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What goes to the LVTS central queue?

Lindsay Cheung and Ben Fung
Bank of Canada

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*The views expressed in this presentation reflect those of the authors and do not necessarily represent those of the Bank of Canada.

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Purpose

- Purpose of paper is two-fold
  - Establish stylized facts for the use of the LVTS central queue for T2 payment stream;
  - Study the extent to which participants used the jumbo queue algorithm, which allows for payments offset, to manage large payments.

- Motivation
  - Understanding how to make a large-value payment system more liquidity efficient without undue risk.

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Main features of Canada's LVTS

- A hybrid payment settlement system subject to Bank of Canada's oversight.
  - Immediate finality in spite of settlement occurring on a multilateral net basis at the end of the day
  - Dual-payment streams with corresponding risk-control limits
    - 'RTGS-equivalent' T1
      - Subject to a net debit limit that is fully collateralized
    - 'Liquidity-efficient' T2
      - *Bilateral credit limits (BCLs) and multilateral net debit caps (NDCs)* to prevent uneven liquidity distribution among participants
      - *T2 collateral pool* allows participants to send payments with values greater than their accumulated in-payments but below their NDCs
      - *Central queue algorithm* allows batches of payments to offset against one another on a multilateral basis
- Current LVTS rules **restrict** participants from using the central queue without active management of payment release to the LVTS.

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Flows and participation structure of LVTS

- Significant daily payments throughput
  - In 2010,
    - T1: 330 payments totalling $27 billion
    - T2: 22,900 payments totalling $119 billion
- Highly concentrated participation structure with 15 participants

Distribution of LVTS payments activity by participant size (daily average, 2010)

	# Participants	Share of Value	Share of Volume
Small	8	14%	15%
Large	6	77%	84%
Bank of Canada	1	9%	1%

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Questions to be addressed

- What are the characteristics of queuedT2 payments?
  - Provide a benchmark for the central queue activity, especially with respect to the size of participants;
  - Gauge the level of settlement delay and intraday liquidity constraints.
- To what extent participants used the jumbo queue algorithm, which allows netting of payments, to manage large payments?
  - Understand why some participants might choose to use the algorithm;
  - Shed light on trade-off between settlement delay and intraday liquidity.

Key findings

- LVTS participants have generally respected the restriction on the use of the LVTS central queue. However, small participants do rely the central queue algorithm to send and receive large T2 payments.
- Small participants are more constrained by the bilateral credit limits, whereas large participants by their multilateral net debit limits.
- Queued payments *to/from* small participants faced longer settlement delay than those *between* large participants.

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Data and the BoF-PSS2

- System operator provides regular LVTS data
  - No data on central queue activity until recently
- BoF-PSS2 specified to exactly replicate LVTS functionality to identify
  - Which of the T2 jumbo payments went to the queue
  - What triggered the queue to re-try and release these payments
- Sample period: Jan 2005 to April 2009

