Middleman Finance and Product Market Distortions

Bo Hu[1] Makoto Watanabe[2] Jun Zhang[3]

[1, 3] Fudan University

[2]KIER, Kyoto University

Fudan School of Management
Jan 12, 2026

Middlemen as Liquidity Providers

Middlemen, who purchase goods from suppliers and sell to consumers, provide liquidity support to suppliers.

Historically, middlemen and liquidity provision were closely related:

- *Colonial Trade*: The Dutch East India Company extended credit to local growers in the form of advanced payments
- *Input Financing:* Middlemen provide seeds, fertilizers, and farming equipment to small farmers

Nowadays, with advances in financial technologies, financing suppliers has become increasing critical for middlemen, e.g., Walmart, Amazon, JD.com, etc.

京保贝

基于京东商城应收账款的融资产品

【打开京麦扫一扫】
进入“融资服务”查看额度

【添加客户经理企业微信】
获取1V1专属客户服务

开通不融资，不收取任何费用

免费查询额度

入库即可提款，一键提前结算

京保贝为京东自营供应商提供全线上流动资金融资服务
为供应商的贸易资金保驾护航

免费开通
签约完成，不提款不收费

融资利率低
首笔低至年化4.6%

用款灵活
极速到账，按日计息，随借随还

融资期限长
融资期限可覆盖贸易账期

Get your Walmart invoices paid early with C2FO

Suppliers choose C2FO and the **Walmart Early Payment Program** to get paid faster and put more cash into their business. You select the invoices to accelerate and the discount to offer.

**This program does not apply to employees seeking early access to their paychecks or payroll advances.*

The Co-op Partners with PrimeRevenue to Protect Suppliers Amid Economic Volatility

By **PrimeRevenue** • 4 minute read

UK's sixth largest food retailer makes strategic transition to PrimeRevenue platform

Atlanta, GA – Manchester, UK, August 11, 2020 – PrimeRevenue, the leading platform for working capital finance solutions, and The Co-operative Group, today announce a new supply chain finance partnership. Barclays Bank PLC, who introduced The Co-op to PrimeRevenue, will be providing funding on the supply chain finance programme followed by other financial institutions as the programme grows.

Co-op has made the strategic decision to partner with PrimeRevenue for its new supply chain finance offering. Fueled by a highly challenging business climate heightened by the pandemic, the company aims to offer suppliers a simple method of early payment to help with their cash flow without having a detrimental impact to Co-op's own cash position. This is particularly relevant in the current environment where the old adage "cash is king" has never been truer.

What is special about middleman's liquidity provision?

What is special about middleman's liquidity provision?

1. Trade credit extensions. The middleman requires suppliers to give more trade credit.

What is special about middleman's liquidity provision?

1. Trade credit extensions. The middleman requires suppliers to give more trade credit.
2. Selective inclusion. The middleman finances a selective set of suppliers.

What is special about middleman's liquidity provision?

1. Trade credit extensions. The middleman requires suppliers to give more trade credit.
2. Selective inclusion. The middleman finances a selective set of suppliers.
3. Middlemen set product prices. Upstream liquidity provision is linked to downstream pricing.

What is special about middleman's liquidity provision?

1. Trade credit extensions. The middleman requires suppliers to give more trade credit.
2. Selective inclusion. The middleman finances a selective set of suppliers.
3. Middlemen set product prices. Upstream liquidity provision is linked to downstream pricing.

Research questions:

- What are the economic rational behind trade credit extension and supplier selection?
- How does middleman finance affect retail prices and product market efficiency?

Related literature

- Intersection of IO and Corporate Finance
  - Nocke & Thanassoulis JEEA 2014: Downstream financial constraint leads to risk-sharing between buyer and seller firms, resulting in double-marginalization.
- Multi-product Intermediaries
  - Rhodes, Watanabe & Zhou JPE 2021
  - Liquidity provision and intermediaries' retail advantages
- Diamond-Dybvig model and Trade Credit
  - Petersen & Rajan RFS 1997; Burkart & Ellingsen AER 2004; Cunat RFS 2007;
  - Reallocation of trade credit among suppliers

1. The Benchmark Model

Agents

- A mass of suppliers:
- A mass of consumers:
- One intermediary:

Agents

- A mass of suppliers:
  - Each produces a unique and indivisible good
  - Constant marginal costs, $c \in [\underline{c}, \bar{c}]$, differ among suppliers
  - c is publicly observable
- A mass of consumers:
- One intermediary:

