Foreseen Risks

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Motivation

- Schularick & Taylor (AER, 2012) show that credit booms precede the sharpest economic contractions
  - They suggest that the credit booms cause contractions
- Reinhart and Rogoff (2009), Mian, Sufi, and Verner (2017) and Lopez-Salido, Stein, and Zakrajsek (2017) make similar arguments.
- A causal chain from credit booms to economic contractions suggests a role for central banks in "managing the credit cycle."

This paper

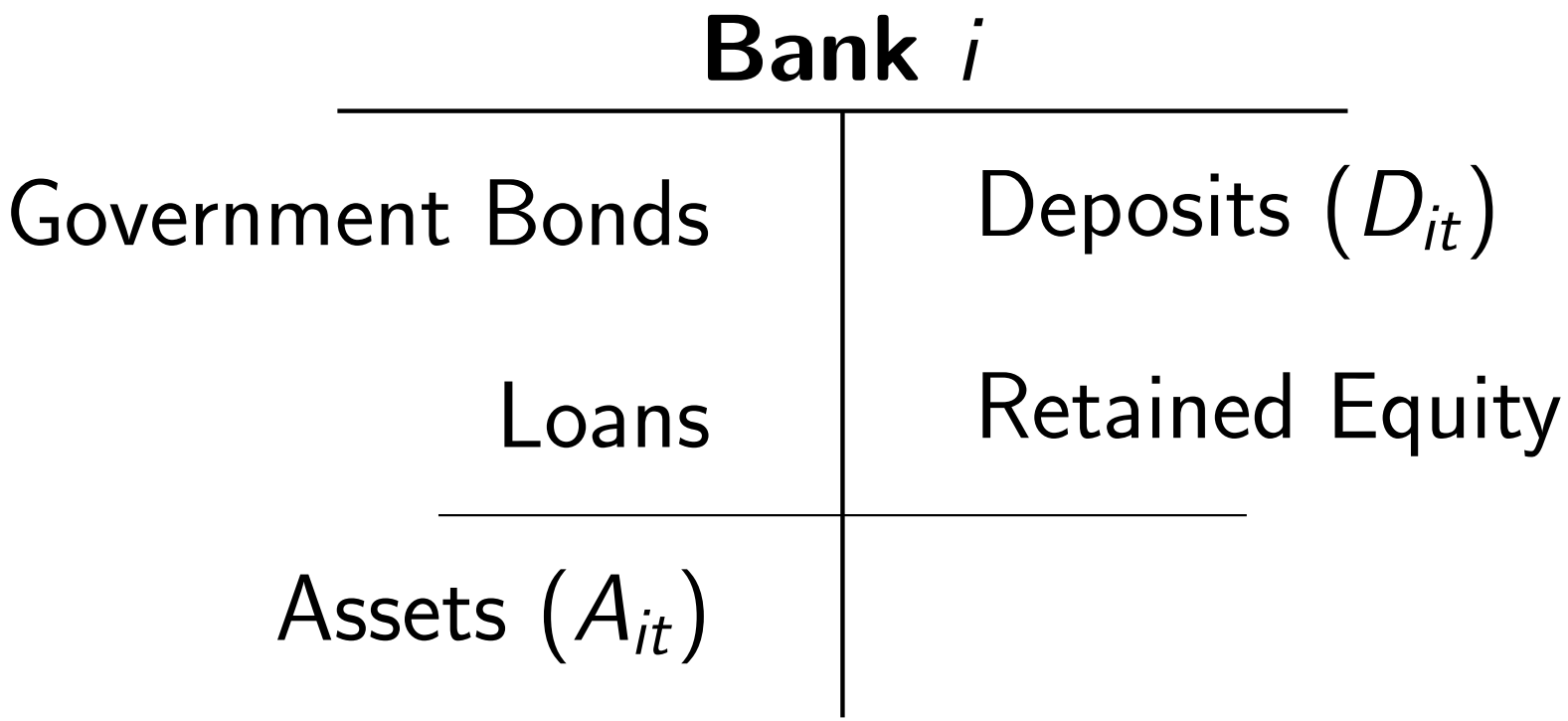
- We present a quantitative model of banking in the spirit of Merton (1978).
- We introduce a business cycle through time-varying risk of rare events.
- We show how bank's changing incentives to lend can produce a *correlation* between credit booms and subsequent economic contractions.
- However, there is no causation in the model.

Bank: Definition

Definition

A bank is an investment management company whose risky investments are financed by equity and guaranteed deposits.

Typical Bank Balance Sheet



Bank investment

- Bank i enters period t with book equity BE_{it} and deposits D_{it}.
- The bank chooses its dividend & pays costs; what's left is invested.

$$A_{it} = BE_{it} + D_{it} - Div_{it} - \Phi_{it}.$$

- The bank invests in a loan portfolio (r^L) and in government bonds (r^G):

$$r^A_{i,t+1} = \varphi_{it} r^L_{i,t+1} + (1 - \varphi_{it}) r^G_{t+1}.$$

- Evolution of book equity:

$$BE_{i,t+1} - BE_{it} = A_{it} r^A_{i,t+1} - r^D D_{it} - Div_{it} - \Phi_{it}$$

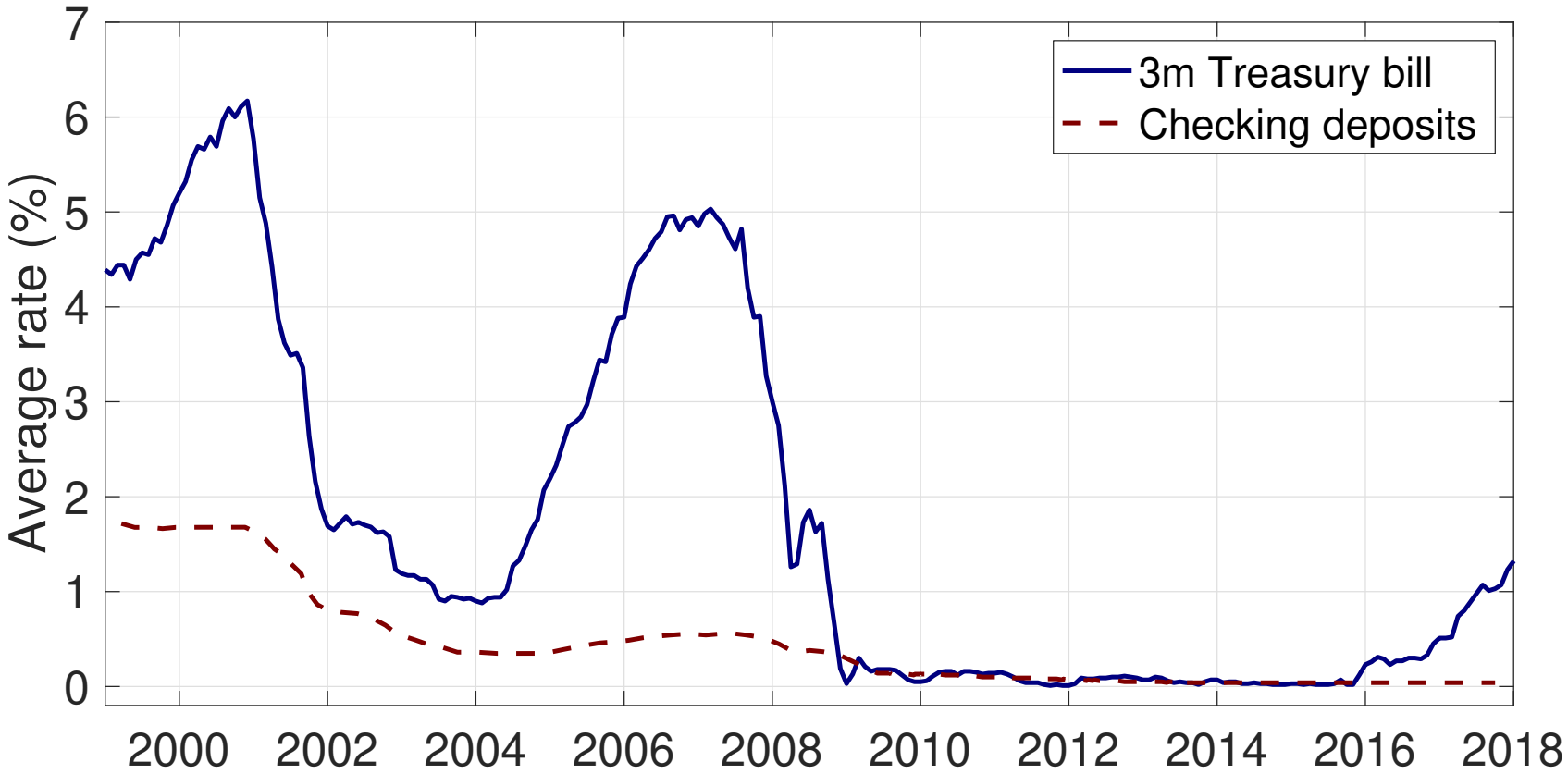
- Equivalently: $BE_{i,t+1} = (1 + r^A_{i,t+1}) A_{it} - (1 + r^D) D_{it}$.

