Lecture 9 The Financial Crisis, Asset Bubbles

Macroeconomics EC2B1

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London School of Economics, Lent 2023

Plan

- 1. Run on Silicon Valley Bank
- 2. The 2008 financial crisis: some facts
- 3. Asset bubbles
- 4. Financial frictions and amplification

A Nobel Prize for Work on Financial Crises

The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2022



Outreach
Ben S. Bernanke
Prize share: 1/3



Douglas W. Diamond Prize share: 1/3



III. Niklas Elmehed © Nobel Priz Outreach Philip H. Dybvig Prize share: 1/3

The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2022 was awarded jointly to Ben S. Bernanke, Douglas W. Diamond and Philip H. Dybvig "for research on banks and financial crises"

Readings

- Two supplements with derivations on moodle:
 - asset bubbles
 - financial frictions and amplification
- EC1B1 lecture notes 3 "Great Depression & Lender of Last Resort"
- Jones, chapter 10.4
- Additional readings for the interested (not examinable)
 - Brunnermeier (2008) "Bubbles" https://link.springer.com/referenceworkentry/10.1057/978-1-349-95121-5_44-2
 - Bernanke and Gertler (1989), "Agency Costs, Net Worth, and Business Fluctuations"
 - Kiyotaki and Moore (1997), "Credit Cycles"
 - Mian and Sufi (2011) "House Prices, Home Equity-Based Borrowing, and the U.S. Household Leverage Crisis" (2011)
 - Mian and Sufi (2014) "What Explains the 2007–2009 Drop in Employment?"
 - Noah Smith on SVB https://noahpinion.substack.com/p/why-was-there-a-run-on-silicon-valley
 - Adam Tooze on SVB https://adamtooze.substack.com/p/chartbook-200-something-broke-the
 - Jiang et al (2023) "Monetary Tightening and U.S. Bank Fragility in 2023" https://www.nber.org/papers/w31048

Run on Silicon Valley Bank

Bank runs as multiple equilibria (from EC1B1)

- Bank takes deposits of \$1 from many borrowers and lends out to project that yields a gross return of R>1 in 2 years
- Bank can call in loan before project is finished. But only at a substantial loss (gross return 0<r<1)
- · Should you run on this bank?

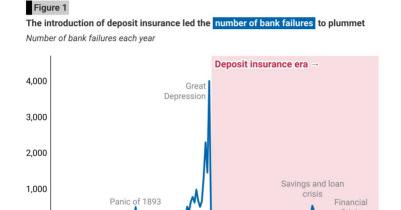
	Everyone else withdraws	Everyone else does not withdraw
You withdraw	r	1
You do not withdraw	0	R

- Multiple (symmetric Nash) equilibria:
 - If everyone else is going to withdraw, you should too
 - If no one else is going to withdraw, you should not.
- Fear of run can become self-fulfilling
 - If you believe everyone else will run, your best response is to run

Deposit insurance

- Solution? Deposit insurance
- In theory on previous slide:
 - eliminates bad equilibrium
 - never even has to be paid out
- In U.S., Federal Deposit Insurance Corporation (FDIC) insures all deposits up to \$250,000

