Too-connected-to-fail Institutions and Payments System's Stability: Assessing Challenges for Financial Authorities *

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Agenda

- Lessons from recent developments and their implications for the oversight framework

- Assessing systemic risk within the payments system

- Simulation: Data, results and analysis

- Concluding remarks

Lessons from recent developments

Too-connected-to-fail (TCTF) institutions were key in recent episodes…

Before…

Big banks were considered…

• the most connected.
• the institutions that most concentrated liquidity and payments.
• the main source of systemic risk.
• the only capable of affecting "widows or orphans" (i.e. the public).
• the most regulated and supervised.
• the target of the tools for crisis |prevention and management (lender of last resort, deposit insurance).

• Banking systemic risk was the key.
• "Funding liquidity" crisis approach.

Now…

Non-bank institutions (securities and insurance firms, mutual and pension funds, others) are also considered…

• heavily connected.
• hubs of liquidity and payments.
• an important source of systemic risk.
• capable of affecting "widows or orphans" via market prices.
• More (but still insufficiently?) regulated and supervised.

But tools for crisis prevention and management were not designed for these institutions.

• "Connectedness" is as important as size.
• "Market liquidity crisis".
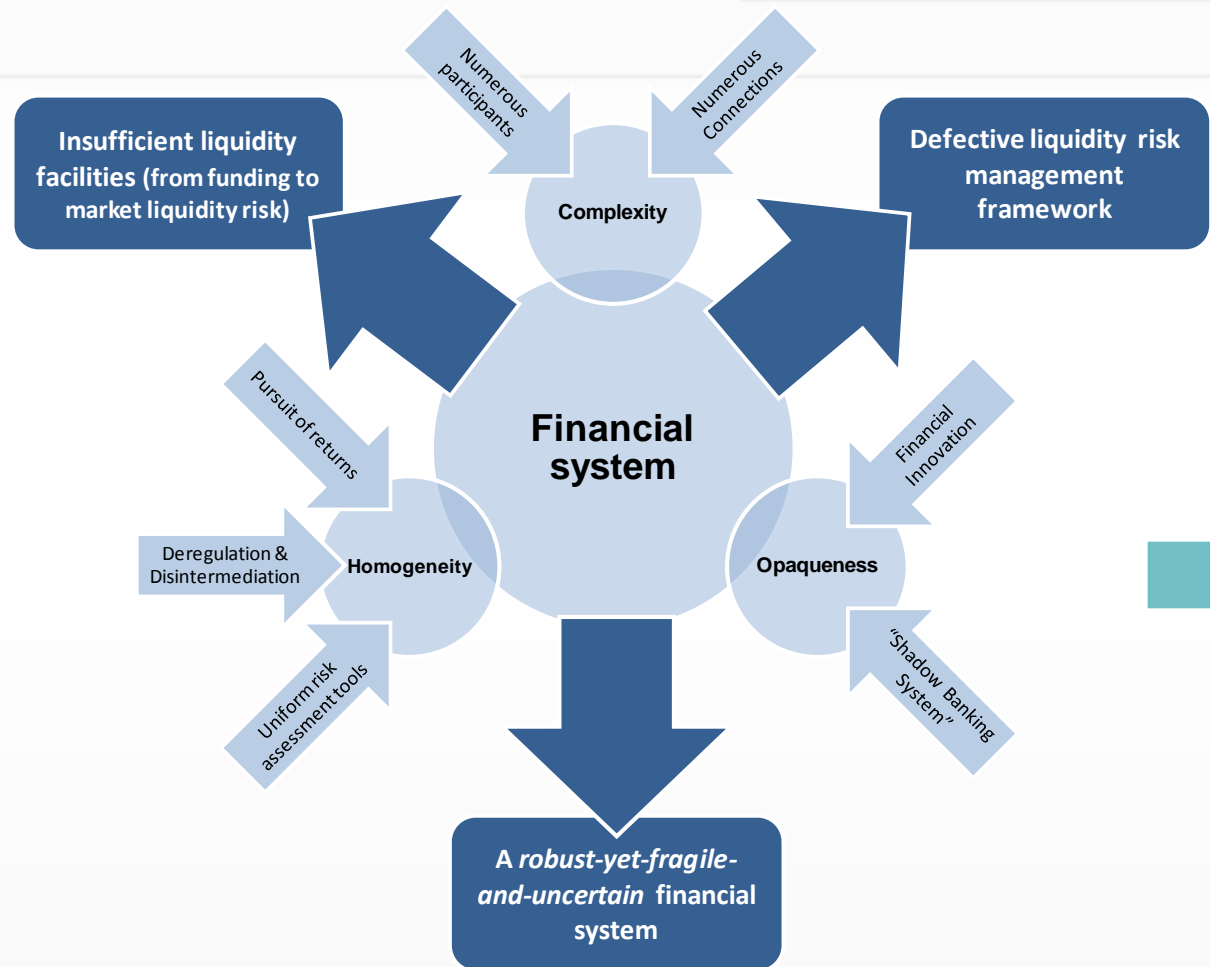
How did we get here?

Why is this important?

Lessons from recent developments

How did we get here?

- Complexity
- Homogenity
- Opaqueness

Why is this important?

- We live in a robust-yet-fragile and uncertain system
- Liquidity risk management is defective (non-systemic)
- Liquidity facilities may turn insufficient

Lessons from recent developments

… strengthening emphasis on macro-prudential approach is mandatory.

Consequences

Regulation and supervision were too institution-centric to see through to the systemic risk (IMF, 2009)

Micro-prudential approach […] to systemic risk […] is insufficient
The connections between components are as important as the components themselves. (León et al., 2011)

[…] preventing failure of an institution is a necessary but not sufficient condition for effective and efficient clearing and settlement where connectedness matters

It is reasonable to put more emphasis on macro-prudential regulation and supervision

From micro to macro-prudential

Micro-prudential approach

Focus: financial institutions

Metrics: financial statements and solvency ratios

Scope: individually analyzing and inspecting financial institutions → default risk

Macro-prudential approach

Focus: financial infrastructures

Metrics: liquidity and connectedness (centrality).

Scope: system –wide perspective on the systemic risk

**[…] the use of prudential tools with the explicit objective of promoting the stability of the financial system as a whole, not necessarily of the individual institutions within it.
BIS (2010)**

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Assessing systemic risk within the payments system

How to identify and assess systemic risk?

