# Pricing Off Accounting Costs

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*Preliminary—subject to change!*

# Pricing and Inventory Purchase Costs: Fed Beige Book

- “Several contacts noted they were still working through pre-tariff inventories, thus delaying price adjustments.”

  — Federal Reserve Bank of Atlanta, June 2025

- “Several contacts across different retail sectors phased in price increases as old inventories were sold and replaced with goods subject to tariffs. Retailers expect additional price increases as this phase-in continues.”

  — Federal Reserve Bank of San Francisco, Sep 2025

- “A coffee roaster noted that while tariffs on coffee have largely been lifted, selling prices will only go down once the stock of inventory acquired at higher costs has been cleared.”

  — Federal Reserve Bank of New York, Jan 2026

# Pricing and Inventory Purchase Costs: Earnings Calls

- Retailers: “Our pricing algorithms seek to maintain a balance between factoring in our higher wholesale costs and keeping us market priced. In practice, this means that for a short period of time, inventory-carrying retailers may have a slight cost advantage. This should dissipate over the next couple of quarters as the market rebalances, pre-tariff inventory is depleted, and all retailers incur higher wholesale costs reflective of tariffs.”

  — Wayfair, Oct 31 2019

- Distributors: “We anticipate implementing additional pricing actions as inventory affected by tariffs moves through our cost of sales.”

  — Global Industrial, July 29 2025

- Manufacturers: “We have the opportunity for those duties that we pay, those tariffs that we pay, to recover that when we deliver the aircraft. Now, you know, it creates a little bit of a cash flow timing issue that we’ll have to work through.”

  — Boeing, Apr 23 2025

# Pricing and Inventory Purchase Costs

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- Yet, firms widely report setting prices based on past inventory purchase costs.
- Part of broader set of puzzles:
  - Firms' prices shaped by hedging gains/losses. [Evidence from airlines in paper]
  - Firms report passing through changes in overhead costs.
  - Firms' prices do not respond much to anticipated future costs, demand shocks.

# Roadmap

1. Firms “price off accounting costs.”
   - Test extent of accounting cost pricing using public firm financial reports.
   - Weight of 60–80% on accounting costs.
   - Replacement cost pricing concentrated in industries with exchanges / reference prices.

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1. Firms “price off accounting costs.”
   - Test extent of accounting cost pricing using public firm financial reports.
   - Weight of 60–80% on accounting costs.
   - Replacement cost pricing concentrated in industries with exchanges / reference prices.
2. Principal–agent model of pricing off accounting costs.
   - Replacement costs unverifiable, but accounting metrics verifiable and contractible.
   - Principal incentivizes manager with accounting performance to limit discretion.
   - Comparative statics: competition, cost observability, inventories.
   - Other puzzles: pass-through of fixed costs, muted response to demand shocks.

# Roadmap

3. Dynamics under accounting cost pricing resemble sticky-price models.
   - But lags come from production lags and inventory stocks, not length of price spells.
   - More delayed response to slow-moving shocks, more amplification in supply chains.
   - Anticipation can further delay pass-through if firms stock up on inventory.

4. How far can we go without sticky prices?
   - Calibrate U.S. input–output model.
   - Delays in CPI adjustment to shocks on par with sticky-price models.

# Selected Related Literature

- Cost-based pricing: Gordon (1981), Blinder et al. (1998).
  - Firms inattentive to / imperfectly observe future costs: Gordon (1990), Mankiw and Reis (2002), Woodford (2003), Minton and Wheaton (2022), Afrouzi et al. (2024).

    $\Rightarrow$ Firms price off historical costs even when they are already importing at higher price!
  - Okun (1981), Gordon (1981): "Many firms, however, appear to base prices on actually costs paid in the past, so-called 'FIFO' (first-in-first-out) pricing practices."
- Other pricing puzzles:
  - Full-cost pricing: E.g., Hall and Hitch (1939), Altomonte et al. (2015), Bewley (2025).
  - Response to cost vs. demand shocks: Cagan (1979), Bils and Chang (2000), Fabiani et al. (2006), Gagnon and Lopez-Salido (2020), Kohler et al. (2026).
- Verifiable info and firm monitoring: E.g., Meckling and Jensen (1976), Holmström (1979), Graham et al. (2005), Rogerson (2008, 2011).

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# Review of accrual accounting

- Matches timing of expenses to revenues, values expenses at historical cost.

## Expense Recognition (Matching) Principle

The expense recognition principle (also referred to as the matching principle) states that we must match expenses with associated revenues in the period in which the revenues were earned. A mismatch in expenses and revenues could be an understated net income in one period with an overstated net income in another period. There would be no reliability in statements if expenses were recorded separately from the revenues generated.

For example, if Lynn earned printing revenue in April, then any associated expenses to the revenue generation (such as paying an employee) should be recorded on the same income statement. The employee worked for Lynn in April, helping her earn revenue in April, so Lynn must match the expense with the revenue by showing both on the April income statement.

