AN EMPIRICAL ANALYSIS OF STRATEGIC GAMES IN THE TRI-PARTY REPO MARKET

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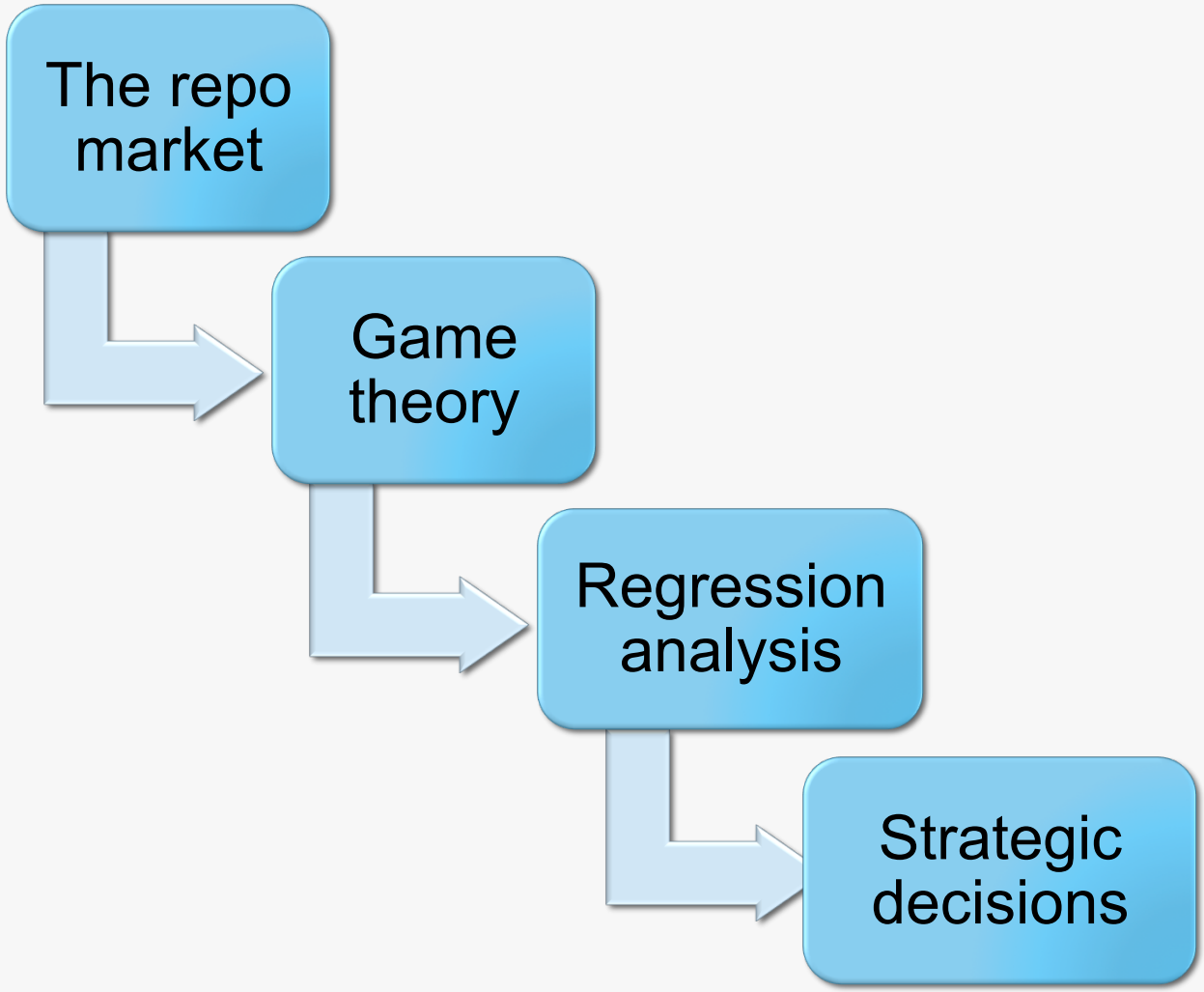
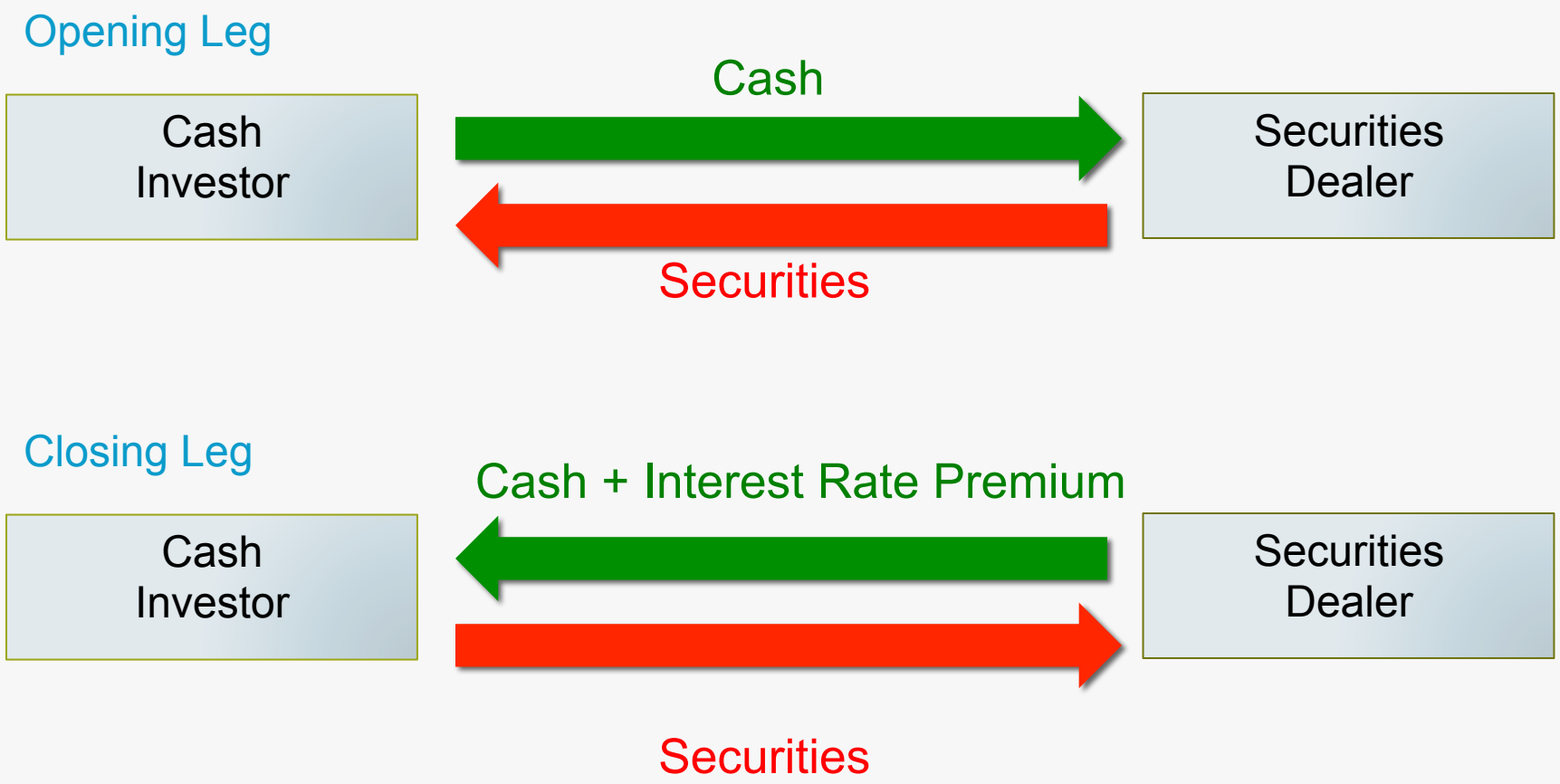
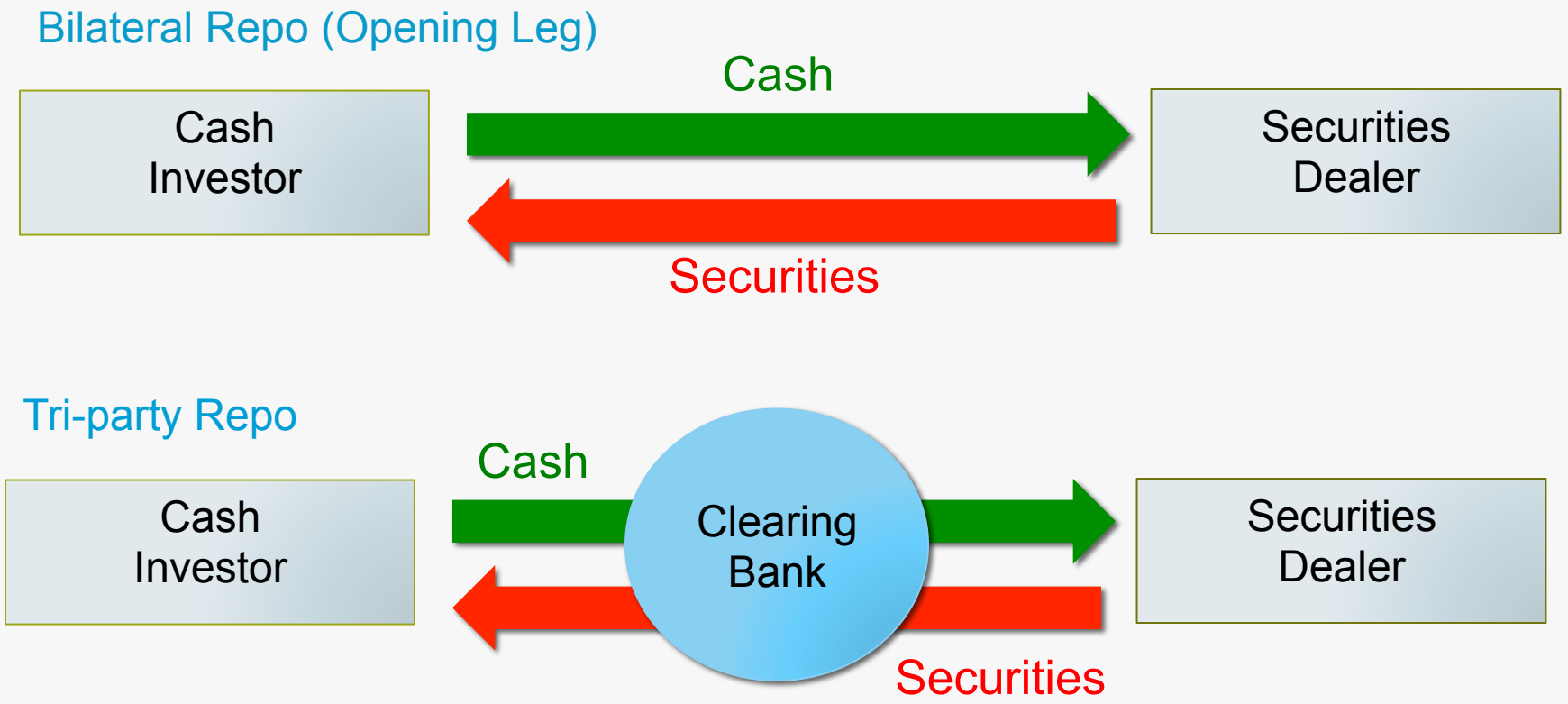
Outline


