

A Theory of Payments-Chain Crises

by Saki Bigio

Discussed by Mathieu Taschereau-Dumouchel

April 21, 2023

A very brief overview of the model

- There are N agents
 - Each agent wants to buy something from someone else
 - Each agent can produce something from someone else

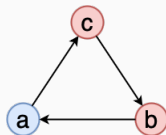
A very brief overview of the model

- There are N agents
 - Each agent wants to buy something from someone else
 - Each agent can produce something from someone else
- Time is continuous on the unit interval $t \in [0, 1]$
 - If production starts at $t = \tau$ the amount produced is the time left: $1 - \tau$

A very brief overview of the model

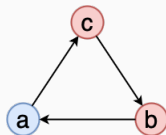
- There are N agents
 - Each agent wants to buy something from someone else
 - Each agent can produce something from someone else
- Time is continuous on the unit interval $t \in [0, 1]$
 - If production starts at $t = \tau$ the amount produced is the time left: $1 - \tau$
- How do agents pay for their order?
 - Some have **cash** and can pay for their order to start right away (fraction $1 - \mu$)
 - Others need to **wait until they are payed** for their own order to start (fraction μ)
 - In all cases payments happens after $1 - \delta$ of production is completed

Example



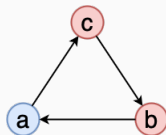
- $t = 0$: firm a orders from b (production = 1 unit)
 - At $t = 1 - \delta$ the payment from a is released to b

Example



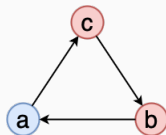
- $t = 0$: firm a orders from b (production = 1 unit)
 - At $t = 1 - \delta$ the payment from a is released to b
- $t = 1 - \delta$: firm b orders from c (production = δ units)
 - At $t = 1 - \delta + \delta(1 - \delta)$ the payment from b is released to c

Example



- $t = 0$: firm a orders from b (production = 1 unit)
 - At $t = 1 - \delta$ the payment from a is released to b
- $t = 1 - \delta$: firm b orders from c (production = δ units)
 - At $t = 1 - \delta + \delta(1 - \delta)$ the payment from b is released to c
- $t = 1 - \delta + \delta(1 - \delta)$: firm c orders from a (production = $\delta - \delta(1 - \delta)$ units)
 - At $t = \dots$ the payment from c to a is released

Example



- $t = 0$: firm a orders from b (production = 1 unit)
 - At $t = 1 - \delta$ the payment from a is released to b
- $t = 1 - \delta$: firm b orders from c (production = δ units)
 - At $t = 1 - \delta + \delta(1 - \delta)$ the payment from b is released to c
- $t = 1 - \delta + \delta(1 - \delta)$: firm c orders from a (production = $\delta - \delta(1 - \delta)$ units)
 - At $t = \dots$ the payment from c to a is released
- Longer delays in getting funds (lower δ) lead to lower production
- More chained orders (higher μ) leads to lower production

- **Assumption:** each order requires one worker regardless of how much it produces

- **Assumption:** each order requires one worker regardless of how much it produces
- Average output per worker in the limit (continuum of firms)

$$\mathcal{A}(\mu, \delta) = \frac{1-\mu}{\mu} \frac{\delta}{1-\delta} \log \left(\frac{1-\delta\mu}{1-\mu} \right) < 1$$

- **Assumption:** each order requires one worker regardless of how much it produces
- Average output per worker in the limit (continuum of firms)

$$\mathcal{A}(\mu, \delta) = \frac{1-\mu}{\mu} \frac{\delta}{1-\delta} \log \left(\frac{1-\delta\mu}{1-\mu} \right) < 1$$

- Chained orders and payment delays **reduce TFP**

- Two types of long-lived agents: natural **borrower** (no wealth but some labor) and natural **saver** (some wealth but no labor)
 - The savers can pay cash for their orders
 - The borrowers might need to use chained orders depending on their debt level