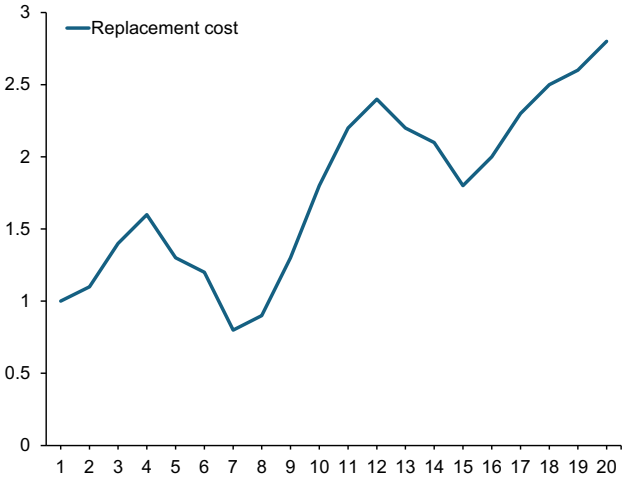
## Cost Principle

The cost principle, also known as the historical cost principle, states that virtually everything the company owns or controls (*assets*) must be recorded at its value at the date of acquisition. For most assets, this value is easy to determine as it is the price agreed to when buying the asset from the vendor. There are some exceptions to this rule, but always apply the cost principle unless FASB has specifically stated that a different valuation method should be used in a given circumstance.

The primary exceptions to this historical cost treatment, at this time, are financial instruments, such as stocks and bonds, which might be recorded at their fair market value. This is called mark-to-market accounting or fair value accounting and is more advanced than the general basic concepts underlying the introduction to basic accounting concepts; therefore, it is addressed in more advanced accounting courses.

Once an asset is recorded on the books, the value of that asset must remain at its historical cost, even if its value in the market changes. For example, Lynn Sanders purchases a piece of equipment for $40,000. She believes this is a bargain and perceives the value to be more at $60,000 in the current market. Even though Lynn feels the equipment is worth $60,000, she may only record the cost she paid for the equipment of $40,000.

# Example: Replacement vs. accounting costs




- Replacement costs $c_t$.
- Inventory stock $I_t$, units sold $D_t$.
- Example: $D$ and $I$ constant.
- $\delta = D/I = 0.5$.
  (Holds two months of inventories.)

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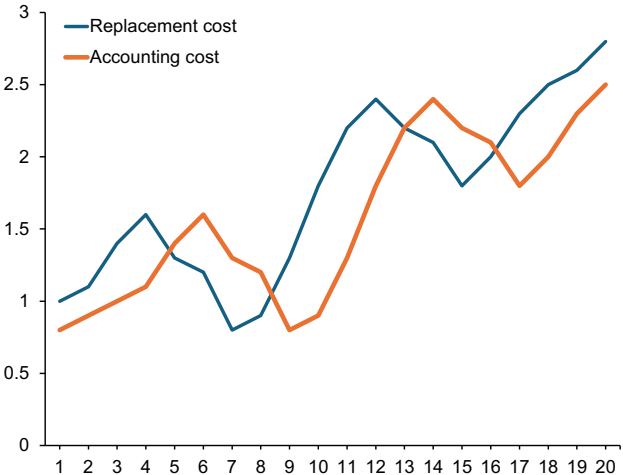


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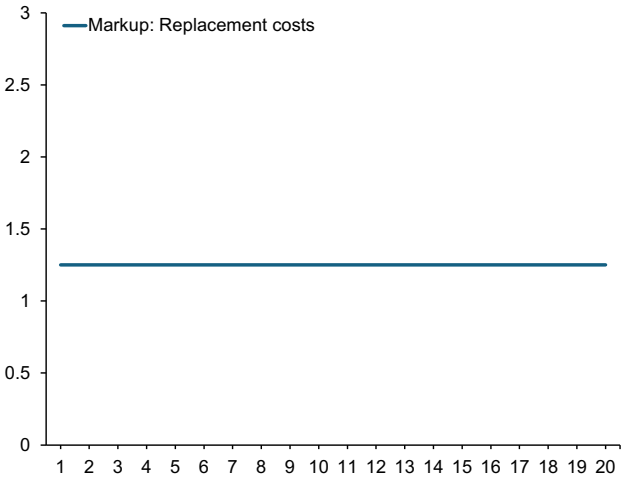
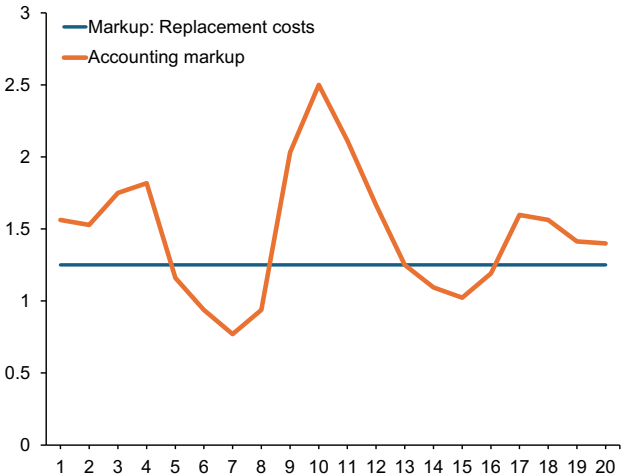
- Inventory stock $I_t$, units sold $D_t$.
- Example: $D$ and $I$ constant.
- $\delta = D/I = 0.5$.
  (Holds two months of inventories.)
- First-in-first-out (FIFO) accounting.
- COGS are $h_t D_t$.

