Counterparty Risk:

Collateral, Volatility and Procyclicality

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Setting The Stage

- Counterparty risk looks very different than it did a few years ago, mainly due to
  - Move to central clearing
  - CVA capital charge for uncleared exposures
  - Increased use of collateral and the resulting transformation of the derivatives industry, pricing and operations

- Collateral mitigates counterparty risk, procyclical collateral policies create liquidity risk

Three Research Questions on Counterparty Risk

1. How large do margin requirements (initial margin, haircuts, default fund contribution…) need to be to be acyclical?

2. What is the magnitude of “wrong-way risk” and to what extent is it procyclical?

3. As the financial system evolves, can we automate the detection of potentially destabilizing interactions between counterparties?

Three Research Questions on Counterparty Risk
And Initial Observations

1. How large do margin requirements (initial margin, haircuts, default fund contribution…) need to be to be acyclical?
   - Large, and possibly uncomfortably large

2. What is the magnitude of "wrong-way risk" and to what extent is it procyclical?
   - Large, with both procyclical and countercyclical elements

3. As the financial system evolves, can we automate the detection of potentially destabilizing interactions between counterparties?
   - Potentially, based on a systems engineering approach

Outline

- Brief motivating background
  - AIG
  - Repo runs
- Post-crisis developments
- Initial work on the three questions
  - Acyclical margin
  - Wrong-way risk
  - Finding positive feedback

Background: AIG

- AIG was undone, in large part, by credit default swaps on CDOs sold by its Financial Products subsidiary

- More precisely, AIG was unable to meet collateral calls that resulted from
  - Widening credit spreads (volatility)
  - Downgrade triggers (procyclicality/positive feedback)
  - Exacerbated by securities lending bets on subprime credit (wrong-way risk)

- Government intervention was prompted primarily by the potential impact on AIG's counterparties of an AIG default
  - [Did these counterparties misjudge the risk or bet AIG was TBTF?]

- AIG was undone by mark-to-market losses – the Maiden Lane II, III vehicles created by the New York Fed were ultimately profitable – a failure of the counterparty risk/liquidity risk management process

Background: Run on Repo

- Gorton and Metrick (2012) document a rapid rise in bilateral repo haircuts in 2007-2008
  - A haircut widening operates like a margin call
  - But here driven by quality of the collateral

- As in the case of AIG, the collateral arrangements reflect
  - Unanticipated volatility and its liquidity implications
  - Procyclicality, with liquidity contracting as the crisis unfolded
  - Wrong-way risk as collateral quality declined together with borrower credit quality

- In the tri-party repo market, Copeland, Martin and Walker (2012) find instead that lenders stopped lending
  - They attribute the difference in part to the greater sophistication of lenders in the bilateral market: dealers rather than money market funds
  - Margin volatility goes with risk sensitivity and "nimbleness"

Some Common Features of These And Other Examples

- Volatility in collateral needs turns counterparty risk into liquidity risk
- The effect is procyclical
- Prudent counterparty risk management by individual agents can have an overall destabilizing effect, with greater risk-sensitivity amplifying volatility and procyclicality

Developments in Counterparty Risk

- Dodd-Frank mandates clearing of most derivatives (and margin for uncleared)

- Basel III adds a CVA capital charge for counterparty risk
  - Captures mark-to-market impact of counterparty risk (as opposed to just default losses), estimated by Basel to be 2/3 of credit losses in the crisis
  - Among the most significant contributors to increased capital requirements

- Progress on tri-party repo reform, reducing or eliminating intra-day credit exposure of clearing banks

- On-going work (e.g., FSB's August 2013 policy framework) on repo on
  - Methodology for setting haircuts to reduce procylicality and reflect wrong-way risk

- Last week's SSG report faults banks' internal counterparty risk data (and collateral management)

What Is The Collateral Cost of Acyclicality?

- The basic trade-off: Set margin levels
  - High and stable or
  - Allow them to be lower, volatile and procyclical
- This applies to initial margin at a clearinghouse, margin on OTC trades, haircuts in repo, bank capital,…
- Usually addressed through a stress-period add-on
  - Sensible, but doesn't provide much insight (and depends on choice of stress)
- Ongoing work with Q. Wu: Is there a more informative way to quantify the trade-off?