This works not only in theory but also in practice



But most SVB accounts were > \$250,000 so not FDIC insured

Exhibit 1 - Deposits Less than \$250k as a Percentage of Total Deposits

		4Q22	2021	2020	2019	2018			4022	2021	2020	2019	201
Company Name	Ticker	(X)	(X)	(%)	(%)	00	Company Name	Ticker	00	(%)	(%)	(X)	(X)
1 Northwest Bancshares, Inc.	NWBI	64.5	65.0	66.3	71.6	72.5	26 Atlantic Union Bankshares Corporation	AUB	46.4	45.4	46.3	51.5	58.
2 NBT Bancorp Inc.	NBTB	55.8	52.9	55.0	51.8	53.6	27 MhT Bank Corporation	MTB	46.4	33.7	37.6	40.9	41
WesBanco, Inc.	WSBC	53.8	55.3	58.1	60.1	62.1	28 Old National Bancorp	ONB	45.9	49.9	51.8	56.2	58.
Glacier Bancorp, Inc.	GBCI	53.0	51.3	56.6	62.8	65.3	29 Citizens Financial Group, Inc.	CFG	45.4	43.1	42.8	47.8	52.
Regions Financial Corporation	85	52.5	49.9	50.1	53.3	54.1	30 SouthState Corporation	SSB	45.0	45.9	50.9	47.6	53.5
6 First Hawaiian, Inc.	FHB	52.2	38.5	41.2	43.1	40.8	31 United Community Banks, Inc.	UCBI	44.8	43.7	48.7	55.4	58.
7 Independent Bank Corp.	ND6	51.5	51.8	52.4	57.5	56.9	32 Trustmark Corporation	TRMK	44.7	42.8	43.5	49.6	49.
Capital One Financial Corporation	COF	50.6	54.1	57.6	60.3	61.3	33 Eastern Bankshares, Inc.	EBC	44.5	36.3	44.7	51.0	53.
P First National of Nebraska, Inc.	FINN	50.4	45.4	49.2	55.4	55.8	34 The PNC Financial Services Group, Inc.	PNC	44.5	41.3	40.4	44.4	46
D Commerce Bancshares, Inc.	CBSH	50.2	44.2	46.3	53.2	52.5	35 Fifth Third Bancorp	FITS	44.1	36.8	37.6	41.1	45.
First Citizens BancShares, Inc.	FCNC.A	50.2	45.6	49.3	55.1	56.1	36 Berkshire Hills Bencorp, Inc.	BHLB	44.1	40.7	50.2	56.0	59.
Webster Financial Corporation	was	50.1	56.8	58.8	62.2	64.5	37 F.N.B. Corporation	FNB	43.3	44.2	46.4	52.2	56.
Community Bank System, Inc.	CBU	50.1	49.0	51.6	55.4	56.7	38 Customers Bancorp, Inc.	CUBI	43.1	19.3	26.3	35.3	36.
Simmors First National Corporation	SFNC	50.0	42.5	47.0	47.2	49.0	39 Sandy Spring Bancorp, Inc.	SASR	43.1	38.1	42.6	45.7	50.
First Bancorp	FENC	49.8	46.8	50.8	55.4	60.8	40 Associated Banc-Corp	ASB	43.0	41.7	41.4	42.7	45.
First Intenstate BancSystem, Inc.	FBK	49.6	46.9	51.1	57.1	57.6	41 Wintrust Financial Corporation	WIFC	42.9	41.2	44.4	48.7	50.
Umpqua Holdings Corporation	LIWPQ	49.5	45.6	48.1	50.6	53.0	42 First Merchants Corporation	FRME	42.8	40.1	42.5	46.7	49.
First Financial Bancorp.	FFBC	49.3	46.8	50.5	56.7	57.1	43 Truist Financial Corporation	TFC	42.8	41.9	43.1	44.8	45.
Barrer Corporation	BANK	49.2	49.0	50.7	56.1	60.0	44 Wells Fargo & Company	WFC	41.6	40.6	40.2	39.2	40.
Pulton Firencial Corporation	FULT	49.2	48.4	49.9	54.0	53.0	45 Huntington Bancshares Incorporated	HIAN	41.1	63.2	63.4	66.5	63.
1 United Bankshares, Inc.	UBSI	48.9	49.8	52.4	50.5	51.7	46 Prosperity Bancshares, Inc.	PB	40.9	40.0	45.4	43.7	47.
2 Washington Federal, Inc.	WAFD	48.7	49.2	54.7	63.6	66.5	47 Renauer Corporation	BNST	40.8	39.3	43.2	47.4	49.
3 International Bancshares Corporation	BOC	47.6	46.7	50.3	52.7	52.6	48 First BarCorp.	FRP	40.7	39.1	46.1	53.5	56
Merchants Bancorp	MEIN	47.2	36.7	26.5	47.5	40.3	49 Heartland Firencial USA, Inc.	HTLE	40.6	37.8	41.1	40.2	44
5 First Busey Corporation Source: SBP Global Market Intelligence.	BUSE	46.7	41.8	46.8	51.9	58.6	50 PacWest Bancorp	PACW	40.0	29.6	32.4	32.7	
Source: SBP Global Market Intelligence.		4Q22	2021	2020	2019	2018			4022	2021	2020	2019	20
Source: SBP Global Market Intelligence. Company Name	Ticker	4Q22 (%)	2021 (%)	2020 (%)	2019 (%)	2018 (%)	Company Name	Ticker	4Q22 (%)	2021 (%)	2020 (K)	2019 (K)	20 ⁻ (X
Source: SBP Global Market Intelligence. Company Name ReyCorp	Ticker	4Q22 (%)	2021 (%) 37.4	2020 (%) 40.0	2019 (%) 41.3	2018 (%) 45.1	Company Name 76 Bank of America Corporation	Ticker BAC	4022 (%) 30.8	2021 (%) 29.0	2020 (%) 30.8	2019 (K) 31.8	20° (X
Source: S&P Global Market Intelligence. Company Name ReyCorp OceanFirst Financial Corp.	Ticker KEY OCFC	4Q22 (K) 40.0 39.9	2021 (%) 37.4 35.2	2020 (%) 40.0 43.0	2019 (%) 41.3 45.6	2018 (%) 45.1 49.9	Company Name 76 Bank of America Corporation 77 Dime Community Sencebares, Inc.	Ticker BAC DCOM	4Q22 (%) 30.8 30.6	2024 (%) 29.0 29.1	2020 (%) 30.8 23.2	2019 (%) 31.8 28.4	20° (X 31. 29.
Source: 50P Global Market Intelligence. Company Name MayCorp Oceanfirst Financial Corp. Silvergate Capital Corporation	Ticker REY OCFC SI	4022 (%) 40.0 39.9 39.7	2021 (%) 37.4 35.2 0.6	2020 (%) 40.0 43.0 1.4	2019 (%) 41.3 45.6 22.1	2018 (%) 45.1 49.9 6.6	Company Name 76 Bark of America Corporation 77 Direc Community Bencisheres, Inc. 78 Farmers & Mercharts Bork of Long Beach	Ticker BAC DCOM FMSL	4022 (%) 30.8 30.6 30.6	2024 (%) 29.0 29.1 29.1	2020 (%) 30.8 23.2 33.0	2019 (%) 31.8 28.4 37.6	20 (X 31, 29, 38,
Source: SBP Global Market Intelligence. Gempany Name I ReyCorp OceanFirst Financial Corp. Silveragnet Capital Corporation Synova Financial Corp.	Ticker KEY OCFC SI SNY	4Q22 (%) 40.0 39.9 39.7 39.6	2021 (%) 37.4 35.2 0.6 34.4	2020 (%) 40.0 43.0 1.4 37.6	2019 (%) 41.3 45.6 22.1 45.5	2018 (%) 45.1 49.9 6.6 48.4	Company Name 76 Bark of America Corporation 77 Dime Commanity Bonchares, Inc. 78 Farmers & Mercharts Bark of Long Beach 79 Cultur/Post Earliers, 19	Ticker BAC DCOM FMBL CFR	4Q22 (%) 30.8 30.6 30.6 30.6 30.3	2021 (%) 29.0 29.1 29.1 29.0	2020 (%) 30.8 23.2 33.0 31.9	2019 (%) 31.8 28.4 37.6 36.3	20° (% 31. 29. 38. 35.
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Source: SAP Glabal Harket Intelligence. COLORARY MARKET	TICKET REY OCFC SI SNV HWC FTIN BOH FHN ABCB BPORP HOWB CADE PNFP	4022 (%) 40.0 39.9 39.7 39.6 39.5 39.0 39.0 38.5 38.5 38.5 37.6	2021 (%) 37.4 35.2 0.6 34.4 38.2 39.4 39.8 34.5 34.6 38.7	2020 (%) 43.0 43.0 1.4 37.6 40.1 43.0 41.5 40.6 44.2 33.7 33.9 90.2 41.9	2019 (S) 41.3 45.6 22.1 45.5 43.3 45.2 41.9 9.1 49.9 39.4 52.7 43.2	2018 030 45.1 49.9 6.6 48.4 45.5 47.1 43.3 48.1 44.5 43.1 53.6 41.4	Constraint Annual Compression To the Community Securities, Tec. To the Community Securities, Tec. To Securities Securities, Tec. T	TICKEY BAC DCOM FMB. CFR EGBN HOPE BKU CMA HTH WTEF.B BOKF WAL TCBI	4022 (S) 30.8 30.6 30.6 30.3 30.2 30.0 22.2 28.7 28.6 28.0 26.1 23.2 20.8	2021 (5) 29.0 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 26.0 25.5 19.0	2020 (5) 30.8 23.2 33.0 31.9 41.3 35.2 22.0 29.4 27.2 31.5 29.4 27.2 20.8 18.2	2019 (%) 31.3 28.4 37.6 36.3 42.7 45.1 36.7 32.2 34.0 32.7 14.8 26.2 20.4	20 (N 31, 29, 18, 15, 17, 90, 35, 32, 36, 35, 34, 27, 22,
Source: SAP Glabal Harves WeetIgence. Conseasy Name Inspirate Conseasy Name Conseasy Conseasy Companies Deservine Transcriat Corp. Solvegate Caption Companies Invoke Witchey Corporation First Promissi Bankharva, No. Bank of Stwall Corporation First Namical Sopposition First Namical Companies Perpuly No. Codence don	TICKEY KEY OCFC SI SNV HWC FTIN ABCB BPOP HOWB POFFP USB	4022 (%) 40.0 39.9 39.7 39.5 39.2 39.0 39.0 38.5 38.5 38.5 37.6 37.4	2021 (%) 37.4 35.2 0.6 34.4 39.8 36.2 39.4 39.8 36.2 38.7 41.0 35.7 37.6	2020 (%) 43.0 43.0 43.7 43.1 43.7 40.6 44.2 33.7 33.9 50.2 41.9 36.5	2019 (%) 41.3 45.5 43.1 45.5 41.9 45.6 90.1 43.9 45.6 93.1 43.9 39.4 52.7 43.9	2018 (%) 45.1 49.9 6.6 48.4 45.5 47.1 40.3 48.1 49.7 44.5 43.1 53.6 41.4 37.5	Company June. To list of America Corporation: To Drive Community Bencheres, No. To Remon a Reventure Base of Long Beach. To Community Bencheres, No. To Light Bencery, No. To Light Bencery, No. To Bankstock, No	TIGKEY BAC DCOM FRAGE CFR EGBN HOPE BKU CMA HTH WTTEF.B BOKF WAL TCBI EWBC	4022 (5) 30.6 30.6 30.6 30.3 30.2 30.0 29.2 28.7 28.6 28.1 23.2 20.8	2024 (%) 29.0 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 25.5 19.0 24.0 25.5 26.0 26.0 27.5 28.0 28.0 28.0 28.0 28.0 28.0 28.0 28.0	2020 (%) 30.8 23.2 33.0 31.9 41.3 35.2 22.0 31.5 29.4 20.8 18.2 22.6	2019 (%) 31.8 28.4 37.6 16.3 42.7 45.1 16.7 32.2 34.0 32.7 34.8 26.2 20.4 12.2	20 (X 31. 29. 38. 35. 37. 50. 35. 32. 36. 35. 34. 27. 22.
