Operational Disruptions in Fedwire:

Simulating Liquidity Needs and Understanding Counterparty Response

BOF-PSS Seminar
August 25, 2005

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Agenda

- Background on Fedwire
- Context: Basic Account Simulator (BAS)
- Research question
  - Identification of historical disruptions
  - Metrics of counterparty response
- Preliminary findings

Background

- Fedwire Funds: US dollar RTGS
- Daylight credit: priced, with limits
- Basic statistics (July 2005):
  - 7,063 banks sent transfers (2,508 on all days)
  - 543,000 transfers, $2.0 trillion per day
  - Half of volume by 13:20 ET, value by 16:20 ET
  - Starting balances: $20 billion
  - Daylight credit: $41 billion average, $117 billion peak (depository institutions only, all Fed services)

Basic Account Simulator

- Goal: Understand potential liquidity needs from an unresolved, participant-level operational (technical) disruption in Fedwire
  - Use of intraday credit
  - Need for overnight loans
- Purposes and applications
  - Real-time projections of account balances after the on-set of an operational disruption
  - Scenario and policy analyses, sufficiency of discount window collateral and intraday net debit caps, etc.

Basic Account Simulator

- Forecasts account balances for the "outage" bank and key counterparties under three key assumptions:
  1. Outage bank cannot initiate Fedwire Funds transactions, Fedwire Securities transactions, or both, after a specified time, and does not regain the capacity to do so
  2. Any applicable real-time risk control on an institution's Federal Reserve account position is ignored: banks are not held to their net debit caps
  3. Counterparty behavior: No strategic response
     - Counterparties send funds and securities transfers to the outage bank as occurred on average in a sample period
     - No second-order "knock-on" effects. Counterparty banks send funds to third party banks as occurred on average in a sample period

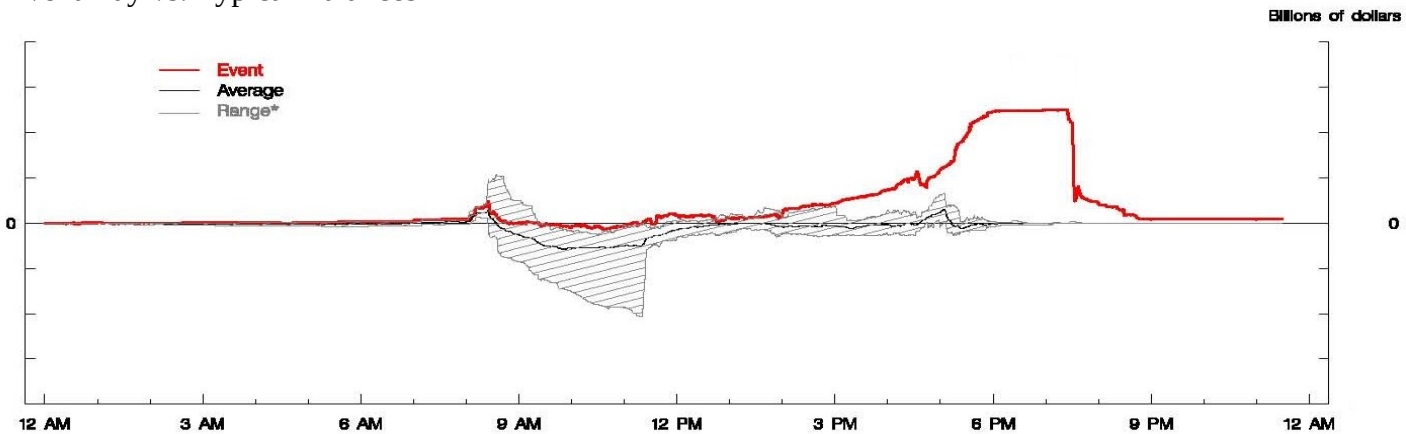
Basic Account Simulator

- Currently limited to forecasting the effects of a disruption at a single institution
- Expansion to multi-institution outages is planned
- Key counterparties selected according to the aggregate value of funds typically received from the outage bank after the outage time
- Fully integrated with transaction database—both in SAS

