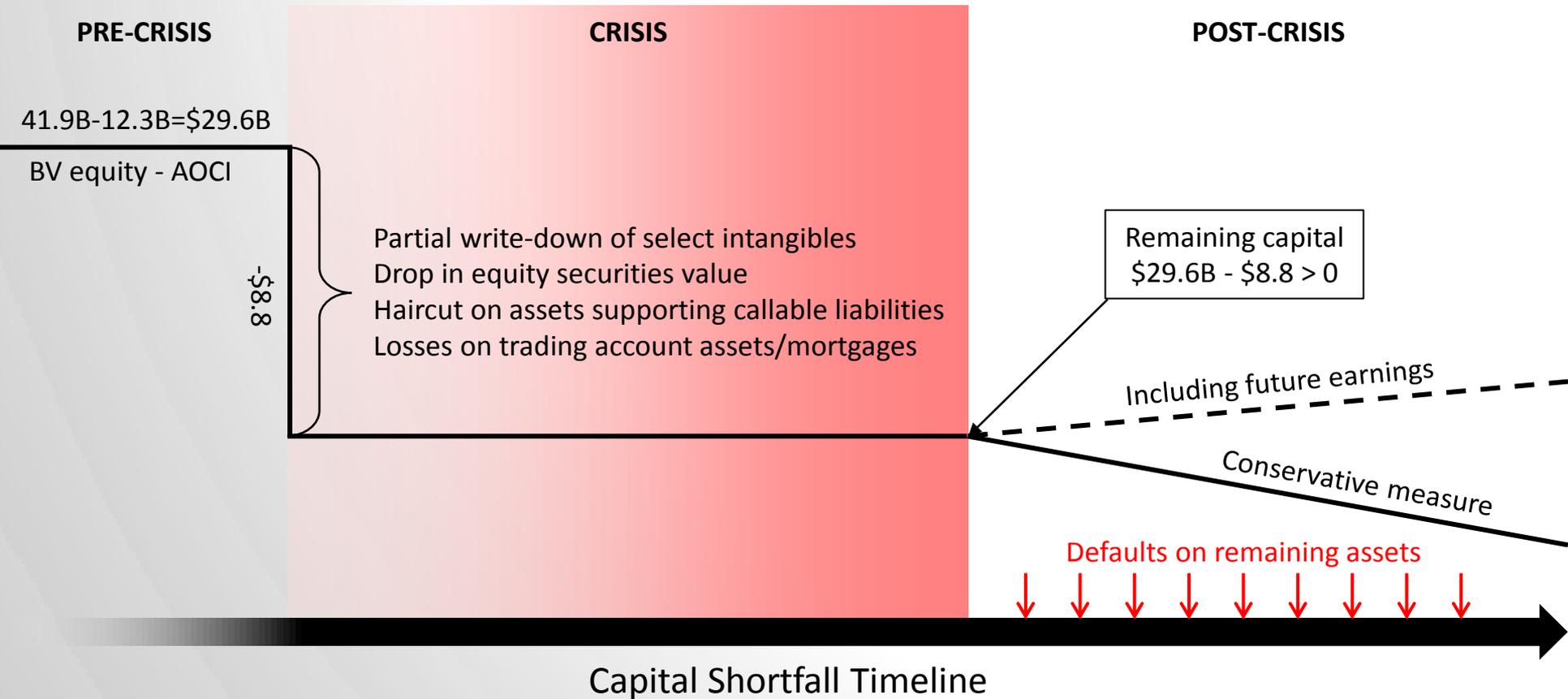
PRUDENTIAL FINANCIAL, INC.
 Consolidated Statements of Financial Position (p. 170)

For separate accounts, the policyholder bears performance risk if called

- Assets
 - Fixed maturities: \$290B
 - Separate accounts: \$286B*
 - Commercial mortgages: \$51B
- Liabilities
 - Separate accounts: \$286B*
 - Future policy benefits: \$224B
 - Policyholders' account balances: \$137B
- Equity
 - GAAP based equity: \$41.9B