Source: 18P Cultar livered yearligence. Company Mane Company Mane Coverheat Prescription Severed Explain Corporation System Empracial Corp. Severed Explain Corporation System Empracial Corp. Fresh Terrical Severed Fresh Coverheat Fresh Coverheat Fresh Coverheat Fresh Mane Severed Location Sever	TICKET KEY OCFC SI SNV HWC FTIN BOH FHN ABCB BPOP HOWB CADE PNFP USB CATY	4022 (%) 40.0 39.9 39.7 39.5 39.2 39.0 39.0 38.5 38.5 37.6 37.6 37.4	2021 (S) 37.4 35.2 0.6 34.4 38.2 39.8 36.2 38.6 34.6 38.7 41.0 35.7 37.6 34.4	2020 (5) 43.0 43.0 1.4 43.7 43.3 43.0 43.0 44.2 38.7 50.2 41.9 36.5 43.2	2019 (S) 41.3 45.6 22.1 45.5 43.3 45.2 41.9 46.6 90.1 40.9 39.4 52.7 43.2 36.9	2018 (%) 45.1 45.1 45.6 6.6 48.4 47.1 43.3 48.1 49.7 44.5 43.1 49.7 44.5 43.1 44.5 43.4 44.5 44.6	Company Mana To Bask of America Corporation To Direc Community Baschees, IX. To Direc Community Baschees, IX. To Galler Office Baschee, IX. To Light Baschees, IX. To Light Baschees, IX. To Western Malace Encorporation To Malace Encorporatio	TICKEY BAC DCOM FMB. CFR EGBN HOPE BRU CMA HTH SORF WAL TCBI EWBC CVEF	4022 (55) 30.8 30.6 30.6 30.3 30.2 28.7 28.0 28.0 28.1 22.2 20.8 20.5 20.4	2021 (5) 29.0 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 24.0 25.5 19.0 14.3 20.1 18.9	2020 (%) 10.8 23.2 33.0 31.9 41.3 35.2 29.4 27.2 29.4 27.2 20.8 18.2 22.6 20.5	2019 (%) 31.8 28.4 37.6 36.3 42.7 45.1 36.7 32.2 34.0 32.7 34.8 26.2 20.4 32.2 26.6	20 (X 31. 29. 38. 35. 37. 50. 35. 32. 36. 35. 27. 22. 26. 28.
Source 18P Guibal Insent Yardigance. Company Marie Source Company Marie Source Company Coverhord Towards Corp. Sovered Court Corporation Systems Elevated Corp. The Towards Beachers, Inc. Bask of Heavil Corporation First Horizott Geologiese, Inc. Bask of Heavil Corporation First Horizott Geologiese, Inc. Bask of Heavil Corporation First Horizott Geologiese Marie Sarcini Heavil Geologiese London Salvin London Salvin Codoros Sa	TICKEY KEY OCFC SI SNV HWC FITN BOH FHN ABCB BPOP HOWB CADE PNFP USB CATY COLB	4022 (%) 40.0 39.9 39.5 39.5 39.0 38.5 38.5 38.5 37.6 37.6 37.6 37.6 36.7	2021 (%) 37.4 35.2 0.6 34.4 39.8 36.2 38.7 41.0 35.7 37.6 34.6 36.7	2020 (%) 43.0 43.0 1.4 37.6 40.1 41.5 40.6 44.2 38.7 38.9 90.2 41.9 36.5 43.2	2019 (5) 41.3 45.5 42.1 45.5 41.9 46.6 90.1 40.9 39.4 52.7 41.2 36.9 47.0 44.8	2018 (3) 45.1 43.9 6.6 43.5 47.1 43.5 43.1 43.1 53.6 43.1 53.6 43.1 53.6 45.4	Company shared The Base of America Composition The Base of America Composition The Terror of Terror The Terror of Terror The Terror The Conference of Terror The Composition The Conference of Terror The Conference of Terro	TICKEY BAC DCOM FME CFR EGBN HOPE BKU CMA HTH WTEF B BOKF WAL TCBI EWBC CYBF FRC	4Q22 (%) 30.8 30.6 30.6 30.3 30.0 29.2 28.7 28.0 26.1 23.2 20.8 20.5 20.5 20.5	2021 (%) 29.0 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 26.0 25.5 19.0 14.3 20.1 18.9 14.4	2020 (%) 10.8 23.2 33.0 31.9 41.3 35.2 32.0 31.5 29.4 27.2 31.2 20.8 18.2 22.6 20.5 18.7	2019 (%) 31.3 28.4 37.6 36.3 42.7 36.7 32.2 34.0 32.7 34.8 26.2 20.4 32.2 26.6 23.6	201 (% 31. 29.) 18.) 15.) 17.) 16.) 15.) 16.) 15.) 16.) 17.) 18.) 18.) 18.) 18.) 18.) 18.) 18.) 18
Source: 180 Guibal Inhesit Variliproce. Company Intera I Indiçacip I Indicacip	TICKER REY OCFC SI SNY HWC FTIN BOH FHN ABCB BPOP HOWB CADE PNFP USB CATY COUB VLY	4022 (%) 40.0 39.9 39.7 39.6 39.0 39.0 39.0 38.5 38.5 37.6 37.4 36.9 36.7	2021 (%) 37.4 35.2 9.6 34.4 38.2 39.8 36.2 38.5 44.5 38.7 41.0 35.7 37.6 34.4 36.7 34.9	2020 (%) 43.0 43.0 1.4 37.6 43.1 43.0 41.2 33.7 90.2 41.2 40.5 44.2 36.5 43.2 40.3 42.6	2019 (5) 41.3 45.6 45.6 45.2 41.3 45.2 41.9 90.1 40.9 93.4 93.4 93.7 43.9 47.0 44.8 90.5	2018 (5) 45.1 49.9 6.6 48.4 43.5 47.1 48.1 49.7 44.5 43.1 44.5 43.1 44.5 44.5 44.6 45.6 41.4 47.0	Company June To Bask of America Corporation To Droc Community Securities, 194. To Famous Reviewla See of Long Beach To Community Securities, 194. To Long See See See See See See See See See Se	TICKEY BAC BAC FMBL CFR EGBN HOPE BKU CMA HTH WTEFLB BOKF WAL TCBI EWBC CVEF FRC FRC FFWM.	4022 (05) 30.8 30.6 30.6 30.3 30.2 30.0 29.2 28.6 28.6 28.6 28.1 23.2 20.8 20.4 19.8 13.9	2024 (%) 29.1 29.1 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 25.5 19.0 14.3 20.1 18.9 14.2	2020 (%) 30.8 23.2 33.0 33.0 35.2 32.0 31.5 29.4 27.2 20.8 18.2 20.5 18.7 22.6 20.5 22.4	2019 (%) 31.8 28.4 37.6 16.3 42.7 45.1 16.7 32.2 34.0 32.7 14.8 26.2 20.4 22.2 26.6 23.6 22.1	26.3 (X) 31.3 29.9 18.3 35.3 37.5 50.3 35.3 36.3 35.3 36.3 36.3 36.3 36.3 36
Source 1887 Gallos Institut Verlagence Company Nation StayComp Overfront Name of Corp. Overfront Name of Corp. Seymon Brancial Corp. First Name of Seymon	REY OCFC SI SI SNV HWC FTIN ABCB BPOP HOWB CADE PNFP USB CATY COLB VLY	4022 (%) 40.0 39.9 39.5 39.5 39.0 39.0 38.5 38.5 37.6 37.6 37.4 36.9 36.7	2021 (%) 37.4 35.2 0.6 34.4 39.8 36.2 38.5 34.6 38.7 37.7 37.7 37.7 37.7 36.7 34.9	2020 (%) 40.0 43.0 1.4 37.6 40.3 41.5 40.4 41.5 40.2 38.7 38.7 38.9 24.9 36.3 41.9 36.3 41.2 40.3 42.3 42.3	2019 (5) 41.3 45.5 22.1 45.5 43.2 41.9 45.6 50.1 40.9 39.4 42.7 43.2 44.8 50.1 44.8 50.1 44.8 50.1	2018 (S) 45.1 49.9 6.6 48.4 45.5 47.1 49.7 44.5 43.1 53.6 44.5 41.4 37.5 46.8 46.4 47.0 40.3	Company Name To Base of America Corporation To Direct Community Benchess, 19: To Direct Community Benchess, 19: To Called river Baseline, 19: To Called rivers Baseline, 19: To Called Review, 19: To Called Review, 19: To Western Allace, 19: To Western Allace	TICKER BAC DCOM FMB. CFR EGBN HOPE BKU CMA HTH WTEF.B BORF WAL TCB: CVEF FRC FRC FRWAL LWARF	4Q22 (5) 30.8 30.6 30.6 30.3 30.2 30.0 29.2 28.7 28.6 22.5 20.8 20.5 20.5 20.5 20.7 21.7 22.7 23.7 24.7 25.7 26.1 27.7 27.7	2024 (%) 29.0 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 26.0 25.5 19.0 14.3 20.1 18.9 14.4 20.0	2020 (%) 10.8 23.2 33.0 31.9 41.3 35.2 32.0 31.5 29.4 27.2 31.2 20.8 18.2 20.5 18.7 22.5	2019 (%) 31.3 28.4 37.6 36.3 42.7 32.7 34.0 32.7 34.0 32.7 34.0 32.6 20.4 22.6 23.6 23.6 23.6	201 (% 31) 18) 15) 17, 10) 15) 16) 15) 16) 17, 17, 18) 18, 18) 18, 18, 18, 18, 18, 18, 18, 18, 18, 18,
Source 18P Guide leviest Verligence. Company Jasines Services Serv	TICKER REY OCFC SI SINV HWC FFINI BOH ABCB BPOP HOWB CADE PINFP USB CATY COLB VLY OZX EFSC	4022 (%) 40.0 39.9 39.6 39.5 39.0 39.0 39.0 38.5 38.5 38.5 37.6 37.4 36.7 36.4 35.7	2021 (%) 37.4 37.4 39.6 39.4 39.8 39.8 39.8 39.7 41.0 35.7 37.6 34.9 36.7 34.9 33.7	2020 (%) 43.0 43.0 1.4 37.6 40.1 43.0 41.2 33.9 50.2 44.2 33.9 50.5 41.9 40.3 42.6 52.1 40.3 40.5 40.3 40.5 40.3 40.5 40.3 40.5 40.5 40.5 40.5 40.5 40.5 40.5 40.5	2019 (5) 41.3 45.6 22.1 45.2 41.9 45.6 50.1 40.9 39.4 52.7 41.2 36.9 47.0 44.8 50.5	2018 (S) 45.1 49.9 6.6 48.4 43.5 47.1 43.3 48.1 49.7 44.5 53.6 41.4 53.6 41.4 47.0 46.8 47.0 40.2 40.2	Company shared The Basic of America Corporation The Basic of America Corporation The Transmitted Section of Text The Transmits Americants Basic of Long Seach To Californities Basic of Long Seach To Californities Basic Operation To Californities Basic Operation To Californities Basic Corporation To Californities Basic Corporation To Californities Company The Californities Company The Californities Californities The	TICKEP BAC BAC FREE CFR EGBN HOPE BRU CMA HTH WAL TCBI EWBC CVIF FRC FRWM LMBF FRC FRWM LMBF SFES	4022 (%) 30.8 30.6 30.6 30.3 30.2 30.0 29.2 28.7 28.6 28.0 121.2 20.8 12.9 19.8 14.9 17.7	2024 (%) 29.1 29.1 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 24.0 25.5 99.0 14.3 20.1 18.9 20.1 18.4 20.0 15.1	2020 (%) 20.8 23.2 23.0 33.0 31.9 41.3 35.2 32.0 31.5 29.4 29.4 20.5 18.2 20.6 20.5 18.7 22.4 20.5 17.4	2019 (%) 31.8 28.4 37.6 36.3 42.7 45.1 36.7 32.2 34.0 32.7 34.8 26.2 20.4 32.2 26.6 22.1 28.6 22.1	200 (K) 311. 29, 18. 35, 37, 50. 35, 32, 36. 36, 35, 34. 27, 22, 26. 28, 22, 22, 20, 20, 20, 20, 20, 20, 20, 20