Regulatory environment

- r^L and r^G are competitive rates (they solve the rep. agents' Euler equation).
- $r^D < E[r^G]$ Deposits insurance implies that depositors accept low rates.
- The bank terminates immediately if $BE_{it} < 0$ and equityholders receive nothing.
- Banks face the following cost function

$$\Phi(A_{it}, D_{it}, A_{i,t-1}) = \underbrace{\eta_B A_{i,t-1} \left(\frac{A_{it} - A_{i,t-1}}{A_{i,t-1}} \right)^2}_{\text{Adjustment costs}} + \underbrace{f D_{it} \mathbb{1}_{D_{it} > \chi A_{it}}}_{\text{Regulatory constraint}} .$$

Deposit rates lie below Treasury bill rates, and are more stable



- See Drechsler, Savov, and Schnabl (2017).

Representative investor

- Assume constant relative risk aversion and preference for early resolution of uncertainty
- To obtain reasonable quantitative implications, assume risk of economic crisis.
- Set up of Gourio (2012) and Wachter (2013)

Representative investor (cont.)

- Consumption:

$$C_{t+1} = C_t e^{\mu_c + \sigma_c \epsilon_{c,t+1} + \xi x_{t+1}}$$

where $\xi < 0$. $x_{t+1} = 1$ with probability p_t, where

$$\log p_{t+1} = (1 - \rho_p) \log \bar{p} + \rho_p \log p_t + \epsilon_{p,t+1}$$

- Stochastic discount factor

$$M_{t+1} = \beta^\theta \left(\frac{C_{t+1}}{C_t} \right)^{-\gamma} \left(\frac{S(p_{t+1}) + 1}{S(p_t)} \right)^{\theta - 1},$$

where $S(p_t)$ is the wealth-consumption ratio, and $\theta = \frac{1-\gamma}{1-\frac{1}{\psi}}$.

Loans to households

- The bank holds a diversified portfolio of loans with face value (κ) and current collateral value, W_{ijt}
- The ex-post repayment (at time $t+1$) for each loan j made by bank i is given by

$$\kappa P(W_{ij,t+1} \geq \kappa) + (1 - \mathscr{L}) W_{ij,t+1} P(W_{ij,t+1} \leq \kappa)$$

  where $\mathscr{L}$ is the loss in default
- The collateral value evolves according to

$$W_{ij,t+1} = W_{ijt} e^{\xi x_{t+1} + \omega_{i,t+1} + \epsilon_{j,t+1}}$$

  where $\epsilon_{j,t+1}$ is loan-specific and $\omega_{i,t+1}$ is bank-specific.
- A crisis ($x_{t+1} = 1$) increases the probability that loans go into default.

Market value of equity

- The bank's market equity is the discounted value of future dividends:

$$V_{it} = \mathbb{E}_t \left[\sum_{s=t}^{T_i^*-1} M_{t+s} Div_{is} \right], \quad t < T_i^*,$$

where

$$T_i^* = \inf\{t : BE_{it} < 0\}$$

otherwise $V_{it} = 0$.

- Investors choose policies to maximize market equity, leading to the recursive formulation:

$$V_i(BE_{it}, A_{i,t-1}, D_{it}, p_t) =$$

$$\max_{\varphi_{it}, Div_{it}} \; Div_{it} + \mathbb{E}_t \left[M_{t+1} V_i(BE_{i,t+1}, A_{it}, D_{i,t+1}, p_{t+1}) \mathbb{1}_{BE_{i,t+1}>0} \right]$$

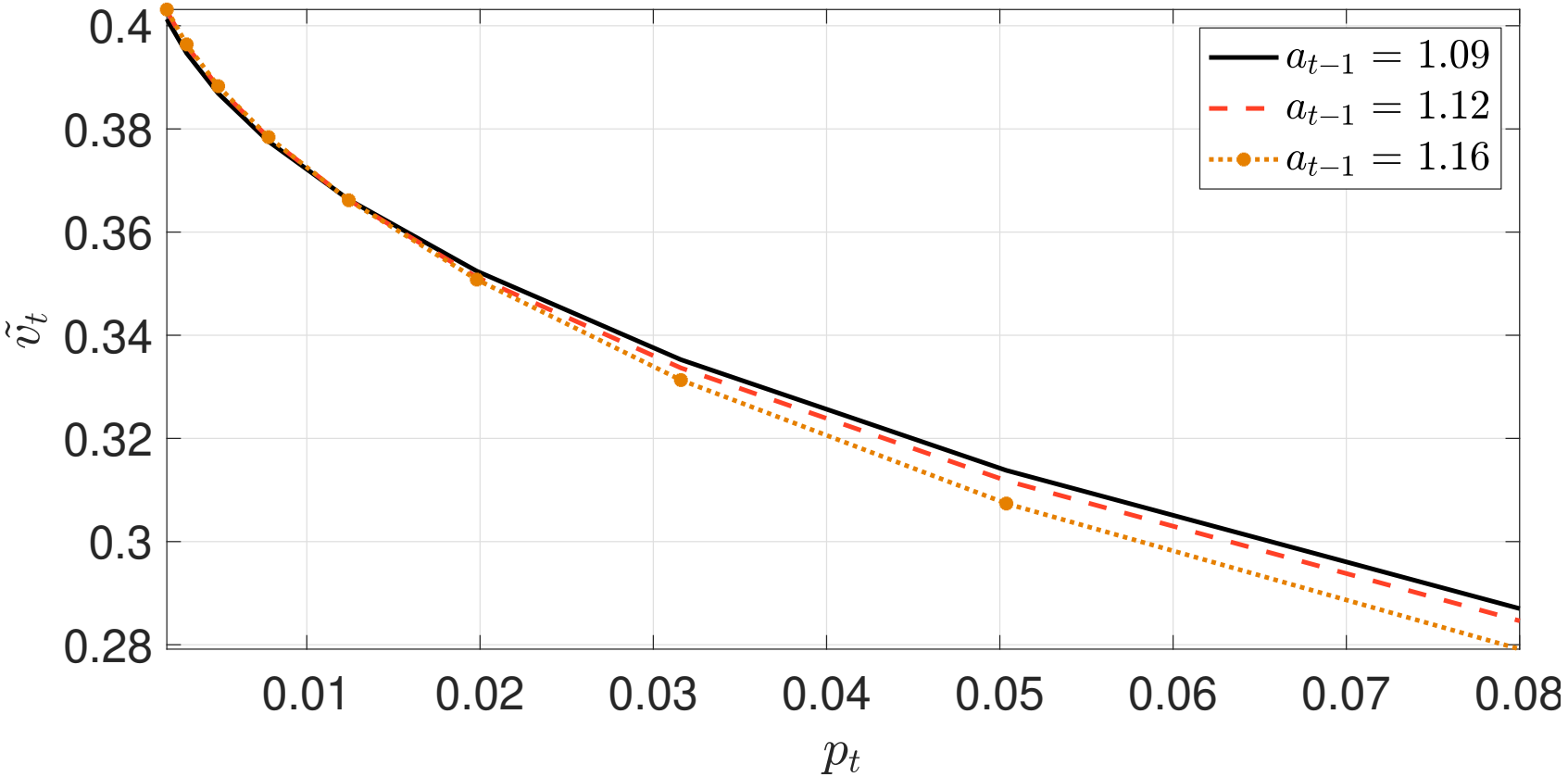
Franchise value

- Scale the problem by deposits.

$$\widetilde{v}(a_{i,t-1}, p_t) = \frac{V_i(BE_{it}, A_{i,t-1}, D_{it}, p_t) - BE_{it}}{D_{it}},$$

  where $a_{it} = \frac{A_{it}}{D_{it}}$ and $be_{it} = \frac{BE_{it}}{D_{it}}$.
- Franchise value is the (scaled) difference between market and book equity.
- Maximizing total value and scaled franchise value is the same at any period t.