Agents

- A mass of suppliers:
  - Each produces a unique and indivisible good
  - Constant marginal costs, $c \in [\underline{c}, \bar{c}]$, differ among suppliers
  - c is publicly observable
- A mass of consumers:
  - Unit demand for each good, *common* utility $u > \bar{c}$
- One intermediary:

Agents

- A mass of suppliers:
  - Each produces a unique and indivisible good
  - Constant marginal costs, $c \in [\underline{c}, \bar{c}]$, differ among suppliers
  - c is publicly observable
- A mass of consumers:
  - Unit demand for each good, *common* utility $u > \bar{c}$
- One intermediary:
  - operates as a middleman and a liquidity provider (more below)

Agents

- A mass of suppliers:
  - Each produces a unique and indivisible good
  - Constant marginal costs, $c \in [\underline{c}, \bar{c}]$, differ among suppliers
  - c is publicly observable
- A mass of consumers:
  - Unit demand for each good, *common* utility $u > \bar{c}$
- One intermediary:
  - operates as a middleman and a liquidity provider (more below)
- Endowments
  - There is a *numeraire* good

Agents

- A mass of suppliers:
  - Each produces a unique and indivisible good
  - Constant marginal costs, $c \in [\underline{c}, \bar{c}]$, differ among suppliers
  - c is publicly observable
- A mass of consumers:
  - Unit demand for each good, *common* utility $u > \bar{c}$
  - Consumers have sufficient endowment of the numeraire
- One intermediary:
  - operates as a middleman and a liquidity provider (more below)
- Endowments
  - There is a *numeraire* good

Agents

- A mass of suppliers:
  - Each produces a unique and indivisible good
  - Constant marginal costs, $c \in [\underline{c}, \bar{c}]$, differ among suppliers
  - c is publicly observable
- A mass of consumers:
  - Unit demand for each good, *common* utility $u > \bar{c}$
  - Consumers have sufficient endowment of the numeraire
- One intermediary:
  - operates as a middleman and a liquidity provider (more below)
  - Intermediary has an endowment $L \geq 0$ numeraire (exogenous for now)
- Endowments
  - There is a *numeraire* good

Agents

- A mass of suppliers:
  - Each produces a unique and indivisible good
  - Constant marginal costs, $c \in [\underline{c}, \bar{c}]$, differ among suppliers
  - c is publicly observable
  - Suppliers have no endowment of the numeraire
- A mass of consumers:
  - Unit demand for each good, *common* utility $u > \bar{c}$
  - Consumers have sufficient endowment of the numeraire
- One intermediary:
  - operates as a middleman and a liquidity provider (more below)
  - Intermediary has an endowment $L \geq 0$ numeraire (exogenous for now)
- Endowments
  - There is a *numeraire* good

Trade and Liquidity Shocks

- Suppliers can trade directly with consumers
  - each supplier can meet all consumers, trade bilaterally
  - trade surplus is split equally: $p - c = (u - c)/2$

Trade and Liquidity Shocks

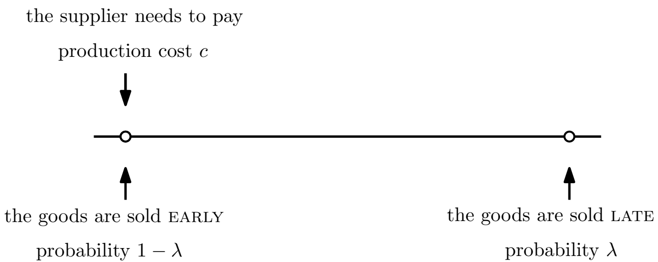
- Suppliers can trade directly with consumers
  - each supplier can meet all consumers, trade bilaterally
  - trade surplus is split equally: $p - c = (u - c)/2$
- Trade may not occur due to liquidity shocks

Trade and Liquidity Shocks

- Suppliers can trade directly with consumers
  - each supplier can meet all consumers, trade bilaterally
  - trade surplus is split equally: $p - c = (u - c)/2$
- Trade may not occur due to liquidity shocks
- Suppliers face no liquidity issue in the textbook
  - retail revenue can be used to cover costs c

Trade and Liquidity Shocks

- Suppliers can trade directly with consumers
  - each supplier can meet all consumers, trade bilaterally
  - trade surplus is split equally: $p - c = (u - c)/2$
- Trade may not occur due to liquidity shocks
- Suppliers face no liquidity issue in the textbook
  - retail revenue can be used to cover costs c
- Supplier's liquidity issue matters when:
  - disparity exists in the timing between production and trade.