Source: 180 Calobal Insent Variations. Company Nation Long-Copin Description Transcale Copin Street, Copins Copins Propaler, Nat. Copins Copins Street, Cop	TICKEY REY OCFC SI SNV HWC FITN BOH FINN ABCB BEPOP HOMB CADE CADE USB CATY COUR COUR EFSC OUR EFSC	4022 (%) 40,0 39,9 39,7 39,5 39,2 39,0 38,5 38,5 37,6 37,6 37,4 36,9 36,7 35,7 35,7	2021 (%) 37.4 35.2 9.6 34.4 39.8 39.8 39.8 34.6 34.7 41.0 35.7 41.0 35.7 37.6 34.4 36.7 34.4 36.7 37.6 34.4 36.7 37.6 34.4 36.7 37.6 34.4 36.7 37.6 37.6 37.6 37.6 37.6 37.6 37.6	2020 (5) 43.0 13.0 1.4 37.6 40.3 41.5 40.6 44.2 33.7 33.9 50.2 41.9 36.5 41.2 40.3 42.6 42.3 42.5 43.0 43.0 43.0 43.0 44.0 44.0 44.0 44.0	2019 (5) 41.3 45.6 22.1 45.5 43.3 45.2 41.9 46.6 10.0 93.4 92.7 41.2 36.9 93.4 92.7 41.2 36.9 47.0 44.8 90.5 46.1 46.5 46.1 46.5 46.6 46.6 46.6 46.6 46.6 46.6 46.6	2018 (%) 45.1 49.9 6.6 48.4 43.5 47.1 43.1 49.7 44.5 43.1 43.1 43.1 43.1 43.1 44.5 44.4 47.0 44.8 46.4 47.0 47.0 47.1 47.1 47.1 47.1 47.1 47.1 47.1 47.1	Cempany Name To Bask of America Corporation To Drow Community Securities, 194. To General Securities See of Long Beach To Securities Securities To Sec	Ticker BAC BAC DCOM FMBL CFR EGBN HOPE BKU CMA HITH WAL TCBI EWBC CVIF FBC FBC FFFWM UMBF SFBS C C	4Q22 (%) 30.6 30.6 30.6 30.3 30.2 30.0 29.2 28.7 28.1 22.2 20.8 20.3 20.4 19.8 18.9 17.7 16.2	2021 (S) 29.0 29.1 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 25.5 19.0 14.3 20.1 18.9 14.4 20.0 15.9	2020 (%) 30.3 33.2 33.0 31.9 41.3 35.2 29.4 27.2 31.2 20.8 18.2 20.5 18.7 20.5 18.7 20.5 17.4 20.5 17.4 20.5	2019 (%) 31.3 28.4 37.6 36.3 34.2 45.1 34.2 34.0 32.7 34.2 20.4 32.2 26.2 26.6 23.6 22.6 19.9 16.8	200 (N 31. 29, 18, 15, 15, 15, 15, 16, 15, 27, 22, 26, 28, 22, 22, 20, 20, 20, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21
Source 1887 Galbal Instant Verlagence Company Nation I Sept Company Nation I Sept Company Company I Sept Compan	TICKEY KEY OCFC SI SNV HWC FTNN BOH FHN BOH FHN ABCB BPOP HOMB LADE PNFP USB VLY COLB VLY COLB VLY TOWN	4032 (%) 40.0 39.9 39.5 39.5 39.0 39.0 38.5 38.5 38.5 37.6 37.6 37.6 37.7 35.7 35.7 35.7	2021 (%) 37.4 35.2 9.6 34.4 38.2 39.8 36.2 38.6 34.6 34.7 41.0 35.7 37.6 34.7 34.7 34.7 34.7 34.7 34.7 34.7 34.7	2020 (95) 43.0 43.0 1.4 43.7 40.1 41.5 40.6 44.2 33.7 90.2 41.9 90.2 41.9 40.3 40.3 40.5 40.3 40.5 40.3 40.5 40.3 40.5 40.3 40.3 40.3 40.3 40.3 40.3 40.3 40.3	2019 (S) 41.3 45.6 22.1 45.2 41.9 45.6 50.1 40.9 39.4 42.2 36.9 47.0 44.8 50.5 50.5 44.8 50.5 44.8 50.5 50.5 50.5 50.5 50.5 50.5 50.5 50	2018 (%) 45.1 45.9 6.6 48.4 43.5 47.1 43.1 49.7 49.7 44.5 43.1 49.7 49.7 49.8 46.8 46.8 47.0 49.2 47.0 49.2 41.4 47.0 49.2 41.4 41.4 41.4 41.4 41.4 41.4 41.4 41	Company Name To Bask of Admiras Corporation To Disse Community Bescheres, Nr. To Disse Community Bescheres, Nr. To Limited States, Nr. To Limited	TICKET BMC BMC FMB. CFR EGGN HOPE BRU CMA HTH WTEF.B BORF WAL TCBI EWBC CYBE FFWM LWARF SFBS C SRNY	4Q22 (%) 30.6 30.6 30.6 30.3 30.2 30.0 29.2 28.6 28.6 28.1 21.2 20.8 19.8 19.8 19.9 17.7 16.2	2021 (%) 29.0 29.1 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 25.5 19.0 14.3 20.1 15.9 20.1 15.9 4.8	2020 (%) 30.8 23.2 23.2 33.0 31.9 41.3 35.2 22.4 27.2 27.2 27.2 20.8 18.2 22.6 20.5 17.4 16.6 7.4	2019 (%) 31.3 28.4 37.6 36.3 42.7 45.1 36.2 32.2 34.0 32.7 34.8 26.2 20.4 32.2 26.6 23.6 22.1 19.9 16.8	200 (%) 31-1 29,9 38-3 35-3 32-3 36-3 35-3 34-1 27-2 22-2 26-1 28-3 20-1 15-3 15-3 15-3 16-1 28-1 28-1 21-1 21-1 21-1 21-1 21-1 21
Gource 180 Guides Investe Verlagence Company Nation Gource Gource Gource Service Servi	TICKET REY OCFC SI SI SNY HWC FITN BOH FINN BOH FINN CADE PNFP USB VLY COLB VLY OZX EFSC PPBI TOWN	4022 (%) 40.0 39.9 39.7 39.5 39.2 39.0 38.5 37.6 37.6 37.4 36.7 36.4 35.7 35.2 34.3	2021 (5) 37.4 35.2 9.6 34.4 38.2 39.8 36.2 38.5 34.6 38.7 41.0 35.7 37.7 34.4 36.7 34.4 36.7 34.4 36.7 36.4 36.7 36.4 36.7 36.7 36.7 36.7 36.7 36.7 36.7 36.7	2020 (5) 43.0 13.0 1.4 37.6 40.3 41.5 40.3 41.5 40.2 38.7 38.9 50.2 41.9 36.5 43.2 40.3 42.6 52.3 44.6 45.3 46.6 50.9 50.9 50.9 50.9 50.9 50.9 50.9 50.9	2019 (5) 41,3 45,6 22,1 45,5 41,9 46,6 90,1 40,9 39,4 40,9 39,4 40,9 39,4 40,9 47,0 44,8 50,5 44,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,1 46,5 46,5 46,5 46,5 46,5 46,5 46,5 46,5	2018 (%) 45.1 49.9 6.6 48.4 43.5 47.1 43.1 49.7 43.1 53.6 41.4 37.5 43.1 47.0 40.3 42.2 44.5 45.4 47.0 40.3 47.1 47.1 47.1 47.1 47.1 47.1 47.1 47.1	Company shared The Basic of America Corporation The Basic of America Corporation The Terminal Reforehand Basic of No. The Terminal Reforehand Basic of Long Seach To Californity Basic Basic Seach To Californity Basic Basic Seach To Californity Basic Corporation The Californity Basic Corporation The Californity Basic Corporation The Californity Basic Basic Seach The Californity Basic Basic Seach The Californity Basic B	TICKET BAC DCOM FMBL CFR EGBN HOPE BRU CMA HTH WTEP.B BONF WAL TCBI EWBC CYEF FRC CYEF FRC SBNY STES ST	4022 (%) 30.8 30.6 30.6 30.3 30.2 30.0 22.2 24.7 24.6 26.1 22.2 20.5 20.5 20.5 19.8 19.8 17.7 16.2 15.0 6.2 4.3	2021 (S) 29.0 29.1 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 26.0 25.5 19.0 14.3 20.1 18.9 34.4 20.0 15.1 15.9 4.8	2020 (S) 30.8 23.2 33.0 31.9 41.3 35.2 29.4 27.2 31.2 20.8 18.2 20.5 18.7 22.4 20.5 18.7 4.7	2019 (S) 31.3 28.4 37.6 316.3 42.7 45.1 36.7 32.7 34.0 32.7 34.0 32.7 26.2 20.4 32.2 22.6 23.6 19.9 16.8 11.5 2.7	200 (N. 31. 29.0 (N. 31. 29.0 (N. 31. 29.0 (N. 31. 32. 32. 32. 32. 32. 32. 32. 32. 32. 32
Source 1887 Galbal Instant Verlagence Company Nation I Sept Company Nation I Sept Company Company I Sept Compan	TICKEY KEY OCFC SI SNV HWC FTNN BOH FHN BOH FHN ABCB BPOP HOMB LADE PNFP USB VLY COLB VLY COLB VLY TOWN	4032 (%) 40.0 39.9 39.5 39.5 39.0 39.0 38.5 38.5 38.5 37.6 37.6 37.6 37.7 35.7 35.7 35.7	2021 (%) 37.4 35.2 9.6 34.4 38.2 39.8 36.2 38.6 34.6 34.7 41.0 35.7 37.6 34.7 34.7 34.7 34.7 34.7 34.7 34.7 34.7	2020 (95) 43.0 43.0 1.4 43.7 40.1 41.5 40.6 44.2 33.7 90.2 41.9 90.2 41.9 40.3 40.3 40.5 40.3 40.5 40.3 40.5 40.3 40.5 40.3 40.3 40.3 40.3 40.3 40.3 40.3 40.3	2019 (S) 41.3 45.6 22.1 45.2 41.9 45.6 50.1 40.9 39.4 42.2 36.9 47.0 44.8 50.5 50.5 44.8 50.5 44.8 50.5 50.5 50.5 50.5 50.5 50.5 50.5 50	2018 (%) 45.1 45.9 6.6 48.4 43.5 47.1 43.1 49.7 49.7 44.5 43.1 49.7 49.7 49.8 46.8 46.8 47.0 49.2 47.0 49.2 41.4 47.0 49.2 41.4 41.4 41.4 41.4 41.4 41.4 41.4 41	Company Name To Bask of Admiras Corporation To Disse Community Bescheres, Nr. To Disse Community Bescheres, Nr. To Limited States, Nr. To Limited	TICKET BMC BMC FMB. CFR EGGN HOPE BRU CMA HTH WTEF.B BORF WAL TCBI EWBC CYBE FFWM LWARF SFBS C SRNY	4Q22 (%) 30.6 30.6 30.6 30.3 30.2 30.0 29.2 28.6 28.6 28.1 21.2 20.8 19.8 19.8 19.9 17.7 16.2	2021 (%) 29.0 29.1 29.1 29.1 29.0 37.3 30.4 28.5 24.1 20.0 25.5 19.0 14.3 20.1 15.9 20.1 15.9 4.8	2020 (%) 30.8 23.2 23.2 33.0 31.9 41.3 35.2 22.4 27.2 27.2 27.2 20.8 18.2 22.6 20.5 17.4 16.6 7.4	2019 (%) 31.3 28.4 37.6 36.3 42.7 45.1 36.2 32.2 34.0 32.7 34.8 26.2 20.4 32.2 26.6 23.6 22.1 19.9 16.8	200 (X) 313 329, 38, 35, 37, 50, 35, 32, 26, 27, 22, 26, 20, 20, 20, 15, 11,

