The Role of Firms for Financial Contagion

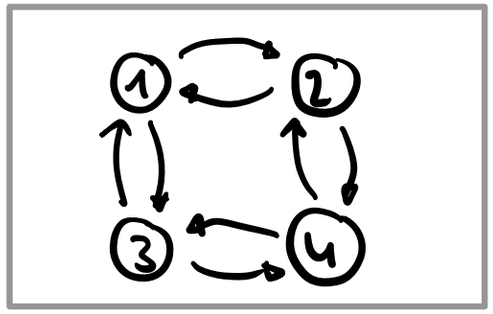
by Fabian Greimel

Macro-Lunch · 1 February 2023

Background : Financial Contagion

- network of banks

  linked if they lend to each other



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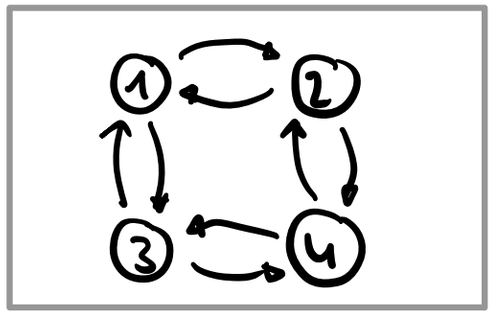
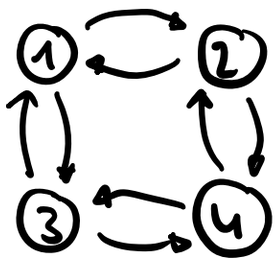


- desirable network structure

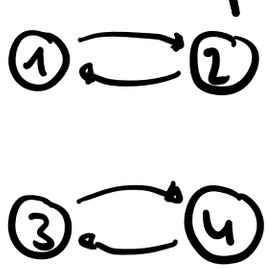
small shocks

complete network



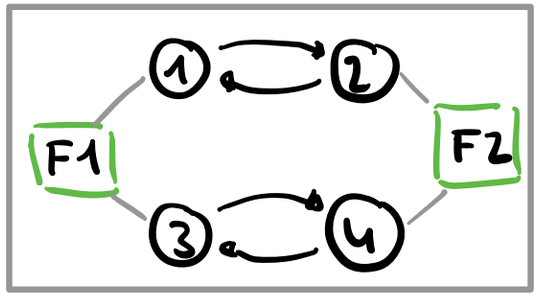
big shocks

network with weakly connected components



- complete financial networks are robust - yet fragile

What, Why & How



Research questions

- Under which conditions do financial shocks spread via firms?
- Should financial regulators take into account common lenders?

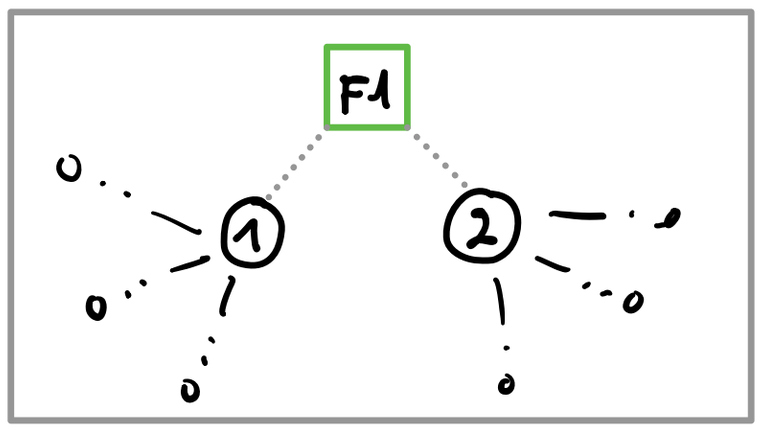
Motivation

- syndicated loans in the US:
  groups of big banks lend to big corporations
- linked banks have similar real exposure (Elliott, Georg & Hazell, 2020)

Method

- analyse extension of model by Acemoglu, Ozdaglar & Tahbaz-Salehi (2015)
- innovations 1.) firms have multiple lenders
  2.) firms need short-term funding

Mechanism



1) firm F1 needs to pay workers in advance — uses short-term loans

2) if bank ① gets into trouble it will not roll over its loan

3) firm F1 replaces external funding by internal funding (retains profits)

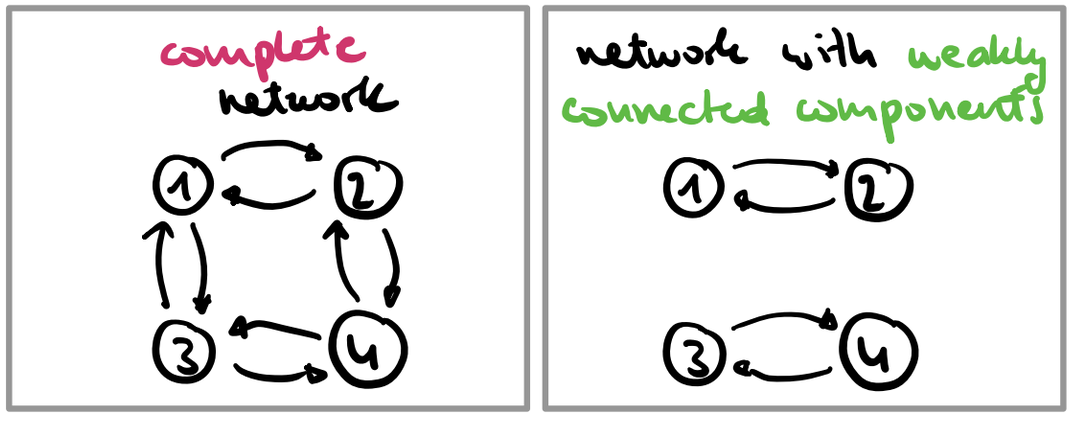
⇒ lowers dividend payments to banks ① & ②

4) bank ② might get into trouble

Related Literature I

- Acemoglu, Ordaglar & Tahbaz-Salehi (2015, AER)

with big enough shocks,
weakly connected components are
better than complete network



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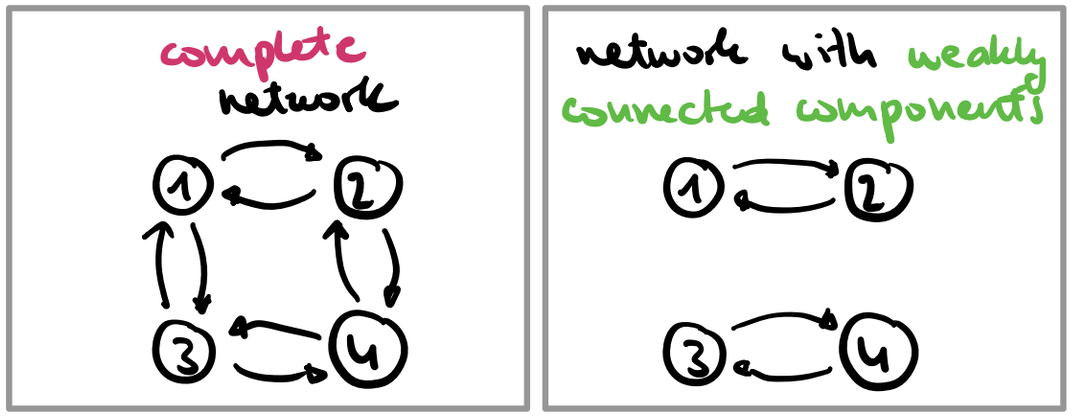
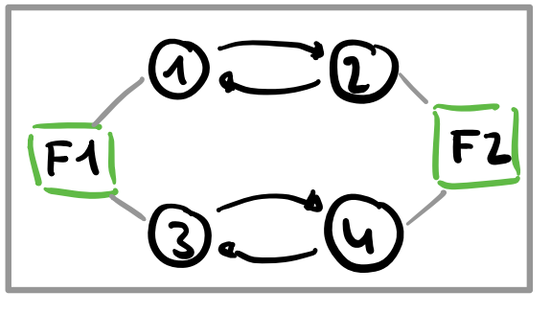


This paper : But what if ...



