

When Do Operational Event Become a  
Systemic Concern:  
An Agent Based Model of the LVTS

Discussion

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# Highlights

- Partial outages: one participant cannot send payments but is still able to receive them
- **Two Questions:**
  - **can a partial outage have a systemic effect?**
  - **show ABM contribution**
- Analysis based on
  - simulation model, capturing the working of the LVTS
  - real time data
  - behavioral assumptions on *other participants' reaction*

# Maintained Assumptions

- How banks process payments that pass/ do not pass bilateral and multilateral credit limits
  - Until “Reaction” banks continue to send payments to impacted bank.
  - After Reaction, they put payment inside outage queue
- Constant CB behavior vis à vis credit limits
- Simplifying assumptions (collateral, processing times...)

# Payment System Performance Indicators

## Outage ends at 4.30 pm

- Can the payment system settle by 6 pm?
  - % of unsettled volume close to zero irrespective of reaction time
- How much time is left before 6pm when the system recovers?
  - too little time may be left: extension needed
- Are other banks impacted?
  - NetAQV: weighted average, across participants, of queued payments, averaged over T 10-minutes intervals
  - .1 to.5 billions at 4.30, depending on reaction
- How many costs does the outage entails? ?

# Comments by an Outsider

- Relevance of Partial Outages
- Possibility of Systemic Breakdown
- Event Study

# Relevance of Partial Outages

- Table 1 with 41 of events, duration, value of payments submitted with/without outages to the system...not very telling to an outsider: cost to the bank? to the system?
- *“Disasters of Note”* Royal Bank of Canada upgrading software, June 2004, on payday
- “Millions of customers” inconvenienced
  - transactions did not reflect in their accounts for up to a week
  - customers of other banks affected as payment from customers of RBC would not have come through when expected
  - 1 billion dollar claim in lawsuit

# Relevance of Partial Outages

## *(Lacker, Richmond Fed, 03)*

- Payment system disruptions common to Banking crises 1863-1914
  - Herstatt failure 1974
  - *Bank of NY software problem 1985*
  - Stock Market Crash 1987
  - *September 11*
- Characteristics:
  - caused by solvency or operational problems
  - possible bank runs
  - Central Bank Intervention
- High incidence in last decades of operational outages due to electronic transfers
  - Causes: software, power, storm, physical attack, virus
- PARTIAL OUTAGES GET VERY RELEVANT!

# Why Should Operational Outages Cause a Systemic Crisis?

- Partial Outage under analysis causes the affected participant to have excess balances and the others to have lower than average balances
- Central Bank may manage this situation, as it did with Sept 11, if banking solvency is not a concern
  - lending to affected counterparts at (below) market rates
  - against assumption of constant CB behavior



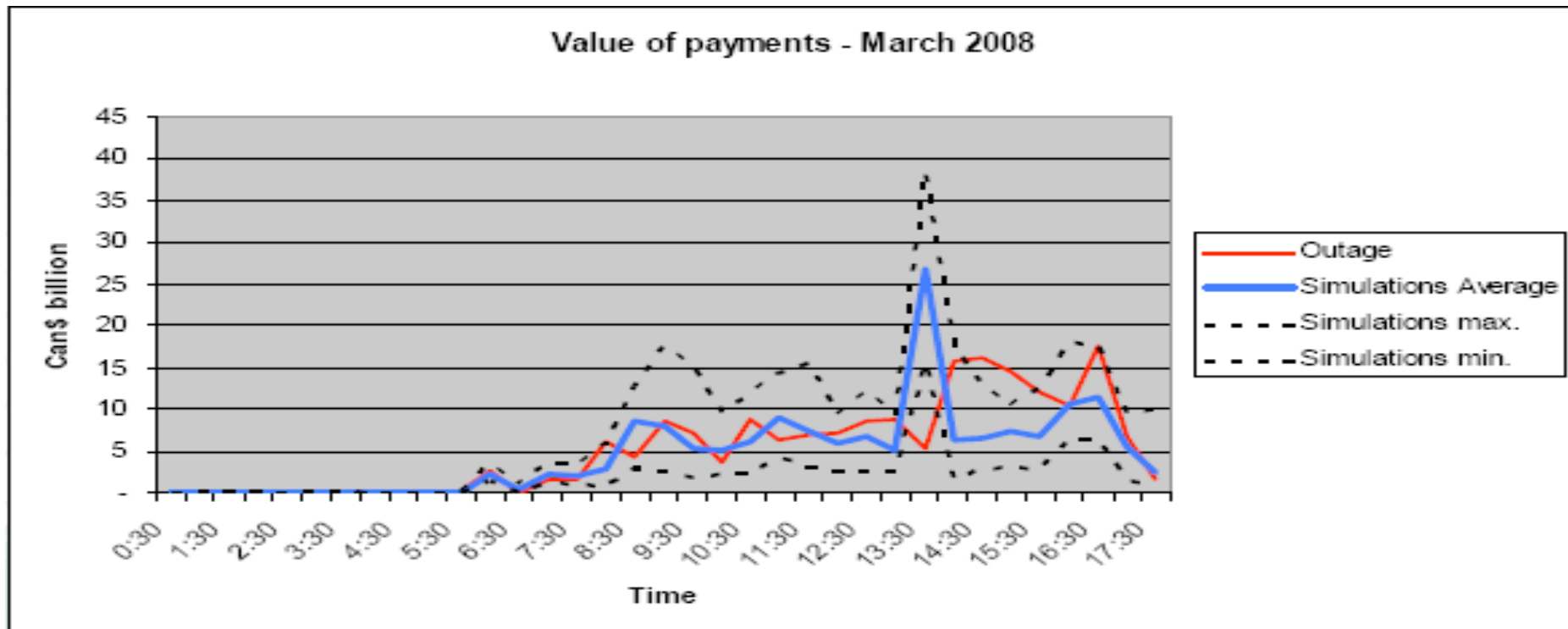
# Why Should Operational Outages Cause a Systemic Crisis?

- Was there ever an operational outage to one bank causing a big systemic problem *absent* solvency issues?
- If not, then essential ingredient are the (behavioral consequences) of weak banks, together with the operational outage
  - Additional “informational features” of LVTS: how it disentangles operational and solvency problems, and how fast it communicates them
  - Reaction includes 1. time it takes for impacted bank to inform CPA 2. time for CPA to inform members
    - discuss assumption concerning “reaction”, i.e. communication from impacted bank to CPA and from CPA to other banks

# Model Validation

(one event in March 2008 in red)

Why is there a peak simulated payment at lunch time?  
Is this a “counterfactual” feature of the simulation model,  
Or was it a peculiar feature of this day?



# Add Event Study as Complement to Sim Method

- 41 events in the LTVS
- “Normal delay”: NetAQV on days without outages
- “Excess delay”: XNetAQV **past** the outages
  - Is the average XN statistically different from zero (at different times)?
  - Is there a systematic relationship to (i) indicators of interventions by CB/CPA and (ii) solvency problems of the impacted bank
- If other segments included, insight on how characteristics impact reaction

# Validation on several days

- How well does the average (excess) simulated response differ from the average (excess) real one?
  - Feedback on behavioral assumptions for banks and CB

# Summing up

- Validation over several days through event study
- Discuss outage incidence, outage costs and system transparency
- Two scenarios
  - No solvency issue // CB releases credit limits
  - Bank solvency issues // CB does not release credit limits, longer reaction times