But most SVB accounts were > \$250,000 so not FDIC insured (zoom)

			4Q22	2021	2020	2019	2018
	Company Name	Ticker	(%)	(%)	(%)	(%)	(%)
76	Bank of America Corporation	BAC	30.8	29.0	30.8	31.8	31.2
77	Dime Community Bancshares, Inc.	DCOM	30.6	29.1	23.2	28.4	29.0
78	Farmers & Merchants Bank of Long Beach	FMBL	30.6	29.1	33.0	37.6	38.4
79	Cullen/Frost Bankers, Inc.	CFR	30.3	29.0	31.9	36.3	35.6
80	Eagle Bancorp, Inc.	EGBN	30.2	37.3	41.3	42.7	37.1
81	Hope Bancorp, Inc.	HOPE	30.0	30.4	35.2	45.1	50.6
82	BankUnited, Inc.	BKU	29.2	28.5	32.0	36.7	35.0
83	Comerica Incorporated	CMA	28.7	24.1	31.5	32.2	32.0
84	Hilltop Holdings Inc.	нтн	28.6	20.0	29.4	34.0	36.9
85	W.T.B. Financial Corporation	WTBF.B	28.0	26.0	27.2	32.7	35.4
86	BOK Financial Corporation	BOKF	26.1	25.5	31.2	34.8	34.7
87	Western Alliance Bancorporation	WAL	23.2	19.0	20.8	26.2	27.5
88	Texas Capital Bancshares, Inc.	TCBI	20.8	14.3	18.2	20.4	22.8
89	East West Bancorp, Inc.	EWBC	20.5	20.1	22.6	32.2	26.5
90	CVB Financial Corp.	CVBF	20.4	18.9	20.5	26.6	28.8
91	First Republic Bank	FRC	19.8	14.4	18.7	23.6	22.7
92	First Foundation Inc.	FFWM	18.9	20.0	22.4	22.1	22.1
93	UMB Financial Corporation	UMBF	17.7	16.0	20.5	28.6	30.4
94	ServisFirst Bancshares, Inc.	SFBS	16.2	15.1	17.4	19.9	20.4
95	Citigroup Inc.	С	15.0	15.9	16.6	16.8	15.0
96	Signature Bank	SBNY	6.2	4.8	7.4	11.5	11.6
97	State Street Corporation	STT	4.3	4.5	4.7	2.7	0.4
98	Northern Trust Corporation	NTRS	4.0	4.5	5.6	7.5	6.8
99	SVB Financial Group	SIVB	2.7	2.3	2.3	3.5	4.0
00	The Bank of New York Mellon Corporation	BK	2.3	2.9	4.2	3.3	5.0