Franchise value as a function of crisis probability



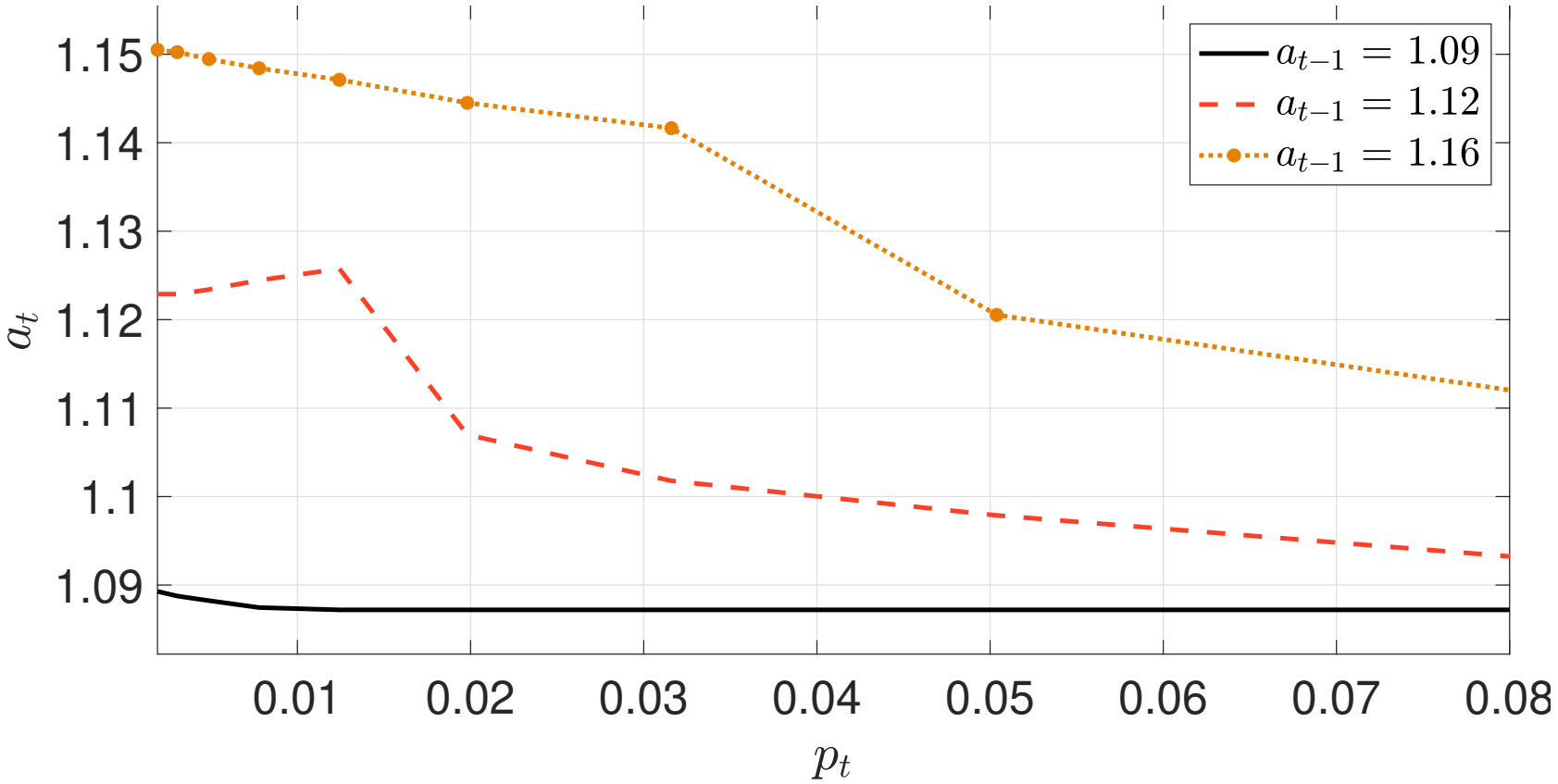
Economic tradeoffs faced by the bank

- Banks face a moral hazard problem (maximizing equity payouts and total payouts not the same)
- However, main business of the bank, taking in deposits and investing in assets, is highly profitable $\Rightarrow$
- Investors wish to avoid shutdown, both now and in the future.

Economic tradeoffs (cont.)

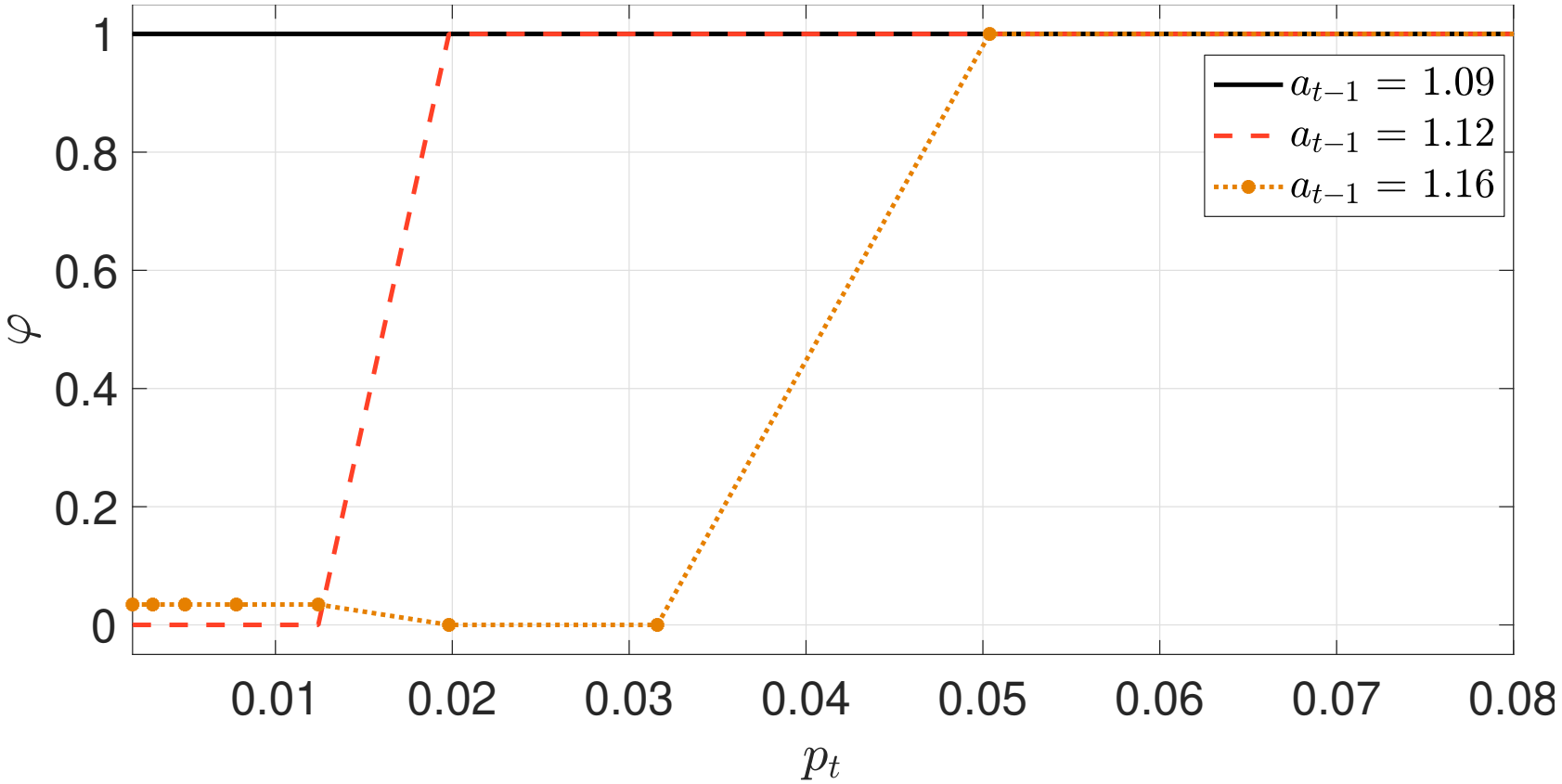
- As the probability of a crisis rises, however, the bank's incentives change.
- The business of the bank is less profitable.
- The probability of shutdown increases, and avoiding it entirely becomes too costly.
- The bank shifts from being a "good bank", making safe investment and seeking to stay in business, to being a "bad bank," taking advantage of the subsidy offered to depositors.

