"OVERHEATING" IN KREDIT MARKETS

WHAT DO WE KNOW?
WHERE ARE WE TODAY?
WANT TO LEARN?
WHAT SHOULD WE DO?

Samuel G. Hanson
Harvard Business School and NBER

4/3/2026

FRBNY AMEC Symposium on "The K-Shaped Economy"

WHAT DO WE KNOW?

Emerging Academic Consensus

- **Credit crunches following periods of booming credit growth often inflict significant damage on real economy**
  - Reduced flow of credits contribute to garden variety recessions
  - Large credit booms raise risk of financial/banking crises which have large and long-lasting real effects
- **Early warning signals for "over-heating" credit markets and heightened risk of a credit crunch:**
  - **Quantity**: Large and rapid expansions in outstanding credit
  - **Prices**: Credit spreads are particularly tight
  - **Quality**: Deteriorating borrower credit quality (i.e., eroding underwriting standards)
- **All signals there has been a large outward shift in credit supply**

Emerging Academic Consensus

- **Early-warning indicators predict:**

1. **Lower average, but more volatile returns to risky lending**
   Greenwood, Hanson (2013); Muir (2019); Sørensen (2026)
2. **Lower average, but more volatile returns on (bank) stocks**
   Baron, Xiong (2017)
3. **Financial crises**
   Borio and Lowe (2002); Borio and Drehman (2009); Schularick and Taylor (2012), Greenwood, Hanson, Shleifer, and Sørensen (2022); Krishnamurthy and Muir (2025)
4. **Slower real growth**
   López, Stein, Zakrajšek (2017); Mian, Sufi, Verner (2017); Kirti (2018);

- **Evidence from both U.S. time series and cross-country panels**
- **Combining indicators—rapid growth in credit quantities and risky asset prices (or narrow spreads)—especially powerful**

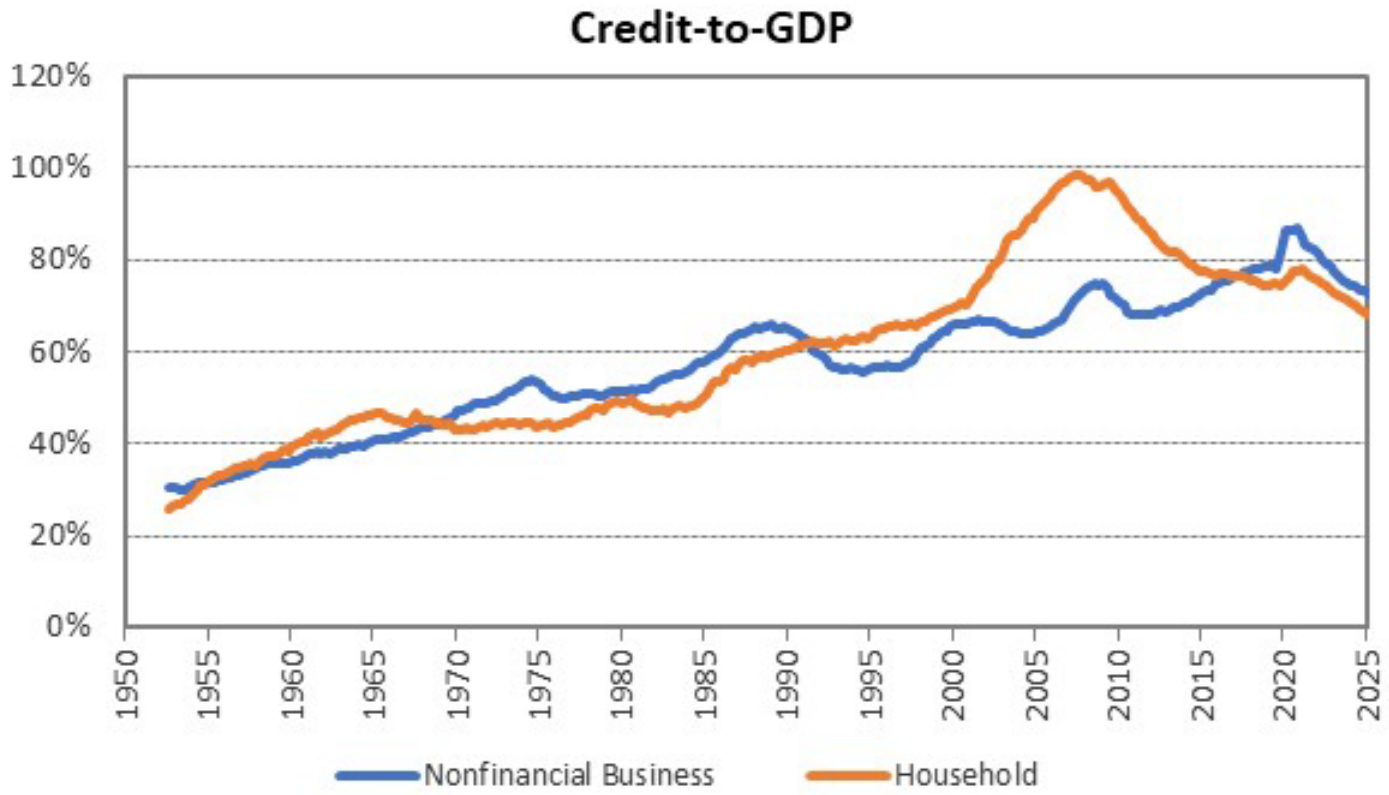
Emerging Academic Consensus

- **Early-warning indicators signal vulnerability over medium term, but not imminent onset of a credit bust/crisis**
  - Bust arrives when (1) pre-existing vulnerability and (2) triggering event
  - While we can construct good measures of vulnerability, much harder to predict whether and when there will be a trigger
- **Normal when worrying about low probability, adverse events**
  - Forest fire analogy
  - Vulnerability: Forest rangers have a good sense of when fire risk is high—e.g., it hasn't rained for a long time and an accumulation of dry underbrush
  - Triggers: But it's almost possible to predict whether and when there will be a trigger—e.g., a lighting straight or carelessly discarded cigarette,
- **Still, reliable signals of vulnerability useful for risk managers**

WHERE ARE WE TODAY?

Indicator's Today

- **Quantities:** Aggregate credit growth not particularly elevated
  - Many studies have used 3-year Changes in Credit/GDP
  - Do this separately for Businesses and Households



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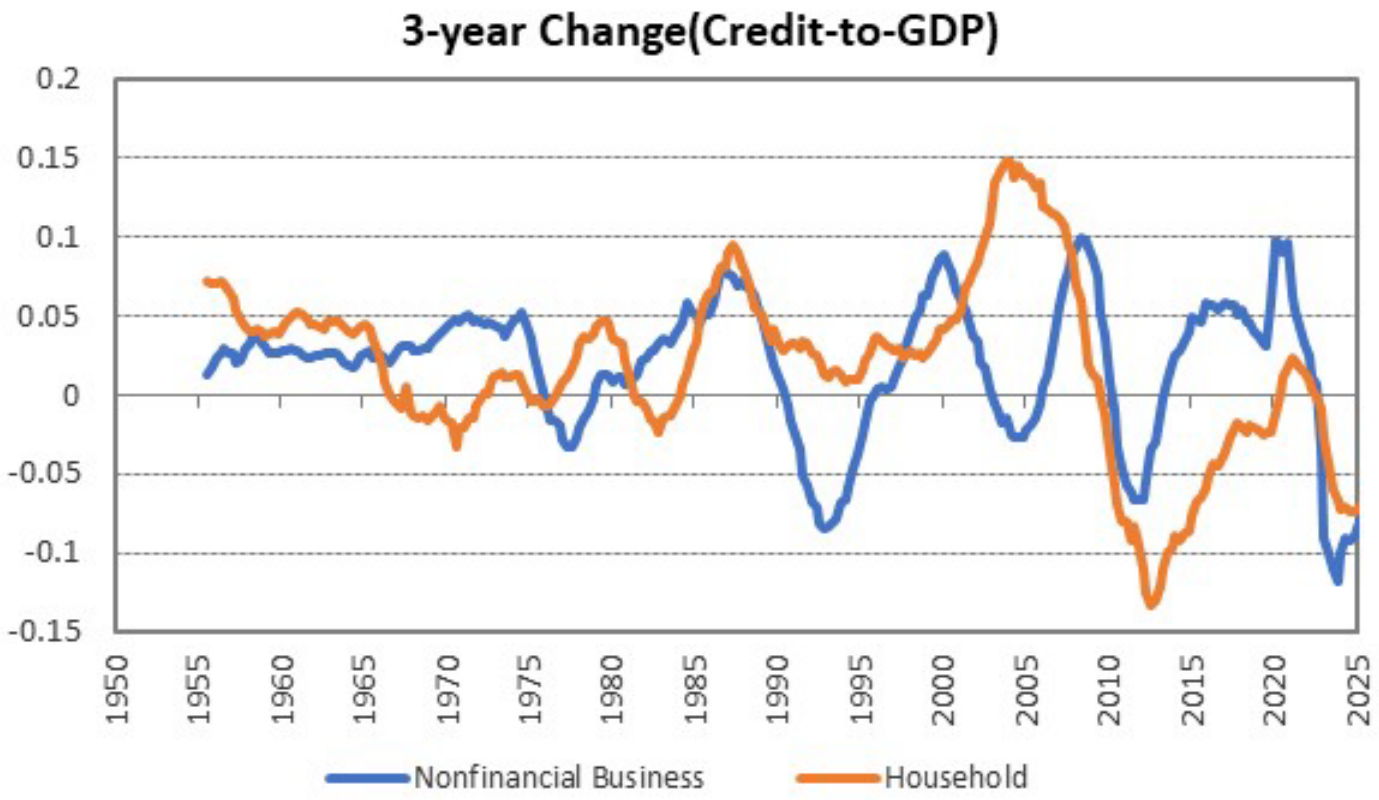

Indicator's Today

- **Prices and quantities:** Following Greenwood et. al. (2022)

$$High\text{-}Debt\text{-}Growth_{it} = 1\{Debt\ Growth_{it} > 80^{\text{th}}\ \text{percentile}\})$$

$$High\text{-}Price\text{-}Growth_{it} = 1\{Asset\ Price\ Growth_{it} > 66.7^{\text{th}}\ \text{percentile}\}$$

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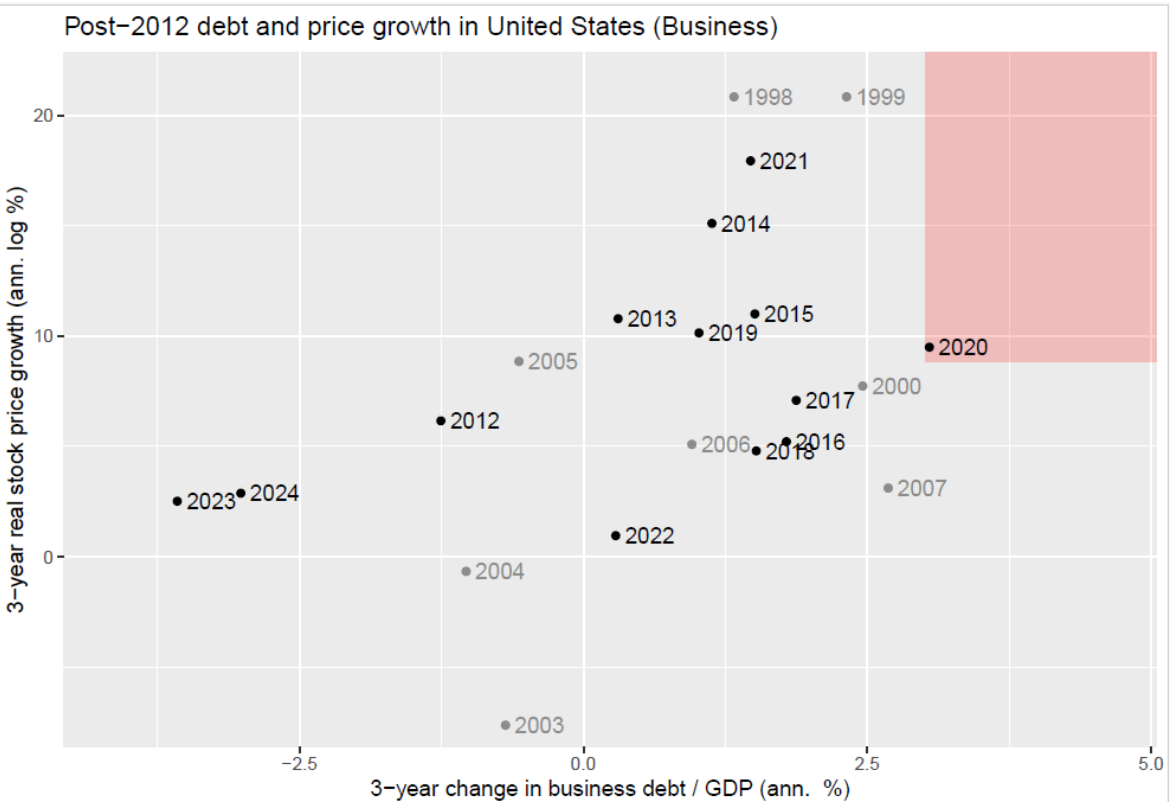

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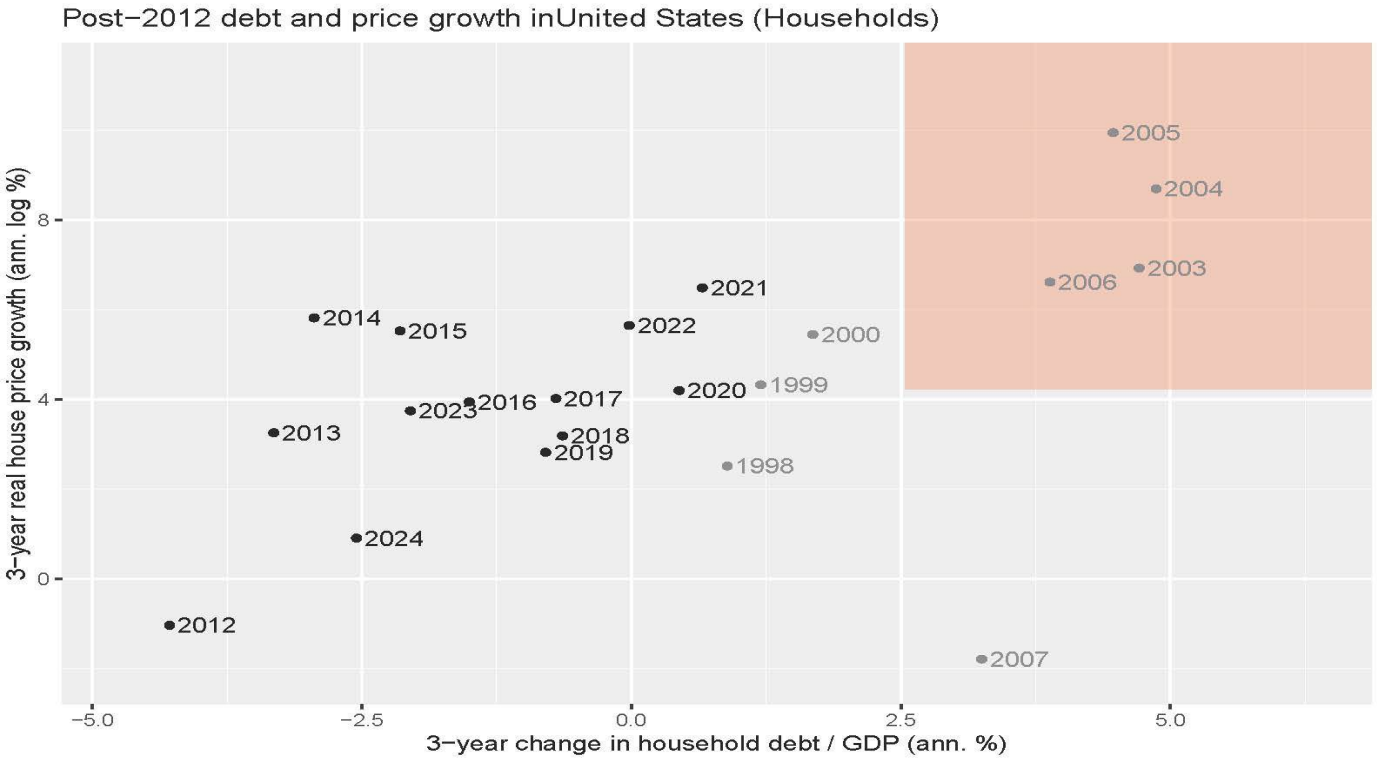