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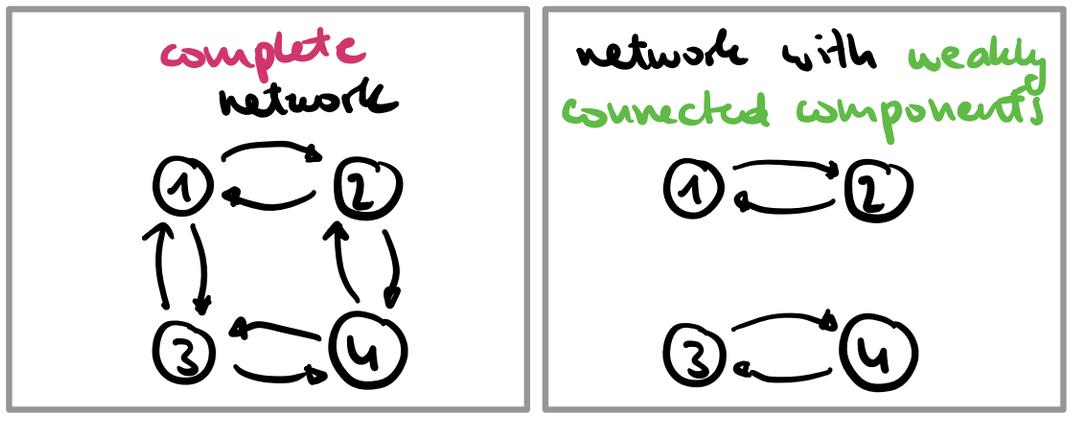
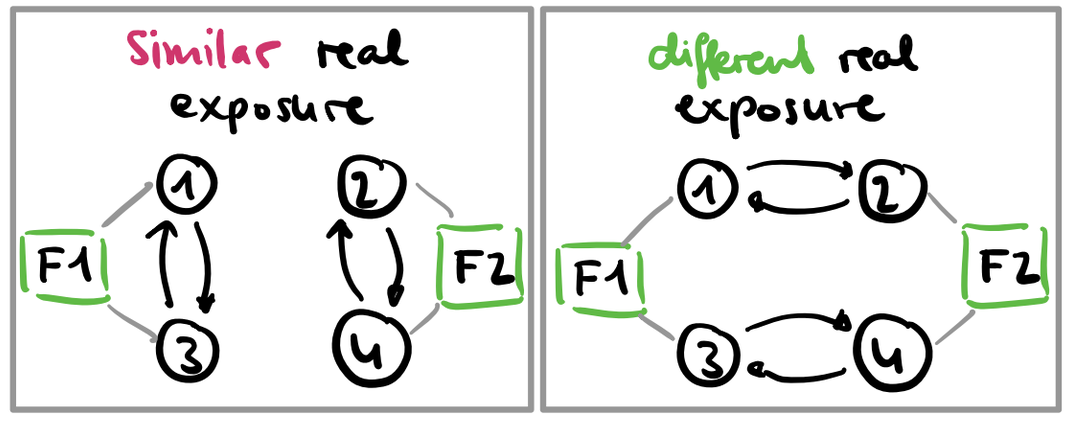


- Elliott, Georg & Hazell (2020, JET)

banks <u>should</u> connect to banks with different real exposure



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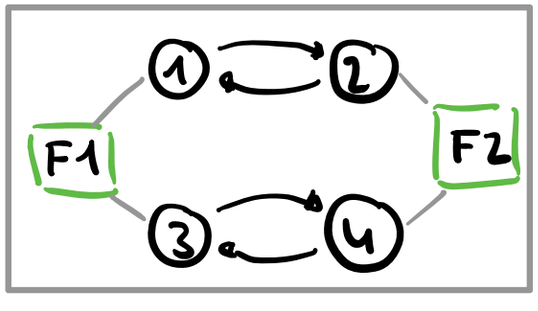

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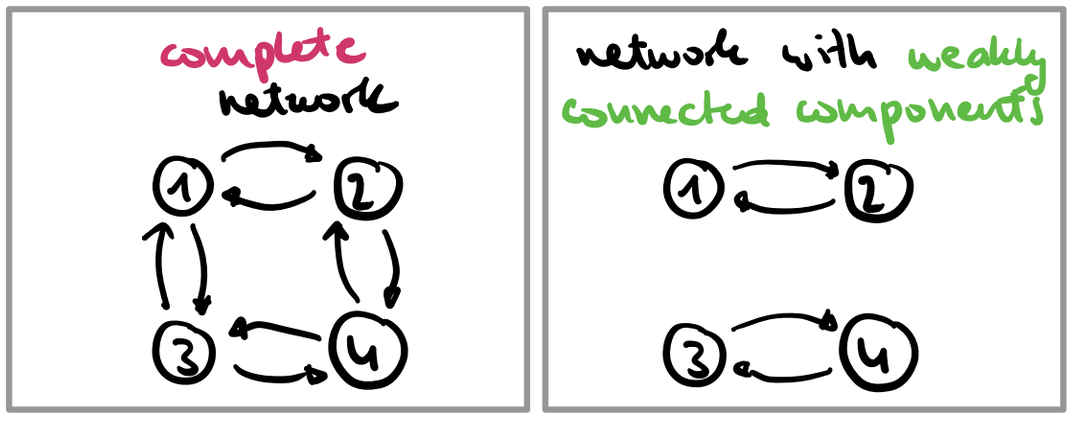

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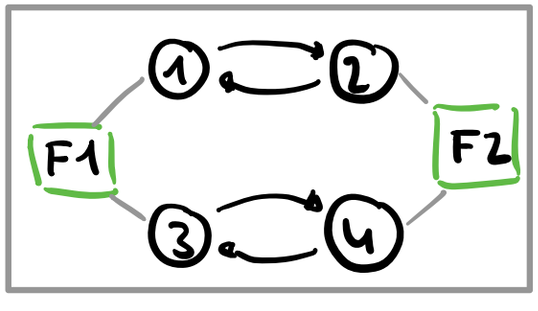

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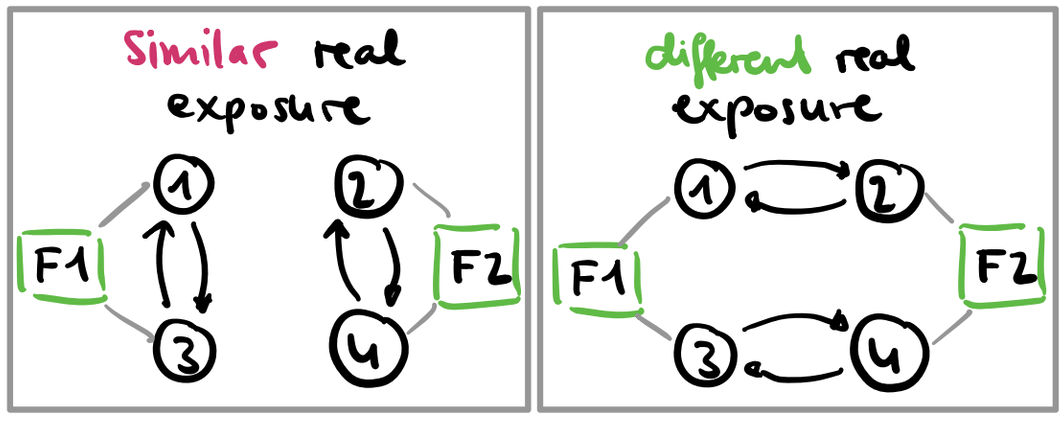


This paper:

provide mechanism
with opposite prescription

Related literature II

- **shock propagation on financial networks**

  Allen & Gale (2000), Eisenberg & Noe (2001)

  Elliott, Golub & Jackson (2014), Gabrieli Gottardi & Vega-Redondo (2017)

  ⇝ add non-trivial bank-firm network

- **Real effects of financial shocks (empirical)**

  Chodorow-Reich (2014), Cingano, Manaresi & Sette (2016), Huber (2018)

  Chodorow-Reich & Falato (2022), Galaasen, Jamilov, Juelsrud & Rey (2022)

  ⇝ model how financial shocks propagate to real economy

- **Measuring and decomposing systemic risk**

  Adrian & Brunnermeier (2016), Dimitrov & van Wijnbergen (2022)

  ⇝ acknowledge empirical evidence that real exposure is important source of systemic risk

- **Macroeconomics with financial frictions**

  Bernanke, Gertler & Gilchrist (1999), Kiyotaki & Moore (1998, 2019), Brunnermeier & Sannikov (2014)