- Two sub-periods: early and late
  - production occurs only in the early sub-period
  - suppliers may match with consumers early or late
- Prob. $1-\lambda$: consumers arrive early, c can be paid by revenue
- Prob. λ: consumers arrive later, c can not be covered using revenue
- It is one micro-foundation for generating liquidity shocks.

So far, the ex ante heterogeneity of suppliers:

- Suppliers are indexed by

$$(\lambda, c) \in \Omega = [0, 1] \times [\underline{c}, \bar{c}],$$

where λ: prob. of liquidity shock;

c: marginal cost.

- The pair (λ, c) of each supplier is publicly observable.
- (λ, c) follows some C.D.F. $G(\lambda, c)$.

Intermediary

The intermediary selects suppliers into either mode:

- Middleman mode (M): pure middleman
- Finance mode (F): middleman *plus* liquidity provider

Intermediary

The intermediary selects suppliers into either mode:

- Middleman mode (M): pure middleman
- Finance mode (F): middleman *plus* liquidity provider

Middleman matching advantage:

- The intermediary sells on behalf of suppliers
- prob. of liquidity shocks decreases to $m \cdot \lambda$
- $m < 1$: middlemen's matching advantage (Rubinstein and Wolinsky 1987)

Middleman Mode (M)

- The intermediary gives Take-It-Or-Leave-It (TIOLI) offers:
  - Supplier pays c by himself;
  - Intermediary makes a transfer $f_M(\lambda, c)$ **upon receipt of consumer payment.**
- Supplier (λ, c) contributes profit:

$$\begin{aligned}\pi_M(\lambda, c) &= (1 - m\lambda)p - \underbrace{(1-\lambda)(u-c)/2}_{\text{direct-selling value}} \\ &= (1-m)\lambda(u-c)/2 > 0 \text{ (since } m < 1).\end{aligned}$$

Finance Mode (F)

- The intermediary resells **and** provides liquidity.
- Financing supplier is costly: per-user cost $k > 0$.
- Intermediary gives TIOLI offers:
  - c is covered by the intermediary in the early sub-period;
  - Intermediary pays $f_F(\lambda, c)$ to supplier **by the end of the period**
- Supplier (λ, c) contributes **profit**:

$$\pi_F(\lambda, c) = \lambda(u - c)/2 - k$$

Finance Mode (F)

- The intermediary resells **and** provides liquidity.
- Financing supplier is costly: per-user cost $k > 0$.
- Intermediary gives TIOLI offers:
  - c is covered by the intermediary in the early sub-period;
  - Intermediary pays $f_F(\lambda, c)$ to supplier **by the end of the period**
- Supplier (λ, c) contributes **profit**:

$$\pi_F(\lambda, c) = \lambda(u - c)/2 - k$$

and contributes **liquidity** (at the time of production):

$$\theta_F(\lambda, c) = (1 - m\lambda)p - c$$

The intermediary's problem

- The intermediary selects suppliers into one of the two modes:

$$\max_{q(\cdot)\in\{0,1\}} \int_{\Omega} \Big((1 - q(\lambda, c))\pi_M(\lambda, c) + q(\lambda, c)\pi_F(\lambda, c) \Big) dG$$

  subject to the liquidity constraint:

$$\underbrace{\int_{\Omega} q(\lambda, c)\theta_F(\lambda, c) dG}_{\text{total liquidity}} + L \geq 0.$$

- Define $\Delta\pi(\cdot) = \pi_F(\cdot) - \pi_M(\cdot)$. The objective is equivalent to

$$\max_{q(\cdot)} \int_{\Omega} \Big(\pi_M(\lambda, c) + q(\lambda, c)\Delta\pi(\lambda, c) \Big) dG,$$

Profit-maximizing selection rule

- Solve the problem using Lagrangian:

$$\mathcal{L} = \int_{\Omega} \Big[\pi_M(\cdot) + q(\cdot) \Big(\Delta\pi(\cdot) + \mu\theta_F(\cdot) \Big) \Big] dG(\lambda, c)$$

$\mu \geq 0$: The shadow value of liquidity

- The optimal selection rule is:

$$q(\lambda, c, \mu) = \begin{cases} 1 & \text{if } \Delta\pi(\lambda, c) + \mu\theta_F(\lambda, c) \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Proposition (Selected Suppliers)

The intermediary optimally selects suppliers from three regions

- *Region A:* **positive** *profit and* **positive** *liquidity contributions*

$$\Delta\pi(\lambda, c) \geq 0, \quad \theta_F(\lambda, c) \geq 0$$

- *Region B:* **positive** *profit and* **negative** *liquidity*

$$\Delta\pi(\lambda, c) > 0, \quad \theta_F(\lambda, c) < 0, \quad \underbrace{-\Delta\pi/\theta_F}_{\text{returns}} \geq \mu$$