Example: A Simple Model of Margin Dynamics

- Suppose margin is proportional to a GARCH volatility model
- A GARCH model (Engle 1982, Bollerslev 1986) produces
  - Bursty volatility clustering
  - Persistence and slow mean-reversion
- Also, the unconditional distribution is heavy-tailed (has a power law distribution), *even if the shocks are normally distributed* (Mikosch and Starica 2000)
- This implies that margin levels need to be quite high to be acyclical and helps explain how high and why

A Quick Comparison Across Asset Categories

- Lower tail index → heavier tail

	Shock Sensitivity	Autoregressive Coefficient	Constant	Tail Index	99th Percentile /Mean	Lognormal
	α	β	ω			
5yr Interest Rate Swap	0.050	0.950	0.005	2.5	10.8	3.9
S&P 500	0.070	0.922	0.009	5.1	3.1	1.4
AA Bond Index	0.041	0.955	0.000	7.1	2.2	1.1
Crude Oil	0.046	0.947	0.031	8.5	1.9	1.3
Euro/Dollar	0.032	0.963	0.002	9.8	1.8	1.1

- Suggests that acyclical margin needs to be 2-3 times larger than average margin, not 10%-40% larger
- Experience in 2007 suggests that gradually increasing margin as volatility increases may not be an option

Wrong-Way Risk and What Drives It

- Wrong-way risk: adverse dependence between the market value of exposure to a counterparty and the counterparty's default risk
- Examples:
  - Dealer A sells CDS protection on Dealer B
  - Emerging market bank pays USD to US bank in currency swap
  - Energy swap with energy producer (could be right- or wrong-way)

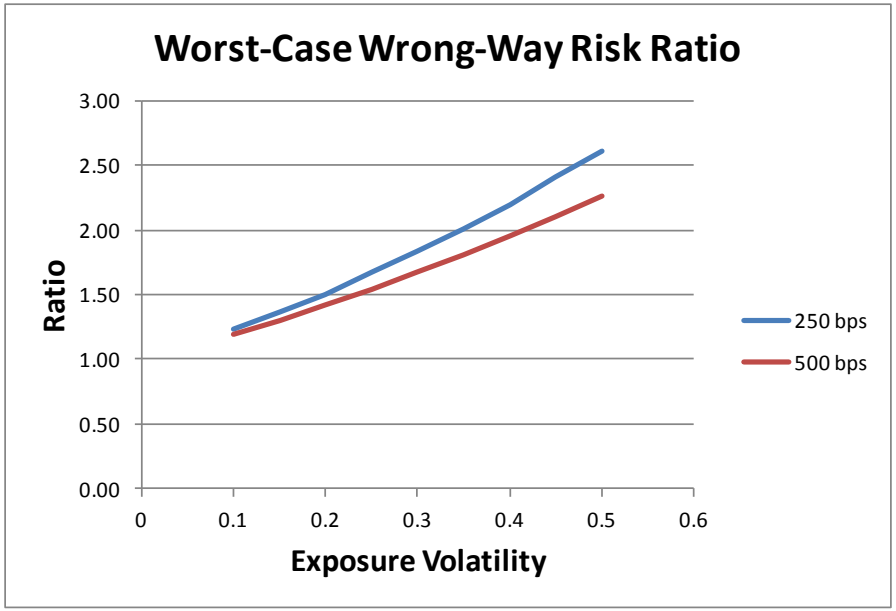
- In general, difficult to estimate the dependence between market and credit risk

- The Basel standardized formula for CVA assumes independence and then multiplies by 1.4

- In work with L. Yang, we bound the impact based on marginal information on market and credit risk

How Do Credit Spread and Exposure Volatility Affect Worst-Case Wrong-Way Risk?

- 1 year horizon, lognormal exposure, flat CDS term structure
- Look at ratio of Worst Case CVA/Independent CVA
- Ratio increases with volatility (procyclical), decreases with spread (countercyclical)



- Volatility effect appears to dominate, so increased potential for wrong-way risk adds another layer of procyclicality to counterparty risk. Is this being captured?