  ⇝ network view on the financial accelerator

Related literature III

- **Socially optimal financial networks**

  Acemoglu et al (2015), Elliott et al (2020)

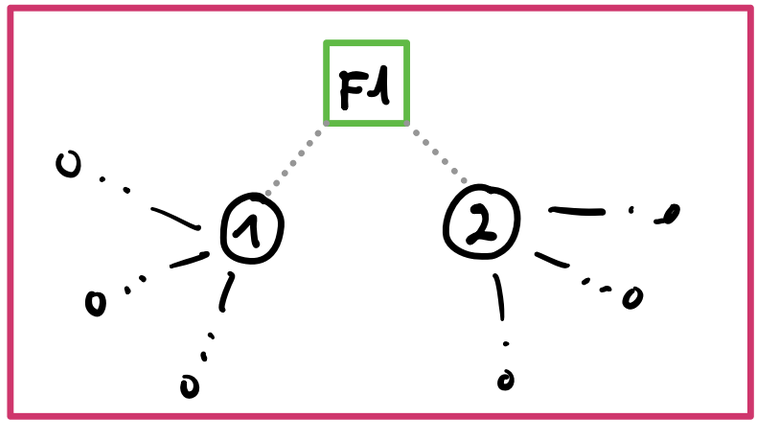
  ⇝ see extra slide

- **Fire sales**

  Shleifer & Vishny (1992, 2011), Caballero & Simsek (2013)

  ⇝ common lending is a different kind of real exposure

Model : Overview



- extend Acemoglu et al (2015)
  - short-term debt
  - non-trivial bank-firm network

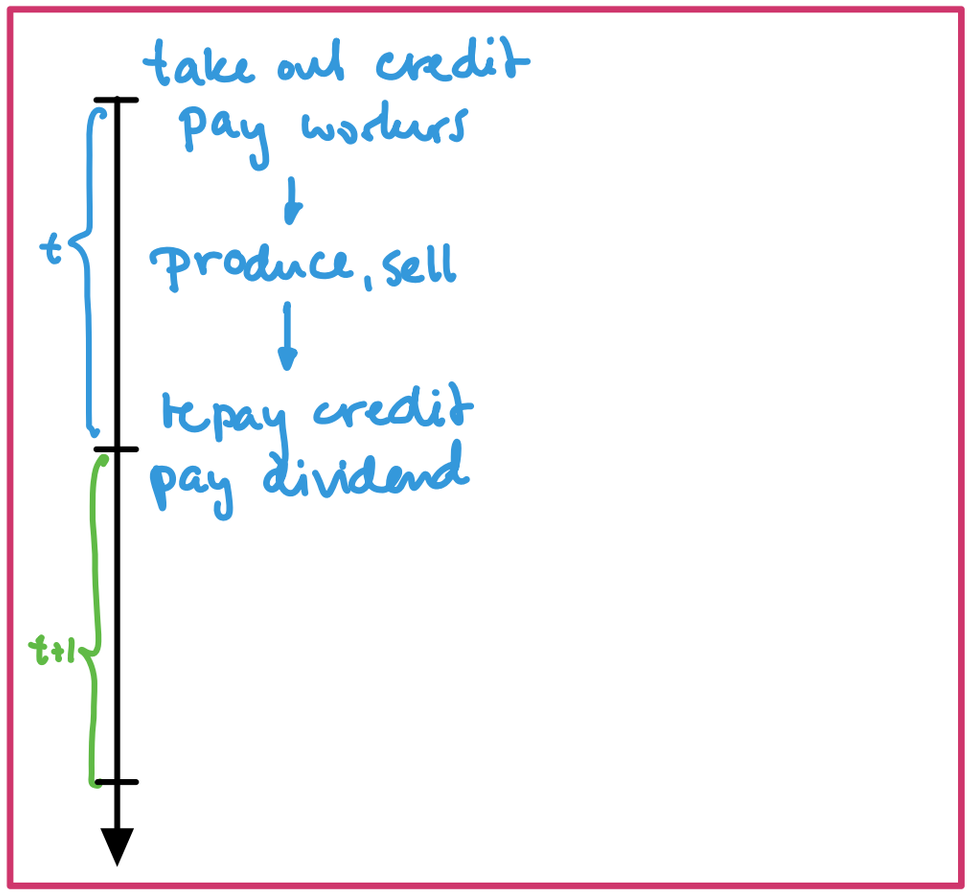
- three periods

- 2N banks (i)
  - exogenous interbank lending
  - own half a firm
  - provide short-term funding to same firm

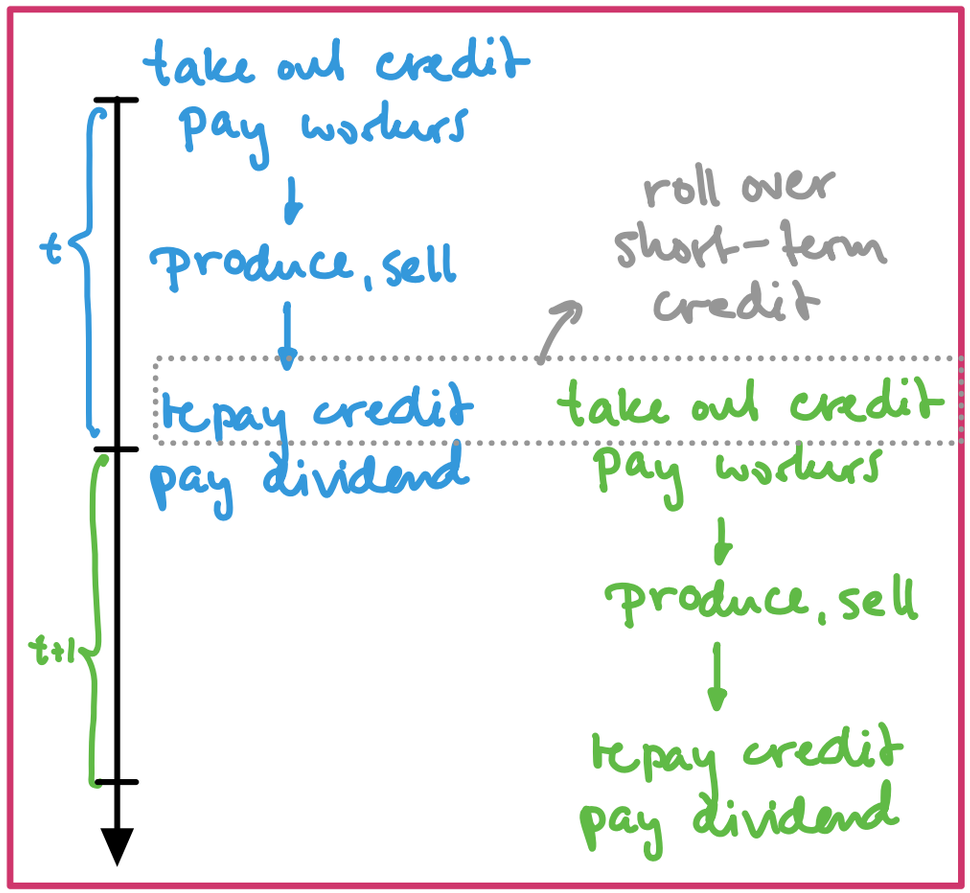
- N firms Fi
  - owned by two banks (long-term)
  - borrow from same two banks (short-term)