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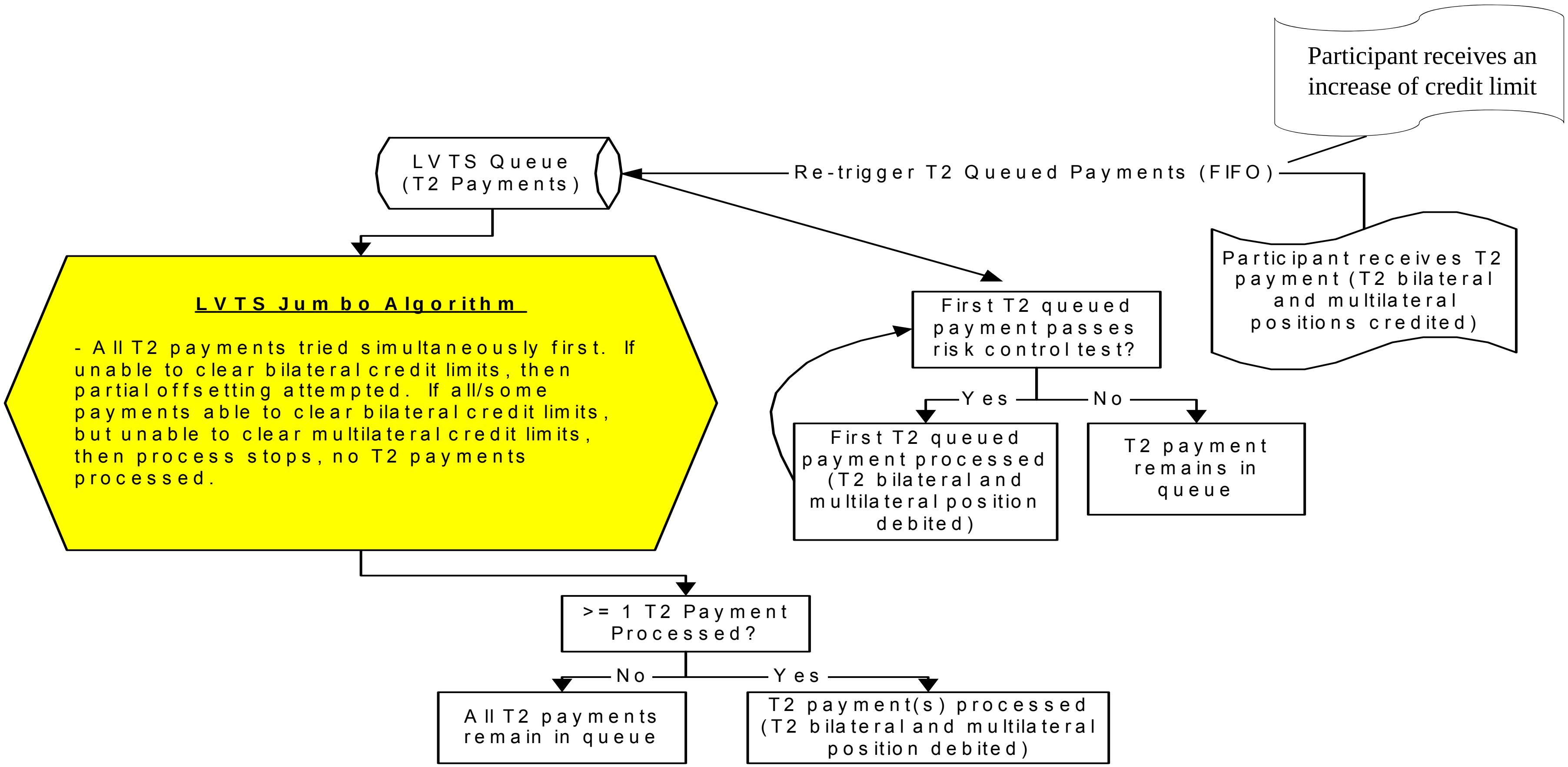
Processing of queued T2 payments

- Central queue takes ‘jumbo’ payments with a minimum value of $100 million.



Courtesy of Neville Arjani

Queued payments: small volume but non-trivial value

The simulator identified a total of 7390 T2 jumbo payments, totalling $4.6 trillion, became queued.

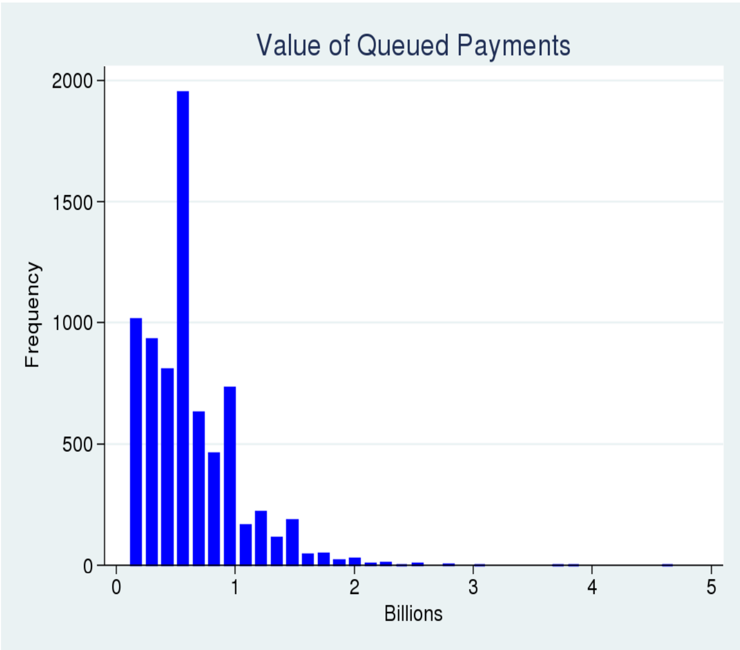
Year	Total T2 payments		Total T2 jumbo payments		% of T2 jumbo became queued	
	Volume (‘000)	Value ($trillion)	Volume (‘000)	Value ($trillion)	Volume	Value
2005	4,489	32	79	21	2%	3%
2006	4,839	36	89	25	2%	5%
2007	5,218	40	98	28	2%	4%
2008	5,634	39	99	27	2%	5%
Jan-Apr 2009	1,808	12	29	8	**1%**	**2%**
Total	21,988	159	394	109	**2%**	**4%**