- *Region C:* **negative** *profit and* **positive** *liquidity*

$$\Delta\pi(\lambda, c) < 0, \quad \theta_F(\lambda, c) > 0, \quad \underbrace{-\Delta\pi/\theta_F}_{\text{costs}} \leq \mu$$

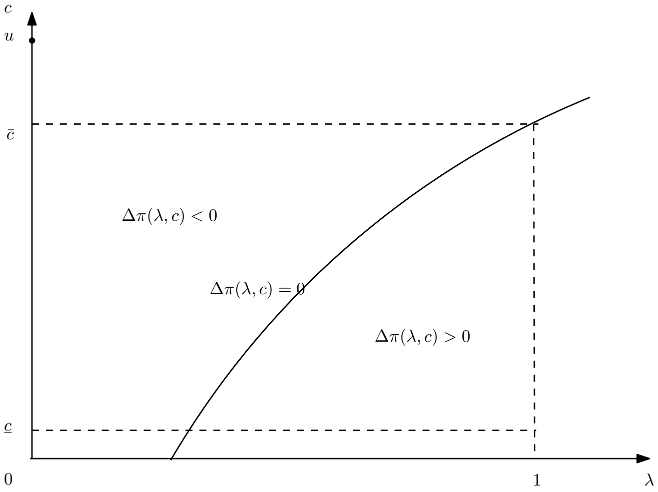


Figure: Incremental profit $\Delta\pi \equiv \pi_F - \pi_M$

$$\Delta\pi(\lambda, c) = m\lambda(u - c)/2 - k$$

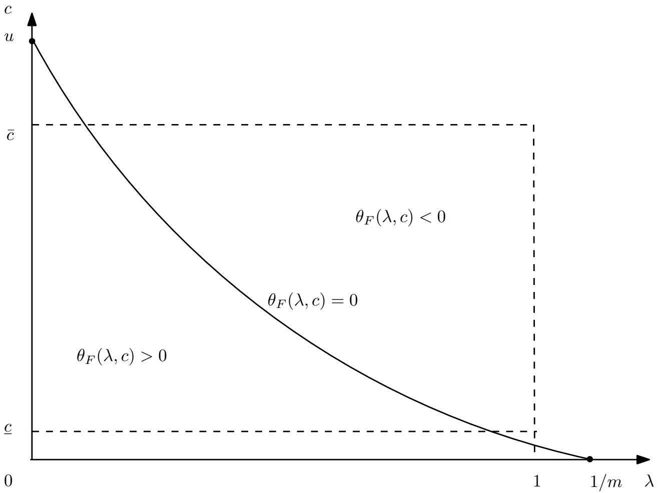


Figure: Liquidity $\theta_F(\lambda, c)$

$$\theta_F(\lambda, c) = (1 - m\lambda)(u + c)/2 - c$$

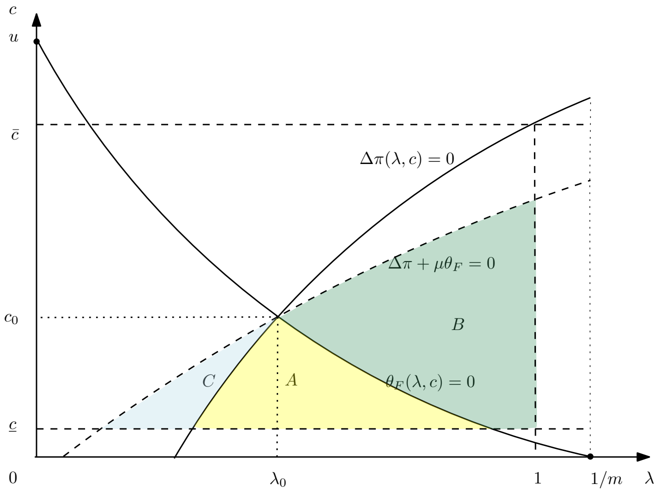


Figure: Profit-based Liquidity Cross-subsidization

- μ is determined by

$$L = -\Theta(\mu) \equiv -\int_{\Omega} q(\lambda, c, \mu)\theta_F(\lambda, c)dG. \tag{1}$$

If liquidity constraint is slack, i.e., $-\Theta(0) \leq L$, then $\mu = 0$.