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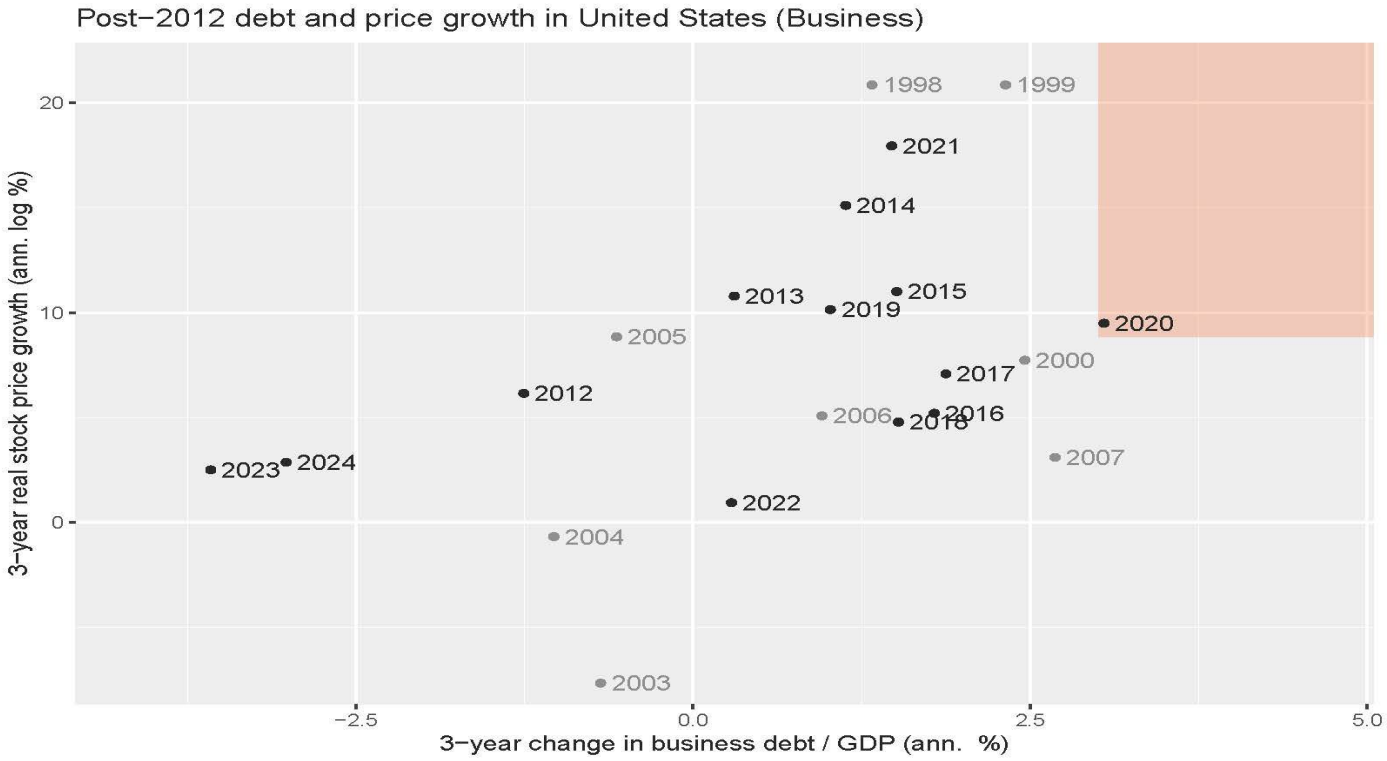
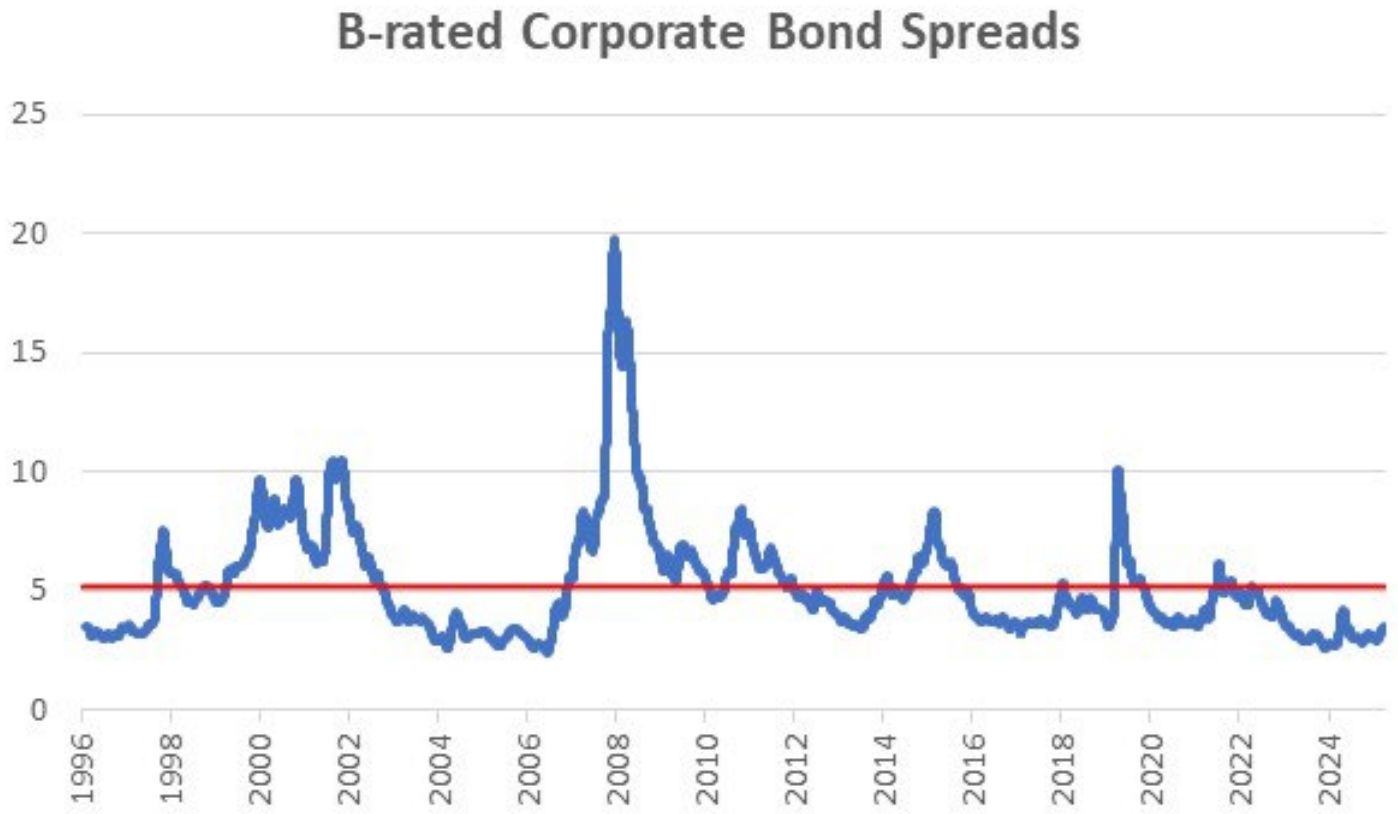


Indicator's Today

- **Credit spreads:** Corporate spreads tight by historical standards
  - B-rated HY Bond Spreads = 360 bps
  - Only times in last 30 years when this tight was 2004 to 2006



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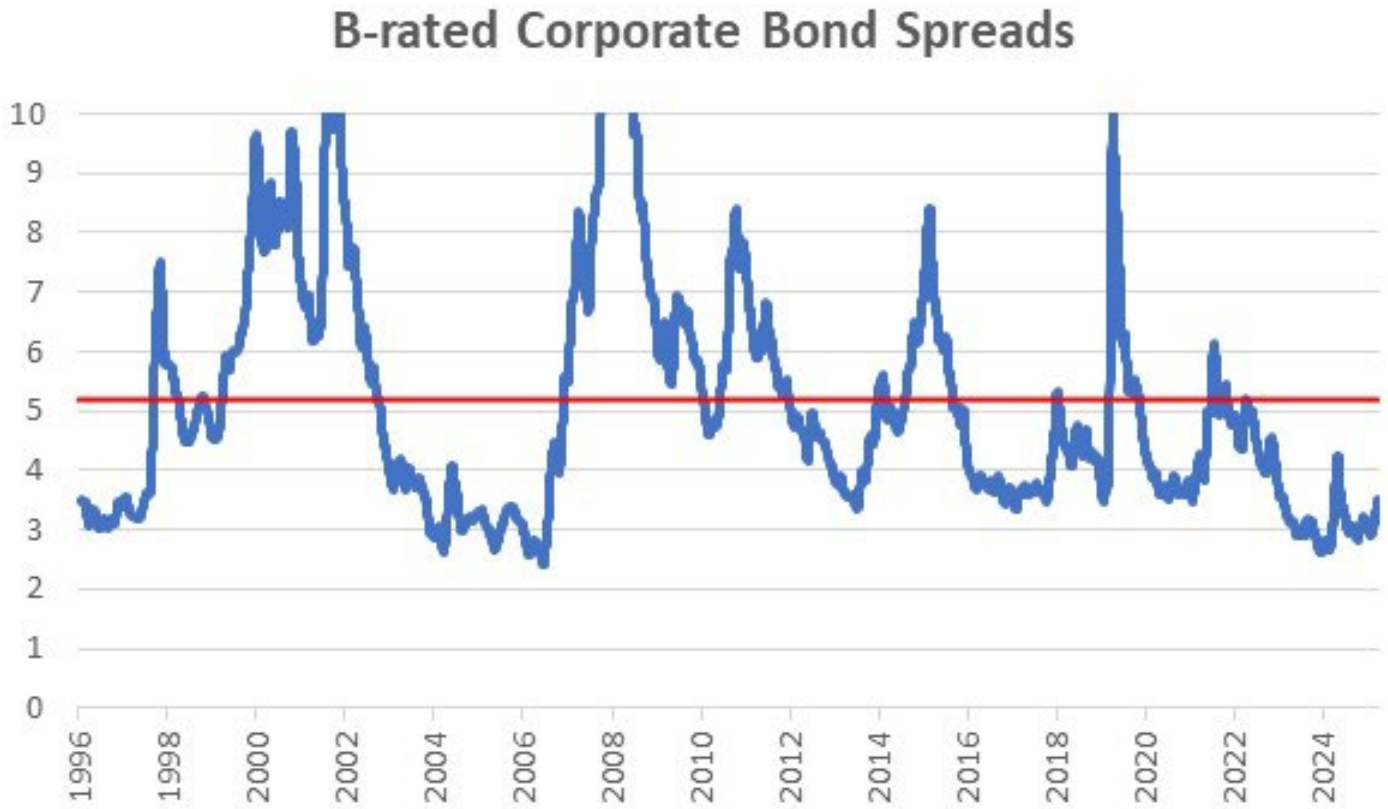


Indicator's Today

- **Quality:** Not seeing kinds of broad-based erosions in business of household borrower credit quality that we saw in 1980s junk bond boom, 1990s boom, or pre-GFC boom
  - But … some pockets where borrower credit quality has decline marked
  - **Private credit** is a clear hot spot
  - Seeing some **K-shaped divergence** between **Private Credit** and **HY Bonds?**

- **Overall:** Some indicators are **flashing orange**, but all lighting up in **red** like we see in a major credit boom

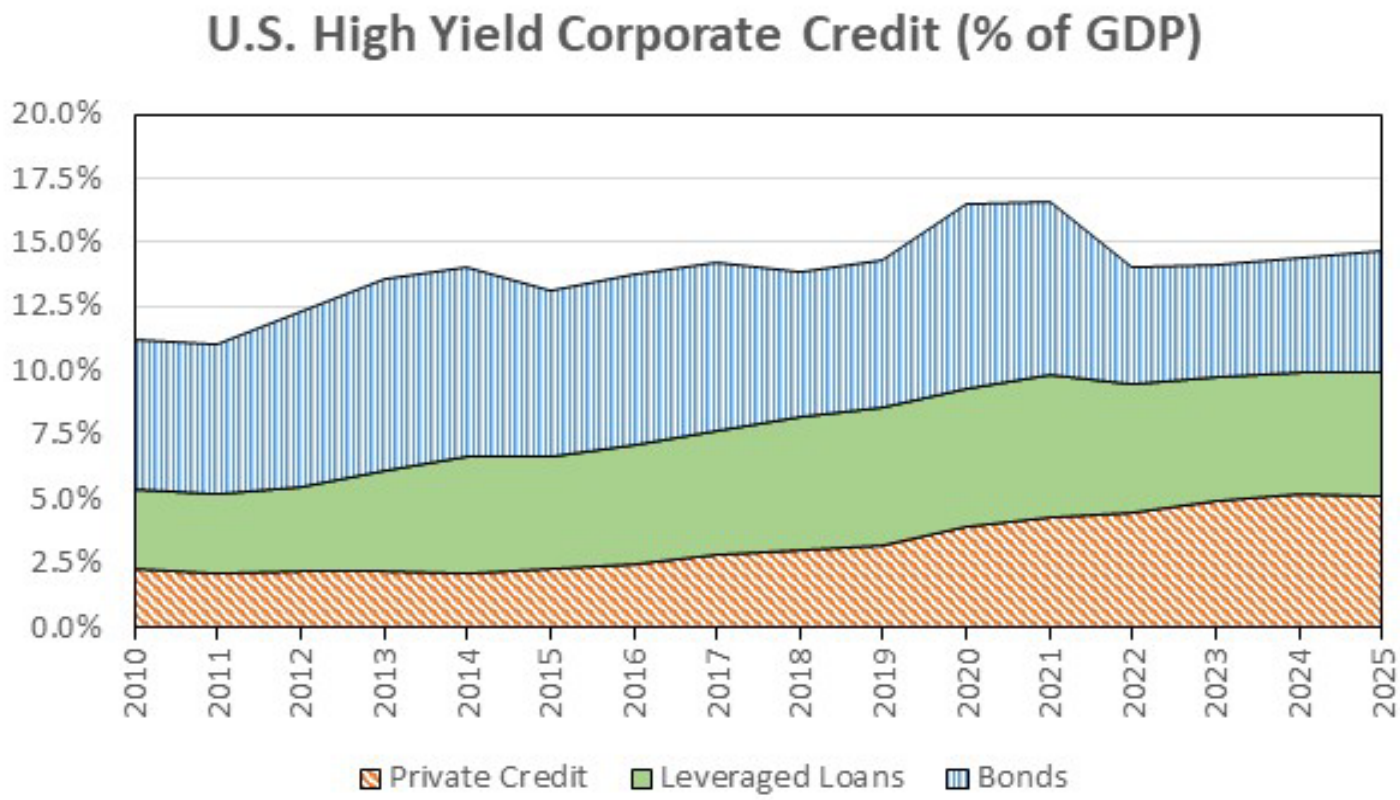
IS TODAY'S KREDIT MARKET ALSO K-SHAPED?