Capital Shortfall Timeline



Sample Calculation – During Crisis

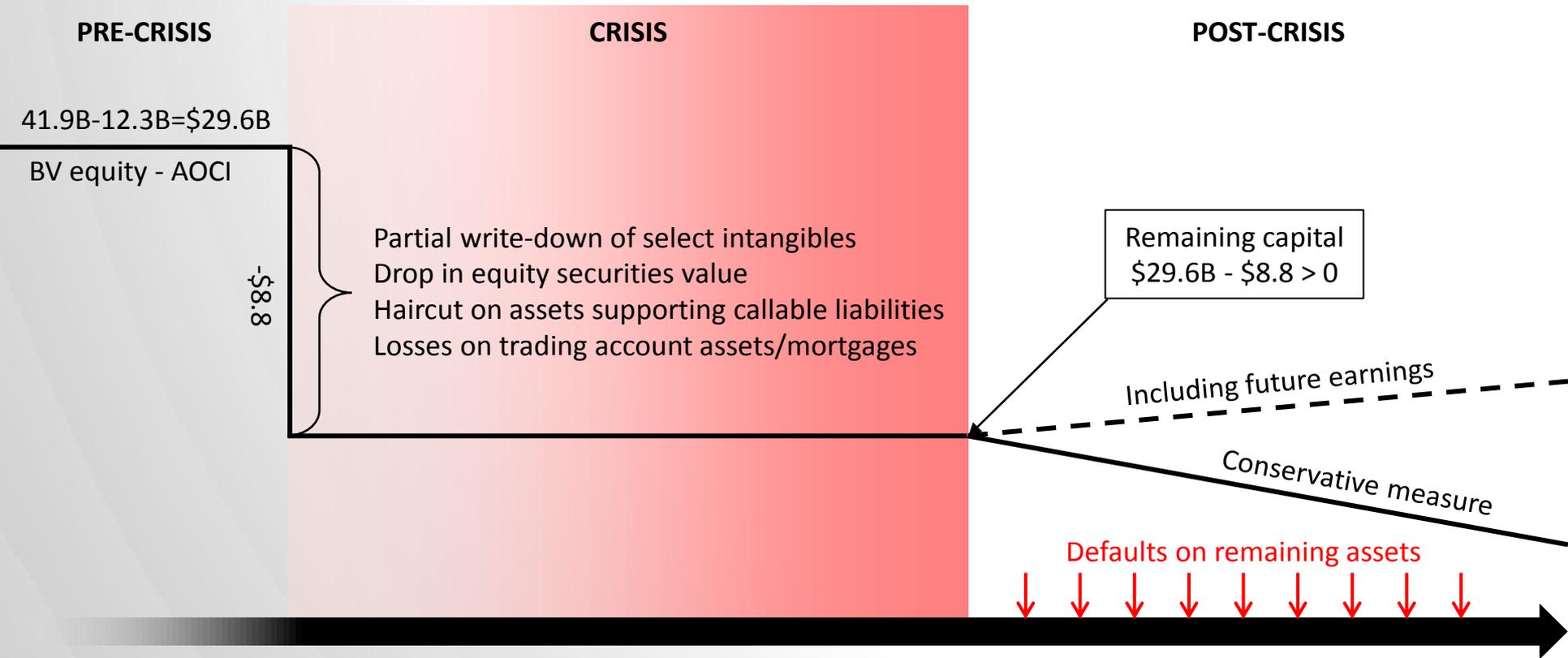
- **Summary**

- “At risk” liabilities: **\$60B**
- Liquidating assets to cover at risk liabilities: **\$60.5B**
- Haircuts on financing at risk liabilities: **\$0.5B**
 - Mostly covered by Cash and Cash Equivalents or Treasuries
- Drop in equity securities value: **\$3.1B**
- Haircuts in trading account assets: **\$2.3B**
- Defaults in commercial mortgages and other loans: **\$0.13B**
- Intangible asset write down: **\$2.8B (VOBA)**

- **Book value of equity write-down during crisis**

$$\text{\$8.8B} = 0.5 + 3.1 + 2.3 + 0.13 + 2.8$$

Capital Shortfall Timeline



POST CRISIS: Remaining capital after crisis of \$20.8B > expected defaults on left over assets computed to \$3B

Sample Calculation – Post Crisis

- **Summary**

- Defaults from remaining fixed maturity securities: **\$2.3B**
- Defaults from non-fixed maturity assets: **\$0.7B**
- Book value of equity write-down during crisis: **\$8.8B**

- **Capital Surplus**

- Capital Surplus = (BV equity – AOCI – write-down) – Post-crisis default
- **\$17.8B** = $(41.9 - 12.3 - 8.8) - (2.3 + 0.7)$

Sample Calculation – Post Crisis

- Defaults from remaining fixed maturity securities
 - NAIC 1-2: investment grade (3 year default rate = **0.54%**)
 - NAIC 3-6: below investment grade (3 year default rate = **11.6%**)

Table 26

Global Corporate Average Cumulative Default Rates By Rating Modifier (1981-2015) (%) (cont.)