Detecting Destabilizing Feedback Between Counterparties

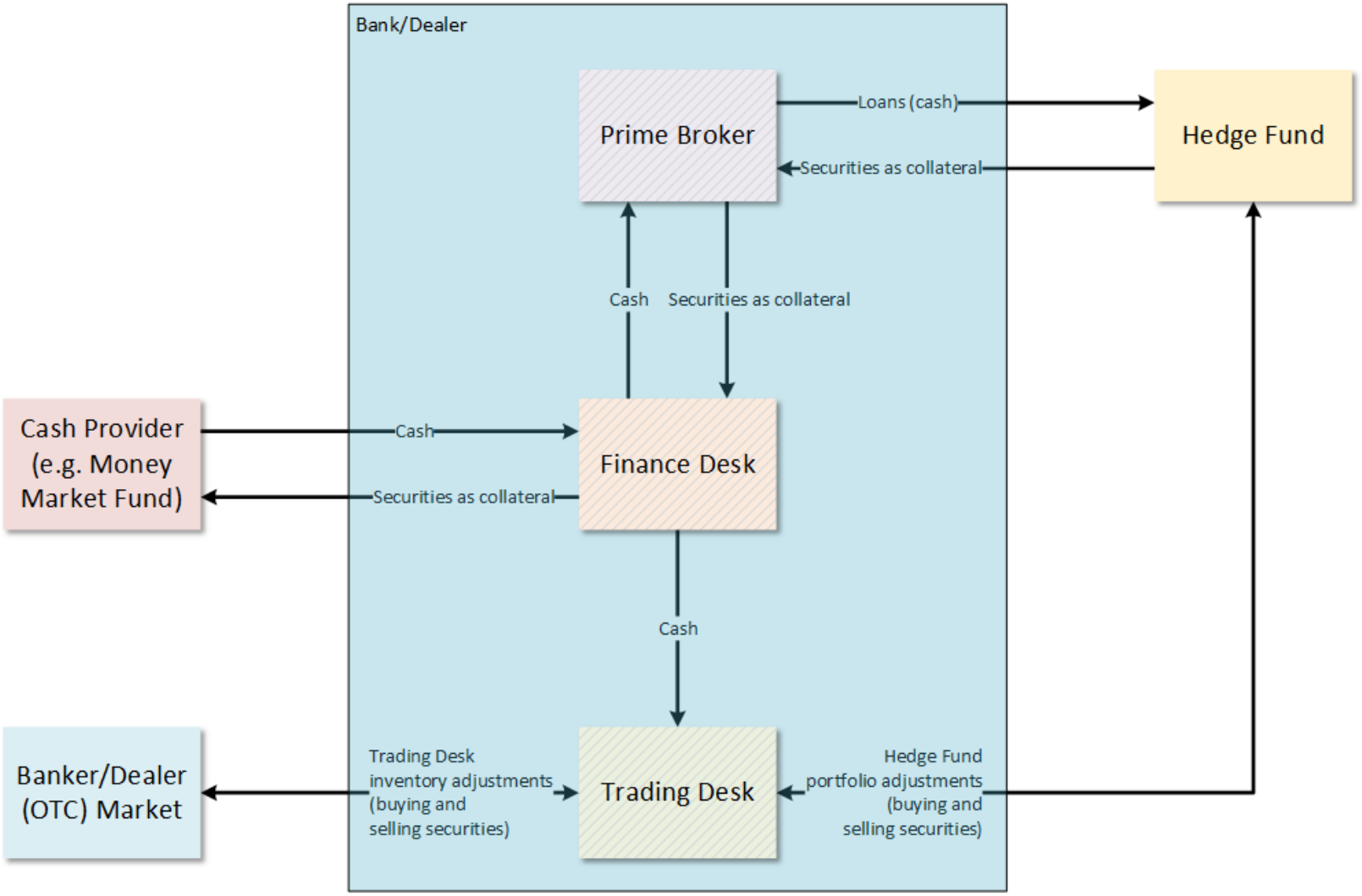
- Two dimensions of procyclicality
  - Time series dimension: amplifying the business cycle
  - Structural dimension: contractual features or risk management practices
    - E.g., downgrade triggers, leverage targets

- The structural dimension is often an unintended consequence of prudent and nimble risk management, with greater risk sensitivity creating greater procyclicality