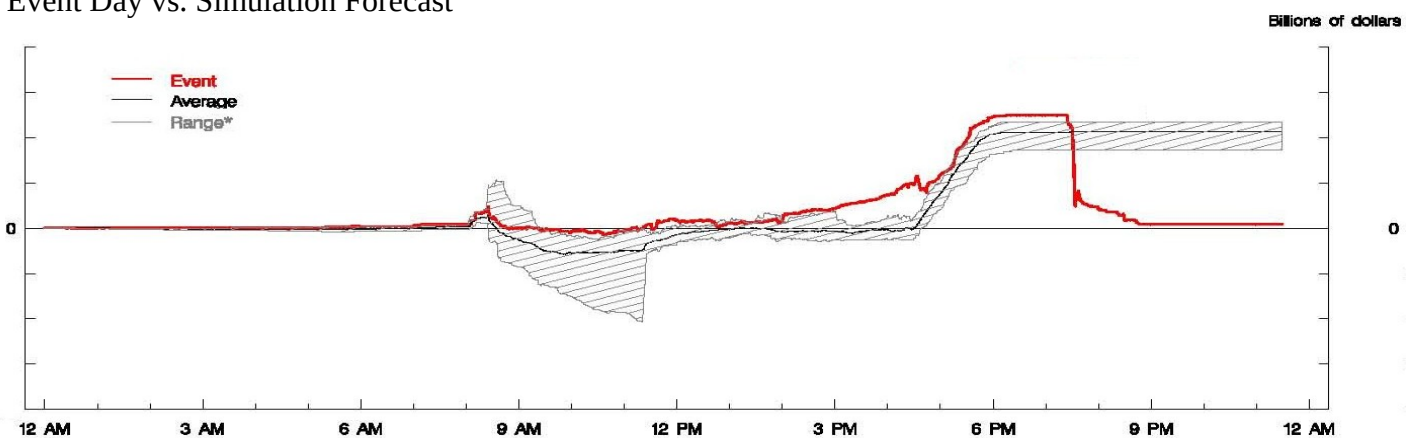
BAS Output Example

Outage Bank

Event Day vs. Typical Balances



Event Day vs. Simulation Forecast

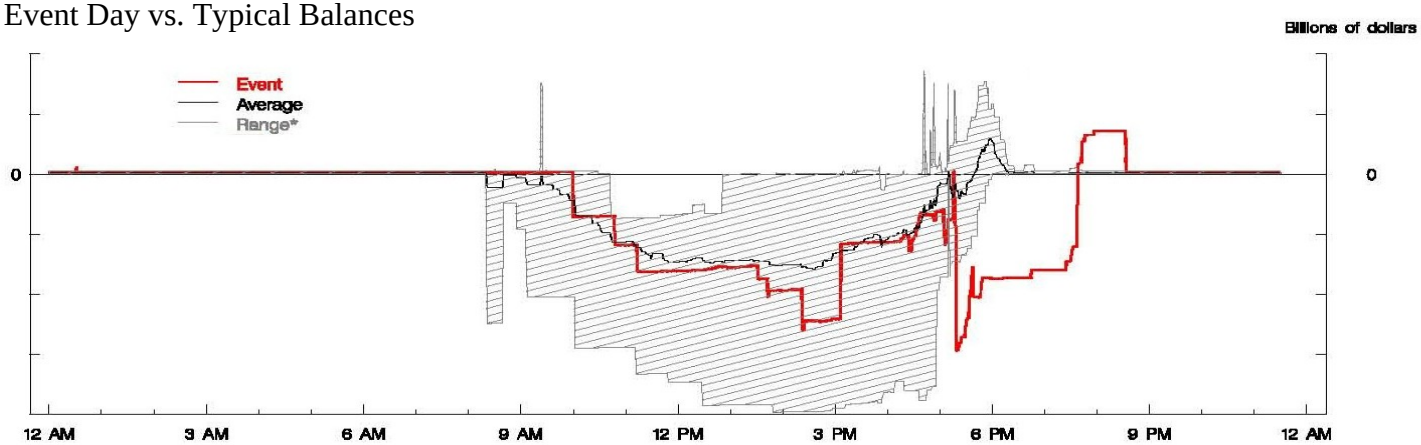


*Range: Minimum and Maximum of sample period.