	TBTF	TCTF
Scope	Individually analyzing and inspecting financial institutions → default risk	Aggregately analyzing and inspecting the financial system → systemic risk
Focus	Financial institutions.	Payment systems and instruments (infrastructure)
Metrics	Assets, Deposits, Loans.	Centrality, betweenness.
Advantages	• Based on observable accounting data. • Easy to track. • "Easy" to forecast.	• Captures complexity of financial systems. • Identifies concealed sources of systemic risk. • Recognizes the increasing role of non-banking institutions ("shadow banking system")
Disadvantages	• Institution centric. • Focus on banking institutions. • Unreliable accounting data. • Unable to capture connectedness • Model risk.	• Requires models able to capture cross-dependency, context-dependency, non-linearity, complexity. • Define connection: claims? payments? • Model risk.
Key cases	• Overend Gurney and Co. Ltd. (U.K., 1866) • Baring Brothers (U.K., 1890) • The Bank of United States (U.S., 1929) • Johnson Matthey Bankers (U.K., 1984) • Continental Illinois (U.S., 1984)	• Herstatt Bankhaus (GER, 1974) • LTCM (U.S., 1987) • AIG, Bear Sterns, Lehman, Freddie Mac, Fannie Mae (U.S., 2008)

Assessing systemic risk within the payments system

Centrality: A key concept from Network Topology

If A fails…
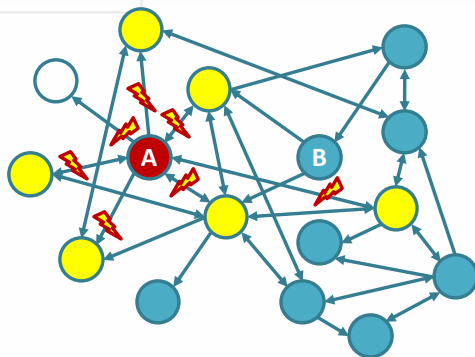
If B fails…

Node A…
• Maintains direct links with 7 nodes
• Sends payments to 7 nodes
• Receives payments from 4 nodes
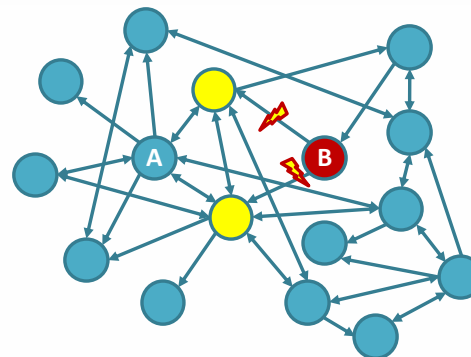
Node B…
• Maintains direct links with 3 nodes
• Sends payments to 2 nodes
• Receives payments from 1 node

Network Topology allows for identifying central institutions
*[centrality: the importance of the participant in the payments system] ***

Simulation techniques allows for assessing the direct and indirect outcomes of "attacks" on central institutions

Banco de la República Colombia (BR) approach:

Network Topology + Simulation techniques

* Currently FIOD is working on a measure of substitutability to complement the systemic importance index

Assessing systemic risk within the payments system
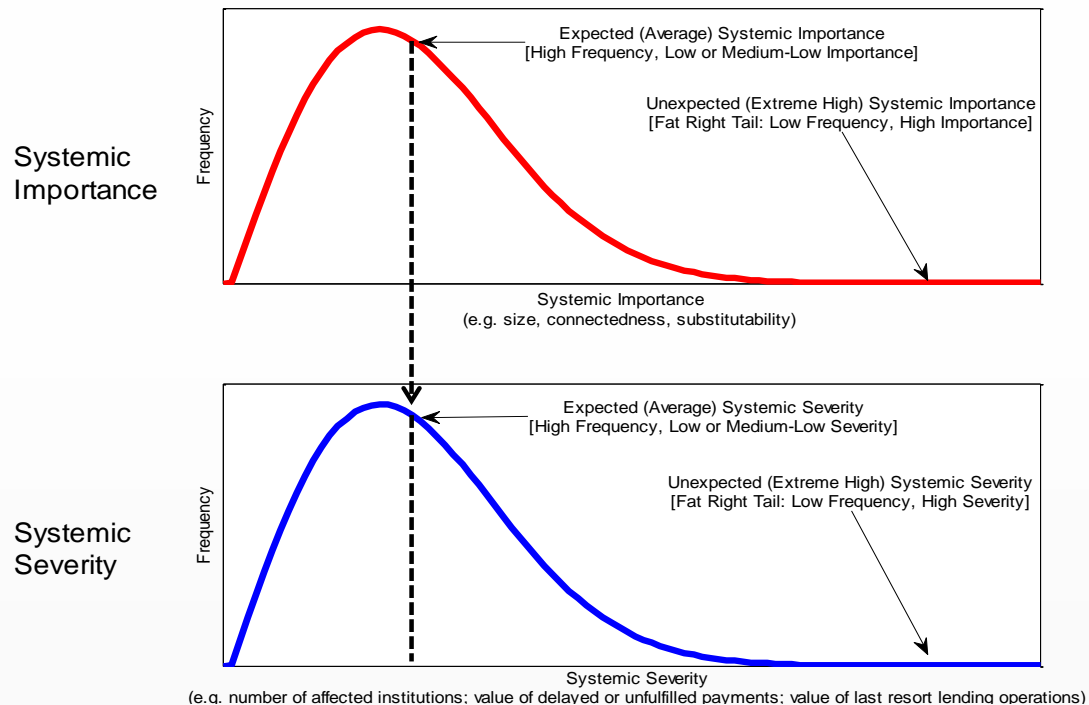
Why is centrality a key concept?
Why not using the average financial institution?
Why not making random shocks to the system?

Financial and payments networks nowadays may be described as <u>robust to random disturbances, but highly susceptible to targeted attacks</u> (Haldane, 2009; León et al., 2011).

Systemic importance of financial institutions (i.e. size, connectedness, substitutability) being distributed with a <u>high degree of asymmetry (right skew) and excess kurtosis, makes the average institution of low systemic importance</u>.