The repo market
Game theory
Regression analysis
Strategic decisions

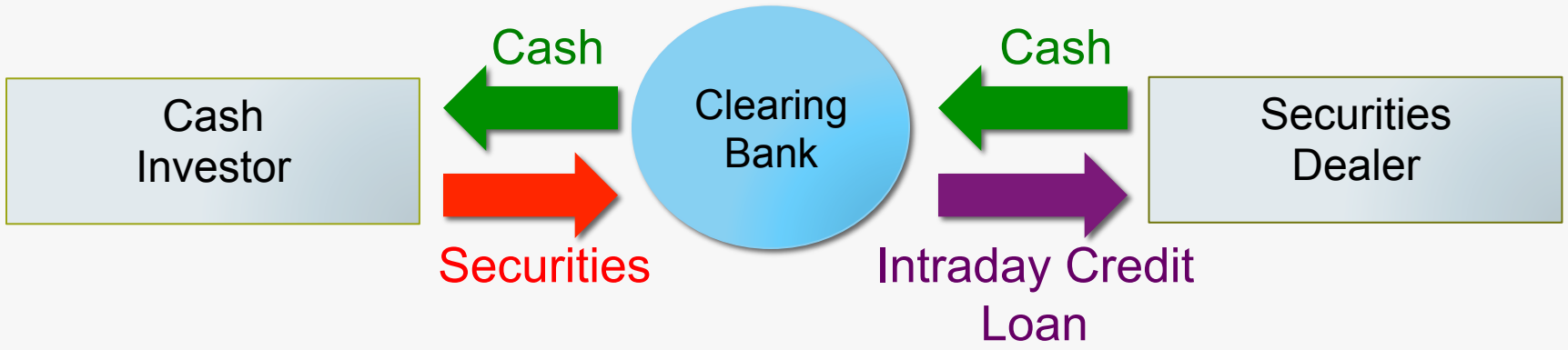
A bilateral repo is a collateralized loan between a cash investor (lender) and financial securities dealer.

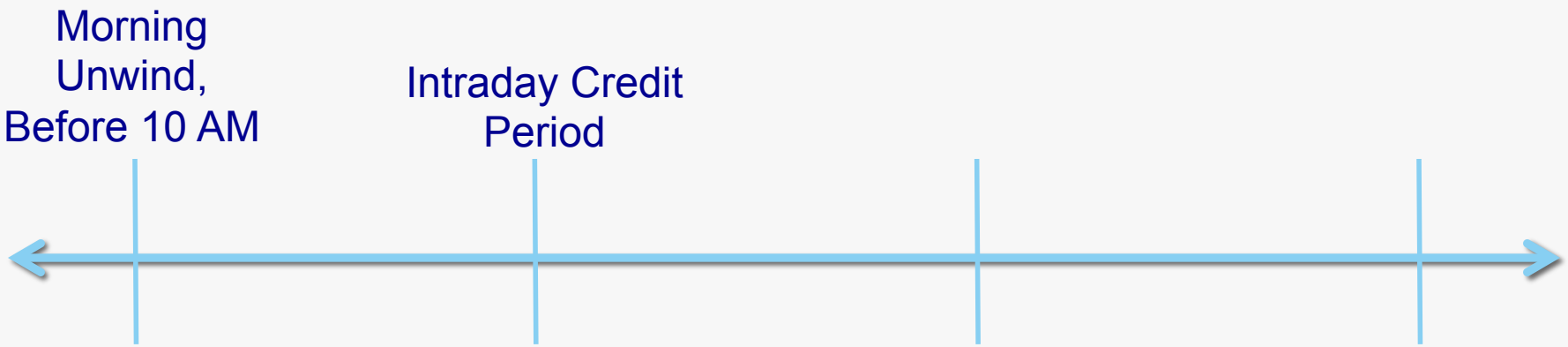


Tri-party repos employ a clearing bank to settle (clear) the collateralized loan between a cash investor and securities dealer.