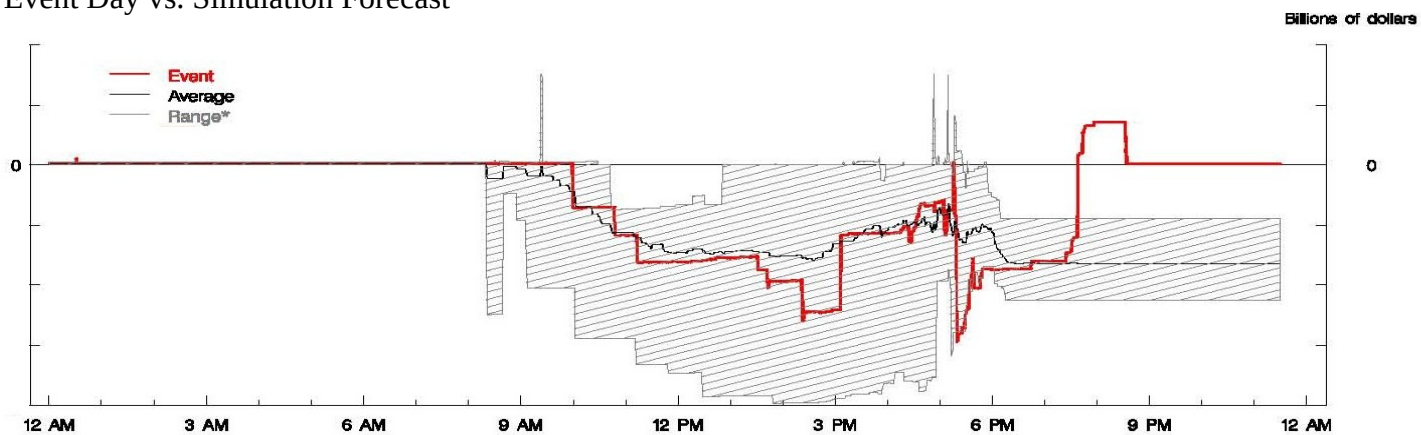
BAS Output Example

Counterparty Bank

Event Day vs. Typical Balances



Event Day vs. Simulation Forecast



*Range: Minimum and Maximum of sample period.

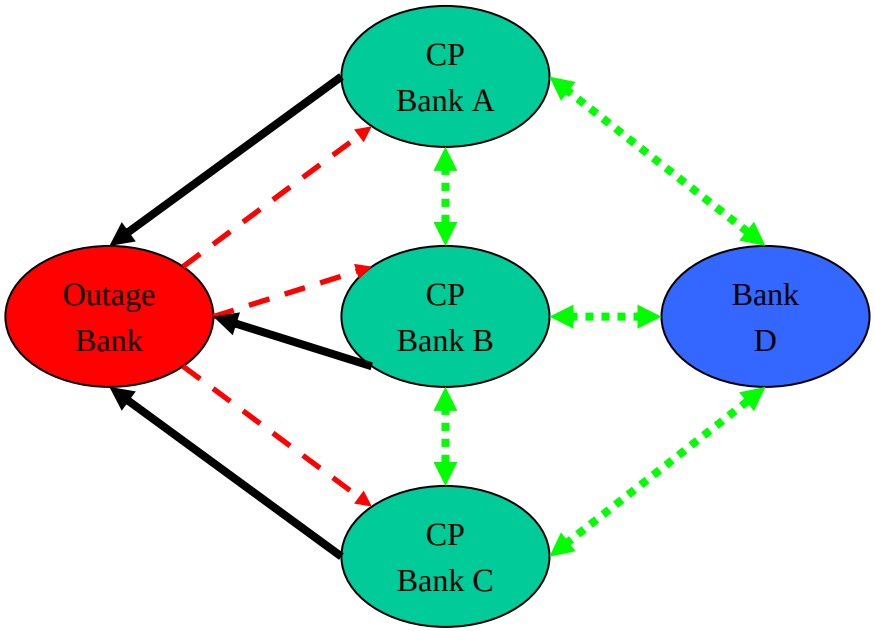
Research Question

- Are the behavioral assumptions of the BAS model sufficient, or is a more complex model required?
- Hypothesis: Assumptions are adequate. Counterparties do not respond strategically. Knock-on effects do not arise.