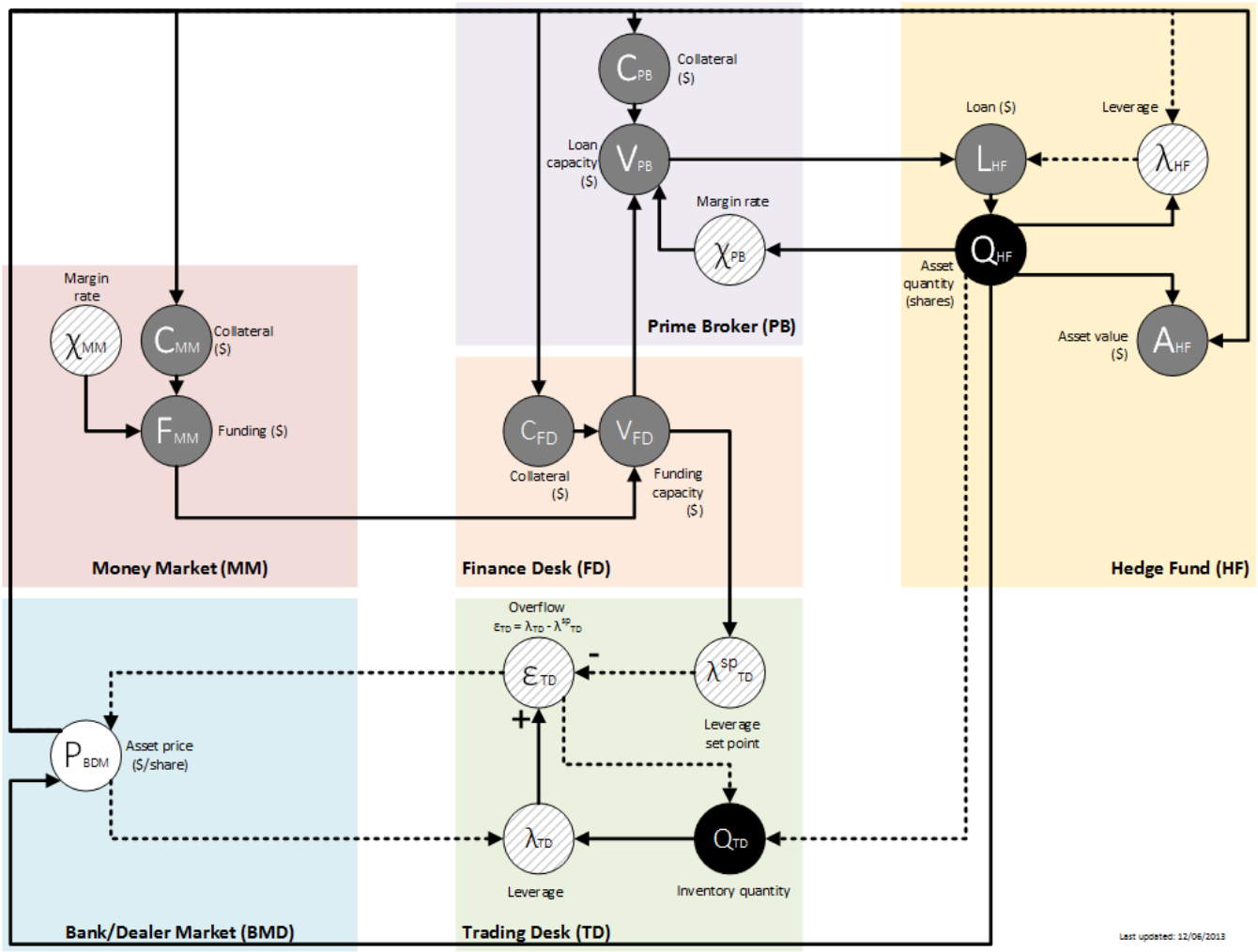
- Current work with R. Bookstaber and engineering colleagues G. Iyengar, V. Venkatasubramaniam, L. You, A. Zhang: Add control information to each unit in a financial map (signed directed graph, SDG) and automate the search for destabilizing feedback

- Internal controls are stabilizing; destabilizing effects result from their interactions.

Start With a Simple Model Showing Flows



SDG Links Units Through Their *Controls* Not Flows
Solids Lines Are Positive Influences, Dashed Lines are Negative



Automated Analysis

- Computerized search of feedback loops through the system
- Feedback loop is net positive or net negative, depending on the individual links

- Loops within individual units are negative
  - E.g., the hedge fund sells/buys when its leverage increases/decreases

- Algorithm finds many positive feedback loops running through the system

- In particular, it discovers several loops that we classify as
  - A funding run: drop in collateral value → reduction in money market funding → sale of assets → drop in collateral value
  - A fire sale: price drop → margin call →forced sale by hedge fund → price drop

Automated Analysis

- Adds an important dimension – interactions between controls – to mapping the financial system

- Has the potential to discover unstable dynamics
  - These result from interactions between the responses of various counterparties

- To do: Incorporate nonlinear controls, such as threshold effects

Stepping Back – Concluding Remarks

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  - Increased use of collateral and resulting transformation of the derivatives industry

- Collateral mitigates counterparty risk, but procyclical collateral policies create liquidity risk

- A lot we don't know
  - The total cost (direct and indirect) of increased collateral use
  - Implications for legitimate hedging by end users
  - Consequences of a splintered system of central counterparties
  - Impact of responses like collateral transformation

Thank You