Queued payments twice the size of non-queued

Average value: $616 million

Standard deviation: $389 million

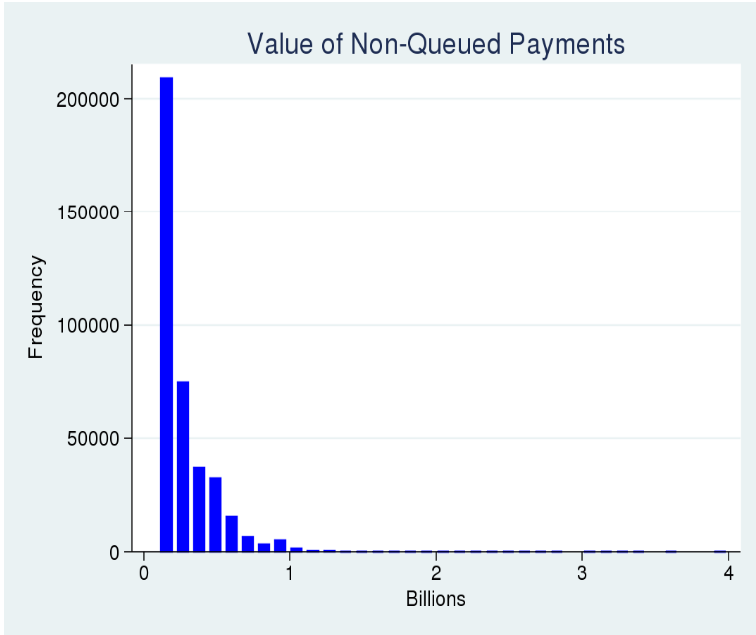
Median: $500 million



Average value: $276 million

Standard deviation: $195 million

Median: $200 million



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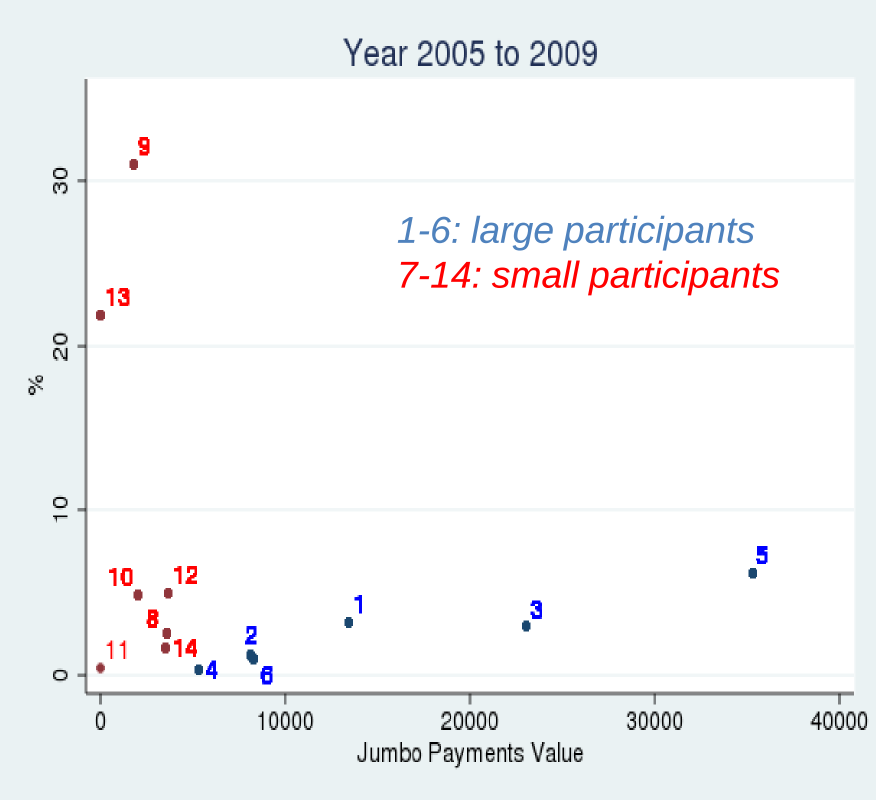
Small participants use queue more intensely