Morning Unwind

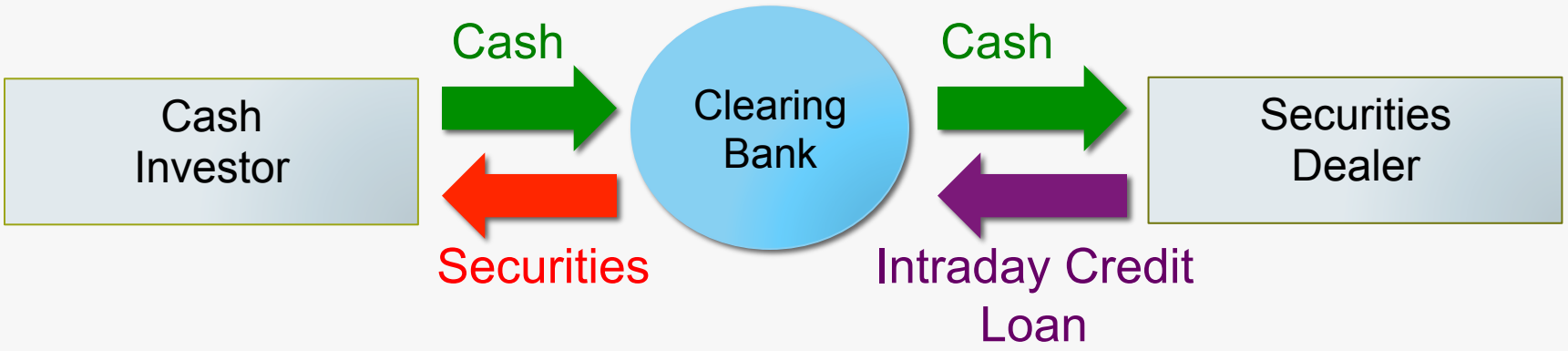


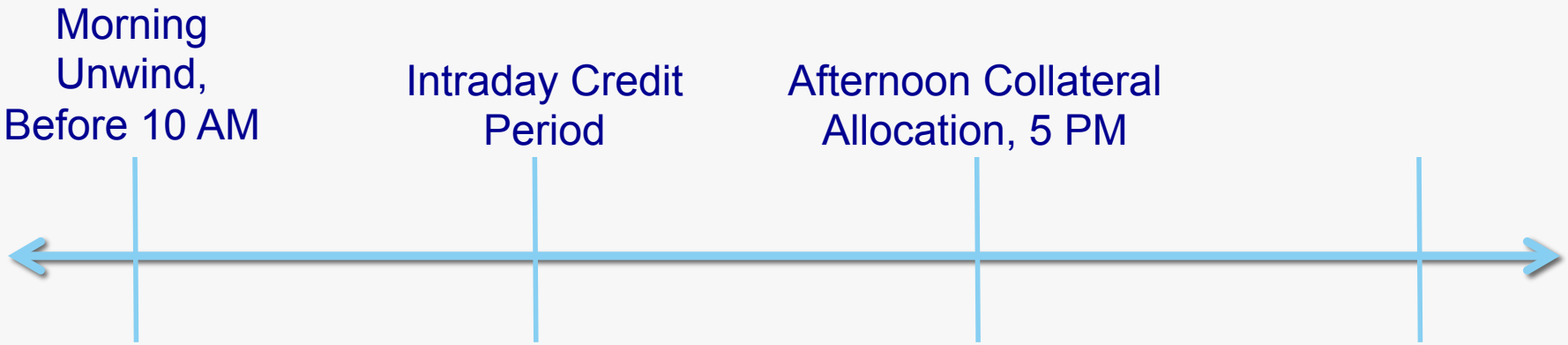


80 – 95 % of repos are arranged & contracted in a Master Repurchase Agreement.

Clearing bank is exposed to credit risk.

Afternoon Collateral Allocation





80 – 95 % of repos are arranged & contracted in a Master Repurchase Agreement.

Clearing bank is exposed to credit risk.

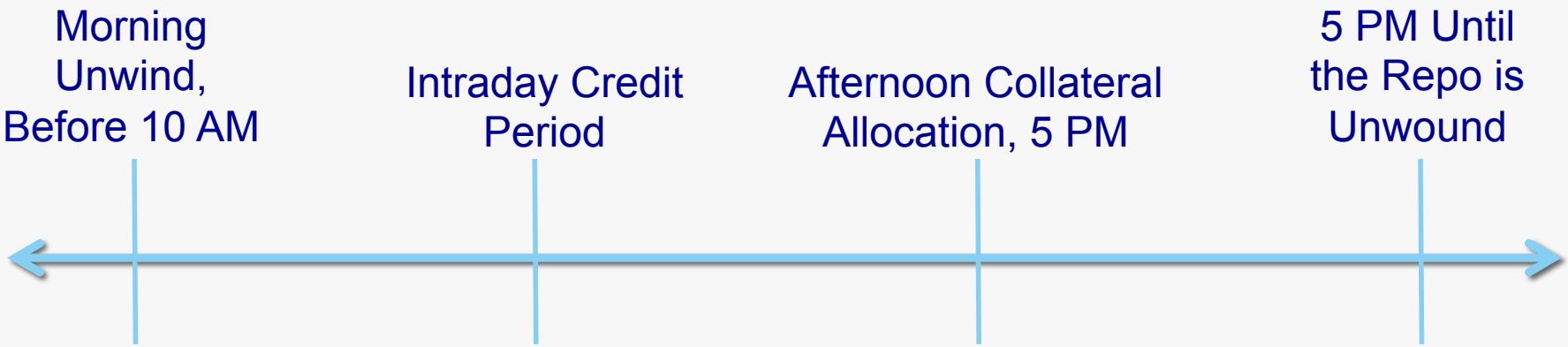
The rewind takes place after the Fedwire Securities Service and Depository Trust & Clearing Corporation close.