- analyse payment equilibrium in present

How the firm operates 1



How the firm operates I



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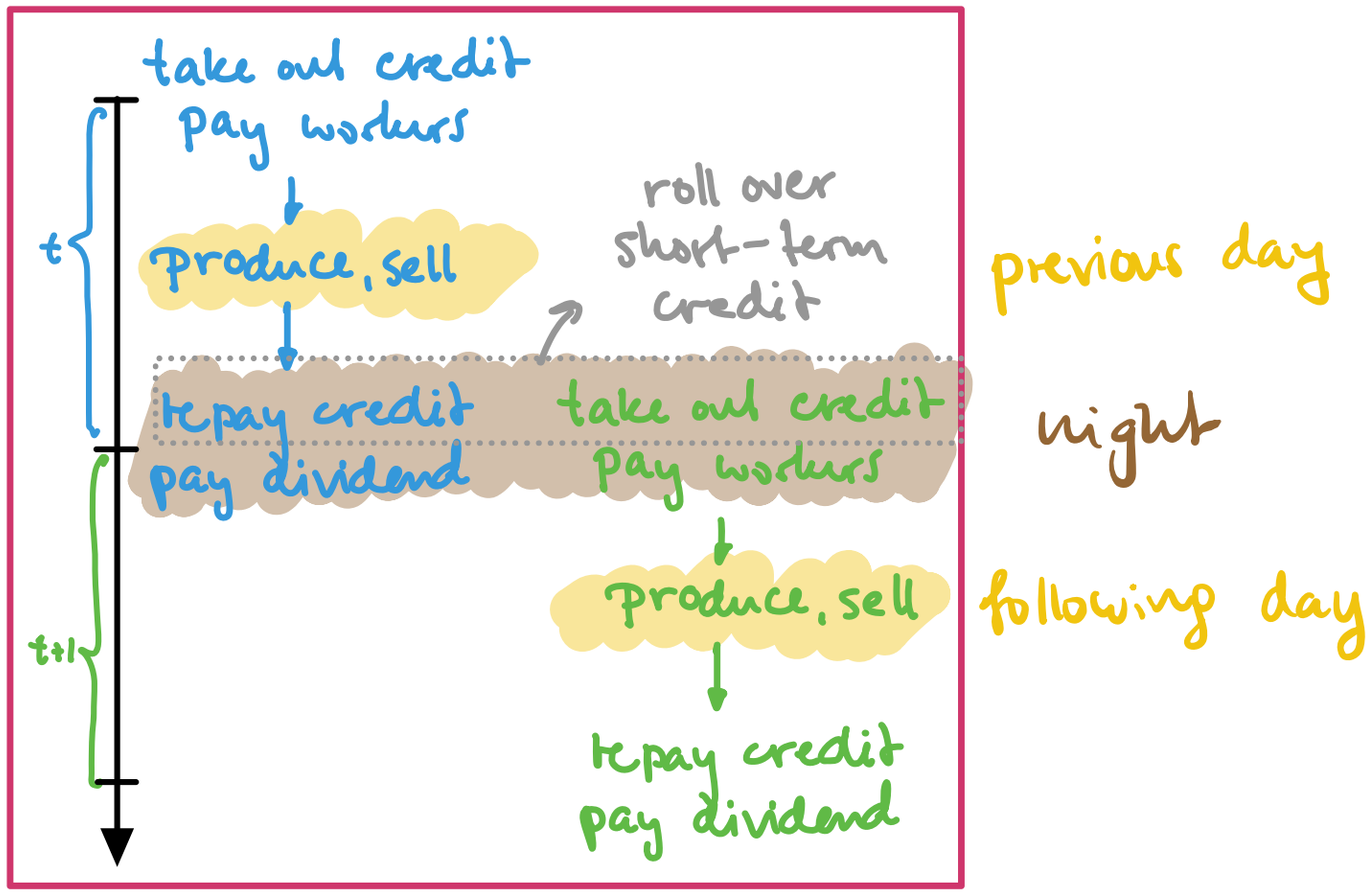