4/3/2026

FRBNY AMEC Symposium on "The K-Shaped Economy"

HIGH YIELD CREDIT

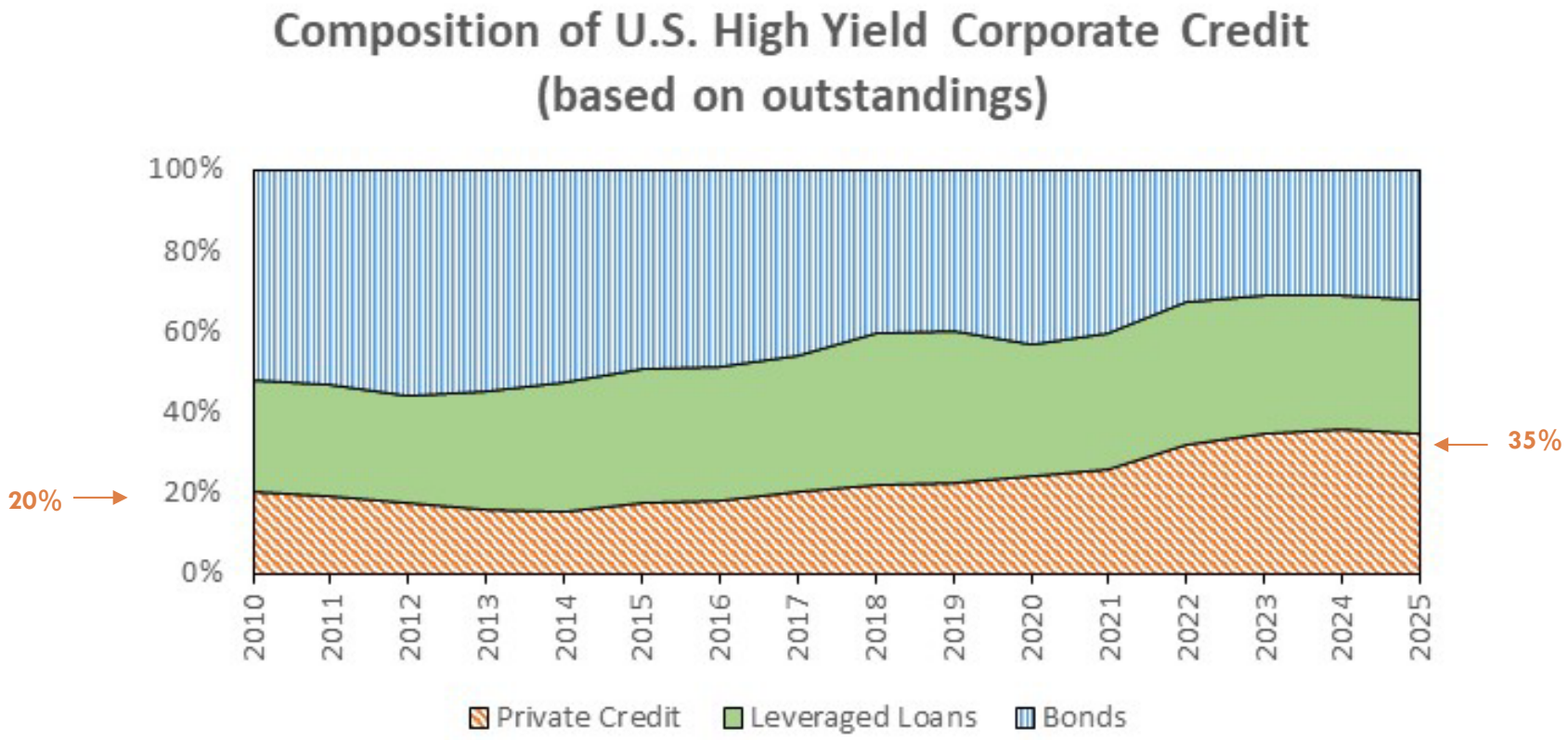
- Quantity of HY credit has expanded modestly over past 15 years



Source: Morningstar

HIGH YIELD CREDIT

- However, outstanding debt has rapidly migrated from HY Bonds to Leveraged Loans and Private Credit, a K-shaped divergence



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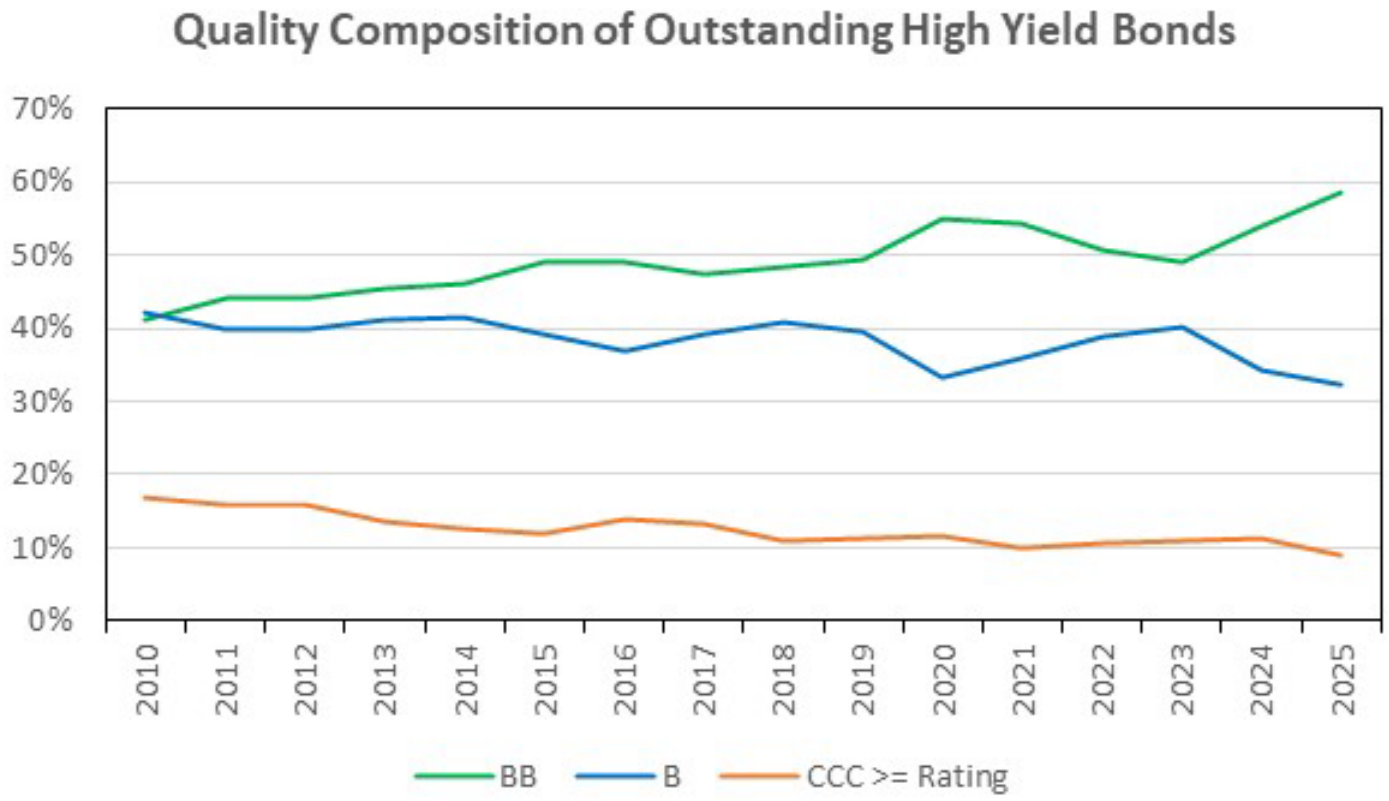
HIGH YIELD CREDIT

- Migration of credit risk even more pronounced:
  - HY Bonds becoming **higher quality**, from "B" and "BB" to **mainly "BB"**



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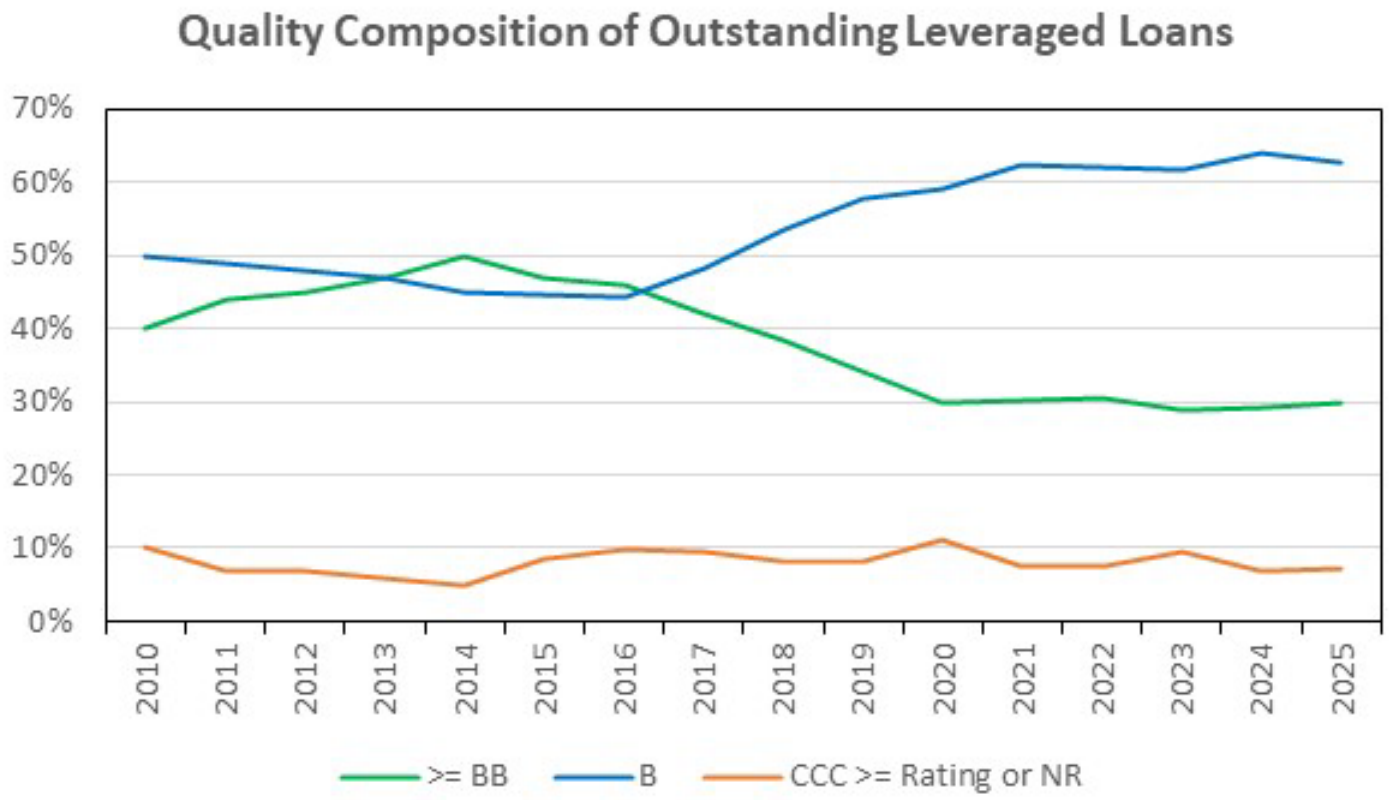
HIGH YIELD CREDIT

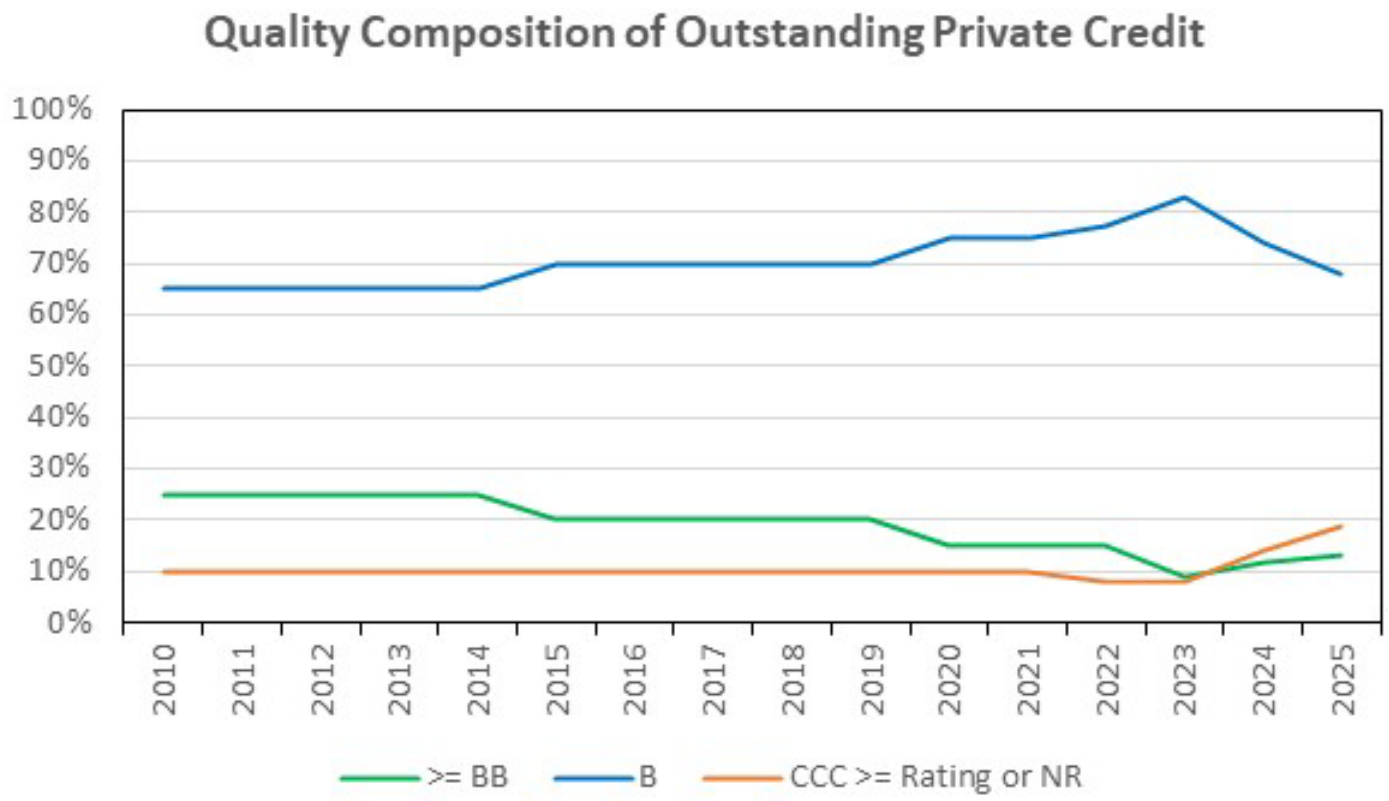
- Migration of credit risk even more pronounced:
  - Leveraged Loans getting **lower quality**, from "B" & "BB" to **mainly "B"**



Source: Morningstar

HIGH YIELD CREDIT

- Migration of credit risk even more pronounced:
  - Private Credit (more guesswork here) has always been **mainly "B"**



Source: Morningstar

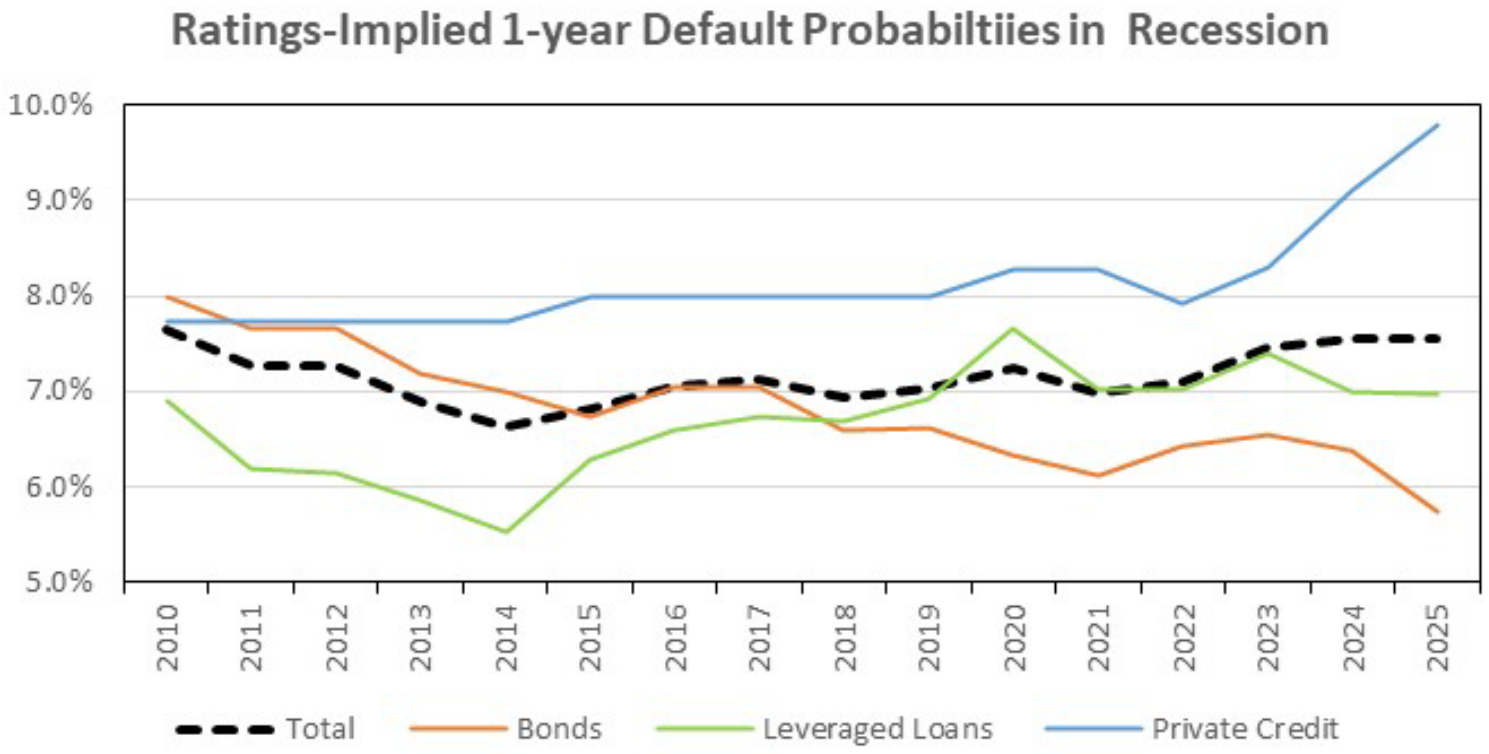
HIGH YIELD CREDIT

- It just one "grade", but huge differences in default risk between (i) BB and B and (ii) B and CCC!