Proposition

Given liquidity endowment $L \geq 0$ and $k/m < (u - \underline{c})/2$, the intermediary's profit-maximizing strategy involves active F mode, which is characterized by

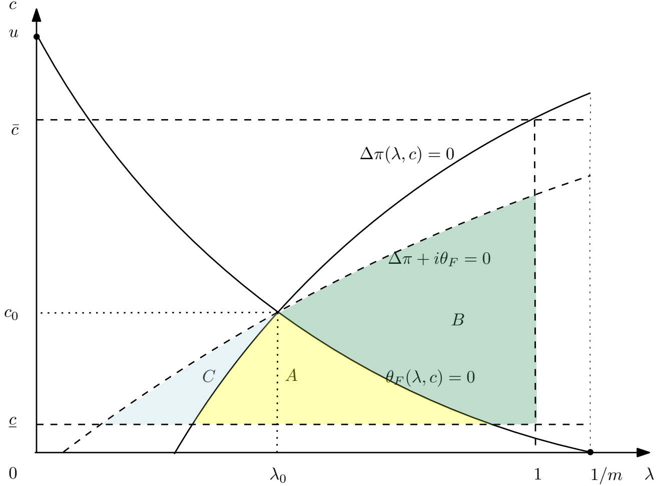
$$\{q(\lambda, c, \mu), f_F(\lambda, c), f_M(\lambda, c), \mu(L)\}.$$

Endogenize L

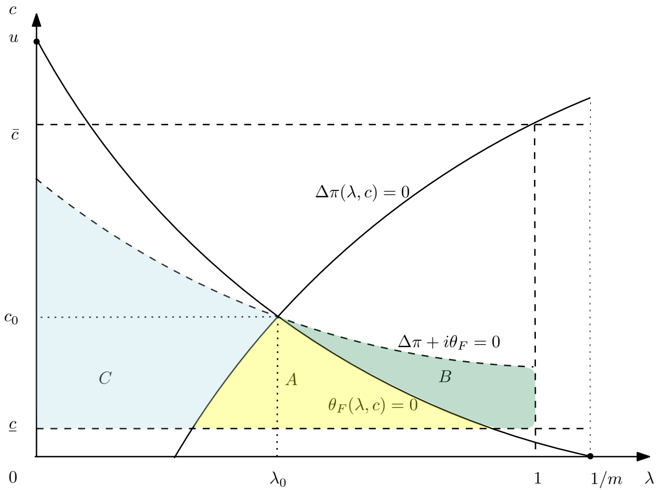
- So far, a downward sloping demand curve for liquidity $\mu(L)$
- Suppose the intermediary faces a liquidity cost i
- The intermediary's liquidity holdings $L \geq 0$ satisfy

$$\begin{cases} \mu(L) = i & \text{if } \; i < \mu(0); \\ L = 0 & \text{if } \; i \geq \mu(0). \end{cases}$$

- The equilibrium liquidity value $\mu = \min\{\mu(0), i\}$ is shaped by
  - richness of suppliers' liquidity: $\mu(0)$
  - cost of external liquidity: i



Positively-sloped selection curve



Negatively-sloped selection curve

Generalize suppliers' direct selling value

- Let suppliers' direct selling value be $\Phi(\lambda, c) \geq 0$.
- We have profit contributions of F and M contracts:

$$\pi_F(\lambda, c) = (u - c)/2 - \Phi(\lambda, c) - k,$$
$$\pi_M(\lambda, c) = (1 - m\lambda)(u - c)/2 - \Phi(\lambda, c).$$

- What matters for our analysis is

$$\Delta\pi(\lambda, c) = m\lambda(u - c)/2 - k.$$

2. Middleman Finance and Product Market

We endogenize the retail price...

Downward-sloping demand $D(p)$

- A continuum of consumers; demand for each product $D(p)$
- c is a per-unit cost

Downward-sloping demand $D(p)$

- A continuum of consumers; demand for each product $D(p)$
- c is a per-unit cost

Direct-selling:

- A supplier produces only if consumers arrive early
- In that state, he sets the monopoly price

$$p^*(c) \equiv \arg\max_{p \geq c} (p - c)D(p)$$

Assume the objective is strictly quasi-concave in p and let the monopoly profit be

$$\pi^*(c) \equiv (p^*(c) - c)D(p^*(c)).$$

The intermediary

The intermediary can offer M or F contracts to suppliers.