- Two types of long-lived agents: natural **borrower** (no wealth but some labor) and natural **saver** (some wealth but no labor)
 - The savers can pay cash for their orders
 - The borrowers might need to use chained orders depending on their debt level
- Main mechanism
 - **More debt** \rightarrow **more chained orders** \rightarrow **lower TFP** \rightarrow **more debt**
 - This can generate permanent recessions

Some general thoughts

- Great idea!
 - First macro paper to look at disruptions of payments between firms
 - Might be a big deal for the macroeconomy
 - Paper is a first step to understand these mechanisms in a tractable way

Some general thoughts

- Great idea!
 - First macro paper to look at disruptions of payments between firms
 - Might be a big deal for the macroeconomy
 - Paper is a first step to understand these mechanisms in a tractable way
- Suggestions for future work on this topic

- Richer network structure
 - What happens when links are not random or when firms have multiple customers/suppliers?
 - Interesting propagation that depends on the shape of the network
 - Centrally important firms?

► Graph

- Richer **network structure**
 - What happens when links are not random or when firms have multiple customers/suppliers?
 - Interesting propagation that depends on the shape of the network
 - Centrally important firms?
- Drop in TFP vs **extra sensitivity to shocks**
 - In the model chained payments lower the level of TFP
 - Alternative: chained payments make the economy *fragile*
 - Firms are okay planning with chained orders during good times
 - Shocks can disrupt the system and lead to bigger losses

► Graph

- **Micro evidence** that firms that use chained orders are at a “disadvantage”
 - TFP loss in the paper, but might be something else in reality
 - Are they more sensitive to shocks?

- **Micro evidence** that firms that use chained orders are at a “disadvantage”
 - TFP loss in the paper, but might be something else in reality
 - Are they more sensitive to shocks?
- **Macro evidence** that payment crisis matter
 - Cyclicity of chained payments, strong correlation with GDP?
 - Look at countries/sectors that rely more on chained orders

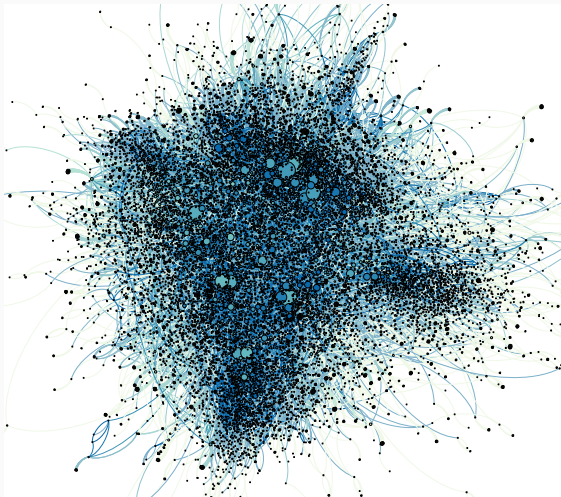
► Graph

- **Micro evidence** that firms that use chained orders are at a “disadvantage”
 - TFP loss in the paper, but might be something else in reality
 - Are they more sensitive to shocks?
- **Macro evidence** that payment crisis matter
 - Cyclicalities of chained payments, strong correlation with GDP?
 - Look at countries/sectors that rely more on chained orders
- Focus on the **structure of the network**
 - Are chained-order firms centrally located in the production network?

► Graph

- Very interesting paper!

- Very interesting paper!
- Opens the door to lots of future work on the topic



Industries That Wait The Longest To Be Paid

Industry	Accounts Receivable
	Days
Management of Companies and Enterprises	125.1
Oil and Gas Extraction	110.9
Technical and Trade Schools	109.3
Automotive Equipment Rental and Leasing	104.4
Outpatient Care Centers	99.0
Support Activities for Mining	90.8
Architectural, Engineering, and Related Services	74.4
Scientific Research and Development Services	70.8
Foundation, Structure, and Building Exterior Contractors	67.5
Other Heavy and Civil Engineering Construction	66.5

Financial statement analysis based on 12 months ended 8/31/15

sageworks®