Asset Holdings, Information Aggregation in Secondary Markets and Credit Cycles

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*Opinions expressed in this presentation are those of the author. They do not necessarily coincide with those of the Banco de España or the Eurosystem.

Broad Motivation

- The criticism - (Akerlof and Shiller (2009), DeLong (2011)) - Macroeconomic theory overlooked important aspects of asset or financial markets in general, failing to analyze how they are linked to macro fluctuations.

- The response - contributions like Brunnermeier and Sannikov (2014), Boissay, Collard, and Smets (2016), Gorton and Ordonez (2014) which look at nonlinear effects of financial frictions, moral hazard and adverse selection in interbank market, and production of information in collateralized markets add to our understanding of the relationship between finance and macro fluctuations.

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Still Missing

- Mispricing of risk/assets. (Originally stressed by Akerlof and Shiller (2009) and Lo (2008))

What this paper does...

- Develops a macroeconomic framework in which mispricing of credit assets is the key outcome. That generates a prolonged credit crisis and increased volatility of real variables.
- Does so by incorporating a set of key features of the banking sector that gained relevance since the 90's
  - Asset holdings of financial intermediaries have grown considerably since the early 90's, together with the increase in the securitization market (Aksoy and Basso (2015)).
  - Share of assets that are allocated to the trading book and thus are mark-to-market have increased significantly (US SEC - Study on Mark-To-Market Accounting - 2008).
  - Bankers compensation is heavily skewed towards short-term payoff (salary + bonuses + equity) - Fahlenbrach and Stulz (2009) and Bolton, Mehran, and Shapiro (2010).

Particularly...

- The combination of an active secondary market, mark-to-market re-valuation (affecting banks' asset holdings) and short-term payoff may provide incentives that in turn affect information aggregation in secondary markets.
- Lack of perfect information aggregation in secondary markets lead new credit assets issued in the primary market to be mispriced. Credit spreads are incorrectly set.
- So, mispricing of assets - when price of assets do not reflect all information available, and as such prices differs from "true" value.
- Our focus is
  - Study how those instances of imperfect information revelation in markets **affect economic activity**.
  - Analyze which **structural characteristics** of the macroeconomy and the banking sector **influence their likelihood**.
  - And look at macroprudential policy.

Model - Structure

- Model economy is populated by firms and households, which are themselves divided into workers, entrepreneurs and bankers.
- Households decide how much to consume and can save buying capital or making bank deposits.
- Entrepreneurs are the main investors of the economy, undertaking long-term risky projects that transform consumption goods into capital goods.
- Bankers are responsible for financial intermediation, offering loan/funding contract to entrepreneurs.
- Firms produce consumption goods using capital, which resulted from entrepreneurs' projects, and labour, supplied by workers.

Thus, so far we have a standard macroeconomic model with credit frictions. Classic Carlstrom and Fuerst (1997) or Bernanke, Gertler, and Gilchrist (1999) framework.

Key ingredients

- Include a risk shock which alters the entire distribution of entrepreneurs returns (see Christiano, Motto, and Rostagno (2014) and Gilchrist, Sim, and Zacrajsek (2011) for similar models)
- This is the crucial variable to determine economic and credit conditions: the dispersion of the distribution of returns (σ_t).
- Banks, have some internal capital, abide by a leverage constraint and have bargaining power thus make profits out of loans. Modify the BGG type of Financial Contract to incorporate these features.
- We assume each banker may receive a signal on the degree of riskiness and participate in a secondary market where baskets of loan/debt contracts are (potentially) traded
- Thus, their view on the economic conditions is formed as the outcome of the information aggregation in this market.

So standard macro model +

- Secondary Market of Credit baskets - allows us to talk about information issues
- BGG type Financial Contract - Where we incorporate the key features of banking to our economy (leverage and profits).
- In order to incorporate those in simple way, we separate a time period into two stages, in the first stage the primary and secondary markets of credit open and in the second the financial flows and other macro decisions are done.