A "bank run via whatsapp"

One account of the run https://twitter.com/torrenegra/status/1634573234187407369?s=20



Alexander Torrenegra

Silicon Valley Bank was the main bank for two of our companies, my personal savings, and my mortgage. This is how things unfolded for us:

Between 2013 and 2023, all good.

Thursday, 9 AM: in one chat with 200+ tech founders (most in the Bay Area), questions about SVB start to show up.

10 AM: some suggest getting the money out of SVB for safety. Only upside. No downside.

10:50 AM: I read the messages in a bathroom break. Immediately cancel the meeting I had. Ask my wife, Tania, to wire all of our personal money out to other banks. Call my teams. Ask them to do the same. One of them, at the dentist, has to stoo the procedure and run home.

11:10 AM: We can't get the money out of any of the accounts. For our personal savings, we don't have other bank accounts readily available. For one of the companies, the permissions are not set up to allow such a significant exit of money. We can only get half of the money out. We wire it to Ameritrade, as we don't have any other bank account set up. For the 2nd company, the banking credentials had been changed. I cannot log in

11:15 AM: Tania gets a hold of another bank we were already talking to, UBS. Ask them to open a bank account pronto.

11:20 AM: I change the permissions for the 1st company. We request another wire out to Ameritrade for the remaining money from that company. We have to wait for the wires to get out.

11:25 AM: After a long wait, I get a hold of an SVB agent. They reset my credentials for the 2nd company.

~12:00 PM: All of my chats with tech founders in the US light on fire with what's happening. Obviously, we have a bank runoff. Surreal.

SVB's other big problem: unhedged interest rate risk

Recall typical bank balance sheet from EC1B1

- Banks borrow from depositors (and others) and make loans
- Example bank balance sheet:
 - 10 to 1 leverage ratio

Assets	Liabilities
\$1,000 of Loans	\$900 of Deposits \$100 of Equity capital

But SVB also held large chunk of other assets: long-term fixed income securities

- e.g. 10-year government bonds
- rising interest rate ⇒ prices of such assets fall
- SVB did not hedge this interest rate risk appropriately

Like all banks, SVB was also very leveraged

Leverage and Risk

- Leverage increases risk
- Say value of assets falls by 2%
- How much does net worth fall if:
 - If leverage ratio is 10 to 1?
 - Net worth falls by 20%
 - If leverage ratio is 20 to 1:
 - Net worth falls by 40%
 - If leverage ratio is 50 to 1:
 - Net worth falls all the way to zero!



Summary: run on Silicon Valley Bank

Two key features made SVB particularly vulnerable

- 1. large runnable deposit base
- 2. big interest rate risk

SVB was special ... but definitely not alone ⇒ will have to wait and see

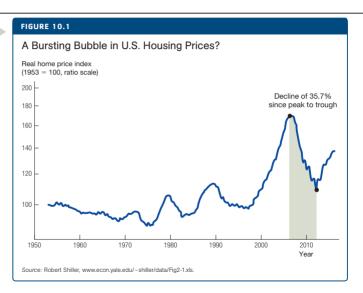
2008 Financial Crisis: Some Facts

2008 financial crisis: some facts

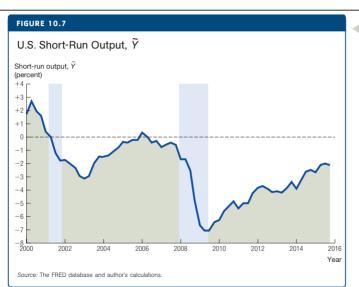
- Will show you data for U.S.
 - purely because many nice graphs are available
- UK and many other advanced economies look similar
 - though some not as extreme

Housing price boom and bust in lead up to crisis

After rising sharply in the years up to 2006, housing prices fell dramatically.

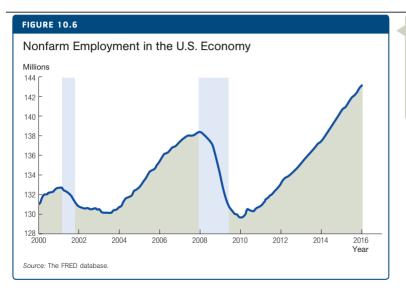


A very large drop in GDP ...