As financial authorities should be prepared to confront a non-average but extreme threat to financial stability or payment systems safety, the <u>supervision, oversight and regulation should be designed to cope with one (or even two) systemically important institution(s) failing or near failing</u>.*

Systemic Importance

Expected (Average) Systemic Importance
[High Frequency, Low or Medium-Low Importance]

Unexpected (Extreme High) Systemic Importance
[Fat Right Tail: Low Frequency, High Importance]

Frequency

Systemic Importance
(e.g. size, connectedness, substitutability)

Systemic Severity

Expected (Average) Systemic Severity
[High Frequency, Low or Medium-Low Severity]

Unexpected (Extreme High) Systemic Severity
[Fat Right Tail: Low Frequency, High Severity]

Frequency

Systemic Severity
(e.g. number of affected institutions; value of delayed or unfulfilled payments; value of last resort lending operations)

(*) As recently suggested by BIS's Committee on Payment and Settlement Systems (2011)

Assessing systemic risk within the payments system

Banco de la República approach: NT + Simulation Techniques
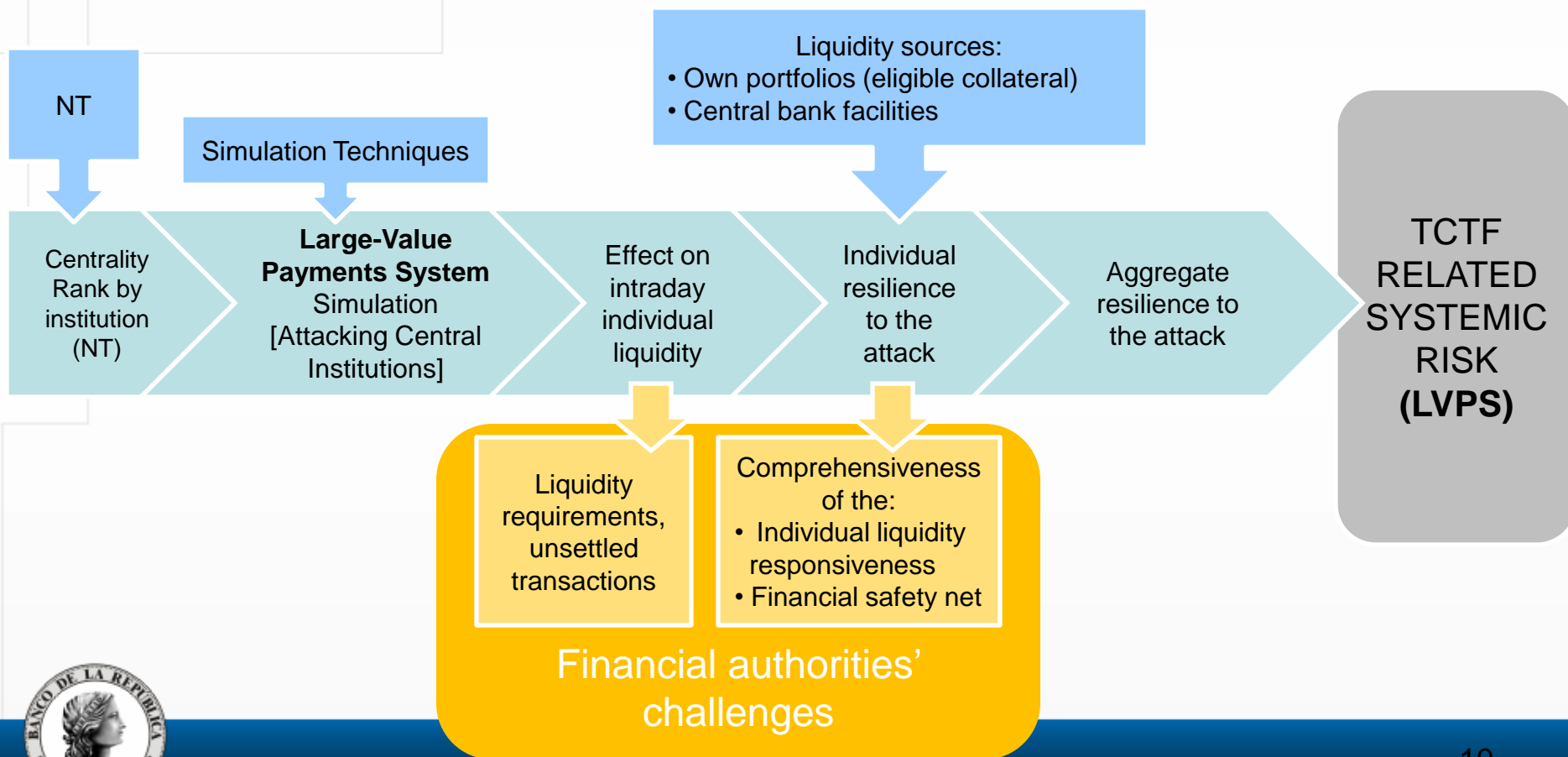
NT

Simulation Techniques

Liquidity sources:
• Own portfolios (eligible collateral)
• Central bank facilities

Centrality Rank by institution (NT)

Large-Value Payments System Simulation [Attacking Central Institutions]

Effect on intraday individual liquidity

Individual resilience to the attack

Aggregate resilience to the attack

TCTF RELATED SYSTEMIC RISK **(LVPS)**

Liquidity requirements, unsettled transactions

Comprehensiveness of the:
• Individual liquidity responsiveness
• Financial safety net

Financial authorities' challenges

Agenda

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• Simulation: procedure, results and analysis

• Concluding remarks

Simulation: procedure, results and analysis

Motivation

An evaluation of liquidity mechanisms of BR required to (World Bank, 2008):
➢ Identify systemically important entities in the LVPS.
➢ Quantify the systemic effect generated by entities such as Brokers (BF) and Trusts (MF) on the stability of the LVPS.
➢ Assess the flexibility of liquidity mechanisms of BR under stress scenarios.

Study Objective

Evaluate the stability of large-value PS of Colombia (CUD) and analyze the PS participants' capacity to absorb attacks to systemically important institutions (centrality).