Signal and Trade Decision

- $$\ln \sigma_t = (1 - \rho^S) \ln \bar{\sigma} + \rho^S \ln \sigma_{t-1} + \iota_t \varepsilon_t^S,$$

- ι_t takes the value of 1 with probability $1 - p$ and the value of -1 with probability p. Bankers may get a signal of the true value of ι_t. Thus, in short some banks receive (accurate) signal of σ_t. Market (all bankers) have a prior (status quo) given by $\tilde{\iota}$.
- No trade theorem applies - only information differences $\Rightarrow$ Signalling Game between bankers who receive signal and the 'market'.
- A banker selects two possible actions (A_t).
  She can set $A_t = S_t$, thus the action reveals the signal received or $A_t = \tilde{\iota}_t$, whereby her market activity does not reveal the signal, only confirming the market status quo.

Signal and Trade Decision II

- A banker problem is then, upon observing signal ι_t to decide $\lambda_t = \Pr(A_t = \iota_t | S_t = \iota_t)$ for $S_t \in \{-1, 1\}$, or set the probability (s)he will trade and reveal the signal to the market.
- Set λ_t to maximise the payoff from its activity in the credit markets.
- α indicates the relative importance of short-term payoff relative to future gains.
- Player 2, the market, needs to infer, upon observing action the confirms status quo $A_t = \tilde{\iota}_t$, what is the probability that indeed true ι_t is equal to the status quo, or $\iota_t = \tilde{\iota}_t$. Using Bayes rule they set

$$\begin{aligned} r(\lambda_t) &= \Pr(\iota_t = \tilde{\iota}_t | A_t = \tilde{\iota}_t) = \frac{\Pr(A_t = \tilde{\iota}_t | \iota_t = \tilde{\iota}_t) \Pr(\iota_t = \tilde{\iota}_t)}{\Pr(A_t = \tilde{\iota}_t)} \\ &= \frac{\Pr(\iota_t = \tilde{\iota}_t)}{\Pr(\iota_t = \tilde{\iota}_t) + (1 - \Pr(\iota_t = \tilde{\iota}_t))(1 - \lambda_t)}. \end{aligned}$$

Secondary Market Equilibrium

Perfect Bayesian Equilibrium (PBE) of the signalling game between bankers and the market is the pair (r^*, λ^*) and

$$\ln \sigma_t^{mtm} = (1-\rho^S)\ln\bar{\sigma} + \rho^S \ln \sigma_{t-1} + \left(\lambda^* \iota_t + (1-\lambda^*)(r^*\tilde{\iota}_t + (1-r^*\iota_t)\tilde{\iota}_t\right)\varepsilon_t^S.$$

Bank Payoff

- Bank portfolio valuation done at the end of Stage 1 of period t. $\Xi_{t,1}$ denote the information set of bankers at stage 1 of period t
- $V_t^0(\Gamma_t, \sigma_t^{E1})$ - banker's value of a new contract (contract conditions - Γ_t, $\sigma_t^{E1} = E[\sigma_{t+1}|\Xi_{t,1}]$)
- $V_t^{mtm}(\Gamma_{t-1}, \sigma_t^{mtm})$ - new value of the bankers asset holdings ($\sigma_t^{mtm} = E[\sigma_t|\Xi_{t,1}]$)
- $V_{t-1}^F(\Gamma_{t-2}, \sigma_{t-1})$ as the final valuation of the contract that matured end of last period
- Bank's current market to marked value - $\Pi_t^B(V_{t-1}^F, V_t^{mtm}, V_t^0)$

Bank Objective

$$J_t^B = \Pi_t^B(V_{t-1}^F, V_t^{mtm}, V_t^0) + \beta\alpha J_{t+1}^B$$

- Value of the bank depend on the current mark-to-market gains and long-term (realized) payoff. Comparing Full versus Partial Information revelation

$$J_t^B(\sigma_t^{mtm}) - J_t^B(\sigma_t) = \underbrace{(V_t^0(\sigma_{t+1}^{E1}) - V_t^0(\sigma_{t+1}^{E2}))}_{\text{Relative Valuation under primary markets}} + \underbrace{(1-\alpha\beta)(V_t^{mtm}(\sigma_t^{mtm}) - V_t^F(\sigma_t))}_{\text{Relative Valuation under MTM vs maturity}} +$$

$$+ \underbrace{\alpha\beta(V_{t+1}^{mtm}(\sigma_{t+1}^{E2}) - V_t^0(\sigma_{t+1}^{E1}))}_{\text{Expected Adjustment under Partial Information}} + \underbrace{\alpha\beta(J^P{}_{0,t+1} - J_{0,t+1}^F)}_{\text{Continuation Value}} > 0$$