After its initial resilience to the financial crisis, the real economy declined sharply. At the bottom of the recession, real GDP was more than 7 percent below potential.

... and employment



Total nonfarm employment peaked in December 2007, the date the recession is said to have started, at more than 138 million. More than 8.4 million jobs were lost by February 2010.

Asset Bubbles

What is a bubble?

- Price of an asset does not reflect its "fundamental value"
- Idea: speculators buy the asset only because they expect its price to rise in the future
- Self-fulfiling expectations: "prices rise because they are expected to rise"
- Now: a simple model of a bubble

A simple asset pricing model

Asset pays dividends

$$\{y_t\}_{t=0}^{\infty} = y_0, y_1, \dots$$

- Individuals discount future at $\beta = 1/(1+r)$ satisfying $0 < \beta < 1$
- How will this asset be priced?
- Main example: asset = house
 - dividend y_t = per-period benefit received from owning the house
 - either rent (investment) or benefit from living in house (owner-occupied)
 - will sometimes say "rent" instead of "dividend"

A difference equation for pricing the asset

• Claim: the asset price p_t must satisfy the difference equation

$$p_t = y_t + \beta p_{t+1} \tag{*}$$

In words: price today = dividend + discounted price tomorrow

- Intuition: arbitrage see supplement
- Claim: A solution to the difference equation (*) is

$$\rho_t = \sum_{j=0}^{\infty} \beta^j y_{t+j} = y_t + \beta y_{t+1} + \beta^2 y_{t+2} + \beta^3 y_{t+3} \dots \tag{**}$$

In words: Price = present discounted value (PDV) of future dividends

• **Example:** constant dividend $y_t = \bar{y}$ for all t (using $\sum_{j=0}^{\infty} \beta^j = 1/(1-\beta)$)

$$p_t = \frac{\bar{y}}{1 - \beta}$$

- Is this a bubble? No
- PDV of future dividends = correct notion of fundamental value

A difference equation for pricing the asset

• Recall: the asset price p_t must satisfy the difference equation

$$p_t = y_t + \beta p_{t+1} \tag{*}$$

with one solution given by

$$\rho_t = \sum_{j=0} \beta^j y_{t+j} = y_t + \beta y_{t+1} + \beta^2 y_{t+2} + \beta^3 y_{t+3} \dots \tag{**}$$

- How can bubbles arise?
- **Key:** asset price p_t in (**) is not unique solution to (*)
 - equation (*) has many more solutions that all correspond to bubbles

A useful case: zero dividends $y_t = 0$

Asset pricing equation is

$$p_t = \beta p_{t+1}$$

Obvious solution

$$p_t = 0$$
 = no-bubble solution

But there is another solution

$$p_t = c \left(\frac{1}{\beta}\right)^t = c\beta^{-t}$$
 for a constant c

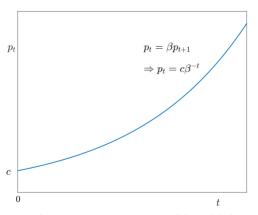
Verify:

$$p_t = c\beta^{-t} = \beta \underbrace{[c\beta^{-(t+1)}]}_{p_{t+1}} = \beta p_{t+1}$$

- In fact this works for any constant c so there are infinitely many such solutions
- All these solutions are bubble solutions: $p_t \neq$ fundamental value = 0

A pure bubble when the asset pays no dividend $y_t = 0$

When c > 0 asset price $p_t = c\beta^{-t}$ grows exponentially (recall $\beta < 1$)



- Buy worthless asset because expect to sell it at higher price tomorrow
- "Prices rise because they are expected to rise"

Putting everything together: positive dividends y_t

• Recall: the asset price p_t must satisfy the difference equation

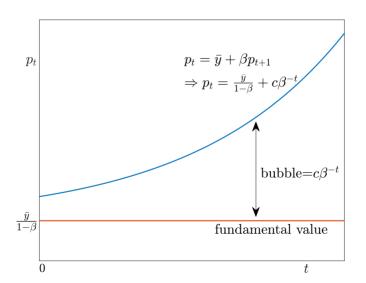
$$p_t = y_t + \beta p_{t+1} \tag{*}$$

• Claim: general solution to (*) is

$$p_t = \sum_{j=0}^{\infty} \beta^j y_{t+j} + c \beta^{-t}$$
 for any constant c bubble component fundamental value

 Next slide: graph with constant dividend and hence constant fundamental value

Asset price = fundamental value + bubble component



Asset bubbles: summary

It's not necessarily true that

asset price = fundamental value = PDV of dividends

Instead there can be self-fulfilling bubbles in which

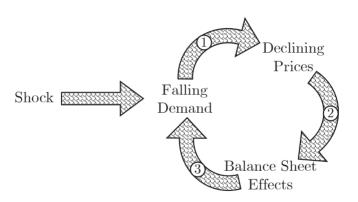
asset price = fundamental value + bubble component

- These bubbles are self-fulfilling in sense that prices rise because they are expected to rise
- For more on bubbles, see survey by Brunnermeier (2008) "Bubbles" in the The New Palgrave Dictionary of Economics

 $\verb|https://link.springer.com/referenceworkentry/10.1057/978-1-349-95121-5_44-2| \\$

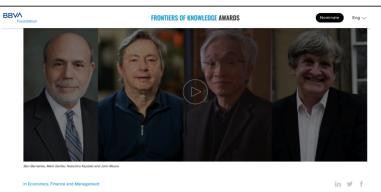
Financial Frictions and Amplification

The idea in a nutshell: "financial doom loop"



- Sometimes people call this "financial doom loop" or "diabolic loop"
- An "LSE idea": Key work by Nobu Kiyotaki and John Moore written while both were at LSE (John Moore still is)

Watch the interviews here, particularly John Moore's



The Frontiers of Knowledge Award goes to Bernanke, Gertler, Kiyotaki and Moore for establishing the nature of the linkage between the financial sector and the real economy and how it operates to amplify crises

https://www.frontiersofknowledgeawards-fbbva.es/noticias/

Plan for this part of lecture notes

- 1. Preliminaries: Borrowing and Saving in a Small Open Economy
- 2. Preliminaries: Consumption Based Asset Pricing
- 3. Borrowing and Saving with a "Collateral Asset": Financial Amplification

Here:

- due to time constraints only provide overview
- see supplement for more detailed version (examinable)

Borrowing and Saving in a Small Open Economy

- "Small open economy": household can borrow and lend at a fixed world interest rate r*
- Consumers solve

$$\max_{c_1, c_2, d_1} u(c_1) + \beta u(c_2) \quad \text{s.t.}$$

$$c_1 = y_1 + d_1$$

$$c_2 + d_1(1 + r^*) = y_2$$

$$d_1 \le \kappa y_1, \qquad \kappa \ge 0$$

- Note: d_1 is debt, i.e. how much household borrows in period 1
- Note presence of borrowing constraint $d_1 \le \kappa y_1$
 - borrow up to fraction (or multiple) κ of first-period income y_1
 - ullet κ parameterizes quality of credit markets
 - $\kappa = \infty$: can borrow as much as you'd like (no constraint
 - $\kappa = 0$: cannot borrow at all

Unconstrained solution $\kappa = \infty$

Can write present-value budget constraint

$$c_1 + \frac{c_2}{1 + r^*} = y_1 + \frac{y_2}{1 + r^*} \equiv y^{PDV}$$

Optimality condition = standard Euler equation

$$u'(c_1) = \beta(1+r^*)u'(c_2)$$

- Assumption: $\beta(1+r^*)=1$
- Then unconstrained solution is

$$c_1^u = c_2^u = \frac{1+r^*}{2+r^*} y^{PDV}, \qquad d_1^u = c_1^u - y_1 = \frac{y_2 - y_1}{2+r^*}$$

where *u*-subscript stands for "unconstrained"