M contract:

- With prob. $1 - m\lambda$, match with consumers early.
- The intermediary sets the monopoly price $p^*(c)$ for that state and pays to suppliers direct selling value.
- Supplier of (λ, c) contributes profit of

$$\pi_M(\lambda, c) = (1 - m)\lambda\pi^*(c).$$

Recall that in the benchmark:

$$\pi_M(\lambda, c) = (1 - m)\lambda\frac{u - c}{2}.$$

F contract:

- Intermediary advances production cost $c \cdot D(p)$ to the supplier.
- The expected profit at retail price p is

$$\pi_F(\lambda, c, p) = (p - c)D(p) - (1 - \lambda)\pi^*(c) - k.$$

- The incremental profit is

$$\Delta\pi(\lambda, c, p) \equiv (p - c)D(p) - (1 - m\lambda)\pi^*(c) - k.$$

- The liquidity contribution from supplier (λ, c):

$$\theta_F(\lambda, c, p) = (1 - m\lambda)pD(p) - cD(p).$$

- The intermediary chooses $q(\lambda, c) \in 0, 1$ and $p(\lambda, c) \in \mathbb{R}_+$:

$$\max_{\{q(\cdot),p(\cdot)\}_{(\lambda,c)\in\Omega}} \int_\Omega \left[q(\cdot)\Delta\pi(\lambda, c, p(\cdot))\right] dG,$$

$$\text{s.t.} \int_\Omega \Big[q(\cdot)\theta_F(\lambda, c, p(\cdot))\Big] dG + L \geq 0.$$

- The corresponding Lagrangian:

$$\mathcal{L} = \int_\Omega \Big[q(\lambda, c) \underbrace{\Big(\Delta\pi(\lambda, c, p(\lambda, c)) + \mu\theta_F(\lambda, c, p(\lambda, c))\Big)}_{\equiv S(\cdot)}\Big] dG.$$

- The net value of financing supplier (λ, c):

$$S(\cdot) = (1 + \mu(1 - m\lambda))\,(p - \tilde{c})\,D(p) - k - (1 - m\lambda)\pi^*(c),$$

with effective cost $\tilde{c} = \gamma c$. γ captures liquidity-related costs:

$$\gamma \equiv \frac{1 + \mu}{1 + \mu(1 - m\lambda)} \geq 1.$$

$\gamma = 1$ iff $\mu = 0$ or $\lambda = 0$; γ increases in μ and λ.

- The net value of financing supplier (λ, c):

  $$S(\cdot) = (1 + \mu(1 - m\lambda))\,(p - \tilde{c})\,D(p) - k - (1 - m\lambda)\pi^*(c),$$

  with effective cost $\tilde{c} = \gamma c$. γ captures liquidity-related costs:

  $$\gamma \equiv \frac{1 + \mu}{1 + \mu(1 - m\lambda)} \geq 1.$$

  $\gamma = 1$ iff $\mu = 0$ or $\lambda = 0$; γ increases in μ and λ.

- The profit-maximizng retail price:

  $$p(\lambda, c) = p^*(\tilde{c})$$

  $p^*(\tilde{c}) - p^*(c)$: liquidity-driven double marginalization.

The new selection rule

- We decompose the net valuation $S(\lambda, c)$ into a baseline component and a premium derived from pricing flexibility:

$$S(\lambda, c, \mu) = \underbrace{S_{base}(\lambda, c, \mu)}_{\text{Baseline value}} + \underbrace{\mathcal{G}(\lambda, c, \mu)}_{\text{Pricing gain}}.$$

- S_{base} represents the valuation if price is fixed to $p^*(c)$

$$S_{base}(\lambda, c, \mu) = \underbrace{m\lambda\pi^*(c) - k}_{\text{Baseline Profit}} + \mu \underbrace{\left[(1 - m\lambda)p^*(c) - c\right] D(p^*(c))}_{\text{Baseline Liquidity}}.$$

Price gain and risk resilience

- $\mathcal{G}(\lambda, c, \mu)$, captures the gain by setting $p = p^*(\tilde{c})$:

$$\mathcal{G}(\lambda, c, \mu) \equiv (1 + \mu(1 - m\lambda))\Big[\pi^*\Big(p^*(\tilde{c}), \tilde{c}\Big) - \pi\Big(p^*(c), \tilde{c}\Big)\Big].$$

- $\mathcal{G}(\cdot)$ is strictly positive, strictly increasing in λ and μ.