Source: Moody's and BofA

HIGH YIELD CREDIT

- Little erosion in overall quality of HY borrowers, but big migration of risk from HY bonds to Leveraged Loans and Private Credit



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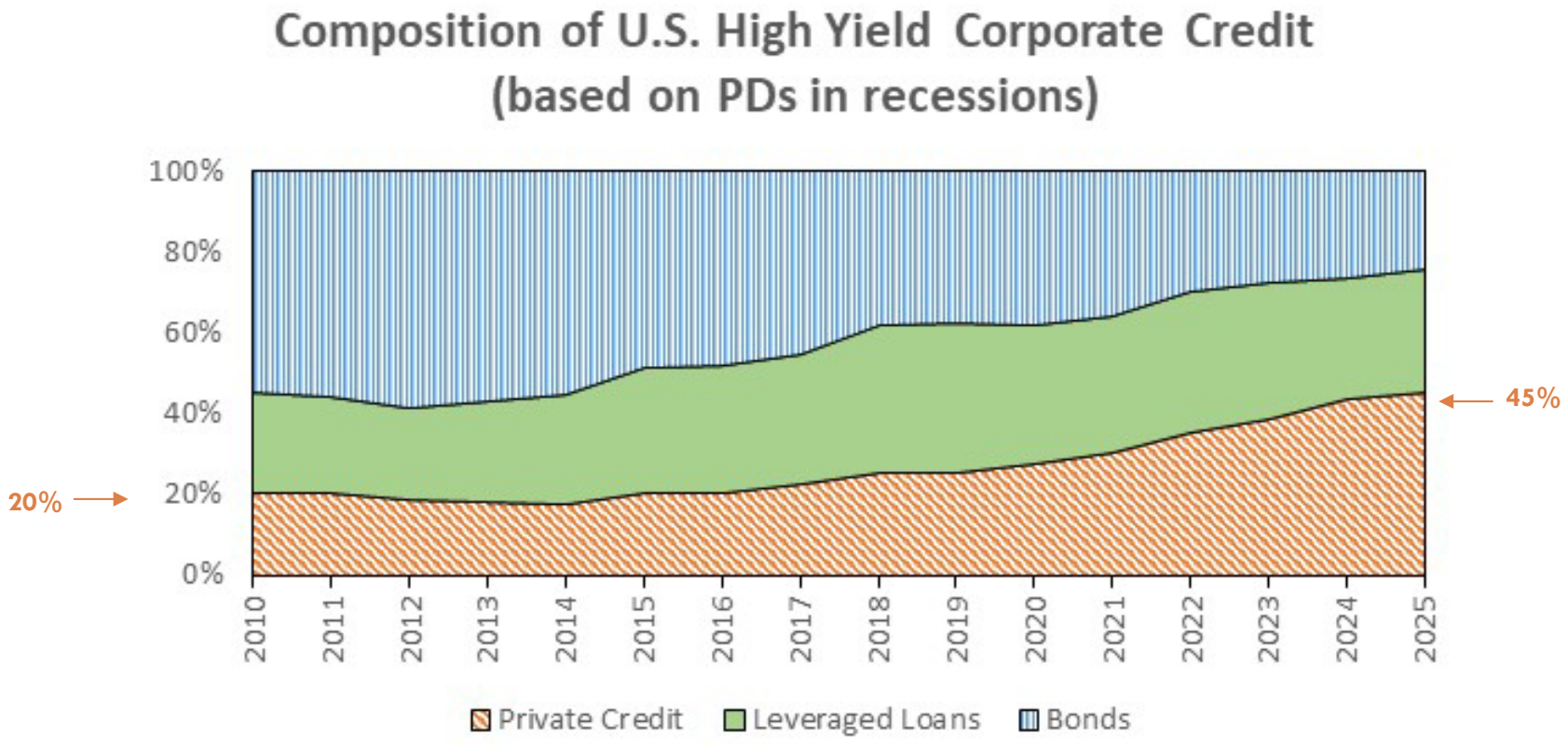

Source: Moody's and BofA

HIGH YIELD CREDIT

- I have **NOT** made a formal study of private credit
- But think history teaches us to worry somewhat when any form of risky credit—especially a new form—grows this fast
  - Worry that boom reflects an unsustainable mispricing of default risk
  - If not, why is risk migrating so rapidly towards this market?
  - Less concerned aggregate amount credit risk, more about who's bearing it
- Two main risks:
  1. Credit crunch: Even if doesn't impact solvency of "core" intermediaries (banks, brokers, insurers), a significant disruption to ordinary normal flow of business credit is a clear headwind for growth.
  2. Systemic contagion and amplification: If Private Credit extended lots of cheap credit, losses may show up in unexpected ways (e.g., impacting insolvency of insurers, reinsurers, pensions, etc.)
- Risk of truly "systemic" seems remote, but risk of some garden variety credit market stress seems to be rising

WHAT DO WE STILL WANT TO LEARN?

BIG POSITIVE QUESTIONS

#1. What deeper economic forces drive credit booms and busts?

- Storied literature back to1980s showing that time-varying **financial frictions** play key role in driving credit busts
  - In bust, intermediaries' constraints tighten, limiting ability to supply credit
  - But harder to explain **credit booms** using frictions alone: absence of frictions is good, shouldn't lead lenders to make (reasonable) mistakes
- Growing consensus **"behavioral" forces** play key role in booms
  - Need "pro-cyclically" biased beliefs (or something similar) to create booms
  - Beliefs should be "reasonable"—things we suspect/know lenders think. But "reasonable" ≠ Perfectly Bayesian!
- **My view**: Both frictional and behavioral forces are at work
  - Explanatory compliments, not explanatory substitutes!
  - Need more research on interactions between frictions, biased beliefs (e.g., Maxted (2024) and Krishnamurthy and Li (2025) for theories)
  - Important role for FRBNY?: Need more data on market participants' beliefs (e.g., more SLOOS-like surveys)

BEHAVIORAL VIEW OF CREDIT CYCLES

- **Greenwood, Hanson, and Jin (2026) build a behavioral model of credit cycle with two key features:**
  1. **Lenders extrapolate endogenous credit market outcomes**
     - Lenders estimate likelihood of future defaults based on recent credit market outcomes (e.g., recent defaults)
     - Generates very different dynamics from extrapolating exogenous borrower fundamentals (e.g., firm cashflows)
  2. **Dynamic feedback between lenders' biased beliefs and credit market outcomes via two channels:**
     i. Lender biases affect near-term defaults because govern terms on which borrowers can refinance maturing debt
     ii. Over longer run, borrowers lever up when credit is cheap

BEHAVIORAL VIEW OF CREDIT CYCLES

- **Dynamic feedback between lender biases and defaults**
  - If defaults have been low recently
    → Extrapolative lenders under-estimate Prob(Future default)
    → Credit is cheap today
  - **In short-run:**
    Availability of cheap credit
    → Easier for borrowers to refinance maturing debt
    → Reduces near-term defaults

➢ **Lender over-optimism often self-reinforcing in short-run**

BEHAVIORAL VIEW OF CREDIT CYCLES

- **Dynamic feedback between lender biases and defaults**
  - **In longer-run:**
    - → Borrowers respond to cheap credit by levering up
    - → Build up of exposure to shocks → Economy becomes fragile
    - → Raises likelihood of defaults
      - When unlucky shock lands in fragile state → **Credit bust** where: (1) Cost of credit spikes (2) wave of defaults by indebted borrowers
  - ➢ **Lender over-optimism usually self-defeating in longer-run**
- **Credit booms can be self-inflating in short-run, but tend to sow seeds of own their destruction in longer-run**

BIG POSITIVE QUESTIONS

#2. Do new credit instruments/markets play an outsized role in driving credit booms and busts? If so, why?

- Seems like most new credit markets need to "put their hands on the stove" in adolescence before becoming adults
  - Consumer installment credit and commercial mortgages in 1920s
  - Petrodollar loans in 1970s
  - High yield bonds in 1980s
  - Collateralized mortgage obligations in 1990s
  - Non-conventional mortgages, private-label RMBS, and CDOs in 2000s
  - Private credit in 2020s?

- Real historical pattern or just selective memory? If real, why?
  - "Newness" makes it easier to neglect risk of future defaults?
  - "Newness" exacerbates tendency to extrapolate recent performance?

THIS TIME IS VERY SIMILAR?

Suspect answer is "yes" which is *interesting*. Why?

- Humans have been lending money to each other—and sometimes not being repaid—since the Sumerians started doing so 5,500 years ago.
- Gains from inventing more efficient ways to extend credit should be diminishing and fairly 2nd order nowadays (i.e., Modigliani Miller)
- Almost by construction, making risky loans goes swimmingly most of the time and terribly on rare occasions
- Obviously, lots of people don't know that, but one might hope/suspect that professional lenders would rarely lose track of this fact. But the do.
- Contrast: Plenty of generals never have to fight in a war, but most are students of military history. Because they've studied past wars, generals are risk managers who obsess about downside even before they've tasted battle.
- Why aren't smart lenders better vicarious learners like smart generals?

THIS TIME IS VERY SIMILAR?

- **Anyways … this seems to happen every 15 to 20 years:**
  - We invent a slightly more efficient way of extending credit, sometimes to new borrows but often just better serving existing borrowers
  - Initially, this is a good thing …
- **But it frequently morphs into a self-inflating boom**
  - Although credit is ancient, lenders treat the new instrument as something completely "new under the sun"
  - Instead of thinking "structurally" about risky credit a la Merton, they start a completely new time-series of outcomes for the new instrument
  - Because borrowers usually repay, the very short time-series of past repayments for the new instrument looks amazing
  - Some smart people think the instrument has eliminated all/most risk.
  - Now the boom really starts to self-inflate, even pulling in some of the prior skeptics—their FOMO wins out.

THIS TIME IS VERY SIMILAR?

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  - We invent a slightly more efficient way of extending credit, sometimes to new borrows but often just better serving existing borrowers
  - Initially, this is a good thing …

- **But it frequently morphs into a self-inflating boom**
  - Time to start worrying when smart investors/lenders are saying things like:
    - "The past is always triple-A. … But if we try to make the future triple-A, we have no future. The future is always single-B."
    - "The risk of default is not the risk of loss."
    - "The [new instrument] delivers equity-like returns with debt-like risk."
    - "Now is the golden age of [new instrument] credit."
    - "If you can earn 12 percent, maybe 13 percent with almost no prospect of loss, that's about the best thing you can do."

THANKS!

WHAT TO DO?

BIG OPEN POLICY QUESTIONS

#1. Should central banks and financial regulators try harder to "lean against wind" of incipient credit booms?

- Policymakers often seem to adopt:

  H_0: Rapid growth in (new form) of credit isn't a threat to financial stability

  Will only take action if they can decisively reject this null

- Given accumulating evidence, does null still make sense?
  - At odds with usual "risk management" approach to policymaking
  - When it comes to price stability, central banks don't wait until see "whites of inflation's eyes" before taking action
  - Should financial stability be so different?
  - What explains asymmetry? Stickiness of academics'/policymakers' beliefs? Political economy considerations?

BIG OPEN POLICY QUESTIONS

#2. If so, what are best policy instruments to tighten credit conditions in face of an incipient credit boom?

- Monetary policy less targeted, but far more flexible, "gets in all cracks"
- Counter-cyclical macro-prudential regulations—e.g., capital and LTV requirements, regulatory guidance—are more targeted, but seem quite hard (or uncomfortable) to adjust quickly in practice
- Can we create institutional structures that make macro-pru more flexible?
  - Post-GFC dream of creating a "free safety" like the FSOC died
  - Bank stress tests might have played this role, but strong political/organizational forces gradually led to ossification
- Perhaps we're in N^{th} best world ($N > 2$) where this is too hard—financial activity can evolve so quickly and policy cannot be made sufficient flexible—so need to accept booms and busts as cost of business?

BIG OPEN POLICY QUESTIONS

#3 How to respond to incipient credit booms in new products and institutions outside of regulatory "core".

- How can/should policy respond in the face of rapid financial innovation?
  - Hard to rapidly bring new institutions, products under regulatory umbrella
  - Use regulatory power over the "core" to control the periphery?
    - Until 2025, was arguably U.S. approach to cryptocurrencies
    - But cryptocurrencies are more of exception than rule
- How can/should a policymaker monitor credit markets in our non-stationary world of continuously evolving instruments, markets, and institutions?
  - How to construct stationary over-heating indicators in non-stationary world?
  - **Example:** Have long thought HY bond market was our best barometer for detecting credit market over-heating. But increasingly worry barometer no longer works.

"PREDICTABLE FINANCIAL CRISES"

Robin Greenwood, Sam Hanson, Andrei Shleifer, and Jakob Sørensen

Journal of Finance, 2022

Paper Summary

- **Prior literature showed that crises can be predicted using past credit growth in simple linear regressions**
  - But predictability is modest

1. **We show predictability rises substantially if focus on large credit expansions that are accompanied by asset price booms**
   - *Probability (Crisis)* is high when:
     - Business credit growth is high + Stock prices have risen sharply or
     - Household credit growth is high + Home prices have risen sharply
   - Joint occurrence of rapid asset price growth & credit growth = "Red-Zone"
     - In Red-Zone, *Probability (Crisis in next 3 years)* = 40% vs 7% normally

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   - Joint occurrence of rapid asset price growth & credit growth = "Red-Zone"
     - Signals outward credit supply shift, which sows seeds of own destruction

2. **How high should *Probability (Crisis)* be allowed to climb before prompting early policy action?**
   - When, if ever, should policy take away the punch bowl from the party?