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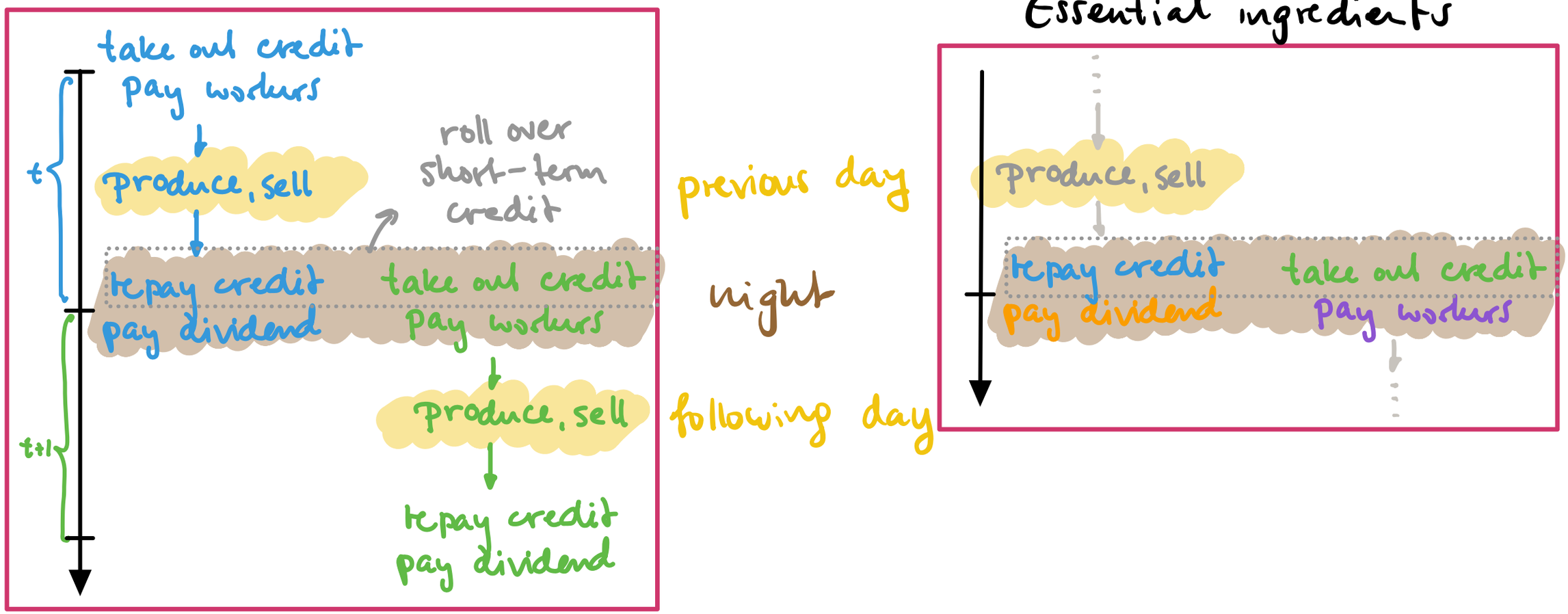
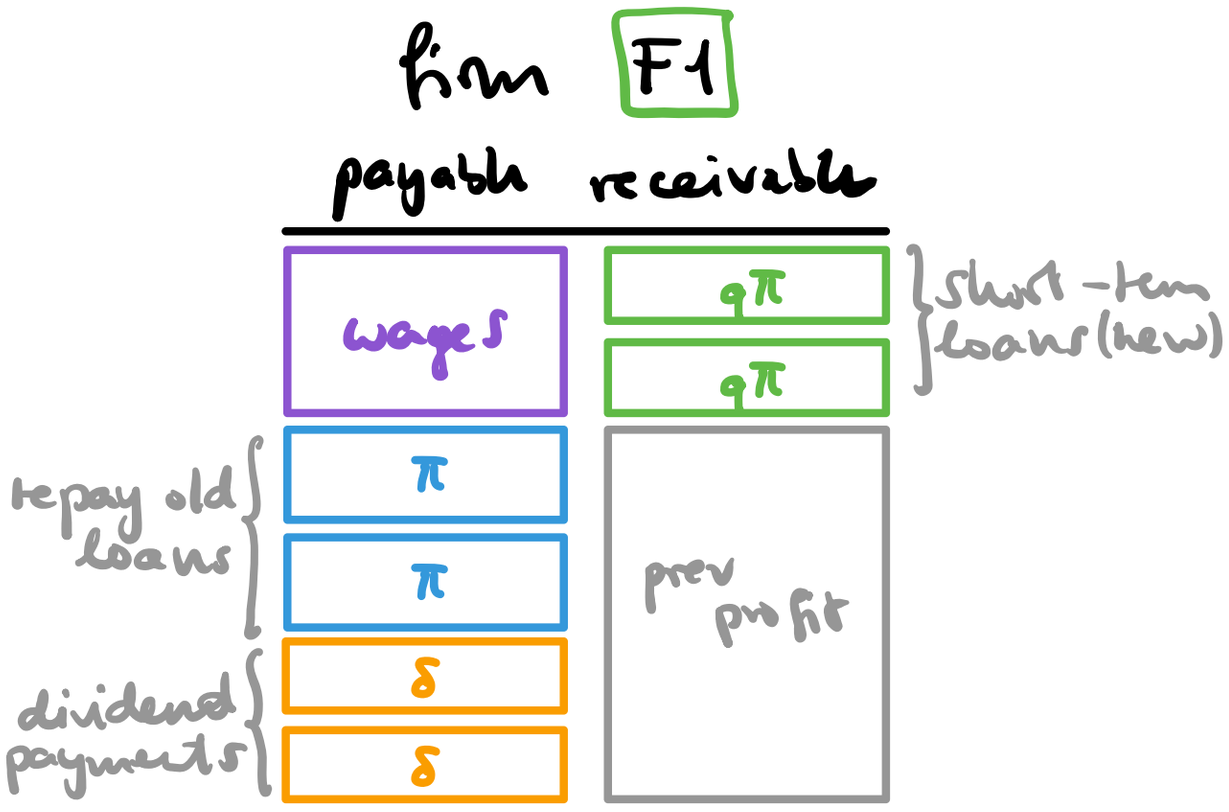
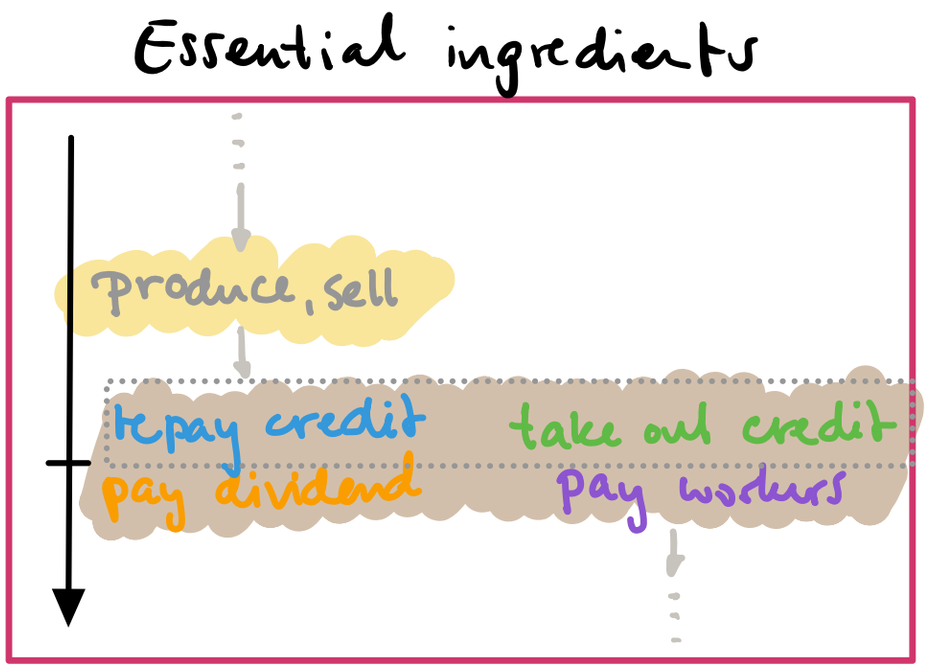
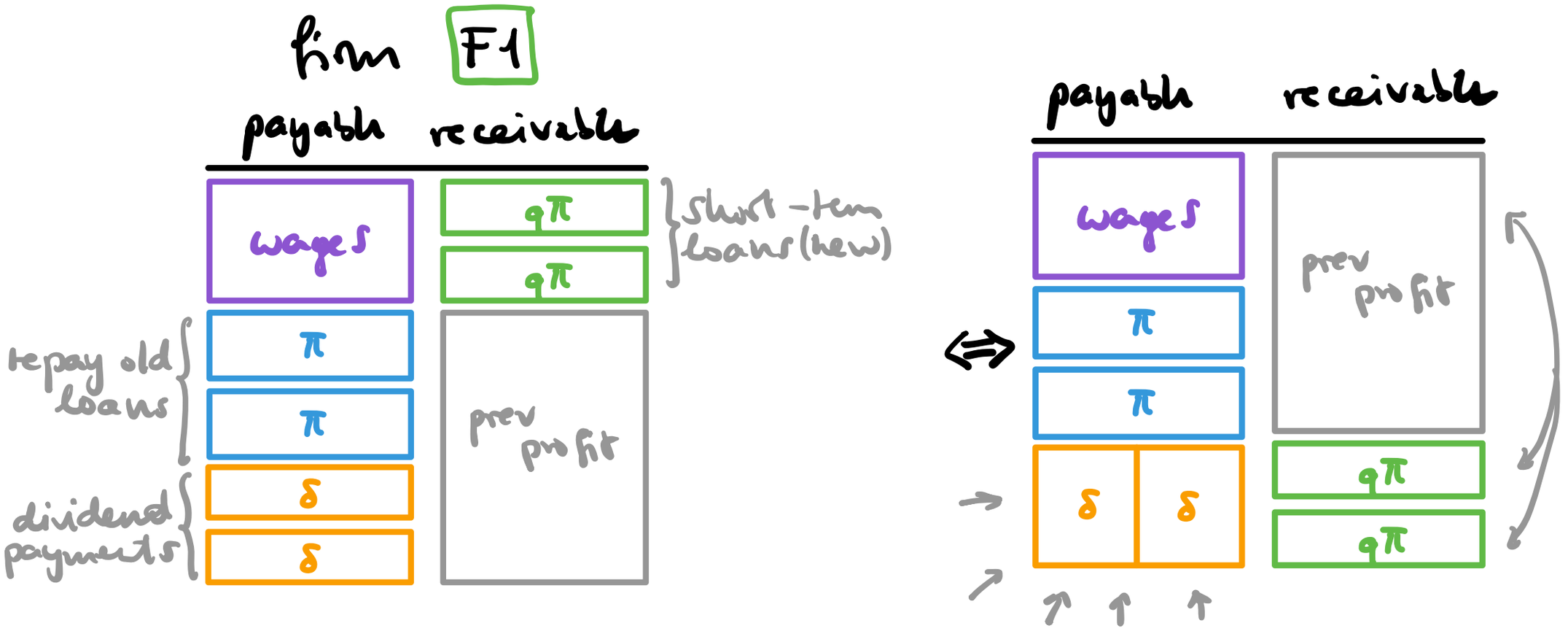


How the firm operates II





How the firm operates III



What if short-term debt is not rolled-over ?

- bank doesn't roll over

  short-term debt

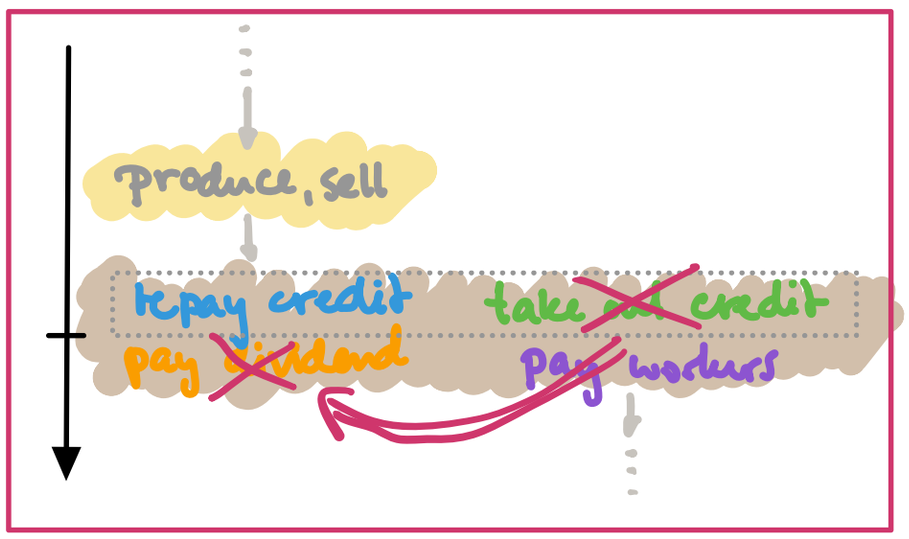
  $\Leftrightarrow$ firm ~~take credit~~