Proposition

The intermediary's selection rule is characterized by a strictly expanded and less risk-sensitive financing boundary:x

$$c^*(\lambda) > c^*_{base}(\lambda), \rightharpoonup \textit{ expanded financed set}$$
$$\partial c^* / \partial \lambda > \partial c^*_{base} / \partial \lambda, \rightharpoonup \textit{ reduced risk sensitivity.}$$

Implications on product market surplus

- The change in trade surplus by financing:

$$\Delta W(\lambda, c) \equiv \underbrace{W\Big(p^*(\tilde{c})\Big)}_{\text{F contract surplus}} - \underbrace{\Big(1 - m\lambda\Big) W\Big(p^*(c)\Big)}_{\text{M contract surplus}}.$$

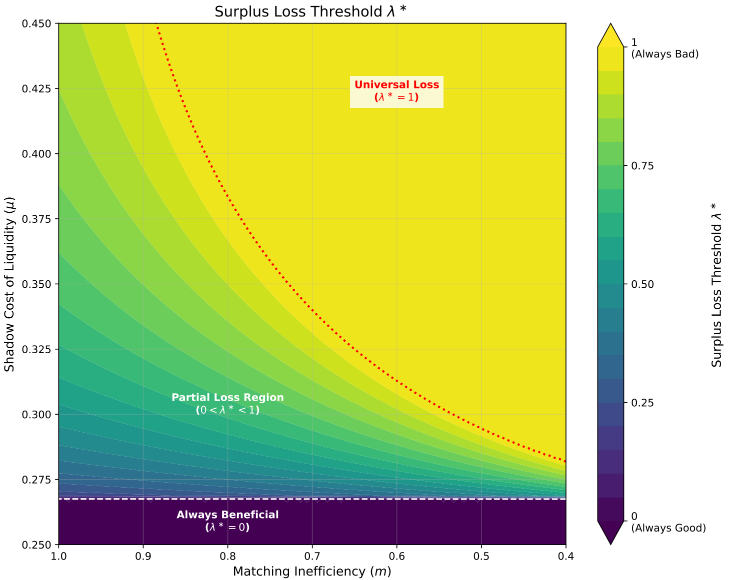
where $W(p, c) = \int_p^\infty D(t)dt + (p - c)D(p)$.

Proposition (Retail trade surplus loss)

Suppose $\Delta W'_\lambda(0, c) < 0$. *There exists a threshold* $\lambda^* \in (0, 1/m)$ *such that* **financing suppliers strictly reduces retail trade surplus** *for* $\lambda \in (0, \lambda^*)$.

Funding cost μ and matching efficiency m

- **Higher funding costs** $\mu \uparrow \Longrightarrow$ **Loss-range expands** $\lambda^* \uparrow$
- Higher μ exacerbates the double marginalization problem, requiring a higher risk λ to offset the price distortion.
- **Better matching** $m \downarrow \Longrightarrow$ **Loss-range expands** $\lambda^* \uparrow$
- As $m \downarrow$, the M contract becomes a tougher benchmark to beat. The insurance value of financing reduces, but the price distortion remains.



Trade surplus loss threshold λ^* with $D(p) = p^{-\varepsilon}$

Implications on consumer surplus

- The change in consumer surplus by financing:

$$\Delta CS(\lambda, c) \equiv CS(p^*(\tilde{c})) - (1 - m\lambda)CS(p^*(c)),$$

where $CS(p) \equiv \int_p^{\bar{p}} D(z)dz$.

Proposition (Consumer surplus loss)

Fix c and suppose $\Delta W(\lambda, c) < 0$ for $\lambda < \lambda^*$. Then there exists $\lambda^*_{CS} > \lambda^*$ such that

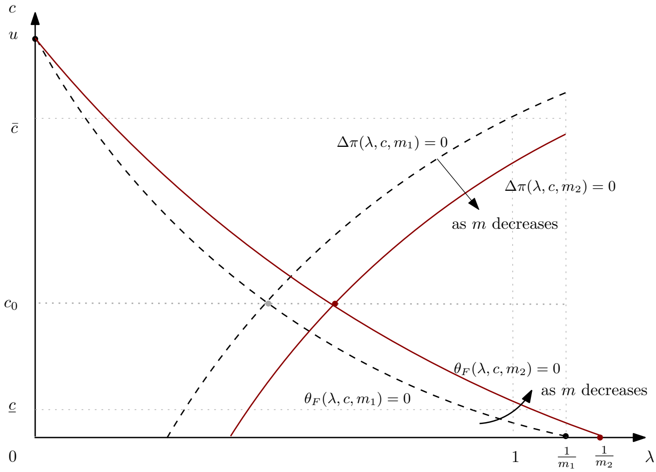
$$\Delta CS(\lambda, c) < 0 < \Delta W(\lambda, c) \textit{ for } \lambda \in (\lambda^*, \lambda^*_{CS}).$$

Summary

- Middlemen finance features **profit-based liquidity cross-subsidization.**
- Middlemen finance leads to **liquidity-driven double marginalization** and potentially harms product market trade surplus.