Overnight

Cash investor holds the dealer's securities in its account at the clearing bank.

Clearing Bank

Securities dealer holds the investor's cash in its account at the clearing bank.



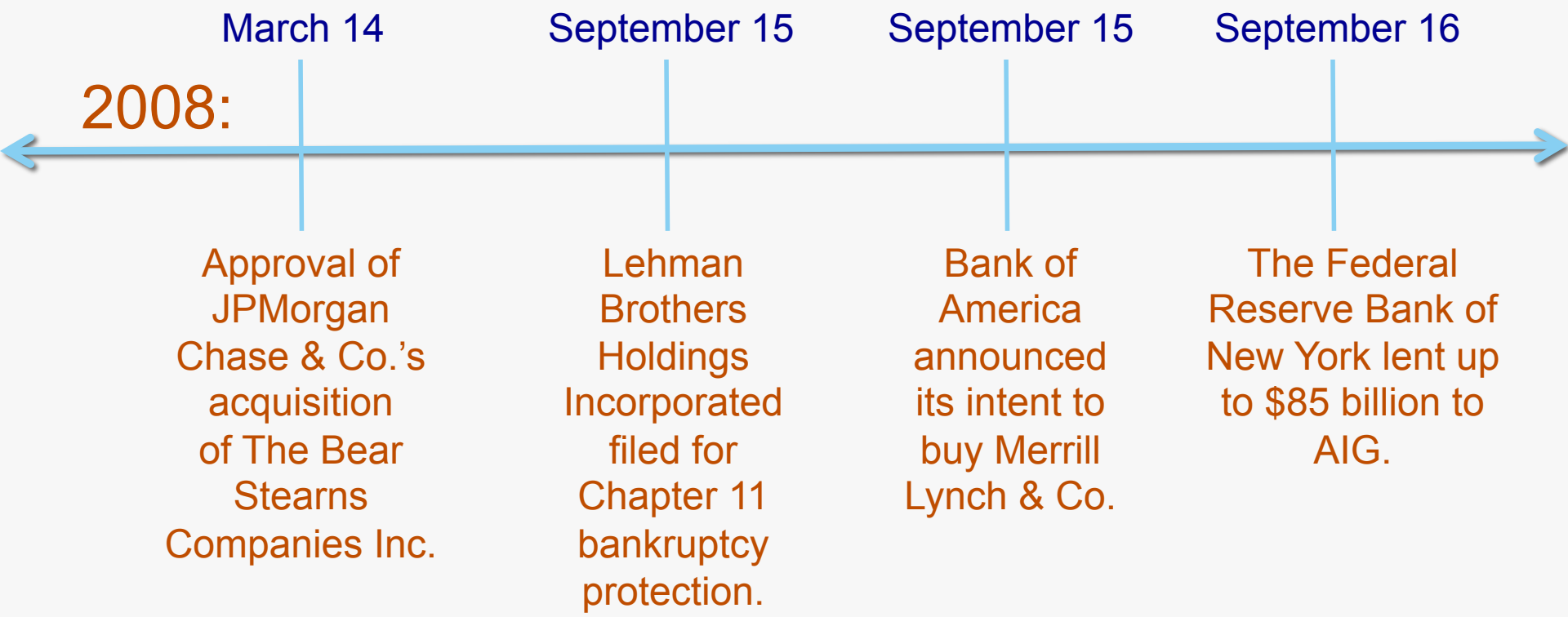
80 – 95 % of repos are arranged & contracted in a Master Repurchase Agreement.

Clearing bank is exposed to credit risk.

The rewind takes place after the Fedwire Securities Service and Depository Trust & Clearing Corporation close.

Credit risk is now on the cash provider if the securities dealer fails overnight.

"The American financial system was shaken to its core." -*Wall Street Journal*



Strategic Decisions

- Intraday credit (an overdraft) exposes the clearing bank to credit risk.
- *Strategic Behavior in the Tri-Party Repo Market* by Huberto M. Ennis (2011).
- The tri-party repo market was valued at $2.8 trillion in May of 2008.