Data

- **Panel dataset: 42 countries from 1950 to 2016**
- **Dependent variable = Financial crisis indicator**
  - Baseline = Baron-Verner-Xiong (2021) indicator
  - Uses narrative data on bank failures/panics + data on bank stock prices
- **Independent variable #1 = Growth in credit**
  - 3-year change in Credit-to-GDP for Businesses and Households
- **Independent variable #2 = Asset price growth**
  - Equities: 3-year real price growth
  - Residential Housing: 3-year real price growth

The Red-Zone

- **Define three indicator variables:**

$$High\text{-}Debt\text{-}Growth_{it} = 1\{Debt\ Growth_{it} > 80^{\text{th}}\ \text{percentile}\})$$
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- **To assess how elevated credit and asset price growth shape *Prob(Crisis)*, estimate forecasting regressions:**

$$Crisis_{i,t+1\ \text{to}\ t+h} = \alpha_i^{(h)} + \beta^{(h)} \cdot High\text{-}Debt\text{-}Growth_{it} + \delta^{(h)} \cdot High\text{-}Price\text{-}Growth_{it} + \gamma^{(h)} \cdot R\text{-}zone_{it} + \varepsilon_{i,t+1\ \text{to}\ t+h}$$

← Focus on interaction effect

Forecast with R-Zone (Household)

$$Crisis_{i,t+1 \text{ to } t+h} = \alpha_i^{(h)} + \beta^{(h)} \cdot High\text{-}Debt\text{-}Growth_{it} + \delta^{(h)} \cdot High\text{-}Price\text{-}Growth_{it} + \gamma^{(h)} \cdot R\text{-}zone_{it} + \varepsilon_{i,t+1 \text{ to } t+h}$$

	Crisis within 1 year				Crisis within 3 years			
	(1.1)	(1.2)	(1.3)	(1.4)	(3.1)	(3.2)	(3.3)	(3.4)
High Debt Growth^{HH} ($\beta^{(h)}$)	7.3**		2.4		20.5***		9.1**	
	[2.2]		[1.6]		[3.3]		[2.3]	
High Price Growth^{HH} ($\delta^{(h)}$)		3.6*	0.4			8.1	0.0	
		[1.7]	[0.3]			[1.5]	[0.00]	
R-Zone^{HH} ($\gamma^{(h)}$)			8.9*	11.2**			20.9***	28.6***
			[1.8]	[2.2]			[3.2]	[3.4]
Sum of coefficients ($\beta^{(h)} + \delta^{(h)} + \gamma^{(h)}$)	7.3	3.6	11.7	11.2	20.5	8.1	30.1	28.6
R^2 *(within)*	1.8	0.7	2.8	2.7	5.6	1.4	7.6	7.0
N	1,107	1,107	1,107	1,107	1,107	1,107	1,107	1,107

- Consistent with literature, rapid credit growth predicts crises

Forecast with R-Zone (Household)

$$Crisis_{i,t+1 \text{ to } t+h} = \alpha_i^{(h)} + \beta^{(h)} \cdot High\text{-}Debt\text{-}Growth_{it} + \delta^{(h)} \cdot High\text{-}Price\text{-}Growth_{it} + \gamma^{(h)} \cdot R\text{-}zone_{it} + \varepsilon_{i,t+1 \text{ to } t+h}$$

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N	1,107	1,107	1,107	1,107	1,107	1,107	1,107	1,107

- Mainly due to the R-zone: Coefficient on interaction is large, significant

Forecast with R-Zone (Household)

$$Crisis_{i,t+1 \text{ to } t+h} = \alpha_i^{(h)} + \beta^{(h)} \cdot High\text{-}Debt\text{-}Growth_{it} + \delta^{(h)} \cdot High\text{-}Price\text{-}Growth_{it} + \gamma^{(h)} \cdot R\text{-}zone_{it} + \varepsilon_{i,t+1 \text{ to } t+h}$$

	Crisis within 1 year				Crisis within 3 years			
	(1.1)	(1.2)	(1.3)	(1.4)	(3.1)	(3.2)	(3.3)	(3.4)
High Debt Growth^{HH} ($\beta^{(h)}$)	7.3**		2.4		20.5***		9.1**	
	[2.2]		[1.6]		[3.3]		[2.3]	
High Price Growth^{HH} ($\delta^{(h)}$)		3.6*	0.4			8.1	0.0	
		[1.7]	[0.3]			[1.5]	[0.00]	
R-Zone^{HH} ($\gamma^{(h)}$)			8.9*	11.2**			20.9***	28.6***
			[1.8]	[2.2]			[3.2]	[3.4]
Sum of coefficients ($\beta^{(h)} + \delta^{(h)} + \gamma^{(h)}$)	7.3	3.6	11.7	11.2	20.5	8.1	30.1	28.6
R^2 *(within)*	1.8	0.7	2.8	2.7	5.6	1.4	7.6	7.0
N	1,107	1,107	1,107	1,107	1,107	1,107	1,107	1,107

- In the R-zone, Prob(Crisis) is roughly 30% points above normal (7%)

Probability Crisis Onset within 3 years

- **Business Debt and Equity Prices**

	Crisis Frequency Debt Quintile					*Diff. from Median* Debt Quintile				
Price Tercile	1	2	3	4	5	1	2	3	4	5
1	4.2	4.9	4.1	7.1	19.3	-3.7	-3.1	-3.8	-0.9	11.3
2	3.5	5.3	8.0	9.5	19.4	-4.4	-2.7	0.0	1.6	11.4*
3	11.5	9.3	11.1	19.3	**45.3**	3.5	1.4	3.2	11.3	**37.4*****

- **Household Debt and House Prices**

	Crisis Frequency Debt Quintile					*Diff. from Median* Debt Quintile				
Price Tercile	1	2	3	4	5	1	2	3	4	5
1	9.5	4.8	11.1	8.2	28.3	6.1**	1.5	7.8	4.9	24.9**
2	7.2	4.0	3.3	16.2	13.1	3.9	0.7	0.0	12.9**	9.8*
3	2.7	3.2	1.4	17.4	**36.8**	-0.6	-0.2	-1.9	14.1**	**33.5*****

- Very strong interaction between past credit and asset price growth

Probability Crisis Onset within 3 years

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- ***Red-Zone or "R-zone"*** = Asset price growth and credit growth both high

Forecasting Errors

- **Contingency table:** A simple representation of the predictive efficacy of the R-zone (either Business or Household) indicator

	Crisis onset: $Crisis_{i,t} = 1$	**No crisis onset:** $Crisis_{i,t} = 0$
R-zone in prior 3 years	True Positives (32)	False Positives (262)
No R-zone in prior 3 years	False Negatives (18)	True Negatives (969)
	50	1,231

- Looking at columns:
  - True Positive Rate: $TPR = 32/50 = 64\%$
  - True Negative Rate: $TNR = 969/1{,}231 = 79\%$

False Negative Errors

- Red zone = (Debt growth > 80% and Price growth > 66.6%)
  - *True Positive Rate* = 64% of crises preceded by R-zone
  - *True Negative Rate* = 79% of non-crisis years not preceded by R-Zone

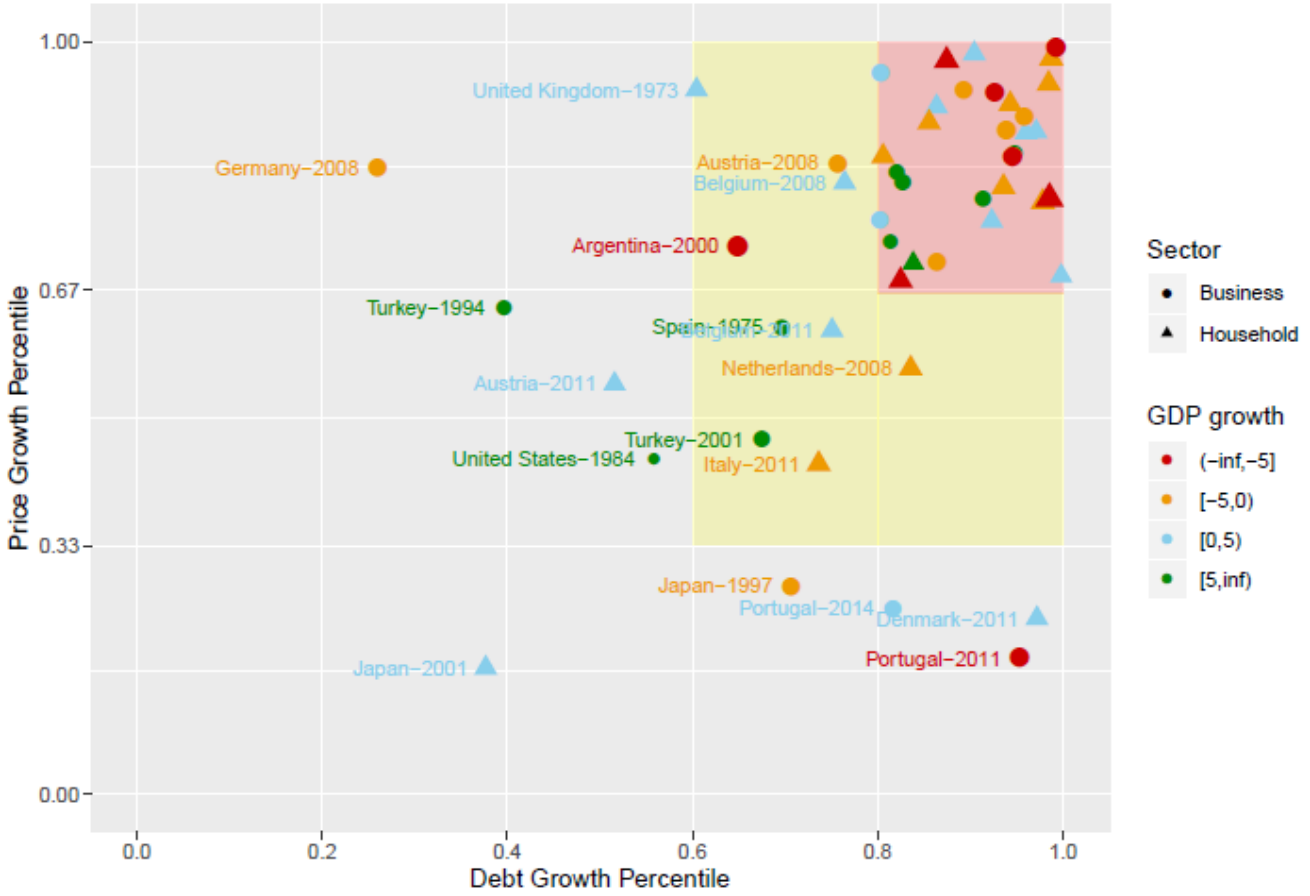
False Negative Errors

- Yellow zone = (Debt growth > 60% and Price growth > 33.3%)
  - *True Positive Rate* = 81% of crises preceded by Y-zone
  - *True Negative Rate* = 41% of non-crisis years not preceded by Y-Zone

The Policy Tradeoff

- **Statistical trade-off: Using a <u>less stringent</u> indicator of over-heating:**
  - Raises the True Positive Rate
  - Reduces the True Negative Rate

The Policy Tradeoff



- **How high of a threshold should policymakers set for taking early actions to reign in a credit boom—i.e., "leaning against wind"?**
  - Tighten monetary policy
  - Tighten limits on bank leverage

The Policy Tradeoff

- **Optimal threshold for taking early action depends on:**
  - Cost of false positive: Set high threshold if acting on false alarms is very costly
  - Cost of false negative: Set lower threshold if failing to confront threats is very costly

The Policy Tradeoff

- **Financial crises are incredibly costly for society:**
  - Growth recovers, but usually does not return to pre-crisis path
  - Permanent GDP loss worth 150% of annual GDP in present value terms

The Policy Tradeoff

- **Financial crises are incredibly costly for society:**
  - Growth recovers, but usually does not return to pre-crisis path
  - Permanent GDP loss worth 150% of annual GDP in present value terms

- **Government should adopt policies to lean against the wind of credit booms**
  - We have meaningful ability to predict crises, so should only adopt the "never lean against wind" strategy if cost of false positives is extremely (implausibly) large relative to costs of false negatives
  - Pre-emptively tightening policy in Red Zone is a good balance
  - Place fighting incipient financial instability more on par with fighting incipient price inflation

The Policy Tradeoff

- What point on the policy possibility frontier should a policymaker choose?
  - Given the statistical tradeoff between false positives and false negatives, what should a policymaker concerned with financial stability do?
  - How high of a threshold should set for taking early actions.
- Tradeoff:
  - Taking steps to avert crises, the policymaker runs the risk of leaning against the wind based on false alarms.
  - But, if they set to high of a threshold they will fail to act.
- Optimal threshold for taking early action depends on the cost of acting based on a false alarm, compared to the cost of failing to act when the risk of a crisis is truly elevated.

The Policy Tradeoff

- **With probability p the risk of a crisis is high and with probability $1-p$ the risk of a crisis is low.**
  - True level of crisis risk is not observed by the policymaker.

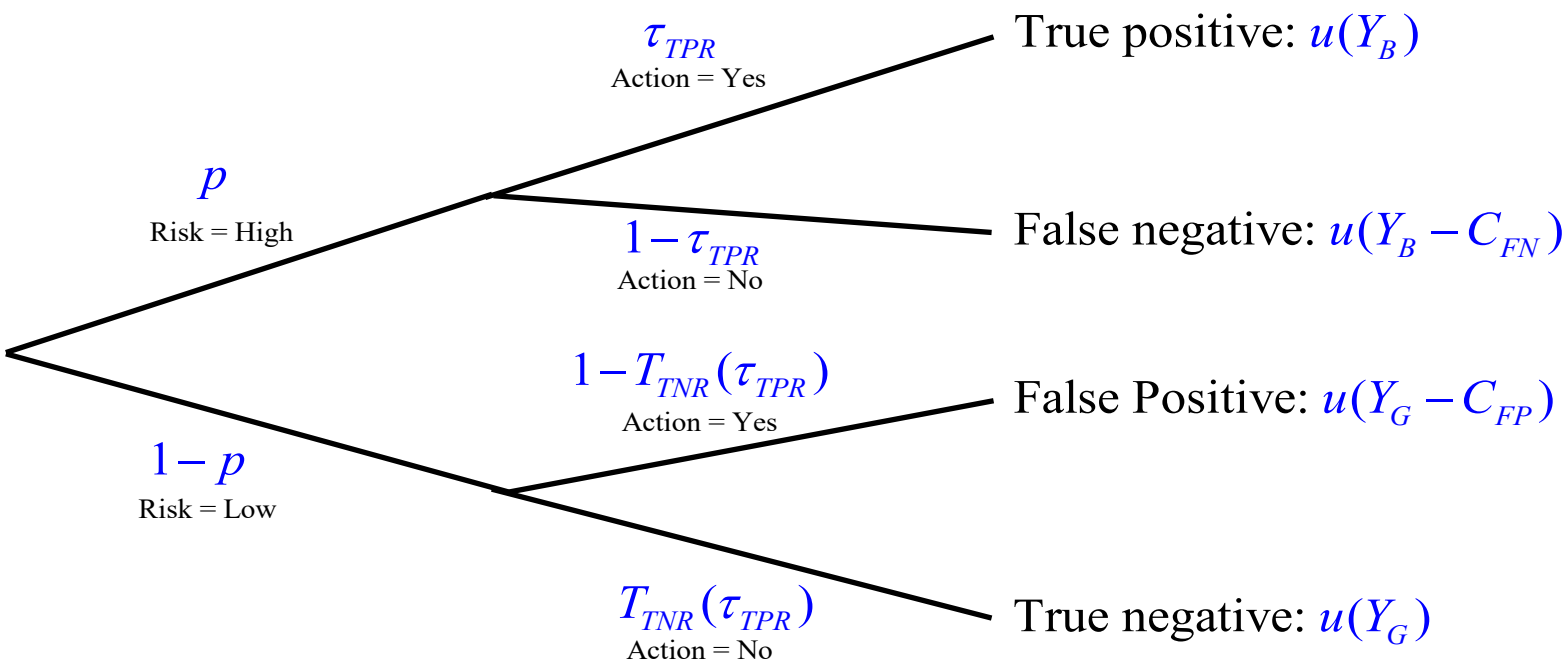
- **Policymaker has access to contiuum of informative, but imperfect binary statistical tests she can use to guide a binary action that can reduce the severity of a crisis.**
  - Preventative policy action yields benefits if risk of a crisis is truly high, but is costly if it is not.