Supplementary materials

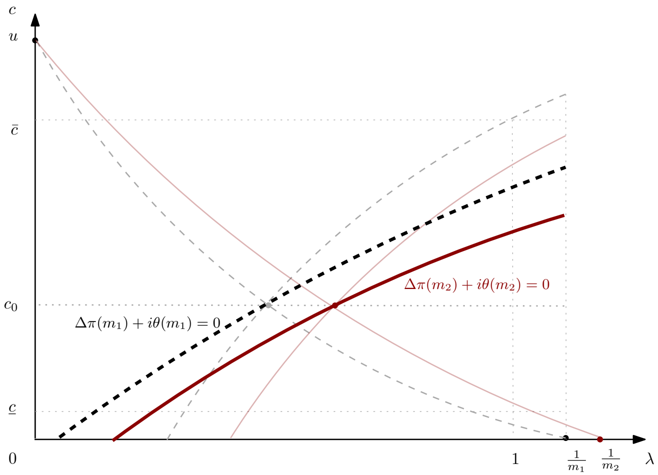
Matching efficiency and liquidity provision



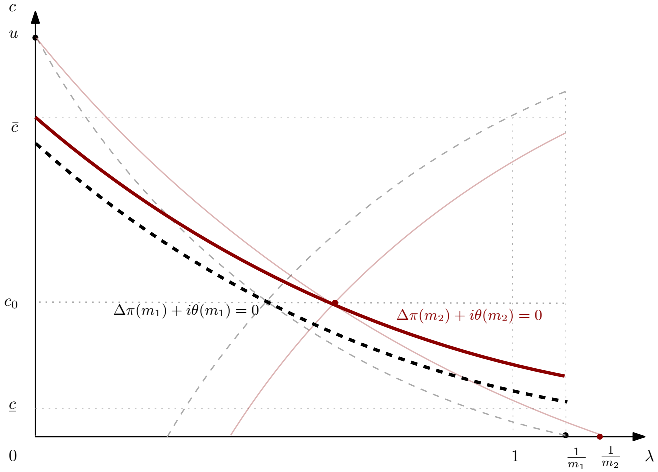
Effects of changes in matching efficiency m:

$$\Delta\pi(\lambda, c) = m\lambda(u - c)/2 - k$$

$$\theta_F(\lambda, c) = (1 - m\lambda)(u + c)/2 - c$$



- If the selection curve is upward-sloping, SF shrinks as m decreases from m_1 to m_2 (matching efficiency improves)



- If the selection curve is downward-sloping, SF expands as m decreases m_1 to m_2 (matching efficiency improves)

Suppliers' access to liquidity

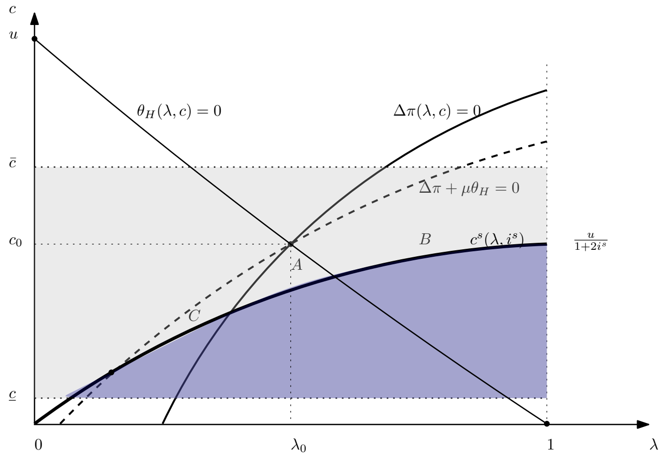


Figure: Suppliers' money holdings coexist with supplier finance

Proposition

Suppose $\lambda_0 < 1$, $\underline{c} > 0$, $i < \frac{k\bar{\lambda}}{mu\bar{\lambda}-2k}$, *and suppliers face money market rate* i^s. *There exist thresholds* $i < \underline{i}^s < \bar{i}^s \equiv \frac{(u-\underline{c})\bar{\lambda}}{2\underline{c}}$ *such that:*

- *If* $i^s \leq \underline{i}^s$, *suppliers with* $c \leq c^s(\lambda, i^s)$ *hold money for liquidity, and supplier finance stays inactive.*
- *If* $i^s \geq \bar{i}^s$, *no supplier holds money, and supplier finance is activated for some suppliers.*
- *If* $i^s \in (\underline{i}^s, \bar{i}^s)$, *suppliers with* $c \leq c^s(\lambda, i^s)$ *have money, while supplier finance activates for other suppliers.*