Let’s jump into the game theory …

Game 1: Normal Operations

1 = Clearing Bank (CB)

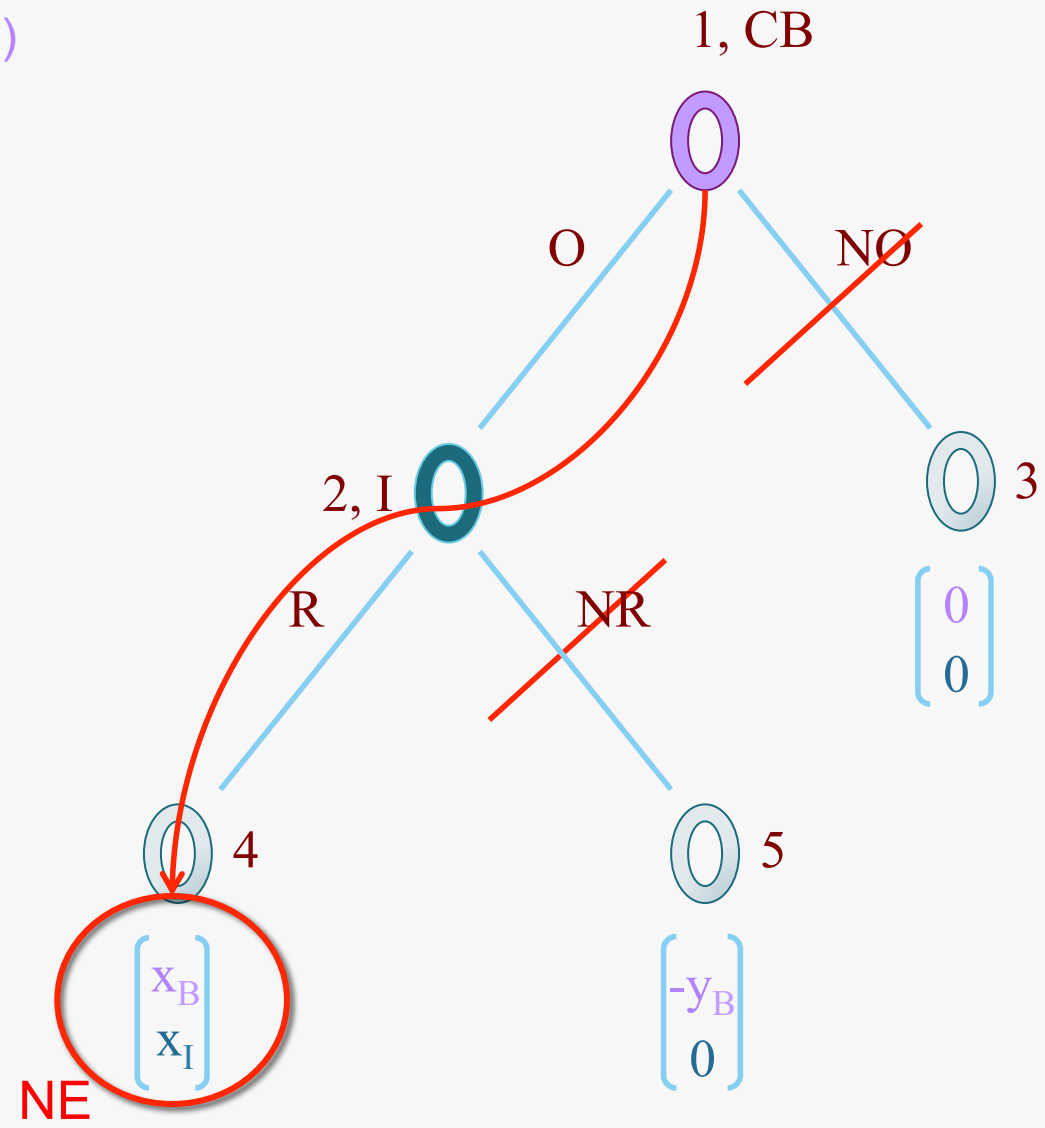
2 = Investor (I)