# Example: Accounting markups



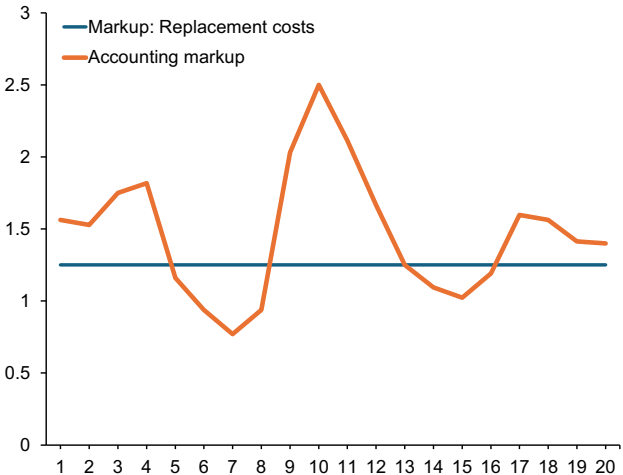

- Suppose optimal price $p_t = 1.25 \times c_t$.

# Example: Accounting markups




- Suppose optimal price $p_t = 1.25 \times c_t$.
- Sales / COGS $= 1.25 \times c_t / h_t$.

# Example: Accounting markups




- Suppose optimal price $p_t = 1.25 \times c_t$.
- Sales / COGS $= 1.25 \times c_t / h_t$.
- What would you infer if always accounting markup $= 1.25$?

# Can we estimate the extent of accounting cost pricing?

- Suppose price is weighted avg. of replacement- and accounting cost-based prices:

$$p_t = \mu \left( \phi c_t + (1 - \phi) h_t \right).$$

- Dividing Sales by COGS:

$$\frac{\text{Sales}_t}{\text{COGS}_t} = \frac{\mu(\phi c_t + (1-\phi)h_t)D_t}{h_t D_t} = \mu \left( \phi \frac{c_t}{h_t} + (1 - \phi) \right).$$

- $\phi > 0 \Rightarrow$ prices high relative to accounting cost when $c_t > h_t$.

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- $\phi > 0 \Rightarrow$ prices high relative to accounting cost when $c_t > h_t$.

- How can we tell when $c_t > h_t$?

# Can we estimate the extent of accounting cost pricing?

- Key insight: Purchases capitalized into inventory.

$$\text{BookValueInventory}_t = \text{BookValueInventory}_{t-1} - \underbrace{\text{COGS}_t}_{h_t D_t} + \underbrace{\text{Purchases}_t}_{c_t Y_t}.$$

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$$\text{BookValueInventory}_t = \text{BookValueInventory}_{t-1} - \underbrace{\text{COGS}_t}_{h_t D_t} + \underbrace{\text{Purchases}_t}_{c_t Y_t}.$$

- Thus,

$$\frac{\text{Purchases}_t}{\text{COGS}_t} = \frac{\Delta\text{BookValueInventory}_t + \text{COGS}_t}{\text{COGS}_t} = \frac{c_t Y_t}{h_t D_t}.$$

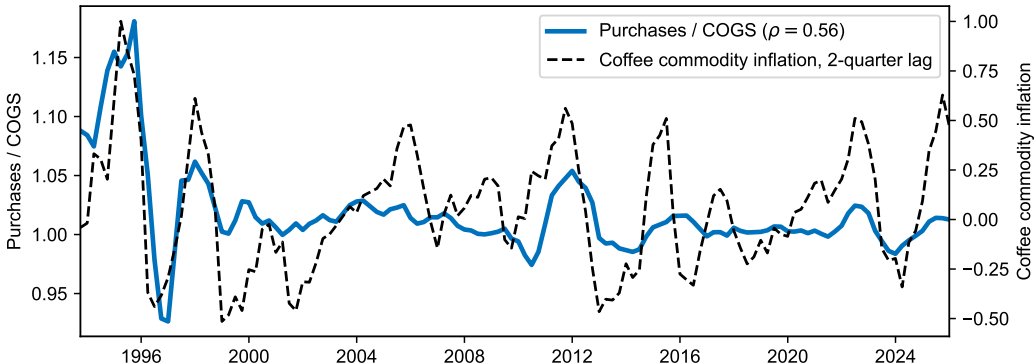
- Log-linearizing:

$$\left(\widehat{\frac{\text{Sales}_t}{\text{COGS}_t}}\right) = \phi \left(\widehat{\frac{\text{Purchases}_t}{\text{COGS}_t}}\right) - \phi\left(\hat{Y} - \hat{D}\right).$$

- Absent changes in quantities and markups, $\phi$ identified by sensitivity of Sales/COGS to Purchases/COGS.