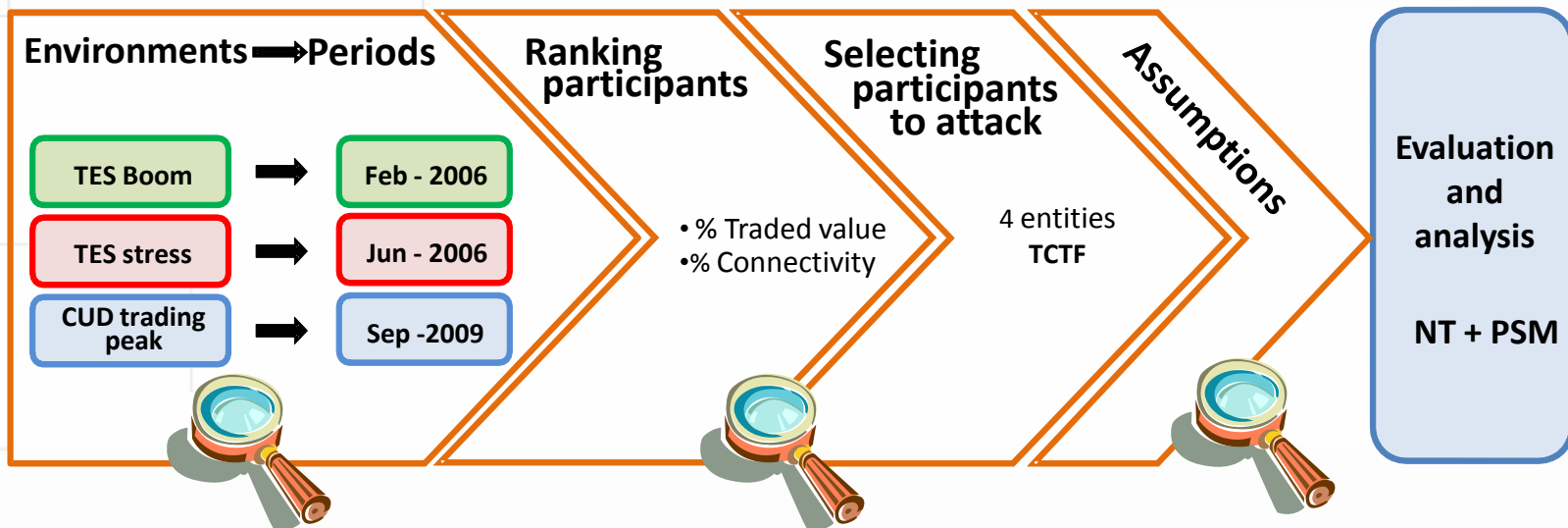# Simulation: procedure, results and analysis

Specific objectives

➢ Identify the LVPS systemically important participants under the too-connected-to-fail approach (TCTF) (Tarashev et al. 2009; Chan-Lau, 2010).

➢ Characterize and evaluate the performance of LVPS through network topology (NT) and simulation models.

➢ Identify the entities directly and indirectly affected by an attack, and quantify the magnitude of contagion.

➢ Ability to absorb attacks by::
        ➢ Liquidating or collateralizing their own portfolio
        ➢ Access to Central Bank liquidity (OMO and LLR)

Simulation: procedure, results and analysis

Methodological approach to systemic risk and the stability of LVSP

Environments → Periods

TES Boom → Feb - 2006

TES stress → Jun - 2006

CUD trading peak → Sep -2009

Ranking participants

• % Traded value
• % Connectivity

Selecting participants to attack

4 entities
TCTF

Assumptions

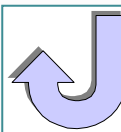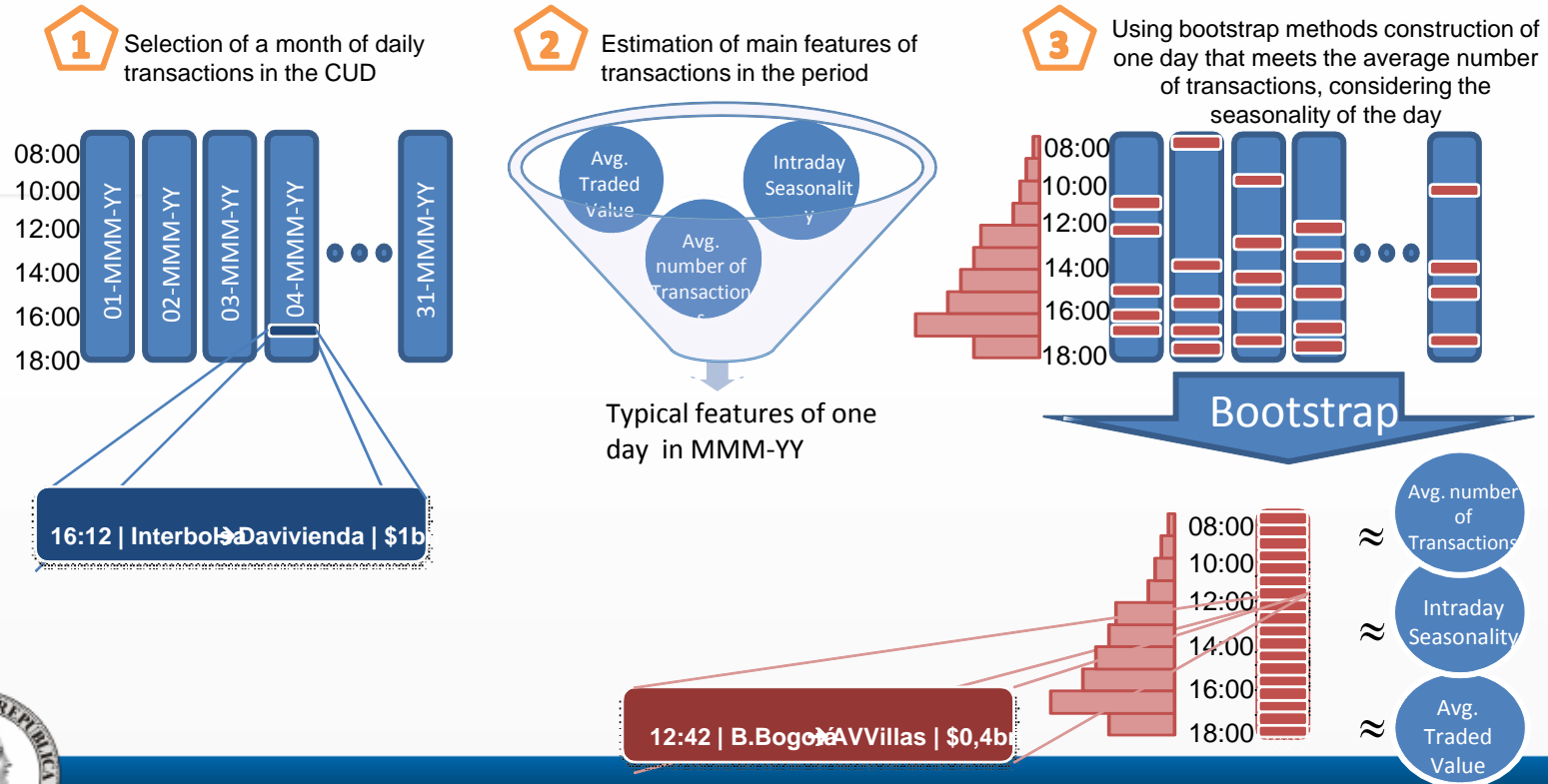**Evaluation and analysis**