Optimal bank assets as a function of crisis probability



- Optimal bank assets (lending), scaled by deposits.

Portfolio allocation



ϕ is the allocation to risky loans.

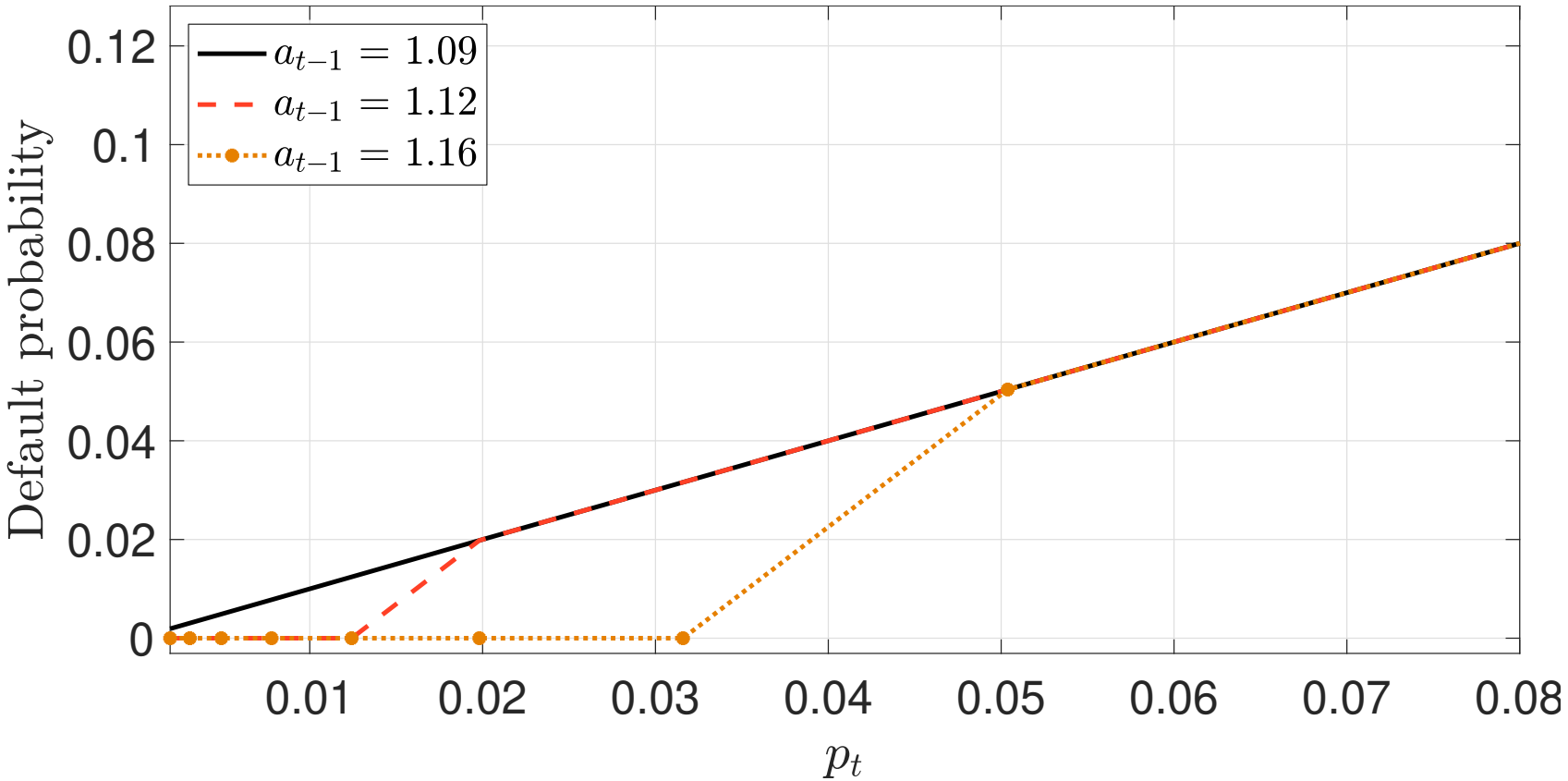
Risk shifting motives

- What explains the shift from "good bank" to "bad bank" at higher levels of the crisis probability?
- Franchise value decreases as a function of the crisis probability.
- At higher levels of p_t, protecting the (now lower) value by increasing assets becomes costlier.
- The bank "gambles for resurrection."
  - A good outcome generates high returns for the equity holders.
  - A bad outcome results in being shut down; however, if shutdown is likely regardless, equityholders cannot be further penalized.

Reaching for yield

- Endogenous shifts in r^G exacerbate risk shifting.
- As p_t rises, r^G falls due to precautionary motives.
- Thus it is harder to protect franchise value by investing in safe assets.