- **If chooses a test with a true positive rate of $\tau_{TPR} \in [0,1]$, the test has a true negative rate given by $\tau_{TNR} = T_{TNR}(\tau_{TPR})$.**
  - **Policy possibility frontier:** Plot of $\tau_{TNR} = T_{TNR}(\tau_{TPR})$ versus τ_{TPR}
  - $T'_{TNR}(\tau_{TPR}) < 0$: tradeoff between true negative and true positive rates.
  - $T_{TNR}(0) = 1, T_{TNR}(1) = 0, T''_{TNR}(\tau_{TPR}) < 0, T_{TNR}(\tau_{TPR}) > 1 - \tau_{TPR}$

The Policy Tradeoff

- Possible outcomes:

(0) Choose test τ_{TPR} (1) Realization of latent state (2) Use imperfect test to guide policy action (3) Outcome and payoffs realized



The Policy Tradeoff

- Policymaker solves:

$$\max_{\tau_{TPR}\in[0,1]}\{p\times[\tau_{TPR}\times u(Y_B)+(1-\tau_{TPR})\times u(Y_B-C_{FN})]$$
$$+(1-p)\times[T_{TNR}(\tau_{TPR})\times u(Y_G)+(1-T_{TNR}(\tau_{TPR}))\times u(Y_G-C_{FP})]\}$$

- First order condition for an interior optimum:

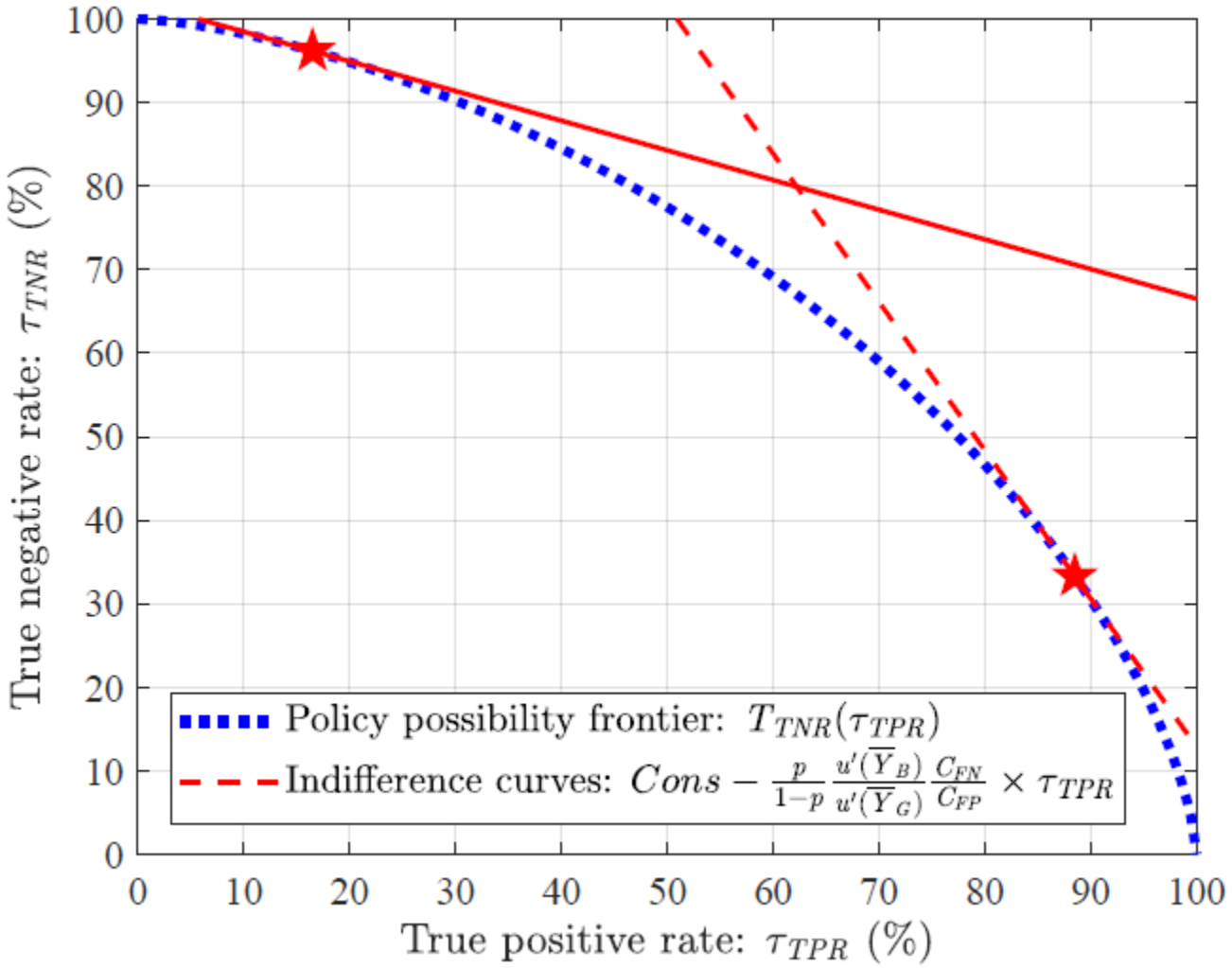
$$\overbrace{T'_{TNR}(\tau^*_{TPR})}^{\text{Slope of policy possibility frontier}} = \overbrace{-\frac{p}{1-p}\frac{u(Y_B)-u(Y_B-C_{FN})}{u(Y_G)-u(Y_G-C_{FP})}}^{\text{Slope of policy indifference curves}} = \overbrace{-\frac{p}{1-p}\frac{C_{FN}}{C_{FP}}\frac{u'(\bar{Y}_B)}{u'(\bar{Y}_G)}}^{\text{Slope of policy indifference curves}}$$

where $\bar{Y}_B \in (Y_B - C_{FN}, Y_B)$ and $\bar{Y}_G \in (Y_G - C_{FP}, Y_G)$.

- In interior solution, $\partial\tau^*_{TPR}/\partial C_{FN} > 0$, $\partial\tau^*_{TPR}/\partial C_{FP} < 0$, and $\partial\tau^*_{TPR}/\partial p > 0$.
- If $u''(Y) < 0$, also have $\partial\tau^*_{TPR}/\partial Y_B < 0$ and $\partial\tau^*_{TPR}/\partial Y_G > 0$.

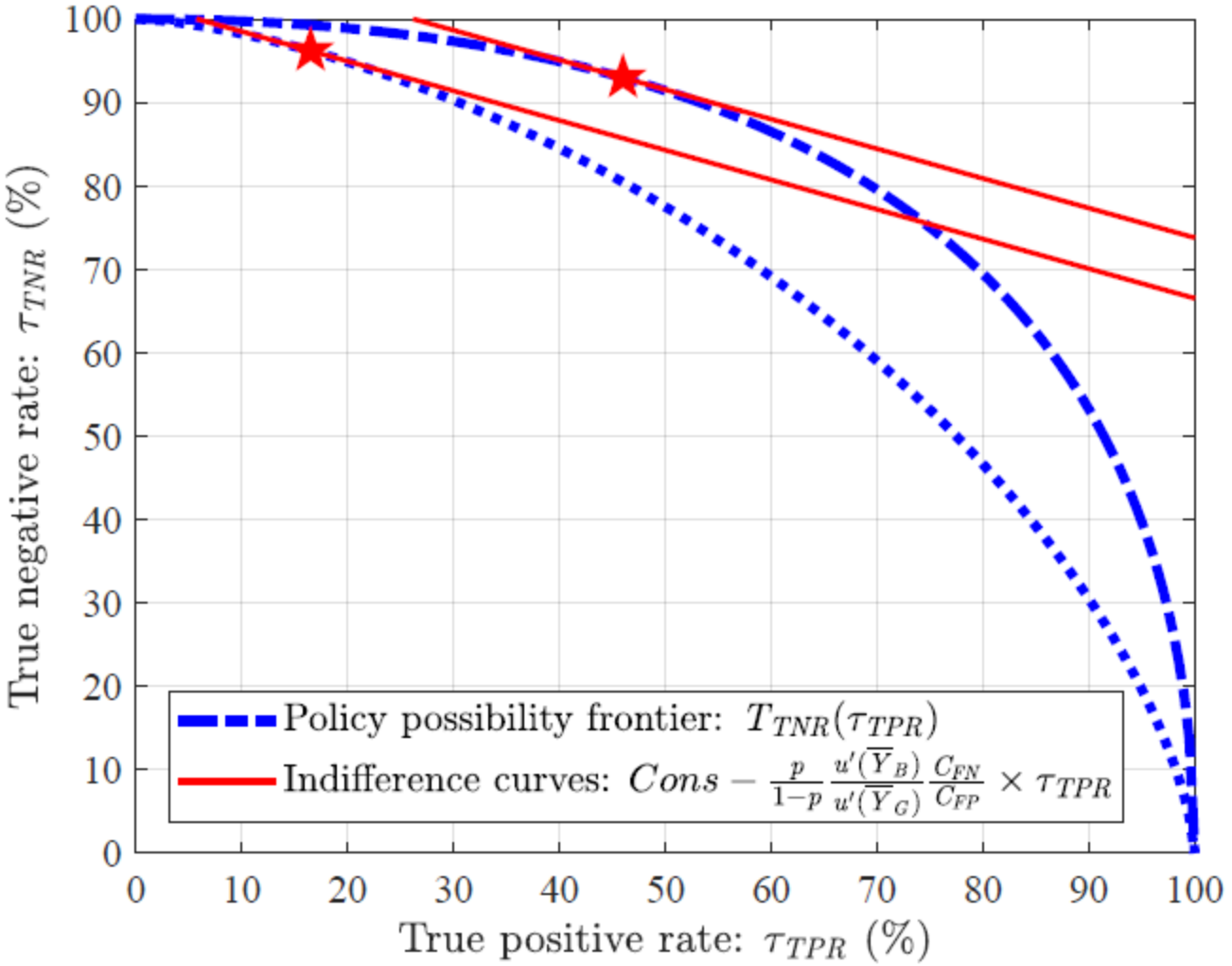
The Policy Tradeoff

- Solid indifference curves: C_{FN}/C_{FP} is small
- Dashed indifference curves: C_{FN}/C_{FP} is large



The Policy Tradeoff

- An outward shift in the Policy Production Frontier



Crude Back-of-the-Envelope

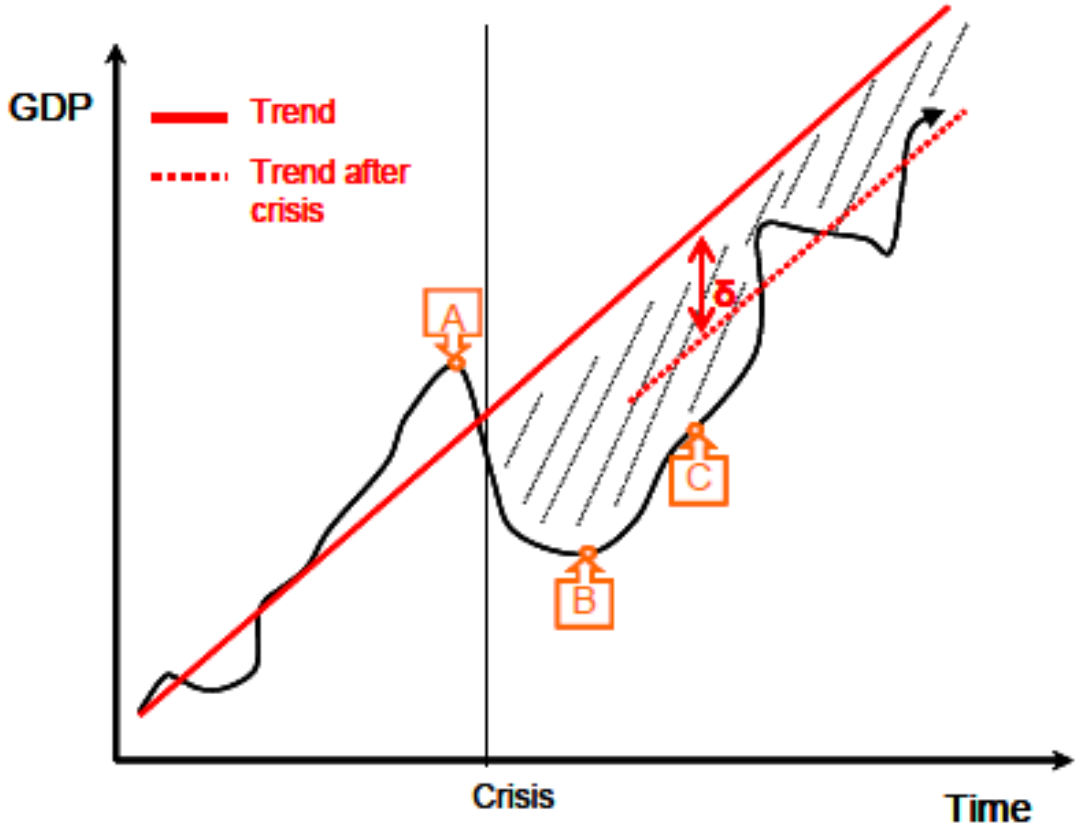
- Write $C_{FN}/C_{FP} = (C_{Crisis}/Y_G) \times (c_{FN}/c_{FP})$
  - c_{FN} = Fraction of costs of financial crisis C_{Crisis} that can be mitigated by taking early preventative action
  - c_{FP} = Fraction of non-crisis output Y_G lost when policymaker takes actions in response to false alarm.
  - c_{FN}/c_{FP} = Ratio of two macroeconomic "treatment effects."
- Based on our estimated Policy Production Frontier, report solutions to

$$T'_{TNR}(\tau^*_{TPR}) = -\frac{p}{1-p} \times \frac{u'(\bar{Y}_B)}{u'(\bar{Y}_G)} \times \frac{C_{Crisis}}{Y_G} \times \frac{c_{FN}}{c_{FP}} = -\frac{0.04}{0.96} \times 1 \times 1.5 \times \frac{c_{FN}}{c_{FP}}$$

  - $p = 4\%$: Unconditional probability of a crisis
  - $\frac{C_{Crisis}}{Y_G} = 150\%$: C_{Crisis}/Y_G is quite large because financial crises typically lead to a *permanent* loss of future output. While output *growth* usually returns to its pre-crisis trend following a crisis, the *level* of output does not return to its pre-crisis trendline
    - Cerra and Saxena (2008) and Basel (2010)

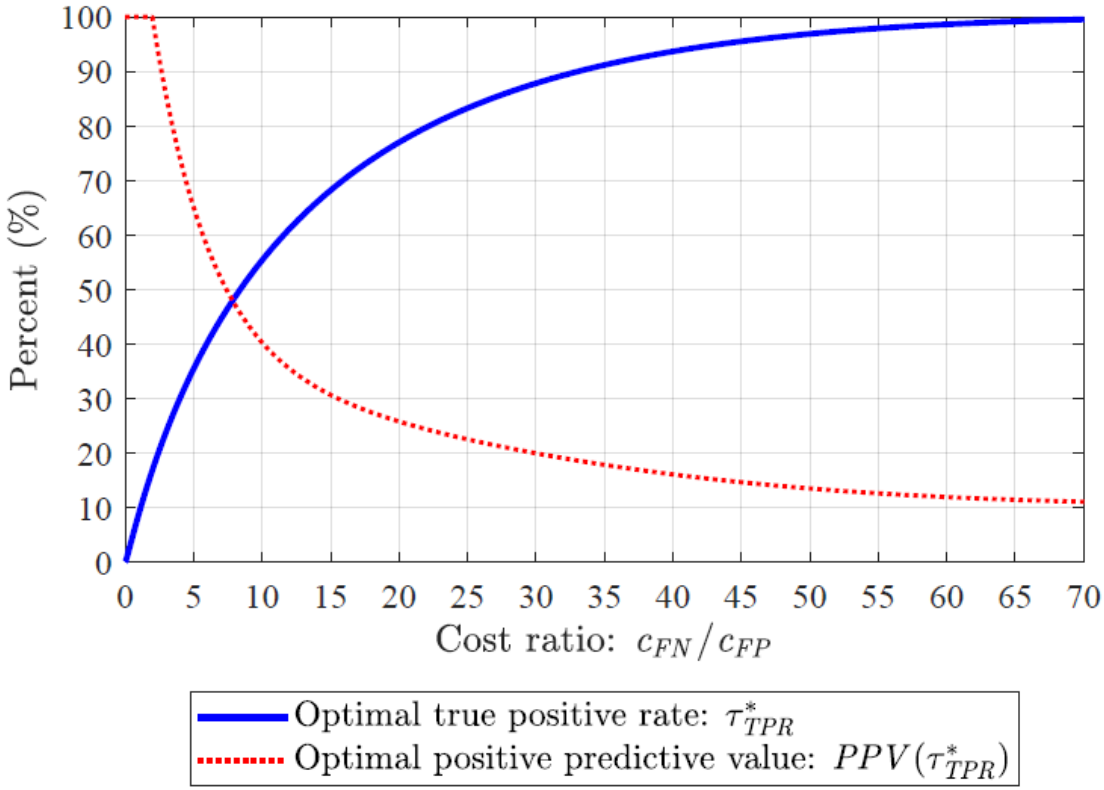
Crude Back-of-the-Envelope

- **Financial crises are incredibly costly.**
  - Cerra and Saxena (2008) and Basel (2010).