Trade-off

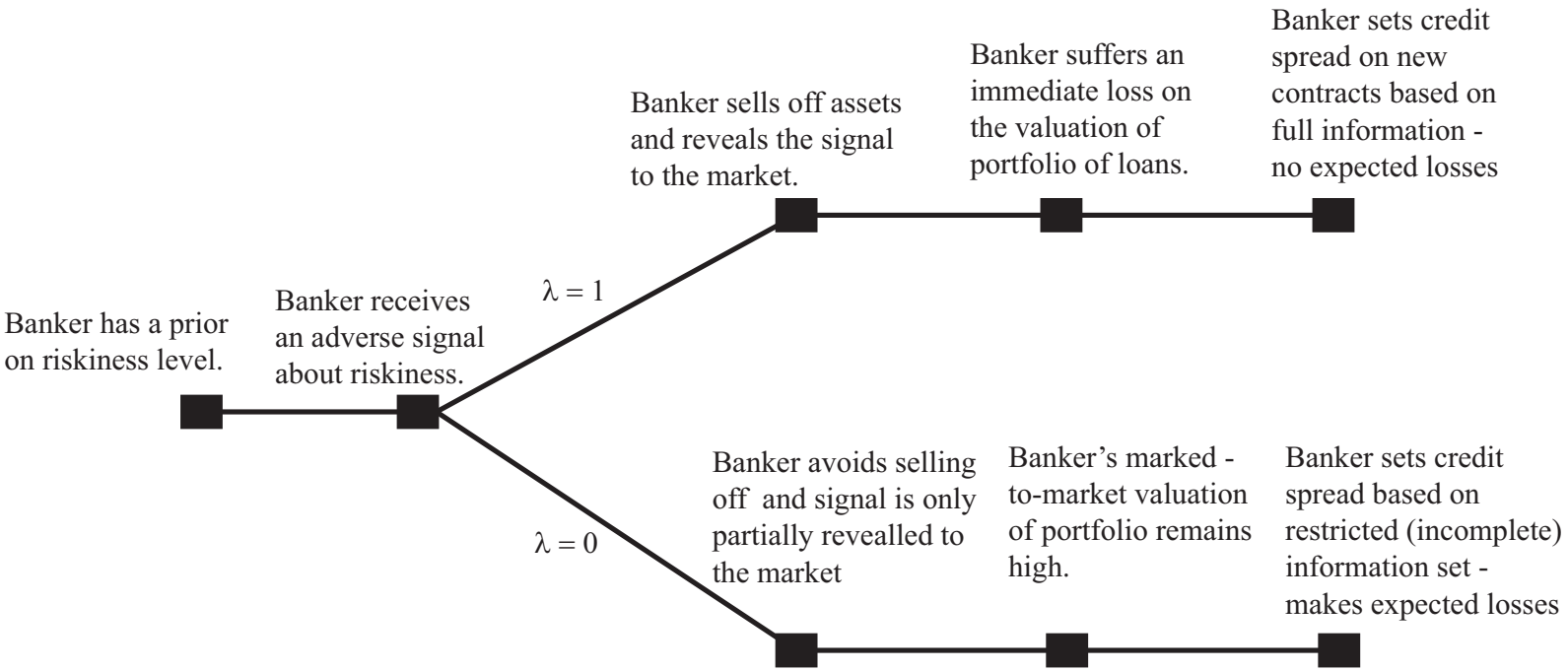

Figure: Banker's trade-off after adverse signal

Results

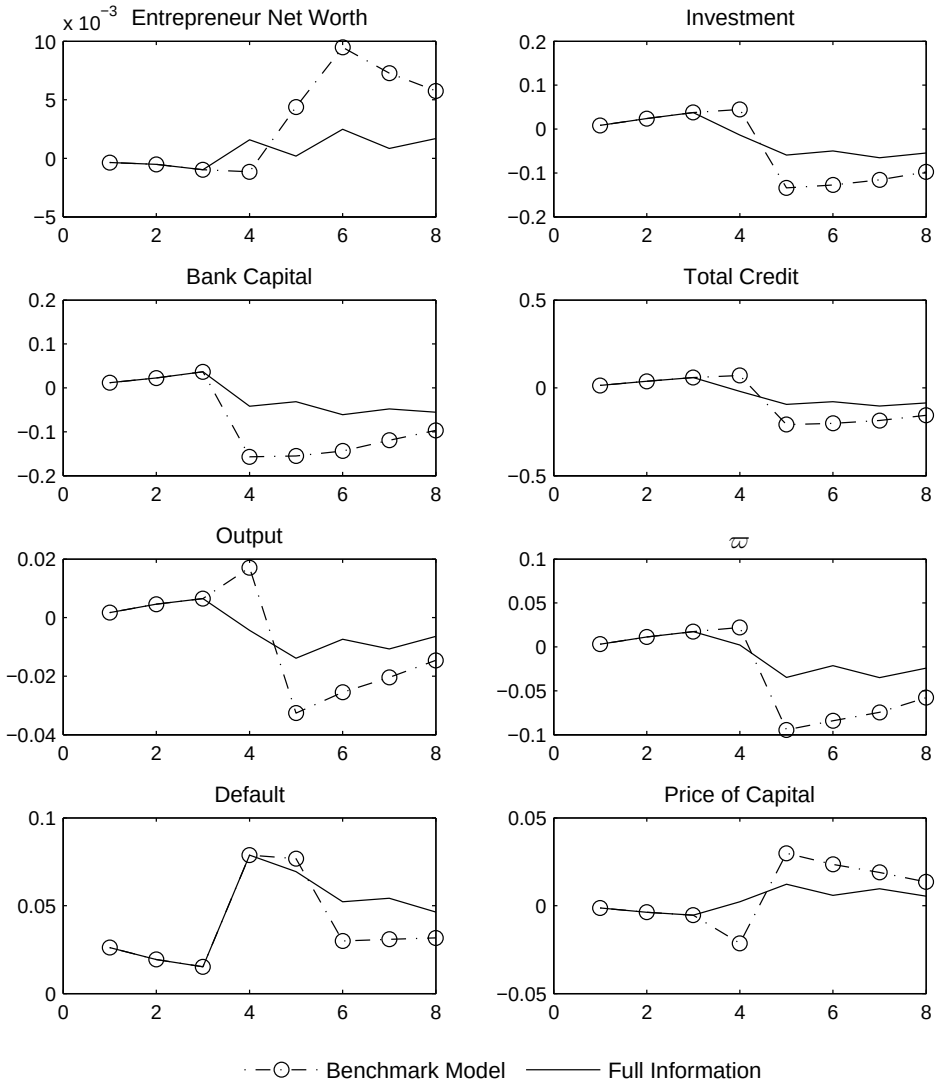

Figure: Boom and bust in the presence of partial information revelation

Discussion

- Shock under full information does not generate crisis.
- Pre-bust boom - low credit spread, high asset prices. Output is even greater than what banks expected although default rates are higher. This is due to gains of successful entrepreneurs from lower credit spreads.
- Output response in subsequent periods is lower due to credit supply problems. Ivashina and Scharfstein (2010) and Cornett, McNutt, Strahan, and Tehranian (2011) show that banks that were more exposed to default reduced credit more strongly.
- Inverted v-shape in output with the peak at the period before the bust (Reinhart and Rogoff (2008))
- Creditless recovery - Abiad, Li, and Dell'Ariccia (2011)

Further Results

- Exploiting the cutoff point where banks are indifferent we verify that mispricing is more likely when
  - Bank profits, level of leverage and variance of return are greater
  - Bank profits are more procyclical
  - Leverage is less procyclical

See Results

- Boom and Bust is robust to changing leverage, variance, profits.

See Results

- When α varies we find that as the probability of mispricing increases the volatility of real variables increases. An economy where probability of misprincing is around 2.5% has a 4% higher volatility of output.

See Results

- Macro-prudential policy - procyclical taxation of bank profits is preferred to countercyclical leverage.