- bank needs to pay their workers

  somehow

  $\Rightarrow$ use internal sources of funds

  $\Rightarrow$ ~~pay dividend~~ *



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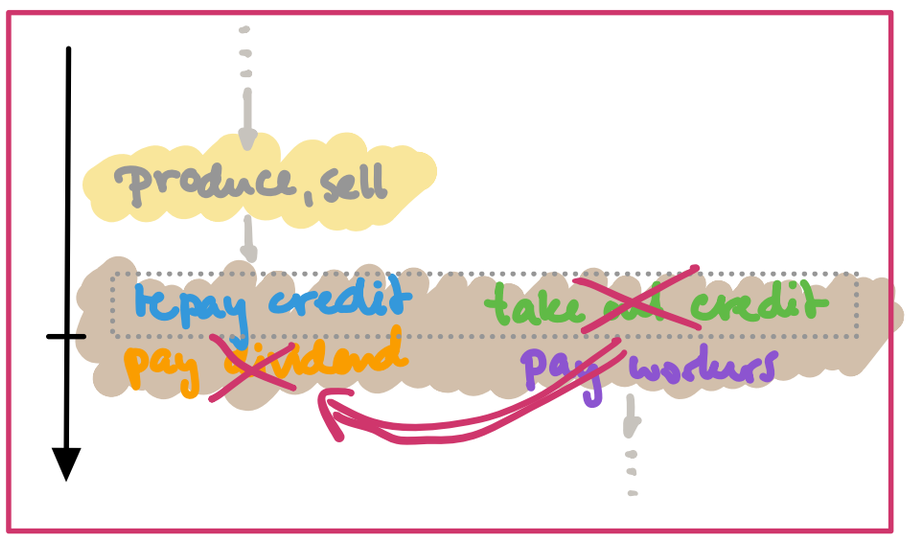

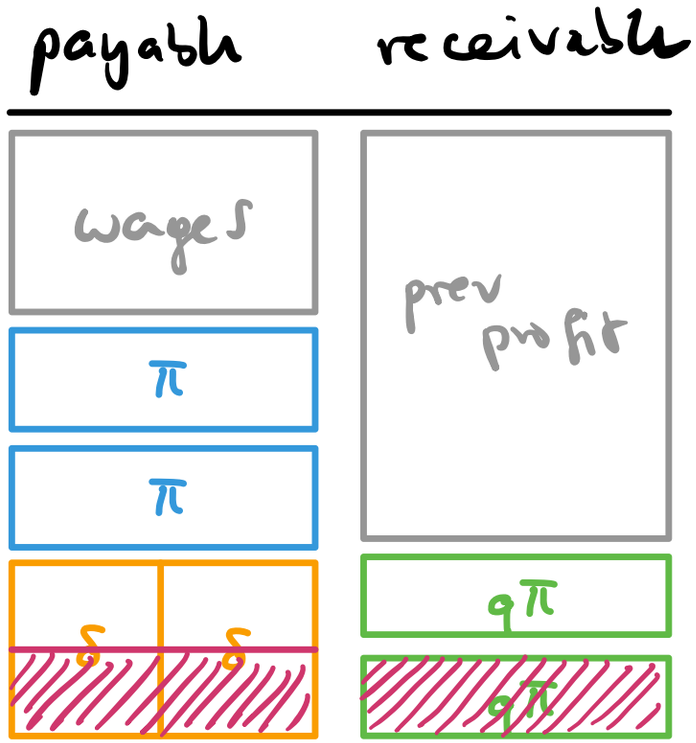

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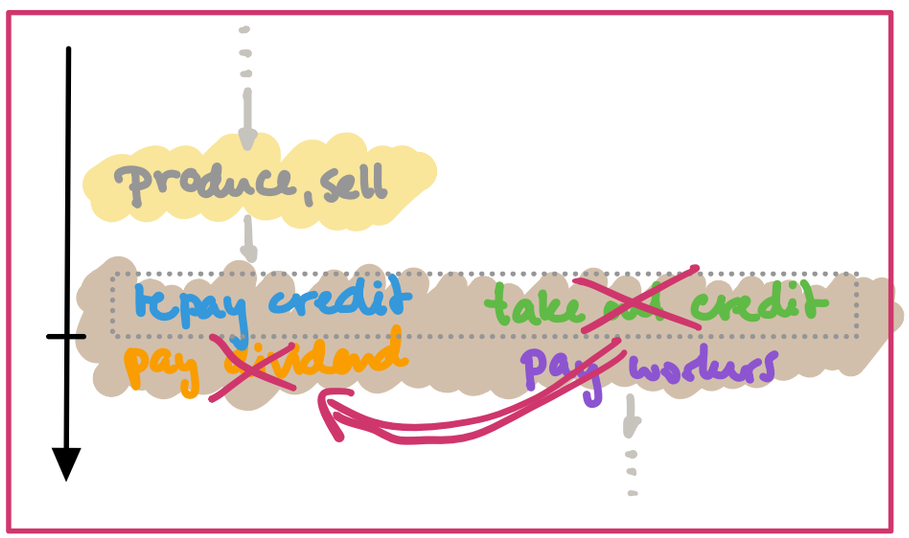
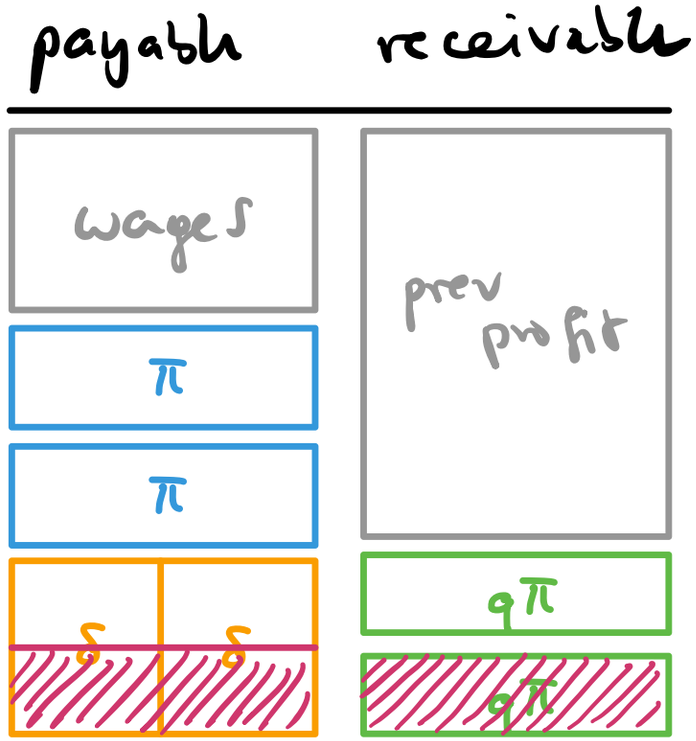
  $\Rightarrow$ use internal sources of funds
  $\Rightarrow$ ~~pay dividend~~ ^{x}

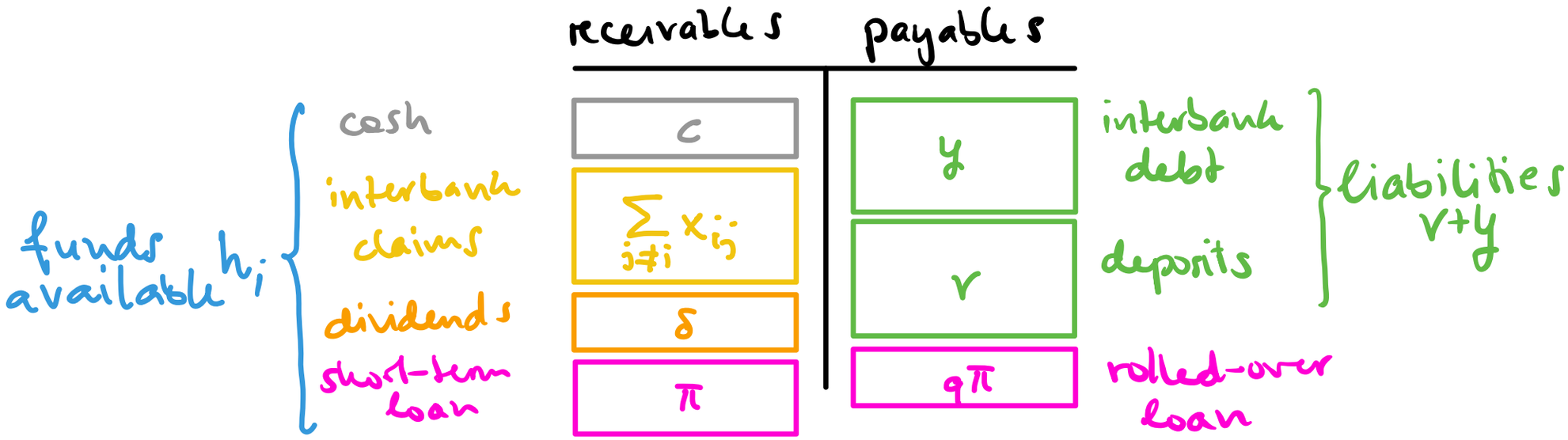




Let $x_1, x_2 \in [0,1]$ be the fraction rolled over by the firm's two lenders.
Then the dividend payment is