Crude Back-of-the-Envelope

- Example: $c_{FN}/c_{FP} = 30\%/2\% = 15$: Forceful early action to lean against the wind, lowers expected severity of incipient crisis by 30%, but reduces GDP by 1 percentage point for two years if there is no crisis
  - $\tau^*_{TPR} = 68\%$: Act once Prob[Crisis arrives within three years] > 31%.



Crude Back-of-the-Envelope

- Predictability we observe is sufficiently strong that policymakers should only adopt a "do nothing" strategy if they hold fairly extreme views about costs of failing to respond to financial stability threats vs. costs of false alarms
  - Based on our estimates, policymakers should only set $\tau^*_{TPR} \leq 0.1$ if they believe c_{FN}/c_{FP} is less 1.1.
  - Policymaker would need to believe a leaning-against-the-wind policy, which would reduce GDP by 1 percentage point for two years if there is no crisis, would only reduce the expected severity of an incipient crisis by 2.2%.

"ISSUER QUALITY AND CORPORATE BOND RETURNS"

Robin Greenwood and Sam Hanson

Review of Financial Studies, 2013

What Drives the Credit Cycle?

- **Why does the quantity of credit and the quality of borrowers fluctuate over time?**

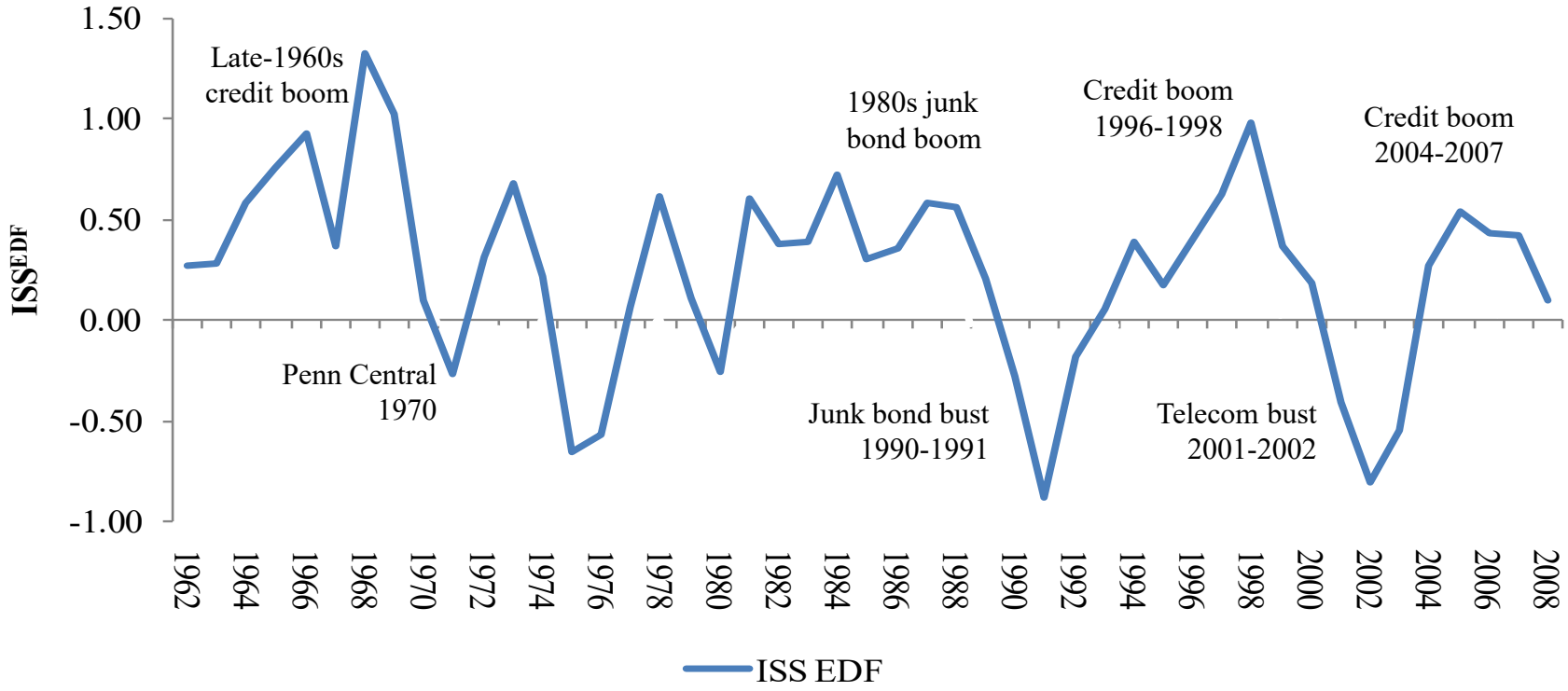
- **What we do:**
  - Construct measures of the credit quality of firms who issue new debt in a given year
  - Use quality measures to forecast returns on HY corporate bonds over like-maturity Treasuries – i.e., returns to risky lending

- **Main findings:**
  - Following years when debt issuers are of poor quality, future returns on risky corporate bonds are low
  - Evidence that predictability arises because investors tend to over-extrapolate recent market outcomes

Measuring Corporate Issuer Quality

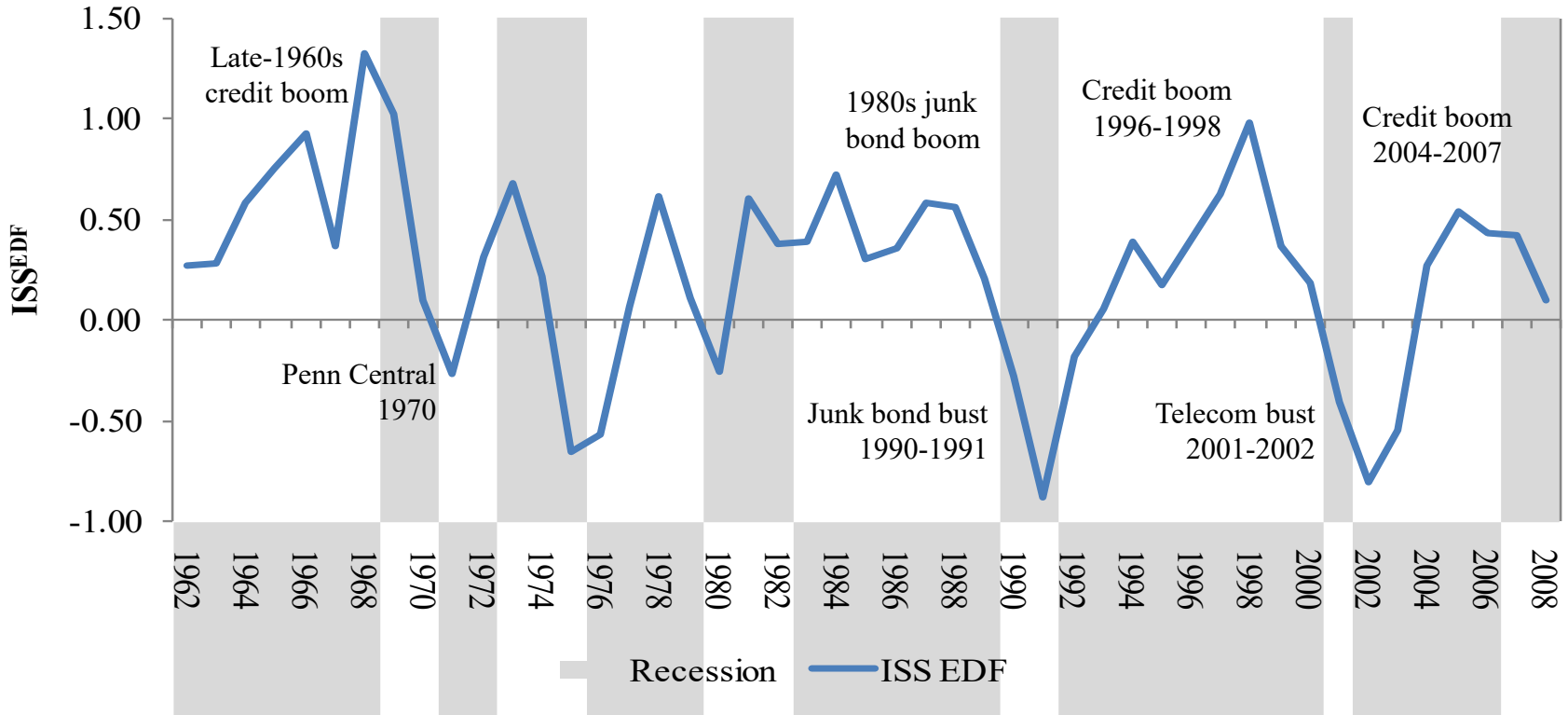
- **Default probability of firms w/ high vs. low debt issuance in year *t***
  - ISS_t^{EDF} is high in year *t* when issuing firms are of poor credit quality
  - $EDF_{i,t}$ = Expected Default Frequency, Debt issuance $d_{i,t} = \Delta D_{i,t} / A_{i,t-1}$

$$ISS_t^{EDF} = E[EDF_{i,t} \mid d_{i,t} = High] - E[EDF_{i,t} \mid d_{i,t} = Low]$$



Measuring Corporate Issuer Quality

- **Default probability of firms w/ high vs. low debt issuance in year *t***
  - ISS_t^{EDF} is high in year *t* when issuing firms are of poor credit quality
  - ISS^{EDF} correlated with business cycle, but removing macro variation doesn't change basic character of series.



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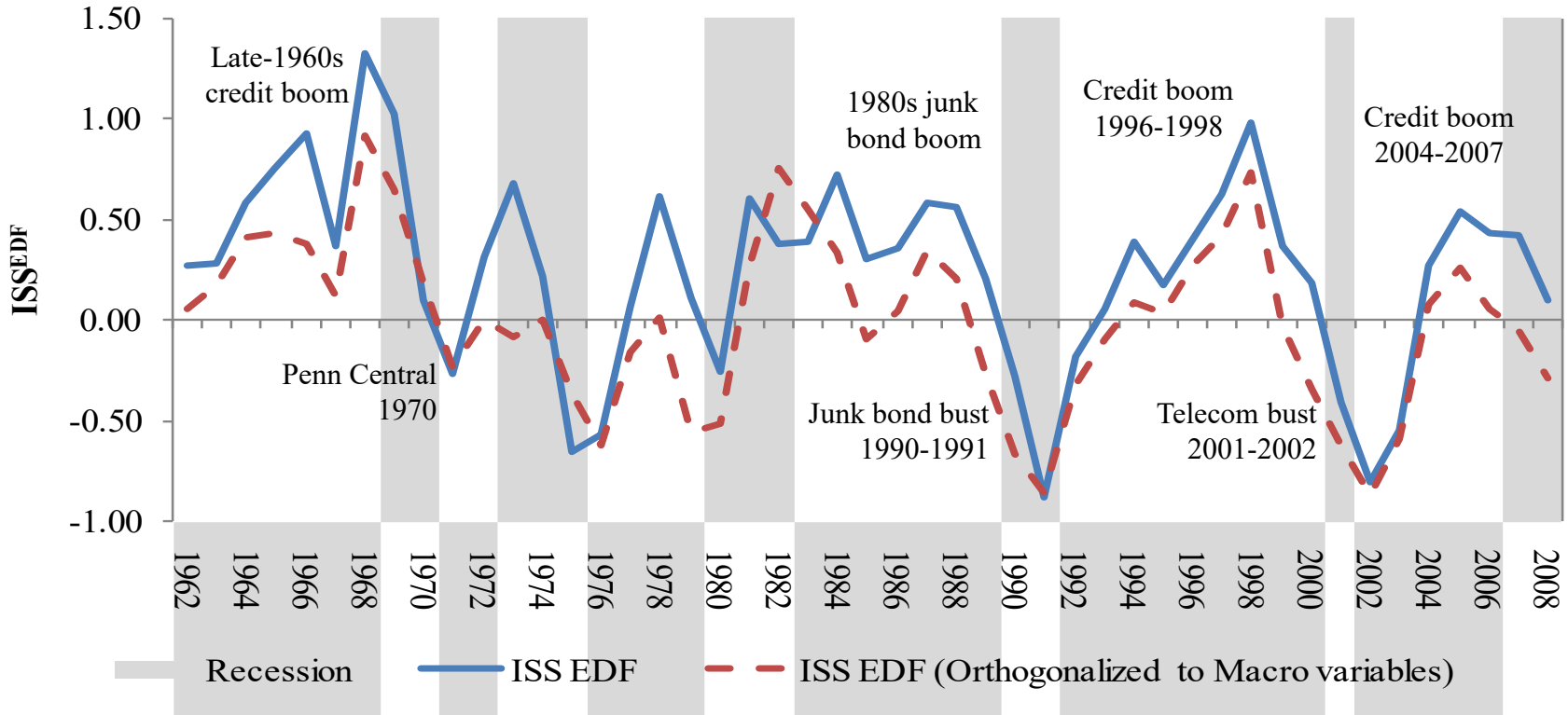
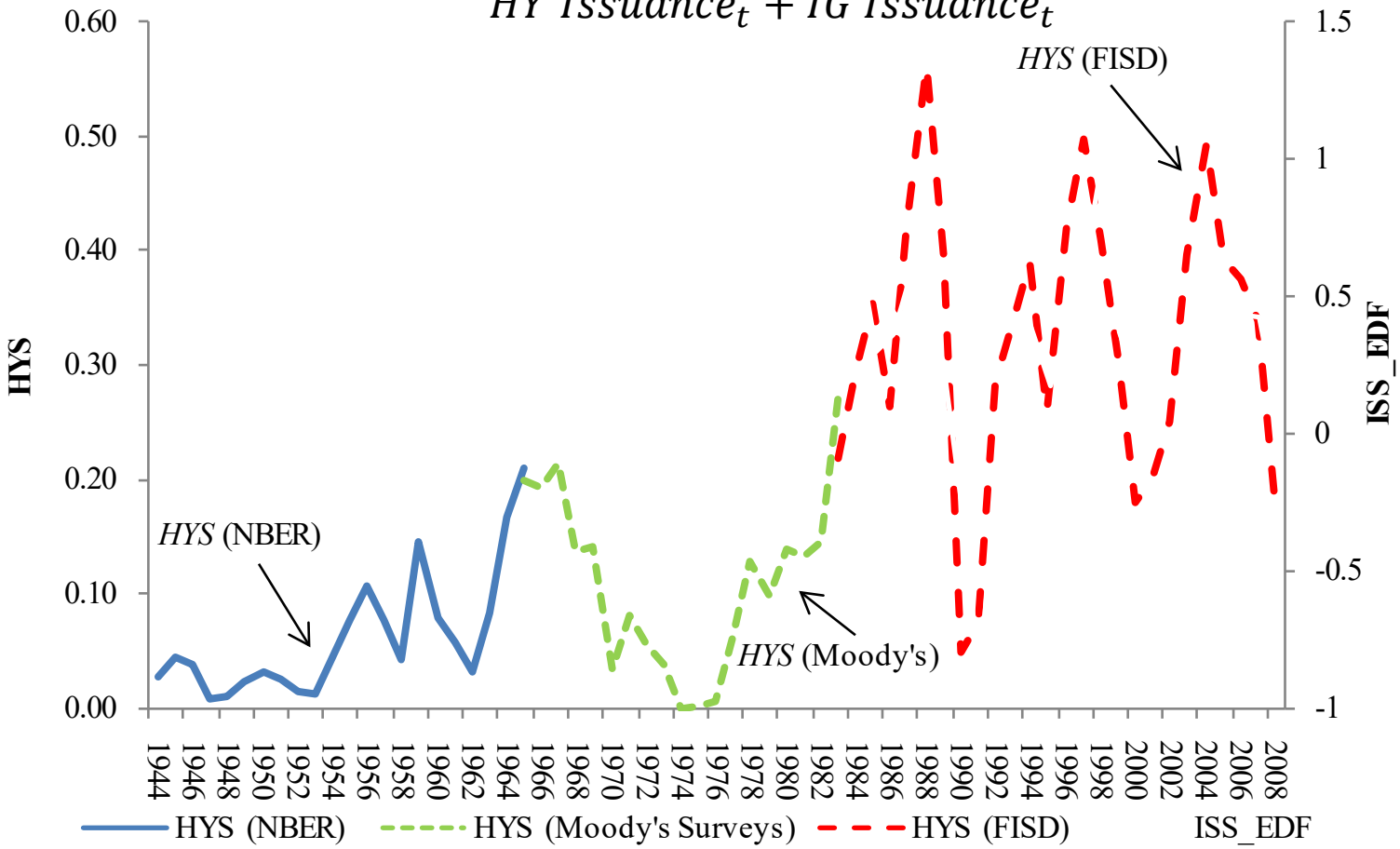