NT + PSM

Simulation: procedure, results and analysis

The periods and the institutions were defined in order to assess the systemic risk and potential threat to the stability of the LVPS and the financial markets.
Selection criteria for analysis periods: liquidity and TES market activity (to capture different volatility and liquidity scenarios for the Colombian financial market)

## Estimation of a typical day of transactions in LVPS - CUD

1 Selection of a month of daily transactions in the CUD

2 Estimation of main features of transactions in the period

3 Using bootstrap methods construction of one day that meets the average number of transactions, considering the seasonality of the day

Avg. Traded Value

Intraday Seasonality

Avg. number of Transactions

Typical features of one day in MMM-YY

Bootstrap

16:12 | Interbolsa→Davivienda | $1b

12:42 | B.Bogotá→AVVillas | $0,4b

≈ Avg. number of Transactions

≈ Intraday Seasonality

≈ Avg. Traded Value

Simulation: procedure, results and analysis

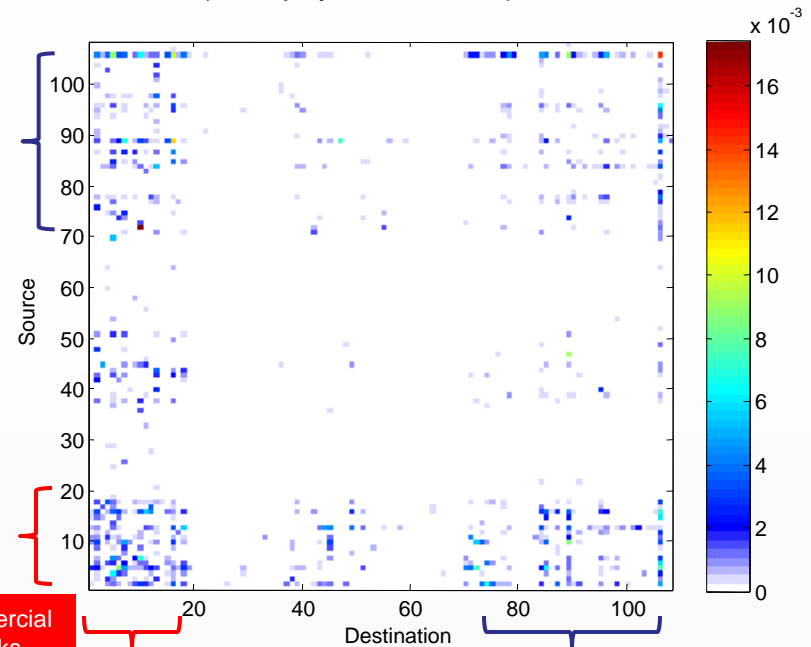## Network Topology (NT)

Some relevant results

JUN2006

Graph
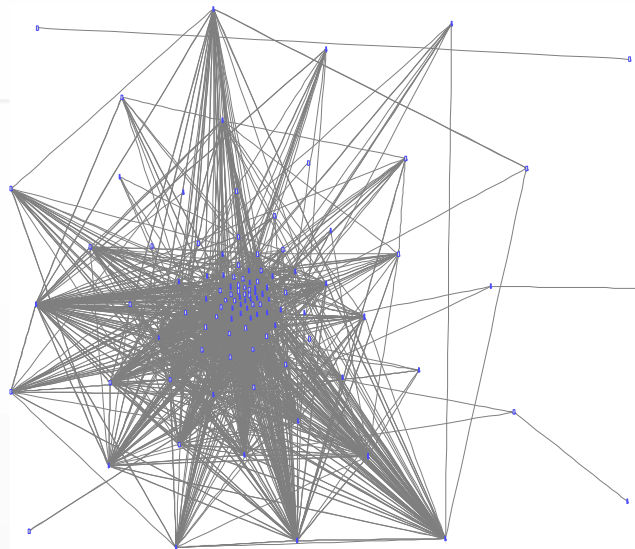
Adjacency matrix
(% of payments value)