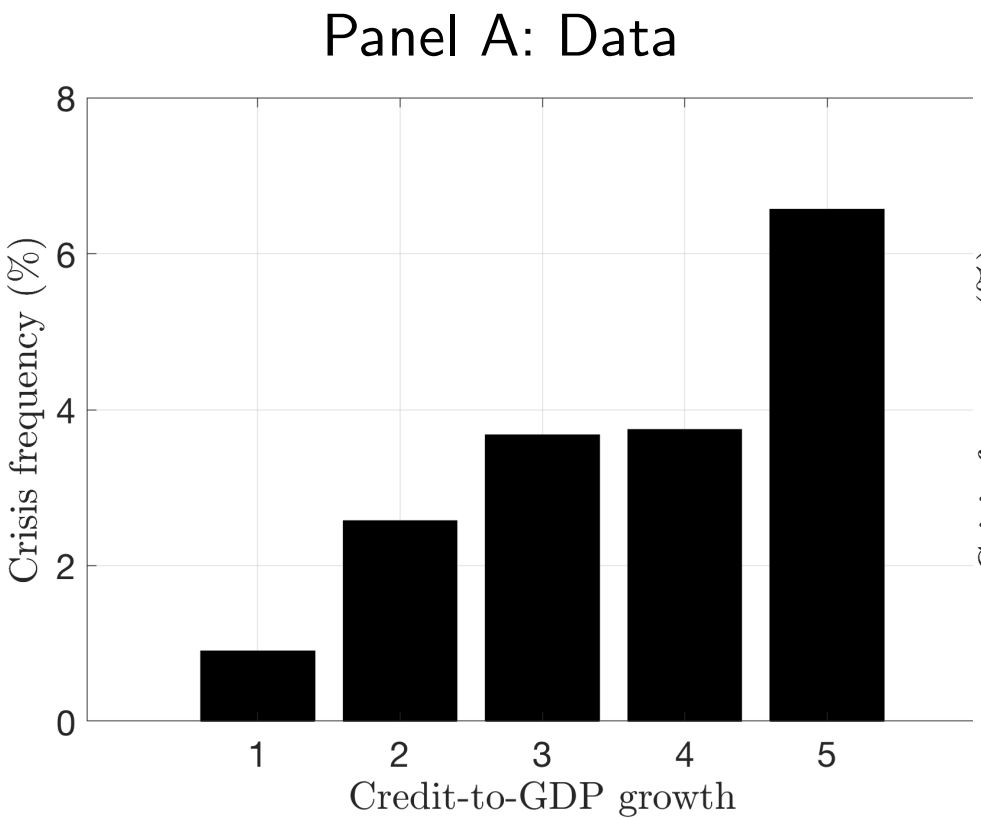
Default probability

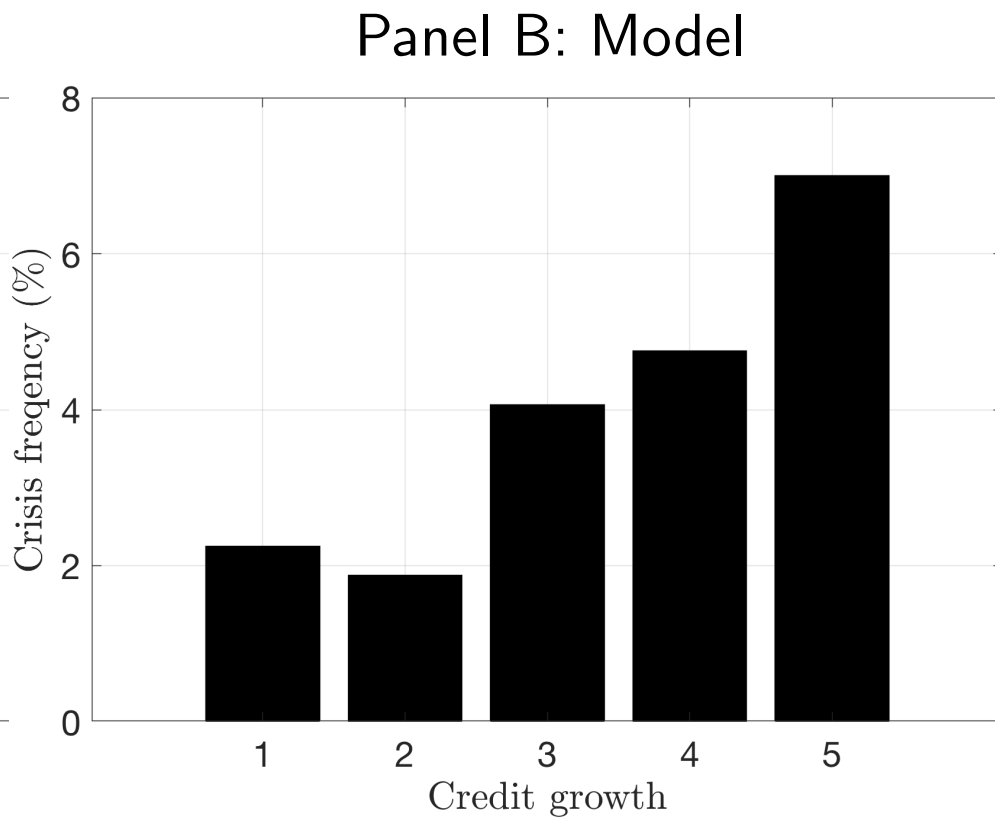


Consequences

- When the environment is riskier, banks may increase leverage, and may allocate assets to riskier loans.
- Within a production model, higher p_t leads endogenously to lower growth (Gourio, 2012; Gomes, Grotteria, Wachter 2018)
- Risky lending by banks can co-occur with lower future growth, without *causing* lower future growth.

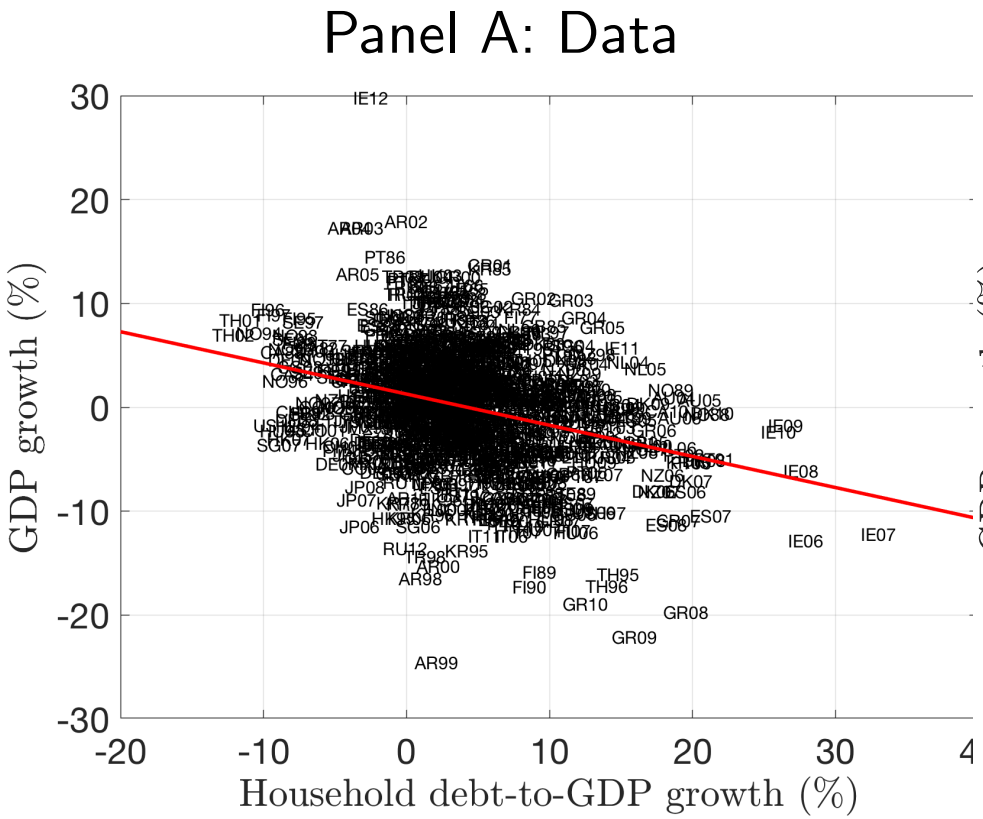
Frequency of crises by lagged credit growth

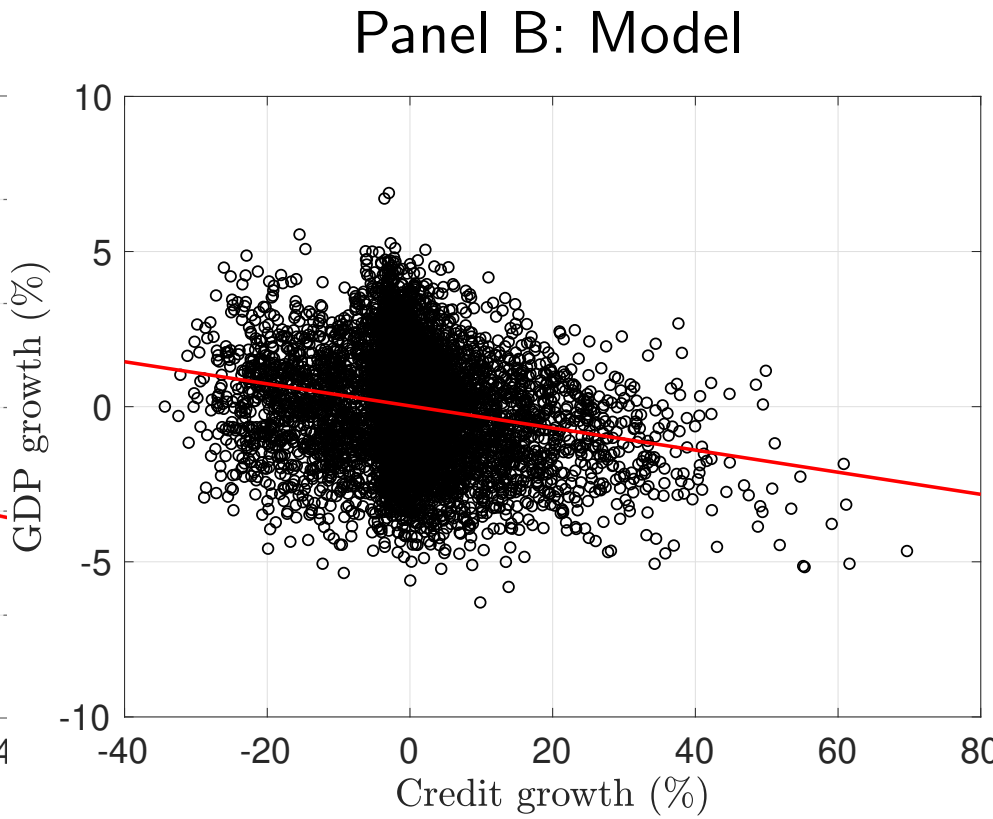




Average frequency of a crisis in year t conditioning on a given quintile of credit growth from year $t-5$ to t. Data are from Jorda, Schularick, and Taylor (2016). In the model, a crisis occurs when the 1-year GDP growth rate is in the bottom 4% of its distribution. In the data, credit is scaled by GDP.