O = Overdraft

NO = No Overdraft

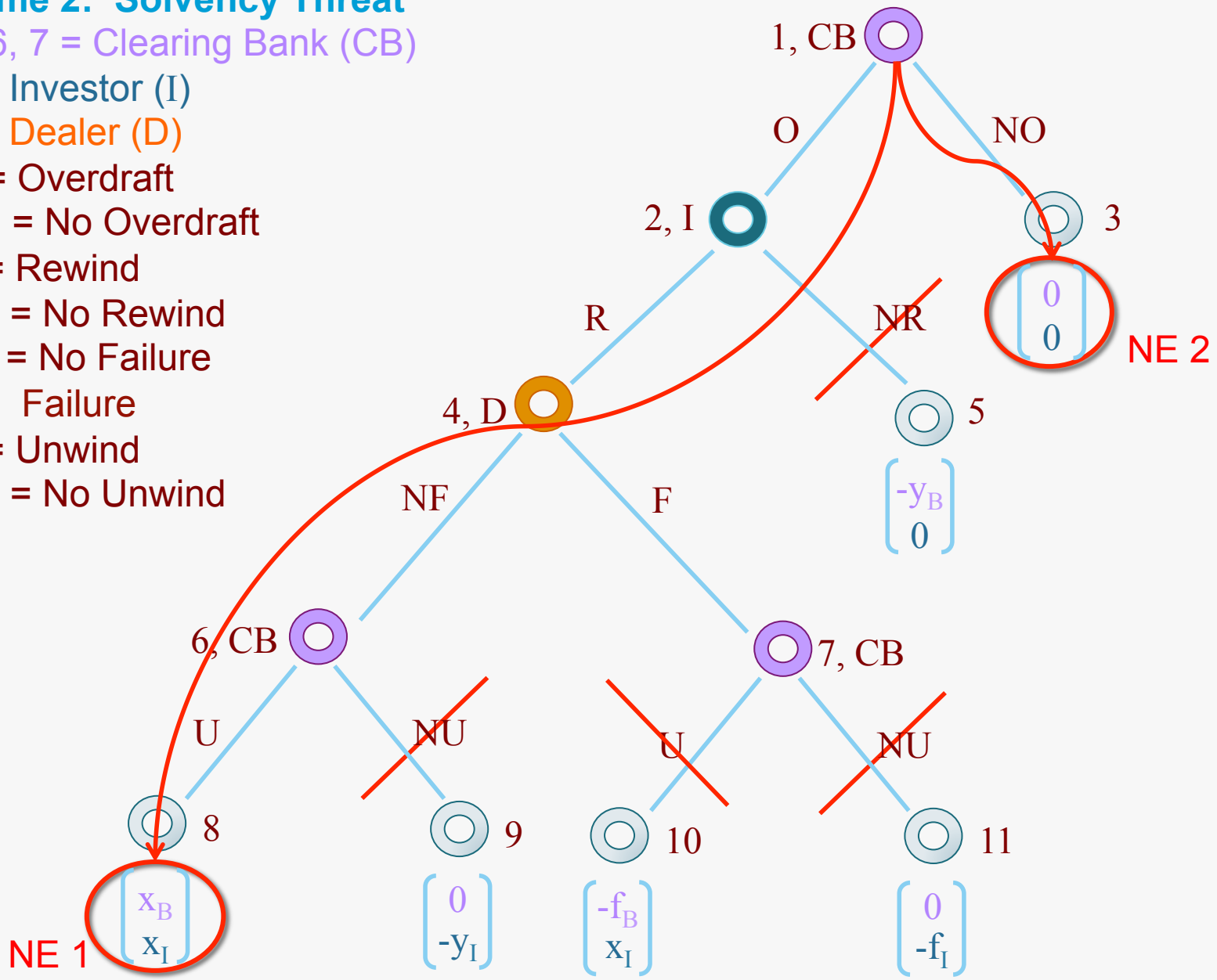
R = Rewind

NR = No Rewind



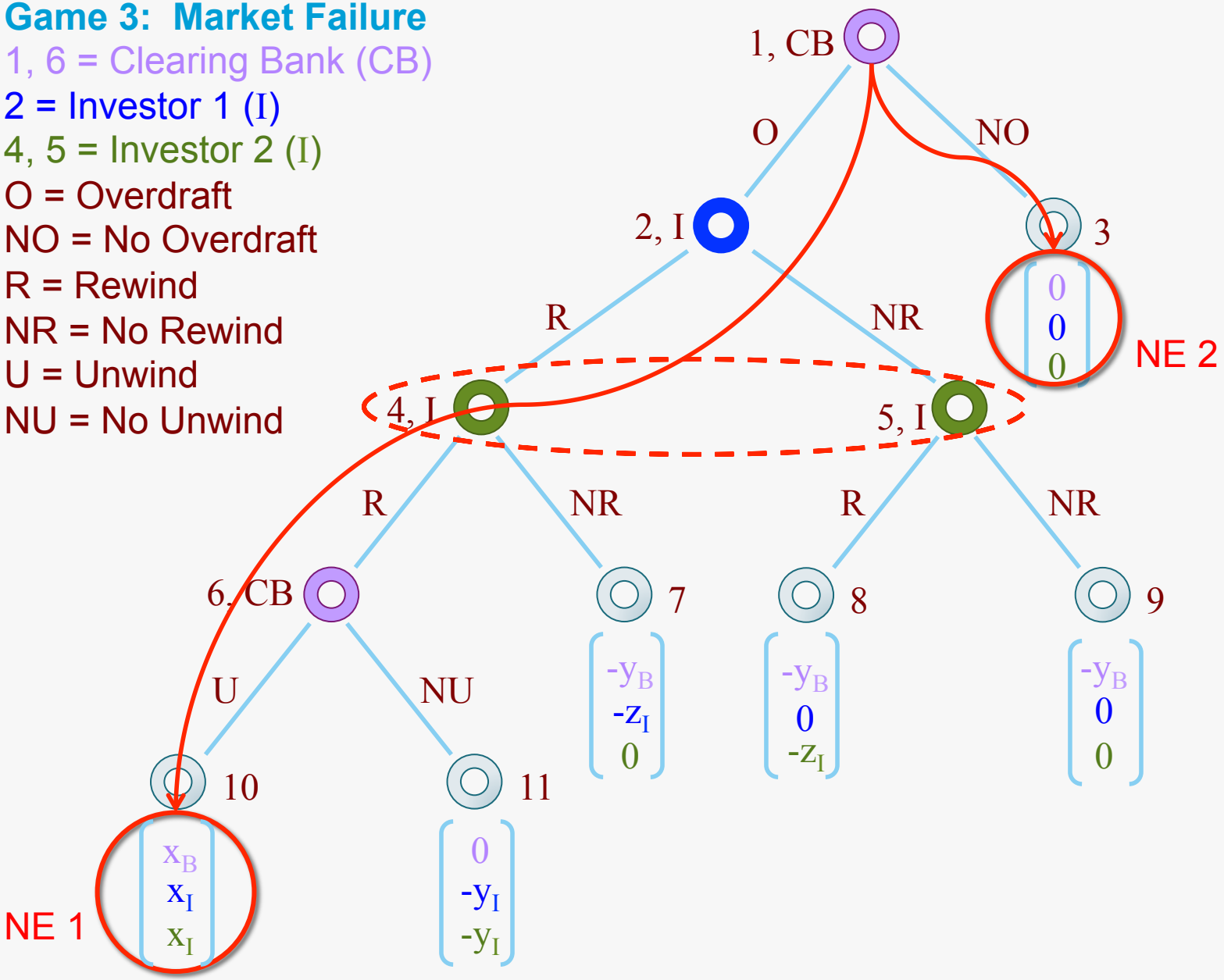
Game 2: Solvency Threat

1, 6, 7 = Clearing Bank (CB)
2 = Investor (I)
4 = Dealer (D)
O = Overdraft
NO = No Overdraft
R = Rewind
NR = No Rewind
NF = No Failure
F = Failure
U = Unwind
NU = No Unwind



Game 3: Market Failure

1, 6 = Clearing Bank (CB)
2 = Investor 1 (I)
4, 5 = Investor 2 (I)
O = Overdraft
NO = No Overdraft
R = Rewind
NR = No Rewind
U = Unwind
NU = No Unwind



The Research Question

Does …

- perception of investor and dealer liquidity
- monetary policy
- expectations about economic growth
- volume of tri-party repos collateralized by agency mortgage-backed securities

affect worldwide tri-party repo balances?

Time Period: 2003 – 2014; Frequency: Quarterly

Variable		Unit	Source
Y	**BNY's market value of worldwide tri-party repo balances**	**Billions of USD**	**Manually extracted data from each 10-Q and/or 10-K report**
X1	Perception of dealer and investor liquidity: CBOE Volatility Index or "VIX"	Percentage at the end of each period	Chicago Board Options Exchange
X2	Monetary policy: three-month U.S. Treasury yield	Percentage at the end of each period	Board of Governors of the Federal Reserve System
X3	Real Gross Domestic Product (GDP)	Annualized and seasonally adjusted, billions of USD	Bureau of Economic Analysis, U.S. Department of Commerce
X4	Agency MBS collateral value for tri-party repos	Billions of USD	Federal Reserve Bank of New York

	Model 1	Model 2
Hypothesis	Perception of dealer and investor liquidity and monetary policy will have a significant impact on worldwide tri-party repo balances.	Perception of dealer and investor liquidity, expectations about economic growth, monetary policy, and agency MBS collateral value will have a significant impact on worldwide tri-party repo balances.