% of own T2 jumbo payments value became queued



- Intensity of queue usage measured by
  - How much of a participant's own total T2 jumbo payments became queued, both in value and volume.
- Intense queue users
  - Small participants # 9, 13, 12, and 10
  - Large participant #5

Small participants proportionally larger queue users

Distribution of queued payments based on the size of participants

Participants		All queued payments			As % of T2 jumbo payments in each grouping	
From	To	Volume	Value ($trillion)	Average Value per payment ($million)	Volume	Value
Small	Small	267	0.1	272	6%	9%
Small	Large	1,340	0.9	708	3%	7%
Large	Small	2,141	1.4	640	4%	9%
Large	Large	3,642	2.2	593	1%	3%

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Queue entry and release triggers

Distribution on the 7390 queued payments regarding queue entry and release triggers

Entry Triggers			Release Triggers	
Failed BCL	**48%**		BCL increase	2%
Failed NDC	31%		Jumbo Algorithm	41%
Failed Both	21%		**Incoming payment**	**57%**

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Small bounded by BCLs; Large bounded by NDCs

From	To	Volume of queued payments	% of which failed the following control(s) in each grouping		
			BCL	NDC	Both
Small	Small	267	93%	1%	6%
Small	Large	1,340	52%	10%	38%
Large	Small	2,141	65%	10%	25%
Large	Large	3,642	34%	52%	14%

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Small participants rely more on the jumbo algorithm

From	To	Volume of queued payments	% of which released after the following triggers in each grouping		
			BCL increase	Jumbo Algorithm	Incoming Payment
Small	Small	267	6%	89%	5%
Small	Large	1,340	5%	79%	16%
Large	Small	2,141	2%	53%	45%
Large	Large	3,642	1%	16%	83%

Large participants face shorter settlement delay

- Average queuing duration was *5 minutes*
  - 25% of all queued payments waited ≤10 seconds
  - 25% waited about 2 minutes

- Regardless of the queue entry reasons
  - *Shortest* delay if released via incoming payments, averaging 2 minutes
    - Almost instantaneously for payments **between** *large* participants
    - Longer than average for those sent **by** *small* banks
  - *Longest* delay if released via a credit limit increase, averaging 21 minutes
    - Shorter for payments **between** *large* participants
  - 8-9 minutes by the jumbo queue algorithm, regardless of the size of participants

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Jumbo algorithm to manage large T2 payments

- The algorithm was predominately used to net l*arge* T2 payments, averaging $700 million.
  - Dominated by one pair of large and small participants (#5 and #9 on slide 11)
    - Give each other a $600 million limit (the *largest* limit given by the small one)
    - Credit limit lower than the average daily largest T2 payment between the pair
    - Pushed through large payments *without* having to raise respective BCLs or resort to T1, thereby saving on liquidity (and collateral).

- Most algorithm sessions had only two payments which were able to net down to a small value (i.e., required a small amount of liquidity), if not offset completely .

- Bilateral coordination
  - *Close queue-enter time* amongst payments netted within a single session;
  - Average duration for payments processed by the algorithm did not vary much.

- The cost of settlement delay for small participants seems to be smaller than the cost of having to pledge more collateral and/or to provide larger intraday credit.

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Summary of results

- Total volume of queued T2 jumbo payments was small, but the associated value was non- trivial;
- Average value of queued payments was very large, twice those that were not queued;
- T2 jumbo payments *to/from small participants* were more likely to fail the bilateral credit limit tests, and most of their queued payments were settled through the *jumbo algorithm*;
- *Large participants* had more difficulty with their multilateral net debit caps when sending large payments to another large participant. These queued payments were mostly released after incoming payments, and they endured the *shortest settlement delay*.
- Some participants did take advantage of the jumbo queue algorithm to save on liquidity when facing large payment shocks.

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Thank you!