GDP growth and Lagged Household Debt





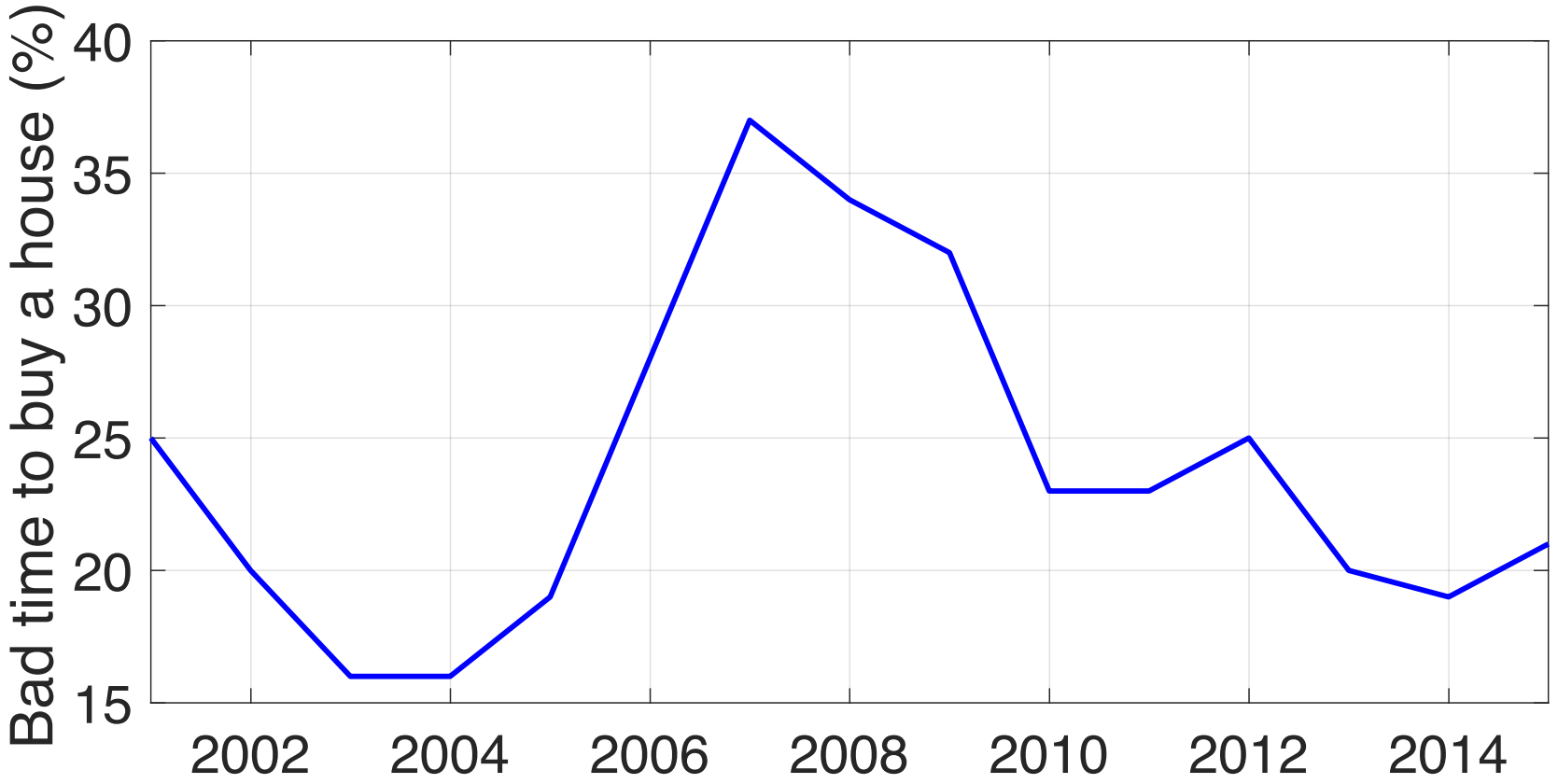
The x-axis shows the growth rate in household debt from $t-4$ to $t-1$ (in the data, household debt is scaled by GDP). The y-axis shows the GDP growth rate from t to $t+3$. Data are from 39 countries from 1961 to 2012.

Additional predictions of the model

In the years directly preceding the crisis:

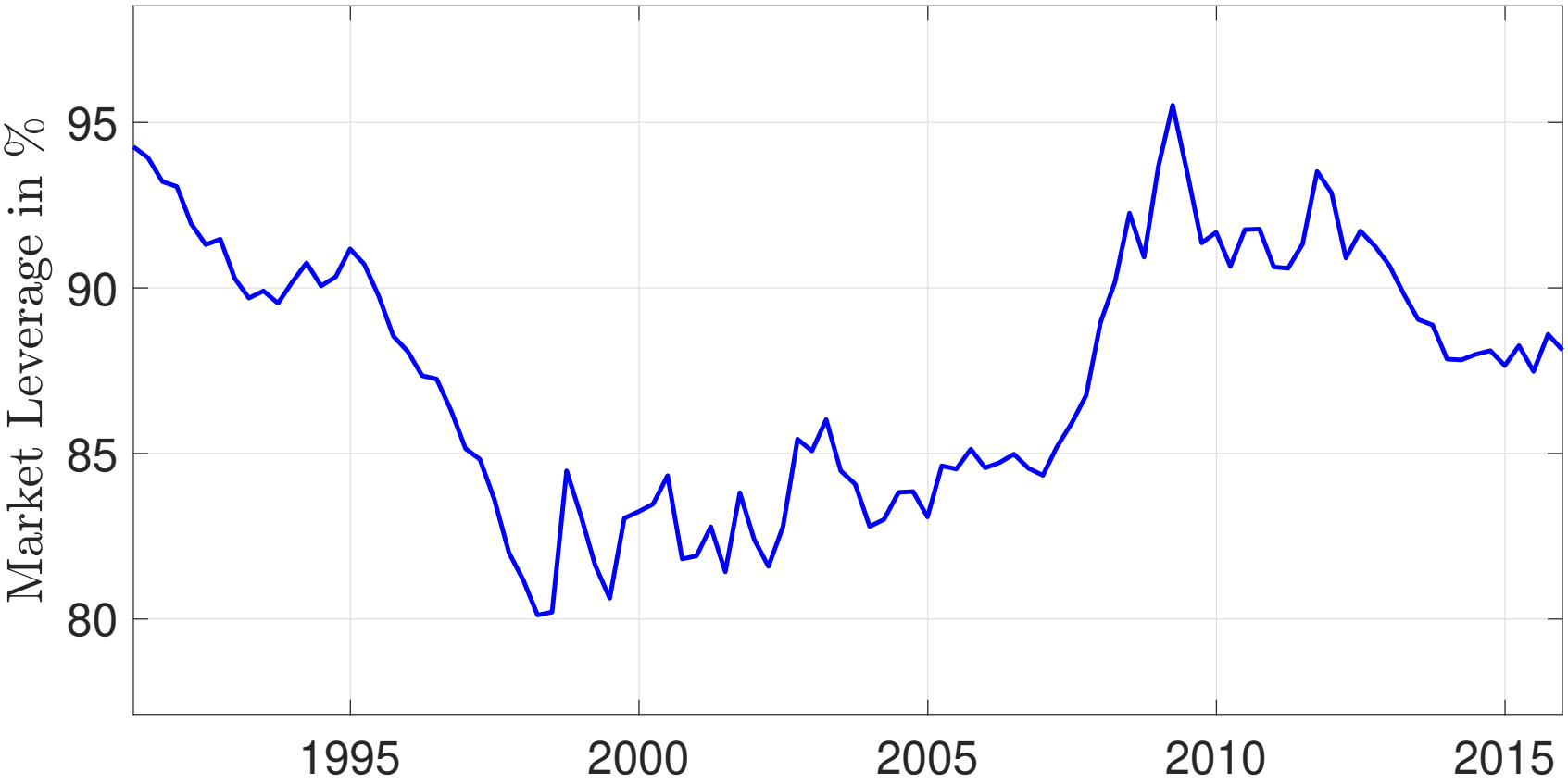
1. Pessimism rose.
2. Banks increased their leverage
3. Franchise values fell.
4. Banks increased risky lending