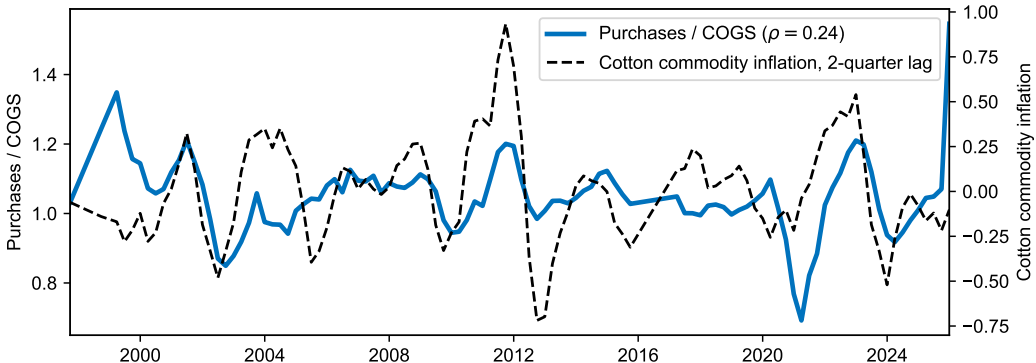
# Does Purchases/COGS capture variation in $c_t/h_t$? Example: Starbucks

- Use 10Qs for sales, COGS, purchases $=\Delta$BookValueInventory $+$ COGS.
- Compare to ICO Arabica coffee bean commodity price (via IMF).



# Does Purchases/COGS capture variation in $c_t/h_t$? Example: Gildan

- Use 10Qs for sales, COGS, purchases $=\Delta$BookValueInventory $+$ COGS.
- Compare to Cotlook benchmark cotton spot price (via IMF).



# Estimating $\phi$ across all firms

- Quarterly financial reporting data for public firms in Compustat:
  - Exclude firms in information (NAICS 51), finance/insurance/real estate (NAICS 52–53).
  - Observations with strictly positive sales, COGS, and inventory stock.
  - Firms using AAC or FIFO. (Under LIFO, $h_t \approx c_t$.)
  - Change in total assets over past year $< 30\%$ (avoid mergers / spin-offs).
- Specification:

$$\log(\text{Sales}/\text{COGS})_{it} = \phi \log(\text{Purchases}/\text{COGS})_{it} + \alpha_{iq} + \varepsilon_{it}.$$

where $\alpha_{iq}$ are firm $\times$ quarter-of-year FEs.

# Estimating $\phi$ across all firms

- Specification:

$$\log(\text{Sales}/\text{COGS})_{it} = \phi \log(\text{Purchases}/\text{COGS})_{it} + \alpha_{iq} + \varepsilon_{it}.$$

- Change in relative quantities of purchases / shipments $\hat{Y}_t - \hat{D}_t$ is omitted variable:

$$\hat{\phi} \to \phi \left[ 1 - \underbrace{\frac{Var\left(\hat{Y}_t - \hat{D}_t\right)}{Var\left(\widehat{\frac{\text{Purchases}}{\text{COGS}}}\right)}}_{\substack{\text{Attenuation bias} \\ <0}} + \underbrace{\frac{-Cov\left(\hat{c}_t - \hat{h}_t, \hat{Y}_t - \hat{D}_t\right)}{Var\left(\widehat{\frac{\text{Purchases}}{\text{COGS}}}\right)}}_{\substack{\text{Forward-buying bias} \\ >0}} \right].$$

  - Seasonal variation in $\hat{Y}_t - \hat{D}_t$: firm $\times$ quarter-of-year FEs.
  - Attenuation bias: IV using NAICS-4 industry $\times$ Känzig (2021) oil shocks.
  - IV estimates are upper bound if firms engage in forward buying ($\hat{Y}_t \downarrow$ when $\hat{c}_t \uparrow$).

# Estimating $\phi$: All firms

- OLS: $\phi \in [0.12, 0.15]$.
- NAICS-4 $\times$ Känzig (2021) oil shock IV: $\phi \in [0.35, 0.4]$.
- Extent of accounting cost pricing $\approx$ 60–80%.

| | *Log(Sales / COGS)* | | | |
|---|---|---|---|---|
| | Levels | | First Differences | |
| | OLS | IV | OLS | IV |
| | (1) | (2) | (3) | (4) |
| Log(Purchases / COGS) | 0.147** | 0.380** | 0.126** | 0.351** |
| | (0.015) | (0.104) | (0.014) | (0.079) |
| Firm $\times$ Quarter-of-Year FEs | Yes | Yes | Yes | Yes |
| *N* | 382 211 | 369 469 | 345 468 | 333 935 |
| $R^2$ | 0.86 | 0.86 | 0.09 | 0.04 |

# Estimating $\phi$: Comparative statics

1. **Homogeneous outputs or observable costs.**
   - Rauch (1999): Industries with reference prices ($r$) or organized exchanges ($w$) vs. administered prices ($n$).
2. **Competitors pricing off replacement costs.**
   - Share of firms in industry using LIFO in industry from Economic Census.
3. **Inventory lags.**
   - $h_t$ moves more slowly toward $c_t$ for firms with lower inventory turnover.
   - Firm inventory turnover, $\delta = \text{COGS}/\text{Inventories}$.