Expected Relationship of Each X-Coefficient with Respect to Y:		
	Y: Tri-party repo balances	*Y: Tri-party repo balances*
X1: VIX	Negative	Negative
X2: Three-month Treasury Yield	Negative	Negative
X3: Real GDP	Not Included	Positive
X4: Agency MBS collateral value	Not Included	Positive

	Model 1	Model 2
Statistical Significance when α = 0.05:		
X1: VIX	Not significant	Not significant
X2: Three-month Treasury Yield	Not significant	Not significant
X3: Real GDP	Not Included	Significant
X4: Agency MBS collateral value	Not Included	Significant

Parsimonious Model: Expectations about economic growth and agency MBS collateral value will have a significant impact on worldwide tri-party repo balances.

$$y_{t=2010-'14} = -0.717.86 + 0.141GDP_t + 0.599MBS_t$$
$$Standard\ Error = \quad (0.02) \quad (0.17)$$
$$T\ Statistics = \quad (6.52) \quad (3.57)$$

	TPR balances	TPR balances, Cochrane-Orcutt Iterated Estimates
GDP	0.167	0.141
	(9.07)**	(6.52)**
MBS collateral value	0.698	0.599
	(4.39)**	(3.57)**
Constant	-1,205.699	-717.855
	(3.95)**	(1.93)
R^2	0.88	0.79
Adjusted R^2	0.86	0.76
F test model	53.50	25.81
P-value of F model	0	0
Observations	18	17

T-statistics are in parentheses. * $p<0.05$; ** $p<0.01$

$\alpha = 0.05$
$t\text{-}critical_{0.025,15} = 1.75$
χ^2 critical = 25
χ^2 calculated = 5.44

Conclusion & Recommendation

- Implications of empirical results.
- A practical application of empirical results.
  - Expansion of annual stress tests to enhance central bank and firm preparedness.
  - Minimize panic during future crises.

THANK YOU
QUESTIONS?