Rising pessimism



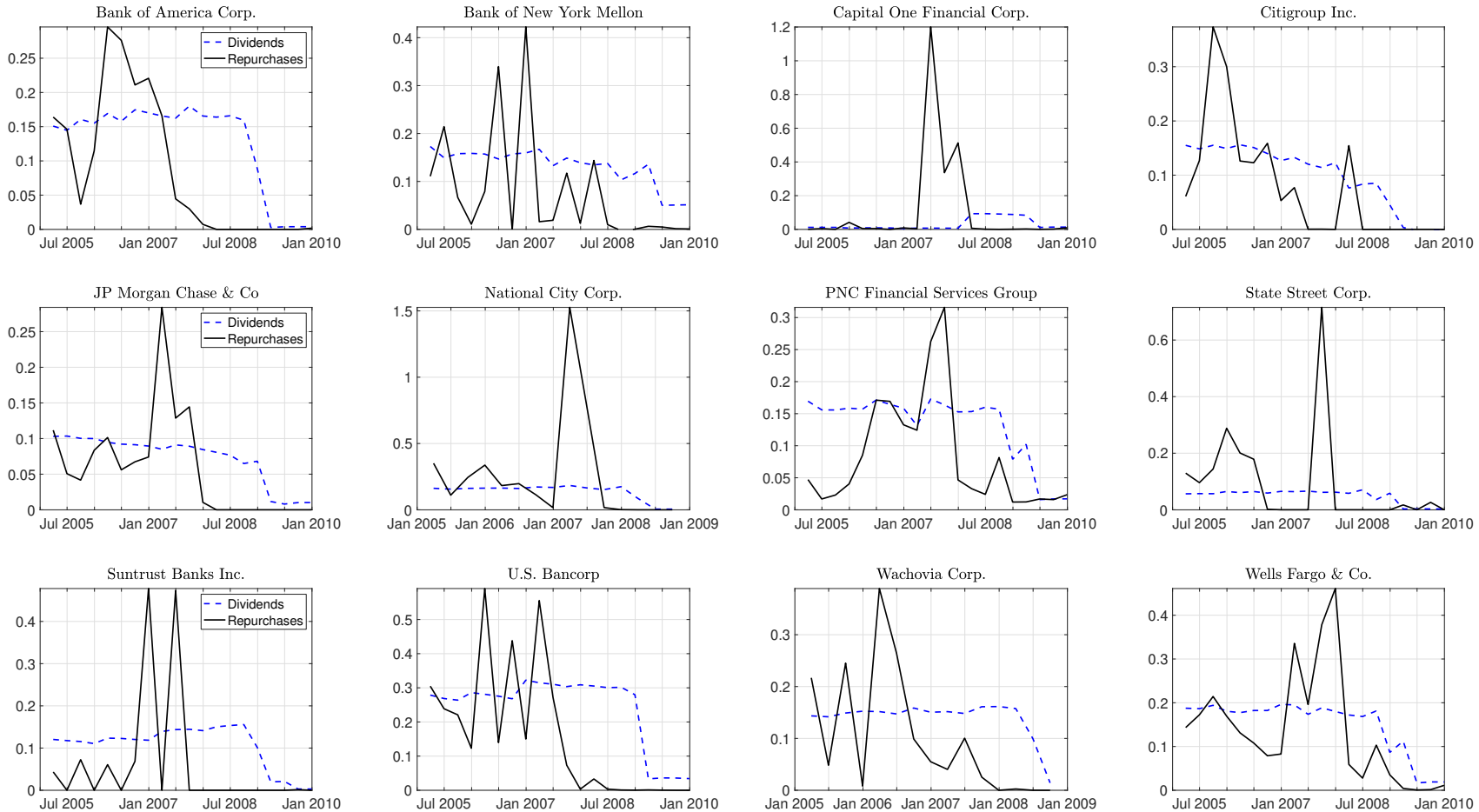
Note: The fraction of households answering the question: "Generally speaking, do you think now is a good time or a bad time to buy a house?" with "now is a bad time."

An increase in leverage

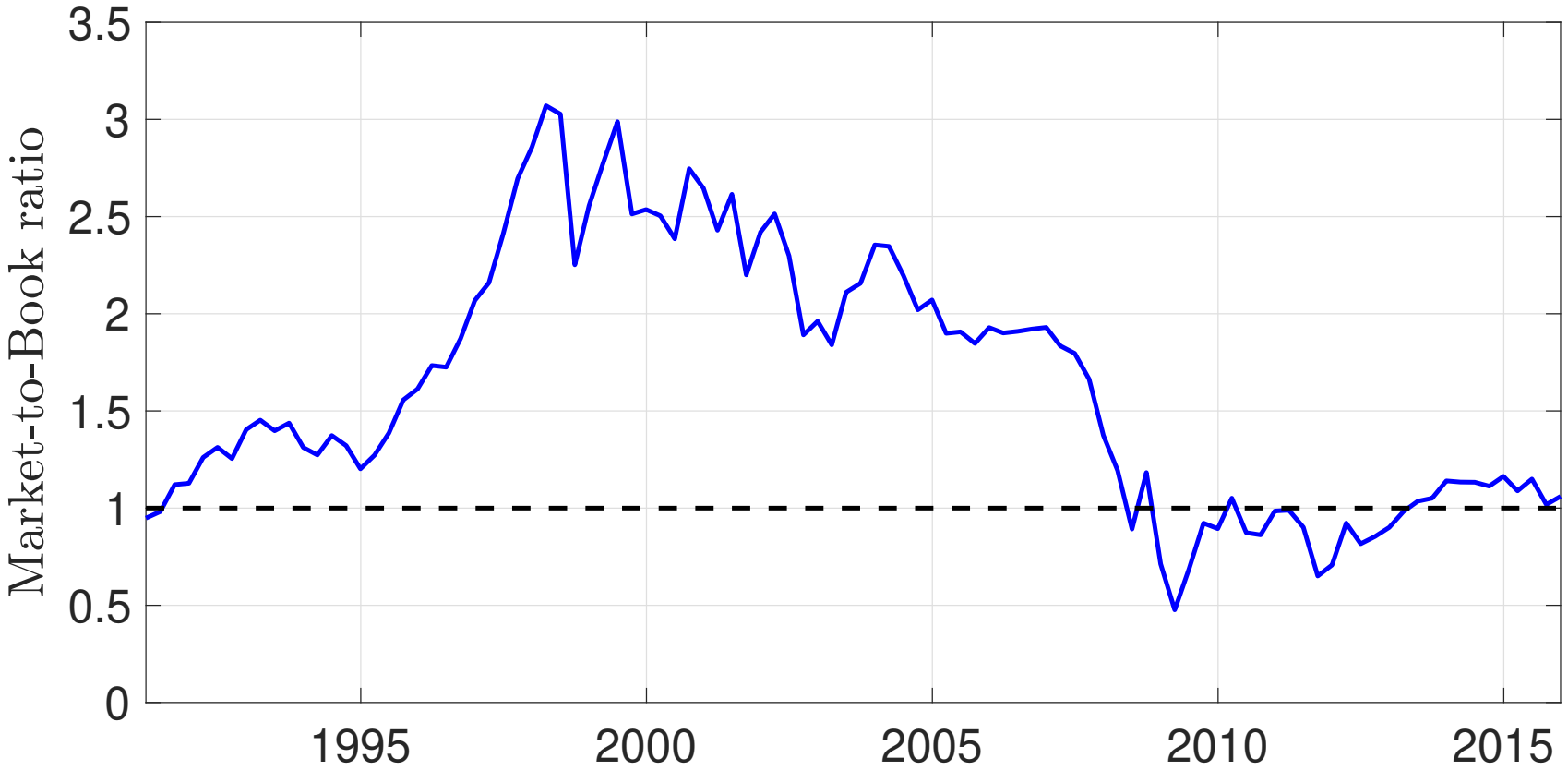


Note: Sum of total liabilities dividend by the sum of market capitalization and total liabilities across banks.