Commercial Banks

Brokerage Firms

Simulation: procedure, results and analysis

An overall index was constructed for each period as primary approximation to the notion of systemic risk combining two measures about each institution
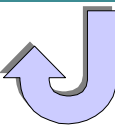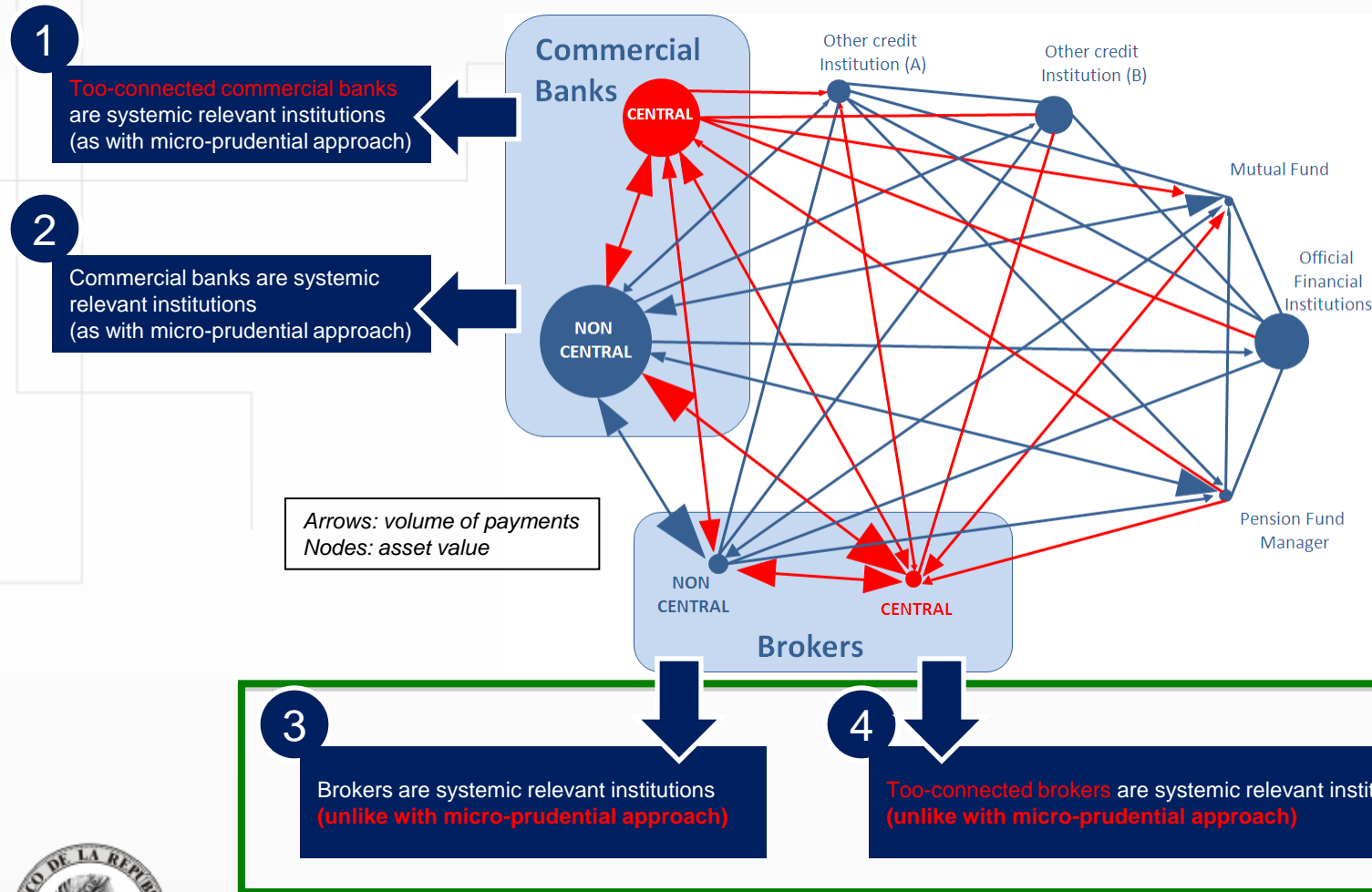(i)   share of total traded value and
(ii)   share of total number of connections *measures of centrality* } TCTF

Ten foremost relevant institutions: TCTF and TBTF
3-period average
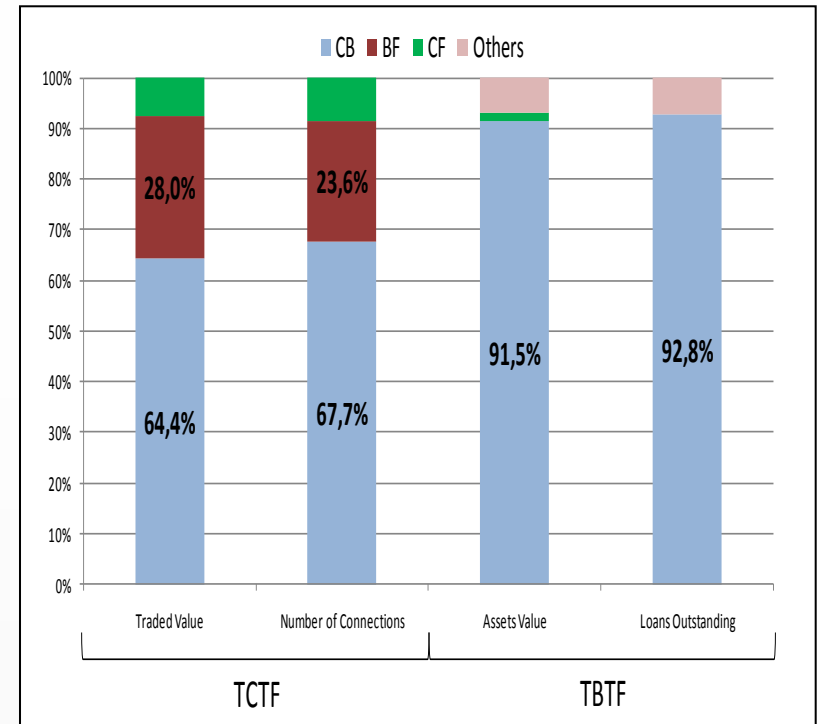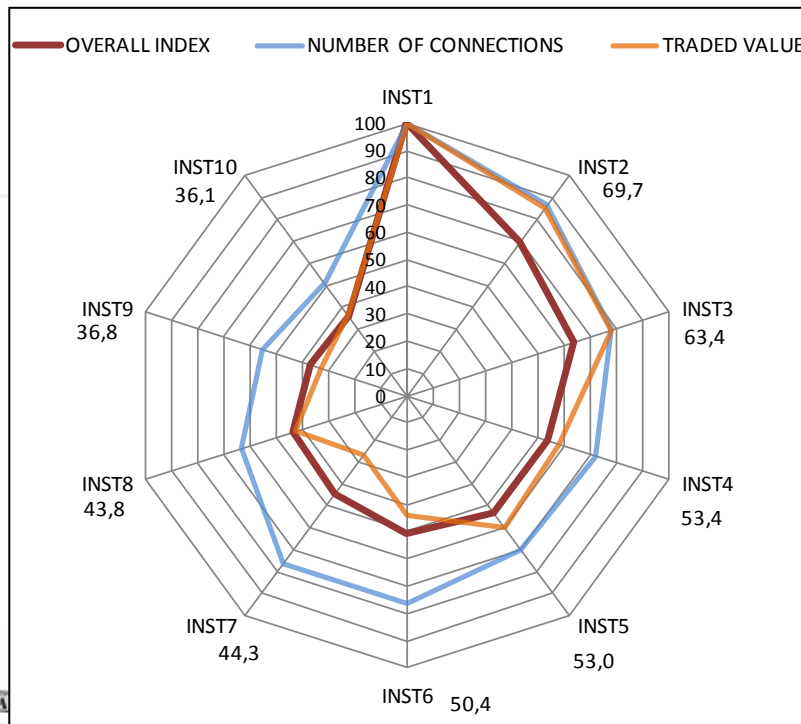
Simulation: procedure, results and analysis