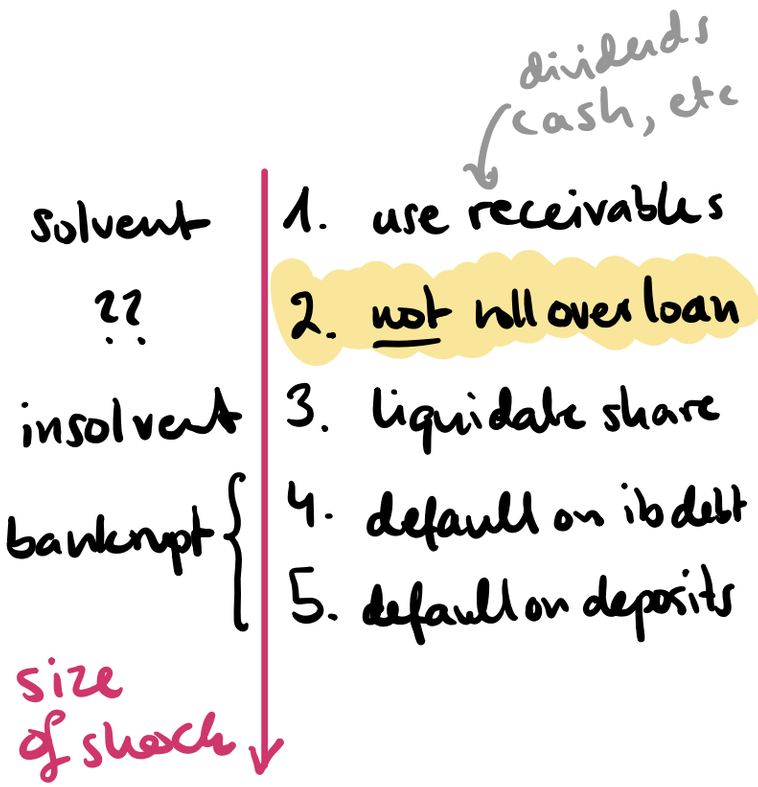
$$\delta(x_1, x_2) = a - (1-x_1)q\pi - (1-x_2)q\pi$$

Banks


receivables
payables
funds available h_i
cash
interbank claims
dividends
short-term loan
c
$\sum_{j \neq i} x_{ij}$
δ
π
y
r
$q\pi$
interbank debt
deposits
rolled-over loan
liabilities $r+y$


scrap value of firm
ξA

How does a bank react to a shock?



How does a bank react to a shock?

dividends, cash, etc

- solvent
  1. use receivables
- ??
  2. not roll over loan
- insolvent
  3. liquidate share
- bankrupt
  4. default on ib debt
  5. default on deposits

size of shock ↓

fraction rolled over

fraction liquidated

interbank payments

	receivables	payables	x_i	$\tilde{\ell}_i$	x_{ij}
if	h_i	$\geq v+y+q\pi$	1	0	y_{ij}
else if	h_i	$\geq v+y$	$\in(0,1)$	0	y_{ij}
else if	$h_i+\beta A$	$\geq v+y$	0	$\in(0,1)$	y_{ij}
else if	$h_i+\beta A$	$\geq v$	0	1	$<y_{ij}$
else if	$h_i+\beta A$	$< v$	0	1	0

How does a bank react to a shock?

solvent
1. use receivables (dividends, cash, etc)
??
2. not roll over loan
insolvent
3. liquidate share
bankrupt
4. default on ib debt
5. default on deposits

size of shock ↓

	receivables		payables	x_i	$\tilde{\ell}_i$	x_{ij}
if	h_i	$\geq$	$v+y+q\pi$	1	0	y_{ij}
else if	h_i	$\geq$	$v+y$	$\in(0,1)$	0	y_{ij}
else if	$h_i+\xi A$	$\geq$	$v+y$	0	$\in(0,1)$	y_{ij}
else if	$h_i+\xi A$	$\geq$	v	0	1	$<y_{ij}$
else if	$h_i+\xi A$	$<$	v	0	1	0

fraction rolled over

fraction liquidated

interbank payments

$\frac{h_i-(v+y)}{q\pi}$ $\quad \frac{v+y-h_i}{\xi A}$ $\quad y_{ij}\frac{\tilde{\ell}_i\xi A+h_i-v}{y}$

Payment equilibrium

Definition: For given $(c_i)_i$ the collection $\left((x_{ij})_{ij}, (x_i, \tilde{\ell}_i)_i\right)$ is a payment equilibrium if

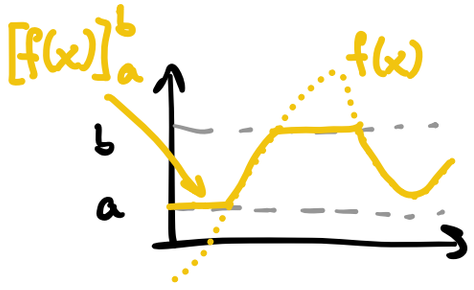
fraction rolled over $x_i = \left[\frac{h_i - (v+y)}{q\pi}\right]_0^1$

fraction liquidated $\tilde{\ell}_i = \left[\frac{v+y-h_i}{\xi A}\right]_0^1$

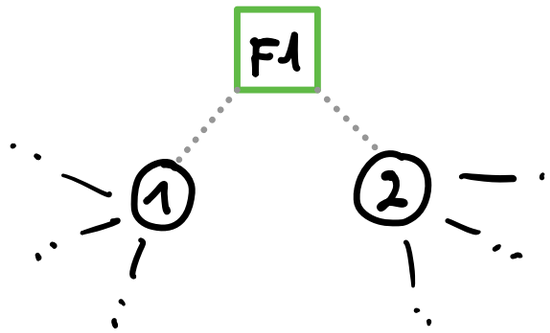
interbank payments $x_{ij} = y_{ij} \cdot \left[\frac{\tilde{\ell}_i \xi A + h_j - v}{y}\right]_0^1$

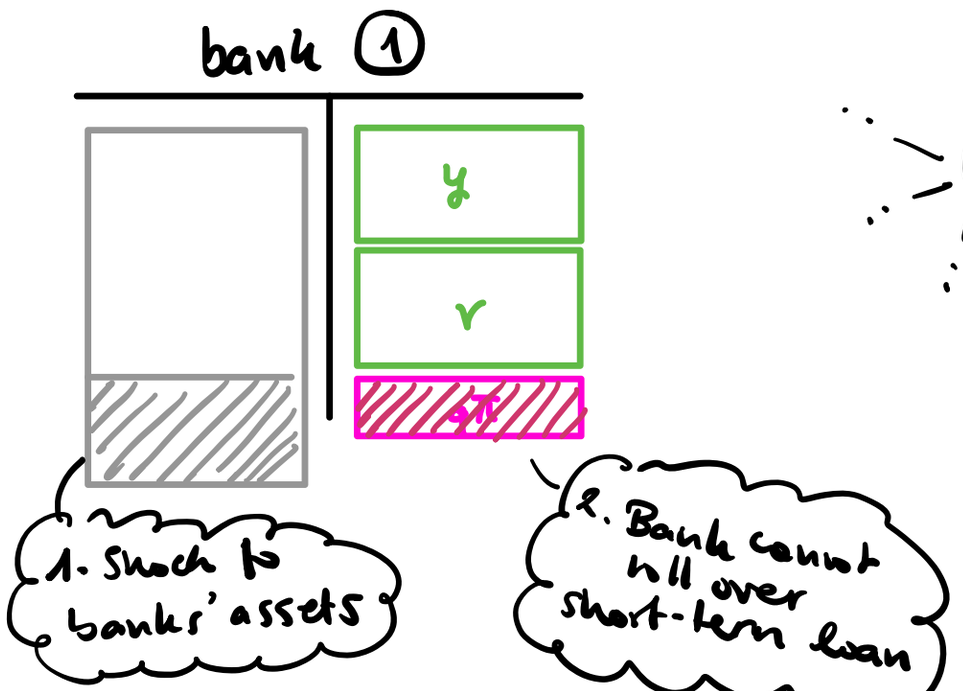
Definition for $a < b$: $[\cdot]_a^b : \mathbb{R} \to [a,b]$

$$x \mapsto [x]_a^b := \begin{cases} a & \text{if } x < a \\ x & \text{if } x \in [a,b] \\ b & \text{if } x > b \end{cases}$$