# Replacement cost pricing in commodity industries

- $\uparrow \phi$ with reference prices / organized exchanges, or where competitors use LIFO.

| | *Log(Sales / COGS)* | | | | | |
|---|---|---|---|---|---|---|
| | Levels | | First Differences | | | |
| | OLS | OLS | OLS | OLS | IV | IV |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log(Purchases / COGS) | 0.122** | 0.125** | 0.101** | 0.103** | −0.268 | −0.136 |
| | (0.016) | (0.019) | (0.017) | (0.016) | (0.376) | (0.265) |
| × Reference prices ($r$) | 0.079** | | 0.074* | | 1.006* | |
| | (0.029) | | (0.042) | | (0.599) | |
| × Organized exchange ($w$) | 0.254** | | 0.168** | | 0.720** | |
| | (0.062) | | (0.051) | | (0.329) | |
| × Industry LIFO share | | 0.185** | | 0.144** | | 0.744** |
| | | (0.090) | | (0.068) | | (0.353) |
| Firm × Quarter-of-Year FEs | Yes | Yes | Yes | Yes | Yes | Yes |
| $N$ | 251 379 | 276 804 | 227 964 | 251 033 | 225 546 | 242 882 |
| $R^2$ | 0.88 | 0.88 | 0.09 | 0.09 | 0.08 | 0.01 |

# More weight on recent costs when ↑ turnover

- More weight on recent replacement costs when inventory turns over faster (↑ $\delta$).

| | *Log(Sales$_{t\to t+4}$/COGS$_{t\to t+4}$)* | | | |
|---|---|---|---|---|
| | Levels | | First Differences | |
| | (1) | (2) | (3) | (4) |
| Log(Purchases$_{t\to t+4}$/COGS$_{t\to t+4}$) | 0.070 | 0.062 | 0.086** | 0.083** |
| | (0.070) | (0.071) | (0.024) | (0.024) |
| Log(Purchases$_{t\to t+4}$/COGS$_{t\to t+4}$) × log($\delta$) | 0.183** | | 0.065** | |
| | (0.064) | | (0.027) | |
| Log(Purchases$_{t\to t+4}$/COGS$_{t\to t+4}$) × log($\delta$) × FIFO | | 0.088 | | 0.043* |
| | | (0.061) | | (0.026) |
| Log(Purchases$_{t\to t+4}$/COGS$_{t\to t+4}$) × log($\delta$) × AAC | | 0.313** | | 0.099** |
| | | (0.081) | | (0.033) |
| Firm × Quarter-of-Year FEs | Yes | Yes | Yes | Yes |
| *N* | 365 785 | 365 785 | 338 437 | 338 437 |
| $R^2$ | 0.89 | 0.89 | 0.11 | 0.11 |

# Summary of estimates

- Average extent of accounting cost pricing $\approx$ 60–80%.
  - Accounting cost pricing $\geq$ 85% for firms in industries with administered prices.
  - Replacement cost pricing in industries with reference prices ($r$) or exchanges ($w$).
- Dependence on historical costs not due to inattention about replacement costs.
  - Our test uses purchases already made by firm!
  - Inventory turnover matters.

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# Why price off accounting costs?

Retailer CEO: All tariff pauses just ended on August 8. . . we all brought in as much previously (lower) tariffed goods before that, and most fall merchandise was here in the spring and early summer. . . so we are still selling goods that didn't have the latest tariff burden. But we are all raising prices slowly and carefully as the tariffed inventory gets sold (remember, accounting wise, we have a cash hit paying tariffs upon receipt, but we have a P&L hit when we sell the tariffed goods). [....]

Cochrane: It's interesting how the accounting treatment of bottom line matters. A pure economist would immediately mark up the current inventory to its opportunity cost[...], not its historical cost, book a windfall profit, and then mark any sales below that value as losses. Business[es] only raise prices when accounting losses force them to do so.

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$\Rightarrow$ Effectively, replacement cost pricing requires firms to "mark-to-market" inventories.

# Why price off accounting costs?

- “The need for objective and systematic measurement forces the cost standard to be backward-looking—or at least sideward- rather than forward-looking. [...] Any attempt to forecast input costs or to put them on a current replacement basis, which necessarily entails a forecast, would add to expenses, introduce a subjective element into cost calculations, and complicate the task of managerial control. Bygones cannot be mere bygones if they are the sole sources of systematic information.”