Rating	--Time horizon (years)--														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B-	8.74	16.36	21.49	25.01	27.82	29.82	31.46	32.51	33.18	33.76	34.56	35.17	35.44	35.75	36.10
CCC/C	27.22	36.41	41.59	44.64	46.99	47.84	48.79	49.59	50.48	51.12	51.61	52.24	53.08	53.74	53.74
Investment grade	0.12	0.32	0.54	0.80	1.06	1.32	1.56	1.79	2.02	2.25	2.47	2.66	2.84	3.02	3.21
Speculative grade	4.29	8.28	11.61	14.19	16.25	17.93	19.36	20.54	21.60	22.55	23.34	24.00	24.60	25.13	25.65
All rated	1.59	3.12	4.44	5.51	6.40	7.16	7.80	8.35	8.85	9.32	9.72	10.05	10.36	10.64	10.92

Sources: Standard & Poor's Global Fixed Income Research and Standard & Poor's CreditPro®.



Sample Calculation – Post Crisis

- Defaults from remaining fixed maturity securities
 - NAIC 1-2: investment grade (3 year default rate = **0.54%**)
 - NAIC 3-6: below investment grade (3 year default rate = **11.6%**)
 - Fixed maturities sold during crisis: **\$43.8B** (60.5B assets sold – 16.7B cash)
 - Defaults: **\$2.3B** = (**244.6** – 43.8) x 0.54% + **10.4** x 11.6%

Fixed maturity portfolio by NAIC Designation or equivalent ratings attributable to PFI excluding the Closed Block (p. 131)

NAIC Designation(1)(2)	December 31, 2015			
	Amortized Cost	Gross Unrealized Gains(3)	Gross Unrealized Losses(3)(4)	Fair Value
				(in mi)
1	\$ 177,350	\$ 22,783	\$ 1,445	\$ 198,688
2	43,731	3,698	1,545	45,884
Subtotal High or Highest Quality Securities(5)	221,081	26,481	2,990	244,572
3	7,085	408	292	7,201
4	2,332	150	100	2,382
5	415	78	12	481
6	367	20	4	383
Subtotal Other Securities(6)(7)	10,199	656	408	10,447
Total Fixed Maturities	\$ 231,280	\$ 27,137	\$ 3,398	\$ 255,019

Compare CRISK with SRISK

- Prudential doesn't bear risk on separate accounts
 - Exclude \$285B Separate Accounts makes SRISK fall by **\$23B** (0.08×285)
- Not all of \$715 Billion of Prudential's liabilities are at risk
 - Most of the \$137B of policyholder account balances and \$224B of future policy benefits are not immediately withdrawable at par
 - Excluding these two items would cause Prudential's SRISK to fall by **\$29B** ($0.08 * [224B + 137B]$)
- The NYU SRISK measure assumes that equity losses from the systemic event would amount to \$26B
 - Not obvious that Pru will incur substantial losses from asset sales during a crisis
 - Pru has high quality assets to offset its at risk liabilities
 - Pru will continue writing policies during the crisis and beyond

Conclusions

- SRISK is easy to compute and appealing but
 - SRISK does not respond well to the different risk profiles of different types of firms
 - Prone to stock market volatility
- CRISK is financial-statement based, reflects the specifics of individual business but
 - Detail heavy and harder to scale
 - Perhaps SRISK could be a first filter, refined with CRISK
 - We have preliminary results for Chubb, JPM and BoNY
- There is a large gap between CRISK and SRISK
 - For Prudential, CRISK reflects a **\$17.8B capital surplus**, compared to SRISK **\$46B capital shortfall**
 - SRISK treating all liabilities as “at risk” explains much of the difference

Thanks and discussion!