An increase in leverage: dividends and repurchases

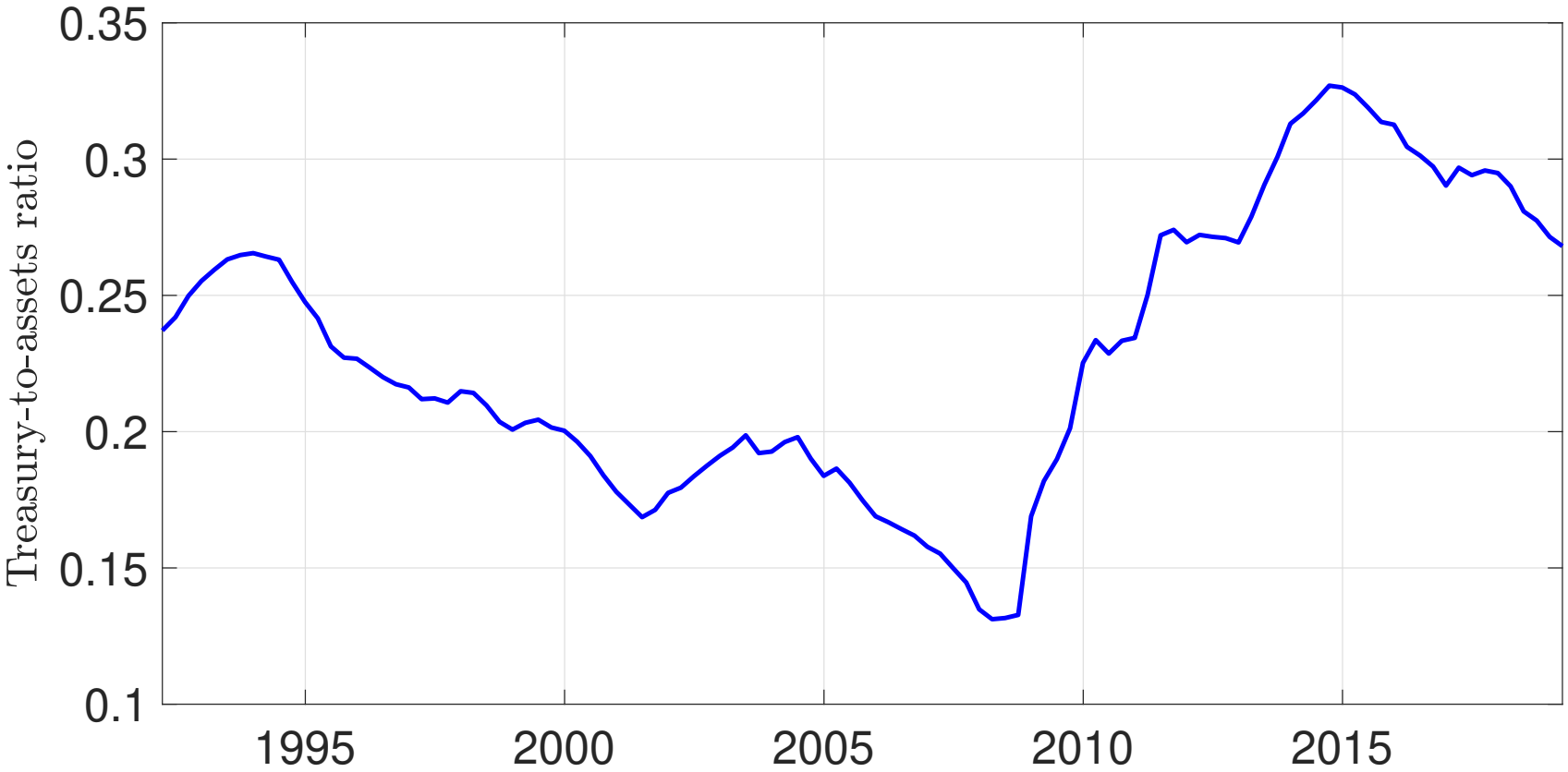


Declining franchise value



Note: Aggregate market-to-book across bank holding companies.

Increases in risky lending

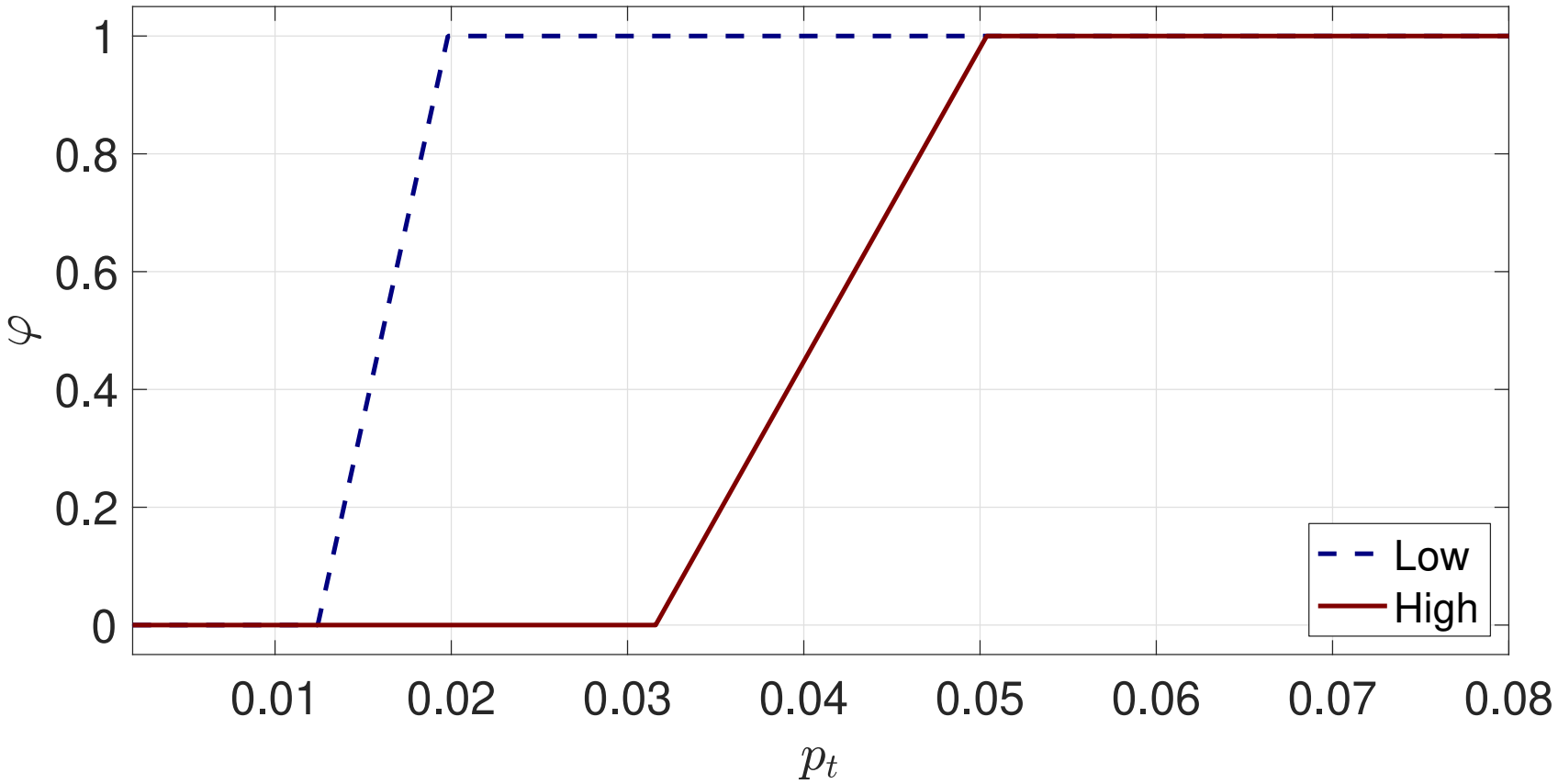


Note: The sum of Treasury and agency securities and cash assets divided by sum of total assets across commercial banks.

Policy implications

- Many policy interventions can be viewed as a means of further subsidizing banks' borrowing costs.
- To the extent that these, or any policy, increases franchise value
- They might *decrease* lending.

Unintended consequences of strengthening banks



- Percent of assets (ϕ) allocated to loans as a function of crisis probability for low (benchmark) and high subsidies.

Conclusion

- Though subject to moral hazard, banks' desire to maintain franchise value usually prevents them from taking undue risks.
- However, as the economic outlook darkens, incentives can change.
  - Fragile banks have more incentives to make risky loans
  - Even though the expected outcome of the loans is less favorable than when the economy was safer.
- Thus credit booms can predict downturns, even though there is no causation.
- Attempting to increase lending by shoring up bank's balance sheets may have the opposite effect.
- More broadly: Regulators may face a tradeoff between growth and stability.