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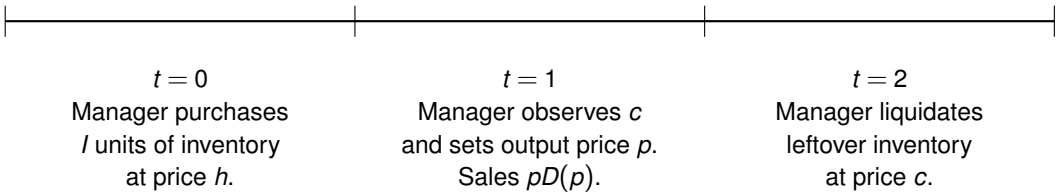
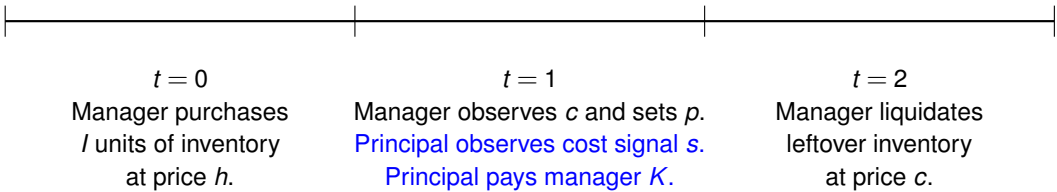
1. Observable accounting metrics, unverifiable info about replacement costs.
2. Misaligned incentives between principal and manager prevent communication.

# Two-period model: Frictionless




- No discounting. Assume $I$ fixed and $D(p) < I$ for all possible $p$ (no stockouts).
- $V^{\text{FB}} = \max_p \{-hI + pD(p) + c(I - D(p))\}$.
- $p^* = \arg\max_p (p - c)D(p)$.

# Two-period model: Frictions




- Principal delegates firm operations to manager.
- Friction 1: Replacement cost $c$ is manager's private information.
- Public signal $s \sim N(c/h, \tau^{-1})$. Friction disappears as precision $\tau \to \infty$.

# Two-period model: Frictions

- Friction 2: Misaligned incentives.

$$V^{\text{manager}} = \max_{p} \Big\{ \underbrace{-hI + pD(p) + c(I - D(p))}_{\text{True firm value}} + \underbrace{(\alpha - 1)\,p}_{\text{Pricing wedge}} + \underbrace{K\left(pD(p), hD(p); s\right)}_{\text{Incentive payment}} \Big\}.$$

- When $\alpha \neq 1$, manager wants to set price lower or higher than optimal.

  E.g., Baumol (1959), Bertrand and Mullainathan (2003), Graham et al. (2005).

- Manager preference $\alpha$ is private information.

- Principal can incentivize manager, but can only condition payment on observed info.

# Two-period model: Frictions

- Why can't principal condition payment on liquidation proceeds at $t = 2$?
  - Liquidation proceeds reveal $c$ to both parties.
  - We assume that contract must be tied to performance observable at $t = 1$ $\Rightarrow$ need to monitor and incentivize manager in a timely manner.
- Why can't manager just tell principal $c$?
  - Manager always has incentive to misreport $c$ in order to justify desired price.
- Principal's trade-off:
  - Stronger incentives limit extent to which manager preference $\alpha$ affects price...
  - ...but also lead manager to disregard valuable info about $c$.

# Two-period model

- Log-linearize around $h = c = 1$ and $\alpha = 1$. Let $\hat{x}$ be log-deviation of $x$.
- Define $\sigma_\alpha^2 = \mathbb{E}[\hat{\alpha}^2]$ and $\sigma_\varepsilon^2 = \mathbb{E}[(\hat{c} - \hat{h})^2]$.
- Local demand elasticity $\eta$. I.e., $\hat{D} = -\eta \hat{p}$.
- Principal's payment locally quadratic around target accounting markup $\mu(s)$,

$$K(pD(p), hD(p); s) = -\frac{\kappa}{2}\left(\frac{pD(p)}{hD(p)} - \mu(s)\right)^2.$$

# Pricing without incentives

- Suppose no incentive payment ($\kappa = 0$). Then, price set by manager is

$$\hat{p} = \hat{c} + \psi_0 \hat{\alpha}, \qquad \text{where} \qquad \psi_0 = \frac{1}{\eta - 1} \left( \frac{\eta}{\eta - 1} \right)^{\eta}.$$

- $\psi_0 =$ elasticity of price to manager preference $\alpha$ when $\kappa = 0$.

- Decreasing in demand elasticity $\eta$, b/c firm value becomes more convex in price.

- Managerial slack harder to sustain in competitive industries.

  Hart (1983), Giroud and Mueller (2010, 2011).

# Optimal contract parameters

- Optimal contract parameters:

$$\underbrace{\mu^*(s) = \frac{\eta}{\eta - 1} \exp\left(\frac{\tau\sigma_\varepsilon^2}{1 + \tau\sigma_\varepsilon^2} s\right)}_{\text{Target accounting markup}}, \qquad \underbrace{\kappa^* = \frac{1}{\eta}\left(\frac{\eta}{\eta - 1}\right)^\eta \frac{\sigma_\alpha^2}{\sigma_\varepsilon^2}\left(1 + \tau\sigma_\varepsilon^2\right)}_{\text{Strength of incentives}}.$$

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- Principal "marks-to-market" inventory using signal $s$.

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- Principal "marks-to-market" inventory using signal $s$.
- Stronger incentives $\kappa^*$ when...
  - Higher risk of manager discretion vs. value of info about replacement cost, $\sigma_\alpha^2/\sigma_\varepsilon^2$.
  - When demand elasticity $\eta$ low. (When $\eta$ high, market already disciplines price).
  - When cost observed precisely ($\tau \uparrow$).