Measuring Corporate Issuer Quality

- **High yield issuance as a fraction of total corporate issuance**

$$HY\ Share_t = \frac{HY\ Issuance_t}{HY\ Issuance_t + IG\ Issuance_t}$$



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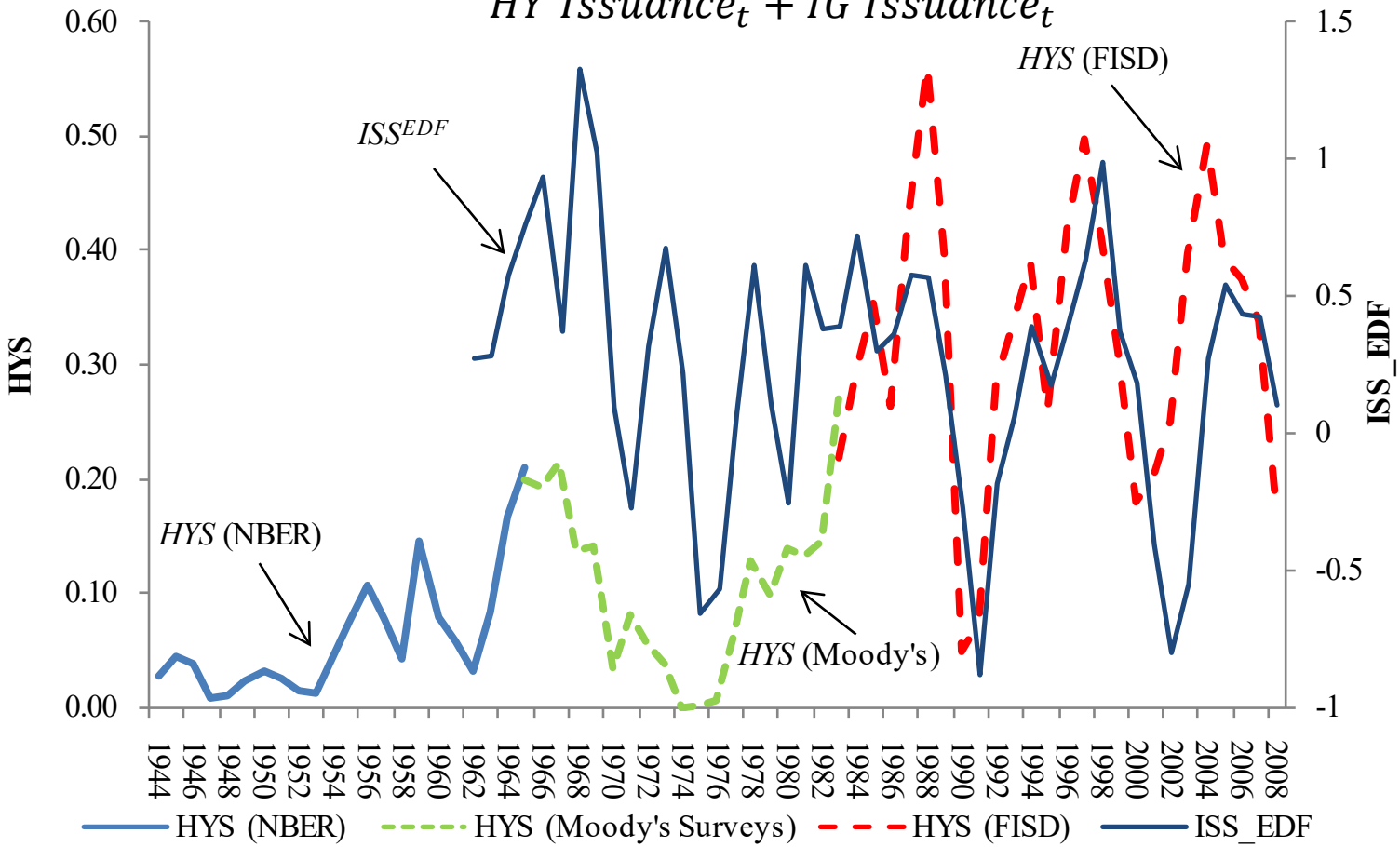
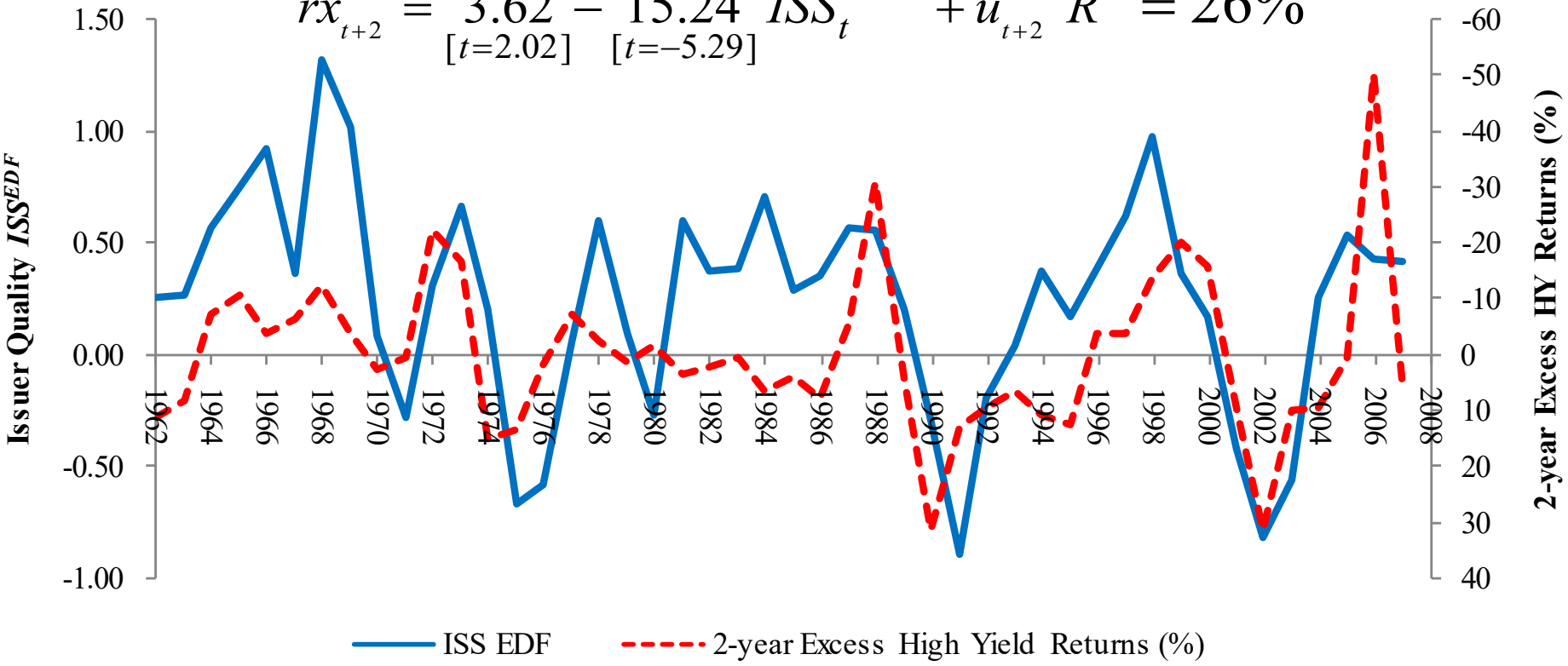


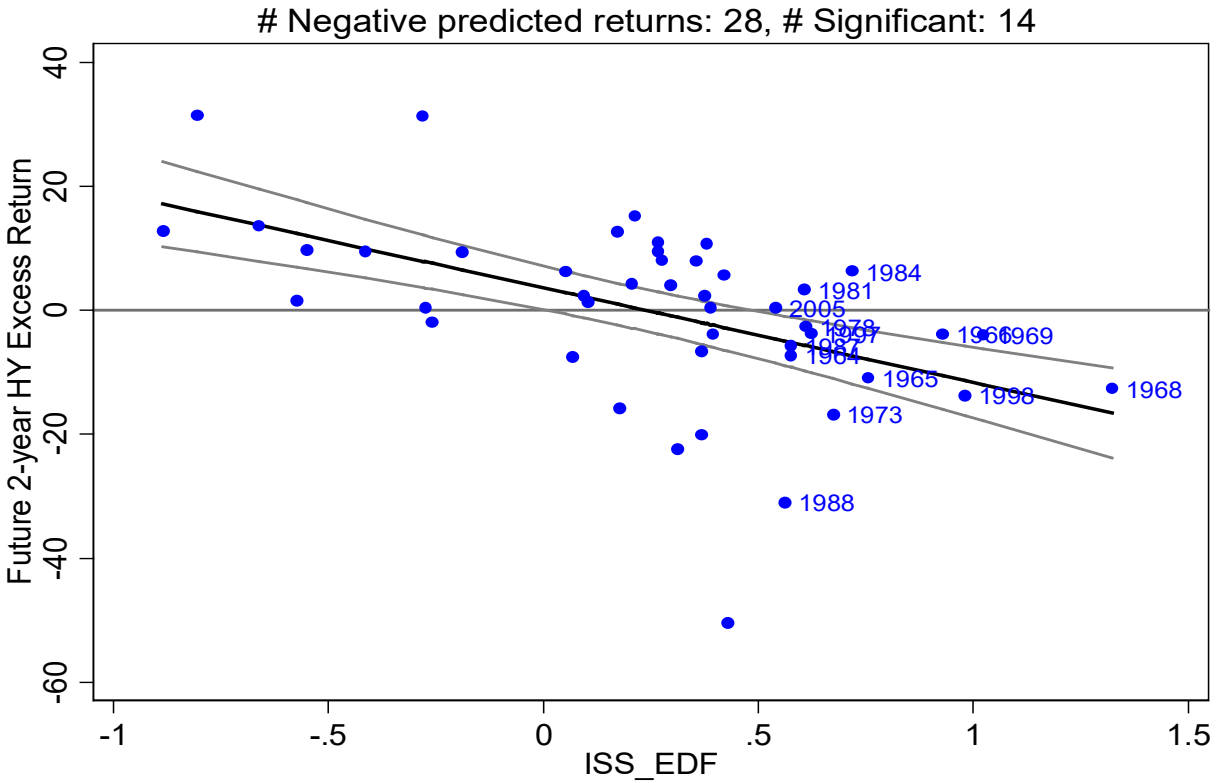
Poor Issuer Quality → Low Bond Returns

$$rx^{HY}_{t+2} = \underset{[t=2.02]}{3.62} - \underset{[t=-5.29]}{15.24}\ ISS^{EDF}_{t} + u_{t+2} \quad R^2 = 26\%$$



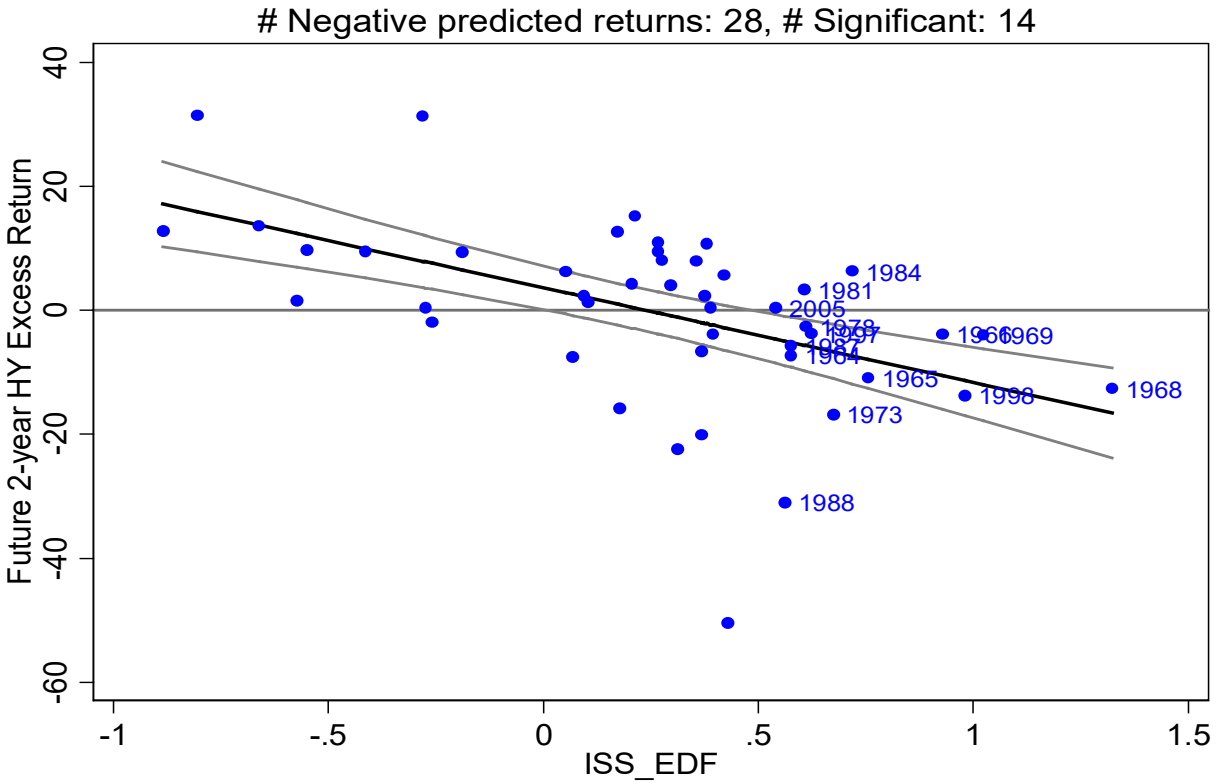
- **Economic magnitudes are significant:**
  - 1-σ increase in ISS^{EDF}
    → Bond returns fall by ~7 %-points over next 2 years

Poor Quality → Bonds Overpriced



- **When issuer quality is especially poor, we predict risky corporate bonds to <u>underperform</u> safe Treasuries bonds**
  - Earning a negative expected return for bearing significant risk = Virtually impossible to reconcile with market efficiency

Poor Quality → Bonds Overpriced



- **Find evidence that debt investors over-extrapolate recent market outcomes … tendency to think "this time is different"**
  - Issuer quality deteriorates when past defaults have been low and when corporate bonds have performed well