Research Strategy

- Identify historical participant-level operational disruptions in Fedwire transactions data
- Compare actual counterparty behavior on the event days to typical counterparty behavior over a sample period: an indication of behavioral response
- Look for knock-on effects: Do counterparties restrict or delay payments to the outage bank, to other institutions, or both, and to what extent?

Method



- Dashed red lines: payments not made due to the operational disruption
- Solid black lines: payments sent by counterparty banks, received by the outage bank
- Dotted green lines: all other payments

- We compare the number, value, and timing of the solid black lines (and dotted green lines) observed during historical outage events to their average over the prior three calendar months

Identifying Disruptions

- Identify unusual lengths of time between an institution's Fedwire transfers
  - For each of the 50 largest Fedwire participants measure the time between sequential payments (gap)
  - For each participant and each half-hour of the Fedwire day, calculate the maximum gap between payments
  - Determine the mean and standard deviation of the maximum gap (for each bank and period) over a rolling three-month range

Identifying Disruptions

- For each gap longer than 15 minutes, standardize the length of each gap across times, dates, and outage banks
  - Using sample period statistics for maximum gap
- Determine and apply an appropriate threshold to the standardized gap
  - Gaps exceeding the threshold are “outages”
- Other criteria and adjustments
- Note: by definition, all outages (gaps) have an “event window” (gap length) that ends prior to the close of Fedwire

Possible Thresholds

Standard Deviation Threshold	Number of “outages”	Number of Banks with “outages”	Average Outage Length (hh:mm)
4 and up	804	38	0:35
20 and up	396	34	0:55
125 and up	104	18	1:14

Analysis

- Metrics
  - Change in the value and number of transfers
  - Change in the value-weighted average transfer time (delay)
- Evaluated at study-wide level (across many outages)
  - Also available at event and counterparty levels
- Several analytical perspectives
  - Within disruption “window” vs. across the entire day
  - Effect on outage bank vs. “third party” banks
- Adjusted for multi-bank, same-day outages
  - Counterparty banks also experiencing outages on a particular event day excluded from metric calculations

Initial Findings

Metric (Weighted Average of Counterparty-level Effects over All Events)	100 Most Unusual Outages			
	During Event Window		Over Entire Event Day	
	Received By Outage Bank	Received By Third Parties	Received By Outage Bank	Received By Third Parties
Value of Payments				
Percent Change from Sample Average	-27.9%	-0.1%	7.7%	4.4%
Number of Payments				
Percent Change from Sample Average	-9.6%	-1.6%	3.4%	2.8%
Average Transfer Time (Value-Weighted)				
Delay (Minutes)	-8	0	22	4

Initial Findings

Metric (Weighted Average of Counterparty-level Effects over All Events)	Excluding September 11-14 2001			
	During Event Window		Over Entire Event Day	
	Received By Outage Bank	Received By Third Parties	Received By Outage Bank	Received By Third Parties
Value of Payments				
Percent Change from Sample Average	-15.3%	2.7%	5.5%	4.5%
Number of Payments				
Percent Change from Sample Average	1.9%	2.4%	5.8%	3.9%
Average Transfer Time (Value-Weighted)				
Delay (Minutes)	-3	1	3	0

Observations

- Some reduction in the value received by outage banks in the outage window, especially larger payments
- Changes in the timing of payments appear limited outside of September 11 events
- Knock-on effects appear limited throughout
- Mixed implications for hypothesis

Next Steps

- Improve analysis
  - Develop and apply statistical tests
  - Determine sensitivity of results to outage pool
- Investigate why counterparties appear to reduce payments to the outage bank
- Determine whether individual counterparties behave consistently across events
- Look for increases in discount window loans, daylight overdrafts, fed funds rate volatility for outage days (colleagues already investigating)