# Optimal contract parameters

- Optimal contract parameters:

$$\underbrace{\mu^*(s) = \frac{\eta}{\eta - 1} \exp\left(\frac{\tau\sigma_\varepsilon^2}{1 + \tau\sigma_\varepsilon^2} s\right)}_{\text{Target accounting markup}}, \qquad \underbrace{\kappa^* = \frac{1}{\eta}\left(\frac{\eta}{\eta - 1}\right)^\eta \frac{\sigma_\alpha^2}{\sigma_\varepsilon^2}\left(1 + \tau\sigma_\varepsilon^2\right)}_{\text{Strength of incentives}}.$$

- Principal "marks-to-market" inventory using signal $s$.
- Stronger incentives $\kappa^*$ when...
  - Higher risk of manager discretion vs. value of info about replacement cost, $\sigma_\alpha^2/\sigma_\varepsilon^2$.
  - When demand elasticity $\eta$ low. (When $\eta$ high, market already disciplines price).
  - When cost observed precisely ($\tau \uparrow$).

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  - When cost observed precisely ($\tau \uparrow$).

# Pricing under optimal contract

- Manager sets

$$\hat{p} = \underbrace{\phi\,[\hat{c} + \psi\,\hat{\alpha}]}_{\substack{\text{Replacement}\\ \text{cost pricing}}} + \underbrace{(1-\phi)\,\hat{h}}_{\substack{\text{Accounting}\\ \text{cost pricing}}},$$

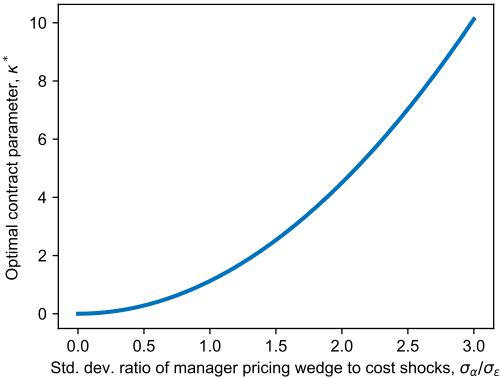
  where

$$1-\phi = \frac{\sigma_\alpha^2/\sigma_\varepsilon^2}{\sigma_\alpha^2/\sigma_\varepsilon^2 + \psi_0^{-2} + \tau\sigma_\alpha^2}, \qquad \text{and} \qquad \psi = \frac{1}{1+\tau\sigma_\alpha^2\psi_0^2}\psi_0.$$

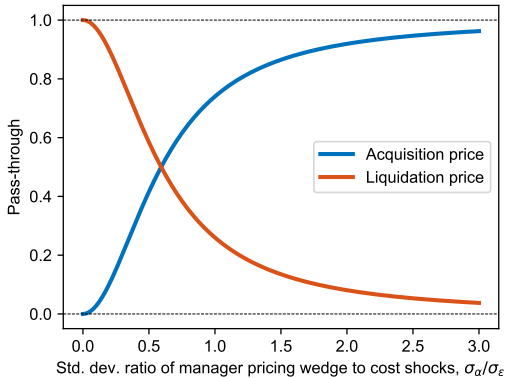
- Firms sets blended average of replacement cost and accounting cost price.
- $1-\phi$ is the extent of accounting cost pricing.
- Extent of accounting cost pricing increasing in $\sigma_\alpha^2/\sigma_\varepsilon^2$, decreasing in $\eta$ and $\tau$.

# Pricing under optimal contract

- As risk of manager discretion grows, $\kappa^*$ rises and $\phi$ falls.

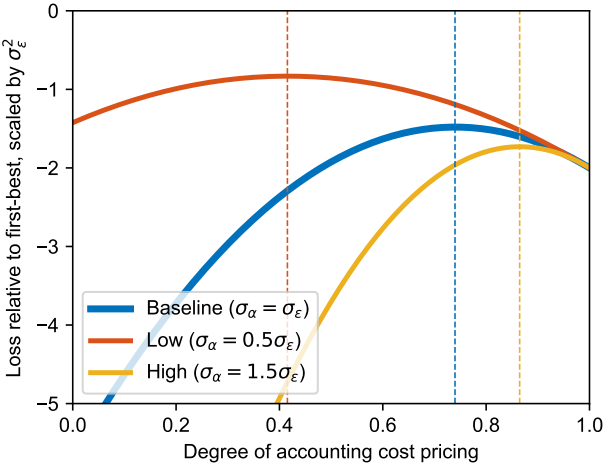



(a) Optimal contract parameter $\kappa^*$.




(b) Replacement vs. accounting cost pricing.