Solution with borrowing constraint $d_1 \leq \kappa y_1$ with $\kappa < \infty$

Case 1: $d_1^u \le \kappa y_1$ (loose constraint)

- can obtain unconstrained allocation (c_1^u, c_2^u, d_1^u)
- = optimal choice and constraint will never bind

Case 2: $d_1^u > \kappa y_1$ (binding constraint)

- cannot obtain unconstrained allocation (c_1^u, c_2^u, d_1^u)
- household will borrow as much as it can $d_1 = \kappa y_1$ and consumption is

$$c_1 = (1 + \kappa)y_1, \quad c_2 = y_2 - \kappa y_1(1 + r^*)$$

- $c_1 < c_1^u = c_2^u < c_2$, i.e. can no longer smooth consumption perfectly
- borrowing constraint makes them strictly worse off

A credit crunch $\kappa \downarrow$

Recall

$$c_1 = (1 + \kappa)y_1, \quad c_2 = y_2 - \kappa y_1(1 + r^*)$$

- Therefore $\kappa \downarrow \Rightarrow c_1 \downarrow$ and $c_2 \uparrow$
- Even worse consumption smoothing ⇒ welfare falls more

Consumption-based asset pricing

- Now: no borrowing and lending but households can invest in an asset a_t
 - buy asset at price p_1 in period 1
 - asset pays a dividend D in period 2
 - asset is in fixed supply $a_0^s = a_1^s = 1$, i.e. there is one unit of the asset
- Households solve

$$\max_{c_1, c_2, a_1} u(c_1) + \beta u(c_2) \quad \text{s.t.}$$

$$c_1 + p_1 a_1 = y_1 + p_1 a_0$$

$$c_2 = y_2 + D a_1$$

• In equilibrium $a_0 = a_1 = 1$ and hence already know (e for "equilibrium")

$$c_1^e = y_1, \quad c_2^e = y_2 + D$$

- Only question: what is the equilibrium asset price p₁?
 - note similarity to finding equilibrium r in last part of lecture 4

Equilibrium asset price

Optimality condition

$$p_1u'(c_1) = \beta Du'(c_2)$$

But we already know that in equilibrium

$$c_1^e = y_1, c_2^e = y_2 + D$$

Therefore equilibrium asset price is

$$p_1 = \frac{\beta u'(c_2^e)}{u'(c_1^e)}D = \frac{\beta u'(y_2 + D)}{u'(y_1)}D$$

• Example: log utility $u(c) = \log c$

$$p_1 = \frac{\beta c_1^e}{c_2^e} D$$

 Note: rather than asking "given prices, what is consumption?" we asked "given consumption, what is the price?"

Equilibrium asset price p_1 is depressed when c_1 is low

Equilibrium asset price

$$p_1 = \frac{\beta u'(c_2^e)}{u'(c_1^e)}D = \frac{\beta u'(y_2 + D)}{u'(y_1)}D$$

• Example: $\log utility u(c) = \log c$

$$p_1 = \frac{\beta c_1^e}{c_2^e} D = \frac{\beta y_1}{y_2 + D} D$$

- Interesting feature: p_1 is low when $c_1^e = y_1$ is low and marginal utility $u'(c_1^e)$ is high
- Intuition: don't want to buy asset if you're starving ⇒ low asset price
- This will be key feature of model we want to get to

Borrowing and saving with collateral asset: financial amplification

- Now combine elements from two preliminaries
 - borrowing and saving in small open economy
 - consumption-based asset pricing
- Key new ingredient = collateral constraint: borrowing constraint in which amount of debt d_1 is constrained by value of its assets
- Here: assume

$$d_1 \leq \kappa p_1 a_0$$

- Idea: can borrow against value of existing assets (in case of housing: "houses as ATMs", i.e. HELOC = home equity line of credit)
- Alternative formulation: $d_1 \le \kappa p_1 a_1$ see supplement

Borrowing and saving with collateral asset: financial amplification

Households solve:

$$\max_{c_1, c_2, a_1, d_1} u(c_1) + \beta u(c_2) \quad \text{s.t.}$$

$$c_1 + p_1 a_1 = y_1 + p_1 a_0 + d_1$$

$$c_2 + d_1(1 + r^*) = y_2 + Da_1$$

$$d_1 \le \kappa p_1 a_0$$

- Asset is still in fixed supply: $a_0^s = a_1^s = 1$
- Unconstrained solution: see supplement
- As before, two cases: loose constraint and binding constraint
- Here: focus on binding constraint

Equilibrium with binding constraint

Borrow as much as possible, imperfect consumption smoothing

$$d_1 = \kappa p_1 a_0 = \kappa p_1$$
, $c_1 = y_1 + \kappa p_1$, $c_2 = y_2 + D - \kappa p_1 (1 + r^*)$

Equilibrium asset price determined by

$$p_1 = \frac{\beta u'(c_2)}{u'(c_1)}D = \frac{\beta u'(y_2 + D - \kappa p_1(1 + r^*))}{u'(y_1 + \kappa p_1)}D$$

- Key feature again: equilibrium asset price p_1 is depressed when c_1 is low
- To solve this neatly change utility slightly: log-linear utility

$$u_1(c_1) + \beta u_2(c_2), \quad u_1(c_1) = \log c_1, \quad u_2(c_2) = c_2$$

• Also assume $\kappa\beta D < 1$

Equilibrium with binding constraint and log-linear utility

• With log-linear utility equilibrium price satisfies

$$p_1 = \beta D c_1$$
$$c_1 = y_1 + \kappa p_1$$

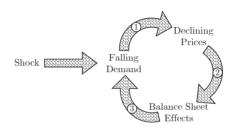
• Solving for p_1 and c_1

$$p_1 = \frac{\beta D y_1}{1 - \beta D \kappa}, \qquad c_1 = \frac{y_1}{1 - \beta D \kappa}$$

- Equilibrium features financial amplification
- Suppose $y_1 \downarrow$. Unsurprisingly $c_1 \downarrow$
- But key: c_1 may fall by a lot more than y_1 !

$$\frac{\partial c_1}{\partial y_1} = \frac{1}{1 - \beta D \kappa} > 1 \quad \Rightarrow \quad \text{multiplier effect}$$

Intuition: "financial doom loop"



Key equations

$$p_1 = \beta D c_1 \tag{1}$$

$$c_1 = y_1 + \kappa p_1 \tag{2}$$

• Mechanism: $y_1 \downarrow \Rightarrow$ consumption $c_1 \downarrow$ from (2) \Rightarrow asset demand \downarrow ("don't want to buy asset when starving") \Rightarrow asset price $p_1 \downarrow$ from (1) \Rightarrow tighter collateral constraint $\Rightarrow c_1 \downarrow$ from (2) $\Rightarrow p_1 \downarrow$ from (1) and so on...

Importance of house prices during the financial crisis

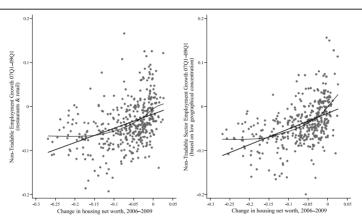


FIGURE 1.—Non-tradable employment and the housing net worth shock. This figure presents scatter-plots of county-level non-tradable employment growth from 2007Q1 to 2009Q1 against the change in housing net worth from 2006 to 2009. The left panel defines industries in restaurant and retail sector as non-tradable, and the right panel defines industries as non-tradable if they are geographically dispersed throughout the United States. The sample includes counties with more than \$0,000 households. The thin black line in the left panel is the non-parametric plot of non-tradable employment growth against change in housing net worth.

Source: Mian and Sufi (2014) "What Explains the 2007-2009 Drop in Employment?"