Network topology allowed for **identifying central participants**

1 Too-connected commercial banks are systemic relevant institutions (as with micro-prudential approach)

2 Commercial banks are systemic relevant institutions (as with micro-prudential approach)

Commercial Banks

CENTRAL

NON CENTRAL

Other credit Institution (A)

Other credit Institution (B)

Mutual Fund

Official Financial Institutions

Pension Fund Manager

Arrows: volume of payments
Nodes: asset value

NON CENTRAL

CENTRAL

Brokers

3 Brokers are systemic relevant institutions **(unlike with micro-prudential approach)**

4 Too-connected brokers are systemic relevant institutions **(unlike with micro-prudential approach)**
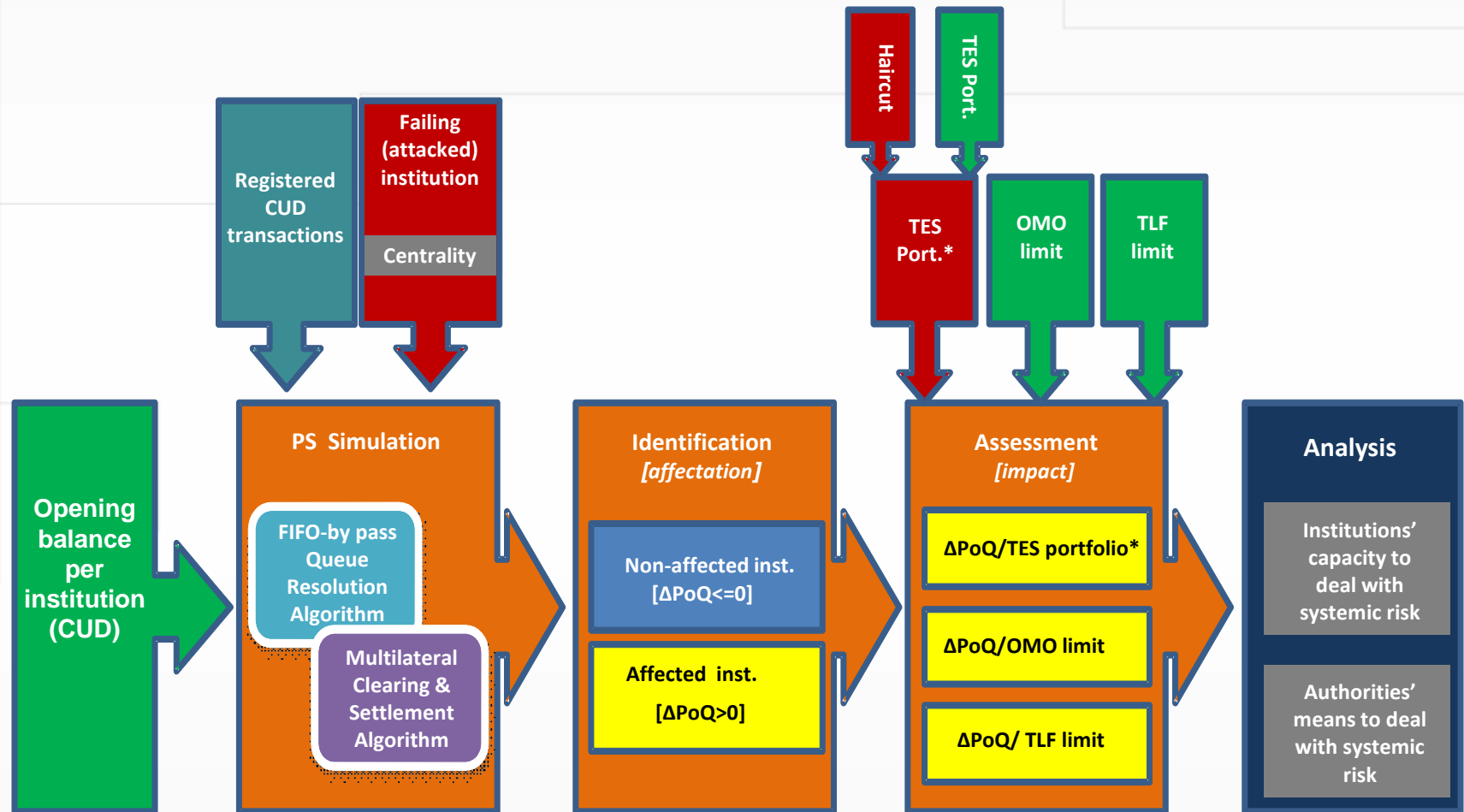
New Info!

Simulation: procedure, results and analysis

Large-value Payments System CUD simulation model *

* The algorithm is developed in Matlab

Simulation: procedure, results and analysis

Main Colombian market's financial institutions directly participating in CUD (2009)		
Class	**Institution type**	**Main purpose**
Credit Institutions (CI)	Commercial Bank (CB)	Provision of deposit and loans, including mortgages. [18]
	Commercial Financial Corporation (CFC)	Provision of deposit and loans focused on goods and services commercialization (e.g. leasing). [26]
	Financial Corporation (CF)	Provision of deposit and loans focused on medium term industrial financing; akin to an investment bank. [3]
Non-Credit Institutitons (NCI)	Mutual Fund (MF)	Provision of investment vehicles with the purpose of investing in securities and other assets according to the risk profile of the investor. [26]
	Brokerage Firm (BF)	Provision of brokerage services with the purpose of buying and selling securities (e.g. stocks, bonds, currencies); allowed to trade for its own account. [32]
	Pension Fund Manager (PFM)	Provision of investment vehicles with the purpose of investing for retirement. [6]
	Special Official Institution (SOI)	Official (government owned) financial institutions with special objectives; due to its main features, they were excluded from the analysis. [10]

Source: authors' design.