Transmission via the firm





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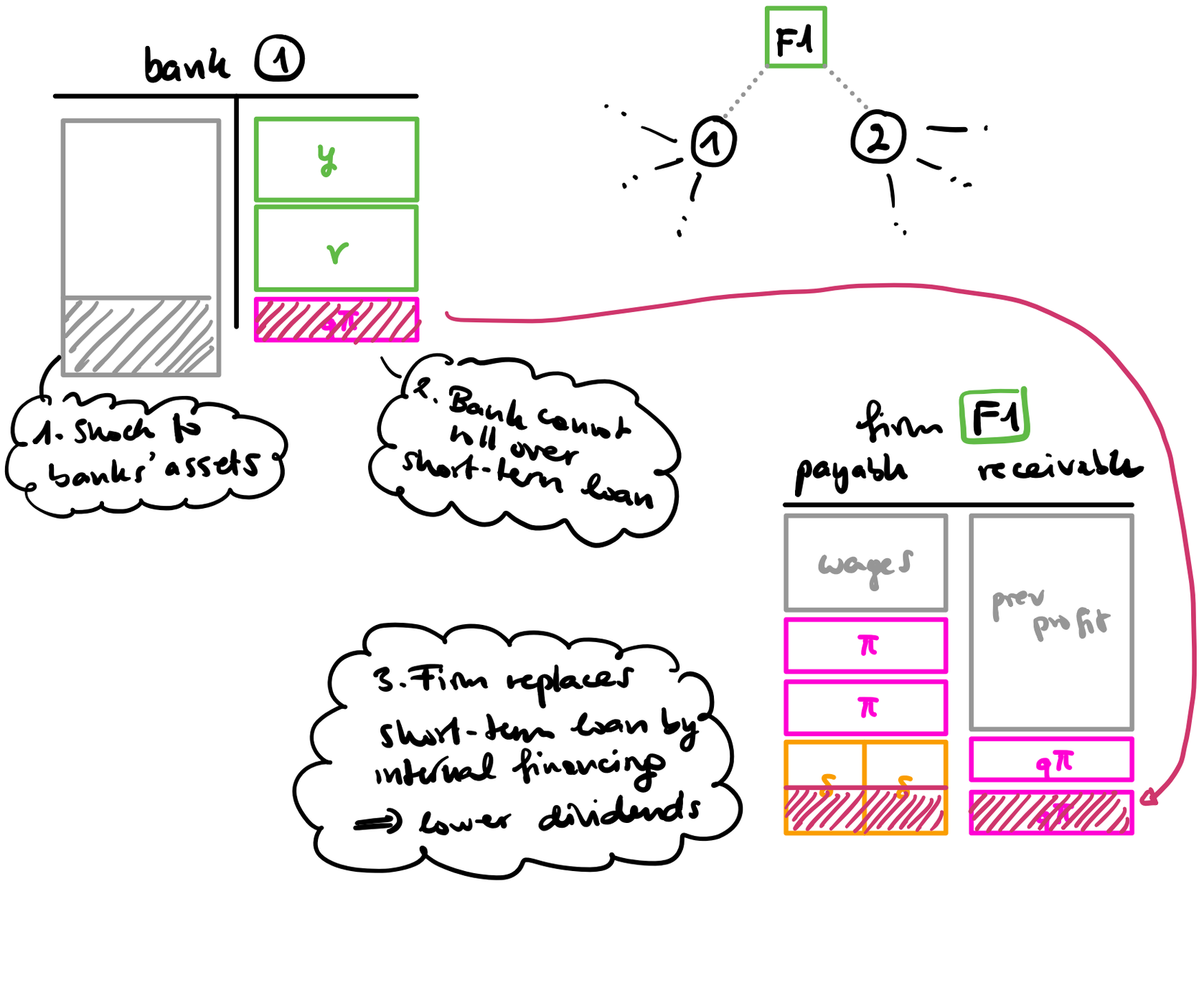
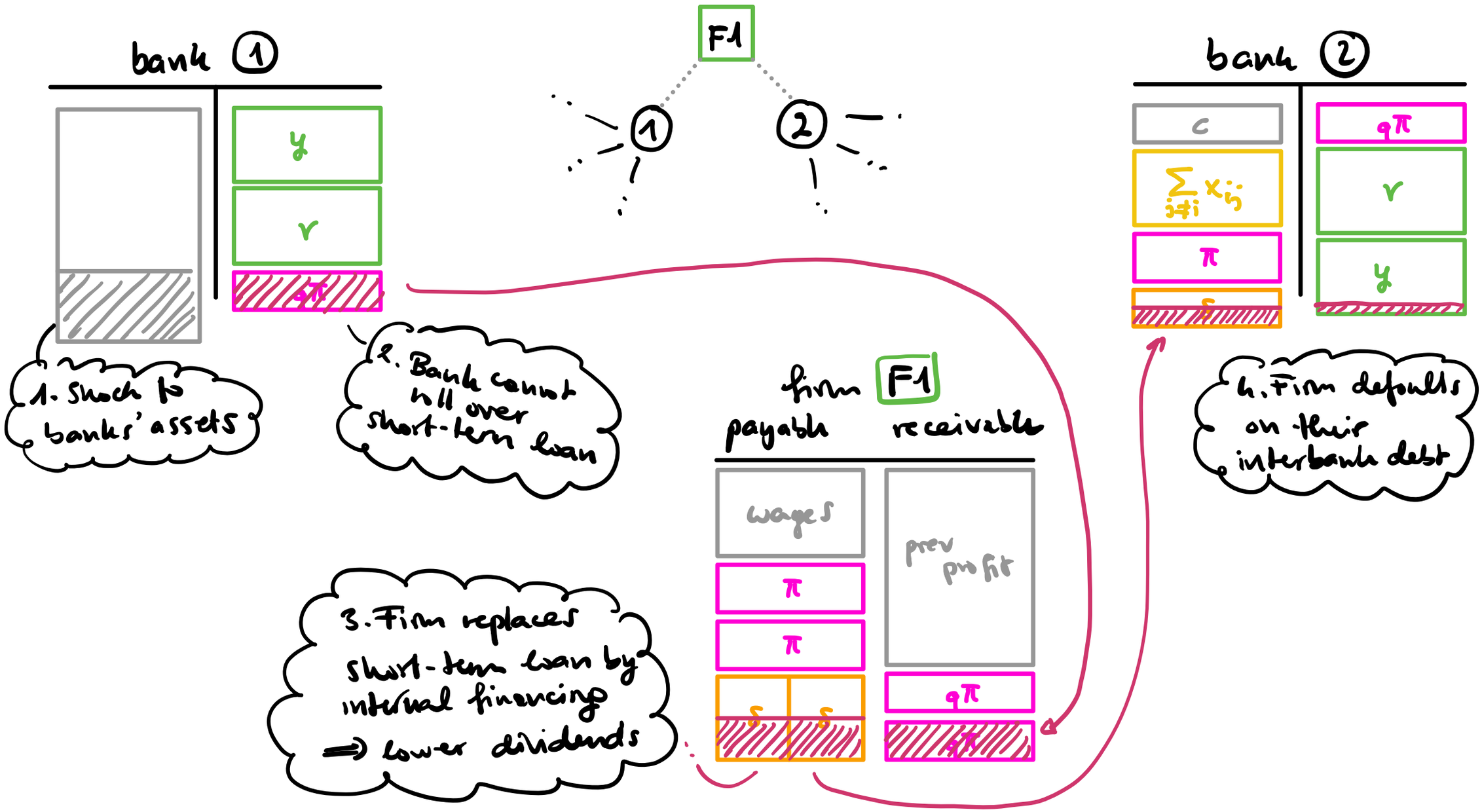


Transmission via the firm



Things to explore

- how likely does a shock spread to other component?
- under what conditions can the other co appnt be wiped out?
  - tradeoff shock bearing capacity vs dividend vs short-term loan
  - small shocks vs big shocks