See Results

Partial Information - Short-term Payoff Bias

Indifference between full versus partial information revelation
$(J_t^B(\sigma_t^{mtm}) - J_t^B(\sigma_t) = 0)$

$$\alpha_{lim} = \frac{\overbrace{(V_t^0(\sigma_t^{mtm}) - V_t^0(\sigma_t)) + (V_t^{mtm} - V_t^F)}^{\text{Total period } t \text{ gains from partial revelation}}}{\underbrace{\beta[(V_t^F - V_t^{mtm}) + (V_{t+1}^{mtm}(\sigma_t) - V_t^0(\sigma_t^{mtm})) + (J^P{}_{0,t+1} - J_{0,t+1}^F)]}_{\text{Expected losses from postponing MTM, mispricing and banking capital effects}}}$$

Table: α_{lim} for different structural parameters

	Benchmark	$\bar{\chi}$ (Bank Profits)	$\bar{\varphi}$ (Leverage)	$\bar{\sigma}$ (Var. Returns)	$\bar{n}/\bar{\Upsilon}$ (Int. Funding)	Φ_χ	Φ_{LT}
α_{lim}	0.33	0.38	0.35	0.41	0.33	0.34	0.29

Back

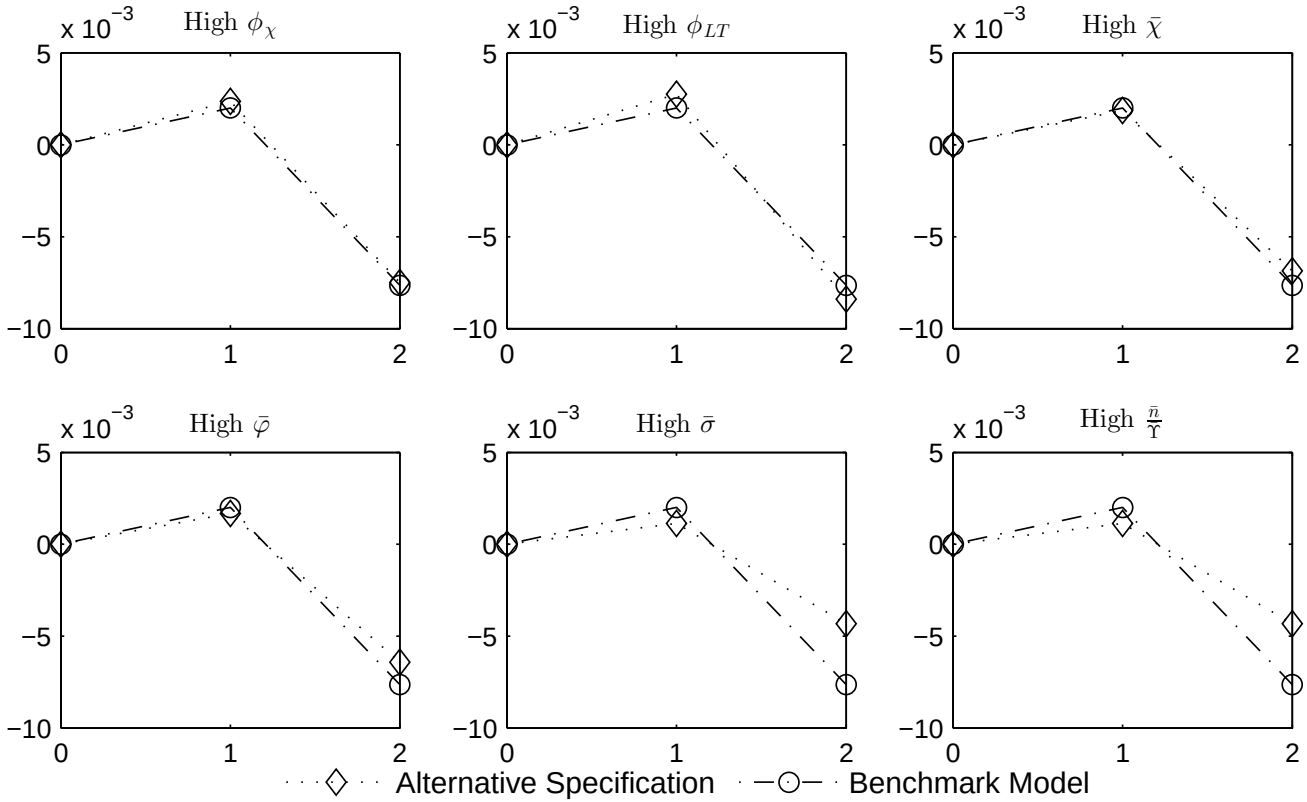

Figure: Output Response - Boom and bust for different structural parameters

Back

Set

$$\alpha_t = \mathfrak{w}\alpha_{t-1} + (1-\mathfrak{w})\frac{1}{1+e^{-\phi_\alpha \hat{Y}_t}}$$