Simulation: procedure, results and analysis

Banco de la República liquidity facilities

	Objective	Scope	Limit	Eligible Collateral	Term
Macro Liquidity [OMO]	Implementing monetary policy	OMO agents (not limited by type of institution)	Linked to reservable liabilities or capital.	Sovereign securities (Central government debt)	1 day
Payments System Liquidity — Intraday Repo	Payments system's efficiency and safety	OMO agents (not limited by type of institution)	Linked to reservable liabilities or capital.	Sovereign securities (Central government debt)	< 1 day
Payments System Liquidity — Overnight Repo	Payments system's efficiency and safety	OMO agents (not limited by type of institution)	Linked to reservable liabilities or capital.	Sovereign securities (Central government debt)	1 day
Lender of Last Resort [Transitory Liquidity Facility]	Tackling liquidity problems	Credit Institutions Only (Banking)	15% of liabilities with the public	Sovereign securities + financial investment + credit loans	30-180 days

Are the liquidity facilities'…
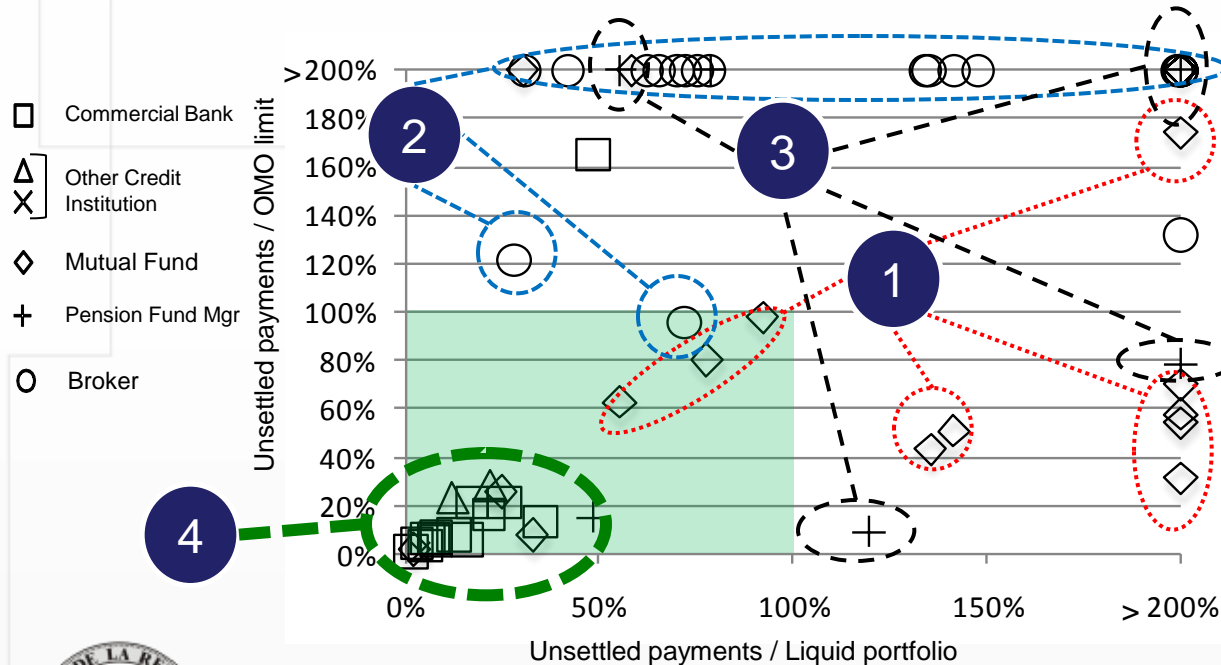
• Scope
• Limits
• Eligible collateral

adequate to cope with systemic shocks?

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Simulation: procedure, results and analysis

Simulation techniques allowed for **assessing the outcomes of attacks on (i.e. failure of selected) central institutions**

Attack on foremost central institution

Legend:
- □ Commercial Bank
- △ / X Other Credit Institution
- ◇ Mutual Fund
- + Pension Fund Mgr
- ○ Broker

Y-axis: Unsettled payments / OMO limit (0%, 20%, 40%, 60%, 80%, 100%, 120%, 140%, 160%, 180%, >200%)

X-axis: Unsettled payments / Liquid portfolio (0%, 50%, 100%, 150%, > 200%)

1 On average, Mutual Funds have no liquid portfolio to withstand an attack to a systemic relevant institution

2 On average, Brokers have insufficient access to OMO liquidity to withstand an attack to a systemic relevant institution

3 Some pension fund managers have insufficient access to OMO liquidity and portfolio liquidity to withstand an attack to a systemic relevant institution

4 Banking and credit institutions have enough access to liquidity via OMO and liquid portfolios (+ LLR) to withstand an attack to a systemic relevant institution

New Info!

Simulation: procedure, results and analysis

Banco de la República liquidity facilities

	Objective	Scope	Limit	Eligible Collateral	Term
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Lender of Last Resort *[Transitory Liquidity Facility]*	Tackling liquidity problems	Credit Institutions Only (Banking)	15% of liabilities with the public	Sovereign securities + financial investment + credit loans	30-180 days

Challenges

It is important to revise…

• OMO limits for Brokers

• Sufficiency of own eligible portfolio of Brokers and Mutual Funds.

• Access to additional liquidity facilities by Brokers → TCTF

… in order to be able to supply liquidity to preserve the payments system's integrity.

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Concluding remarks

• Recent (subprime crisis) and non-recent (1987 crash, LTCM) episodes of turmoil provide evidence of the deficiency emerging from traditional micro-prudential approaches; a macro-prudential approach to systemic risk (oversight) is necessary.

• To be able to oversee financial systems as a whole it is necessary to acquire a comprehensive vision of the payments system, where connections between participants are as important as the participants themselves.

• Banco de la República, pursuant of its oversight and financial stability duties, established in 2010 the Financial Infrastructure Oversight Department…

Concluding remarks

• First results (Machado et al., 2010 & León et al., 2011) are the mainstay of current regulatory challenges and tasks:

• Limits on ordinary liquidity facilities for non-banking institutions and prudential requirements on own eligible portfolio for Brokers and Mutual Funds

• Non-ordinary liquidity facilities for too-connected non-banking institutions (i.e. Brokers)

• Results will provide valuable information for financial stability purposes:

• Assessing liquidity management by non-banking institutions

• Supporting the Financial Authorities macro-prudential regulatory and supervisory tasks.

• Promoting a convenient cooperation between the supervision (by the Financial Superintendence) and the oversight (by the central bank)

Concluding remarks

• Some challenges:

  • User-friendly algorithm for supporting regular oversight duties, including reaction functions to systemic attacks.

  •Simulating transactions taking place in other infrastructures of the payments system (FX settlement, public debt settlement, etc.); not only in the large-value payments system.

  • Analyzing the convenience of direct participation (Colombia) against non-direct participation (U.K.).

  •Ongoing work: a systemic importance index based on 3 criteria: size, connectivity and substitutability (forthcoming Q4-2011)

¡ *Paljon kiitoksia !*

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