	$\phi_\alpha = 10, \mathfrak{w} = 0.5$	$\phi_\alpha = 20, \mathfrak{w} = 0.5$	$\phi_\alpha = 10, \mathfrak{w} = 0.9$
Consumption.	1.0721	1.123	1.0265
Labour	1.0923	1.1611	1.0458
Output	1.1036	1.1926	1.0383
Investment	1.0869	1.1525	1.0315
Bank Profits	1.3798	1.5795	1.2217
Partial Revelation	7.1%	15.1%	2.77%

Table: Relative Volatility and Partial Revelation in Secondary Markets

Back

Macro Prudential Policy Making

- Counter-cyclical leveraging controls the boom by restricting bank lending
- ...but counter-cyclical leverage increases the α_t, since it decreases the response of price of capital making postponement of marked-to-market valuations to lead to higher short-term gains.
- Progressive taxation curbs the increase in banking capital, controlling the expansion of credit and output during the boom periods.
- High profit tax rates in booms reduce the incentive to maintain marked-to-market valuation high, but also reduces the punishment from mispricing of risk (as long as profits are still positive). Effects on α_{lim} are small.
- Both are effective to curb boom, tax on profits more effective to prevent partial information revelation due to bias on short-term payoffs in banking

THANKS FOR YOUR ATTENTION!

References I

Abiad, A., B. G. Li, and G. Dell'Ariccia (2011): "Creditless Recoveries," IMF Working Papers 11/58, International Monetary Fund.

Akerlof, G. A., and R. J. Shiller (2009): *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism*. Princeton University Press.

Aksoy, Y., and H. S. Basso (2015): "Securitization and asset prices," Working Papers 1526, Banco de España; Working Papers.

Bernanke, B. S., M. Gertler, and S. Gilchrist (1999): "The financial accelerator in a quantitative business cycle framework," in *Handbook of Macroeconomics*, ed. by J. B. Taylor, and M. Woodford, vol. 1, chap. 21, pp. 1341–1393. Elsevier.

Boissay, F., F. Collard, and F. Smets (2016): "Booms and Banking Crises," *Journal of Political Economy*, 124(2), 489–538.

Bolton, P., H. Mehran, and J. Shapiro (2010): "Executive compensation and risk taking," Staff Reports 456, Federal Reserve Bank of New York.

Brunnermeier, M. K., and Y. Sannikov (2014): "A Macroeconomic Model with a Financial Sector," *American Economic Review*, 104(2), 379–421.

References II

Carlstrom, C. T., and T. S. Fuerst (1997): "Agency Costs, Net Worth, and Business Fluctuations: A Computable General Equilibrium Analysis," *American Economic Review*, 87(5), 893–910.

Christiano, L. J., R. Motto, and M. Rostagno (2014): "Risk Shocks," *American Economic Review*, 104(1), 27–65.

Cornett, M. M., J. J. McNutt, P. E. Strahan, and H. Tehranian (2011): "Liquidity risk management and credit supply in the financial crisis," *Journal of Financial Economics*, 101(2), 297–312.

DeLong, J. B. (2011): "Economics in Crisis," *The Economists' Voice*, 8(2), 2.

Fahlenbrach, R., and R. M. Stulz (2009): "Bank CEO Incentives and the Credit Crisis," Working Paper 15212, National Bureau of Economic Research.

Gilchrist, S., J. W. Sim, and E. Zacrajsek (2011): "Uncertainty, Financial Frictions, and Investment Dynamics," Mimeo, Boston University.

Gorton, G., and G. Ordonez (2014): "Collateral Crises," *American Economic Review*, 104(2), 343–78.

Ivashina, V., and D. Scharfstein (2010): "Bank lending during the financial crisis of 2008," *Journal of Financial Economics*, 97(3), 319–338.

References III

Lo, A. W. (2008): "Hedge Funds, Systemic Risk, and the Financial Crisis of 2007-2008," *Written Testimony of Andrew W. Lo Prepared for the U.S. House of Representatives Committee on Oversight and Government Reform*.

Reinhart, C. M., and K. S. Rogoff (2008): "Is the 2007 US Sub-prime Financial Crisis So Different? An International Historical Comparison," *American Economic Review*, 98(2), 339–44.