# Losses relative to first best

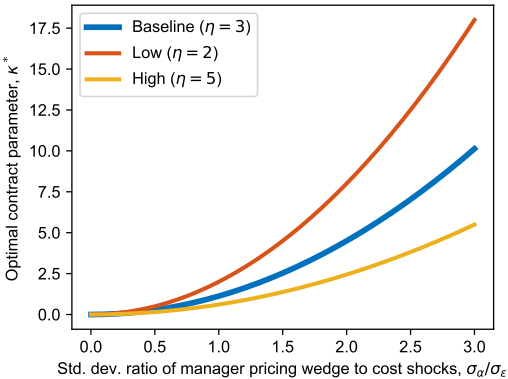



- With optimal contract and $\tau = 0$,

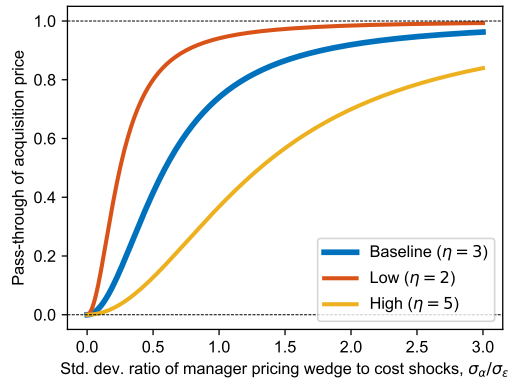
  $$\mathscr{L} = \mathbb{E}[V^{\text{FB}} - V] \approx (\eta - 1)(1 - \phi)\sigma_\varepsilon^2.$$

- If $\sigma_\varepsilon^2 = 0$, $\mathscr{L} = 0$.
- If $\sigma_\alpha^2 = 0$, $\phi = 1$ and $\mathscr{L} = 0$.
- $\mathscr{L}$ nonmonotonic in $\eta$.
  ($\uparrow$ losses but $\phi \to 1$.)

# More accounting cost pricing when demand elasticity is low



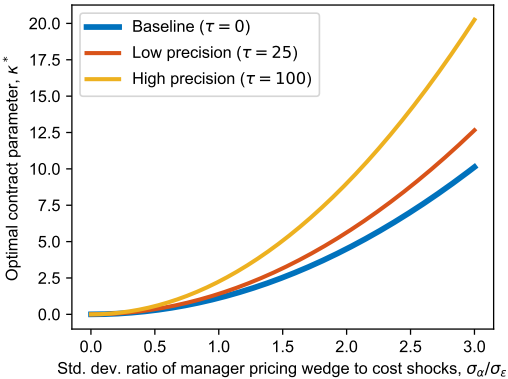

(a) Optimal contract parameter $\kappa^*$.



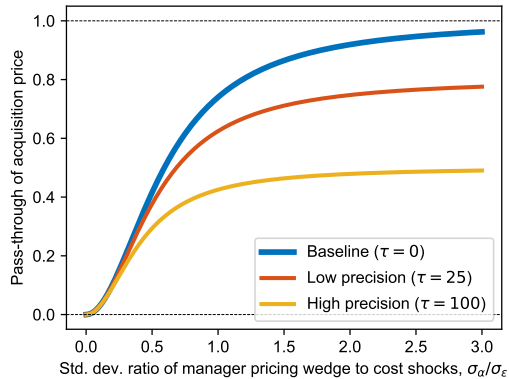

(b) Weight on accounting cost pricing $(1 - \phi)$.

- The reliance of firms on historical costs is evident in many empirical studies. [....] The exceptions that occur to me arise when processed raw materials are sold on auction markets, as in the case of flour or soybean meal. (Okun 1981, pp. 156–157).

# More accounting cost pricing when costs not observable




(a) Optimal contract parameter $\kappa^*$.




(b) Weight on accounting cost pricing $(1 - \phi)$.

- E.g., makers of gold/silver jewelry, typically use current market price of metal inputs.

# Other pricing puzzles

- Main result: Unverifiable info and principal–agent frictions mean:
  - Prices incorporate info irrelevant to $p^{FB}$ (e.g., historical input prices).
  - Prices neglect info germane to $p^{FB}$ but unverifiable (e.g., replacement costs).

# Other pricing puzzles

- Main result: Unverifiable info and principal–agent frictions mean:
  - Prices incorporate info irrelevant to $p^{FB}$ (e.g., historical input prices).
  - Prices neglect info germane to $p^{FB}$ but unverifiable (e.g., replacement costs).
- Fixed costs: Suppose both $c$ and overhead cost $F$ are stochastic.
  - Pass through innovations in $F$ with same weight as $\hat{h}$, $(1-\phi)$.
  - Long history of survey evidence. Hall and Hitch (1939), Altomonte et al. (2015), Bewley (2025).
- Demand shocks: Suppose demand elasticity $\eta$ is stochastic.
  - Pass through innovations in optimal markup with same weight as $\hat{c}$, $\phi$.
  - Empirical evidence. Cagan (1979), Bils and Chang (2000), Fabiani et al. (2006), Gagnon and Lopez-Salido (2020), Kohler et al. (2026).

# Alternative explanations

- **Earnings smoothing.** Graham et al. (2005), Terry (2023).
  - Earnings depend on quantities $\Rightarrow$ depends on what other firms do.
  - If quantities don't change in equilibrium (e.g., all firms set same price and industry demand inelastic), then earnings smoothing $=$ setting target accounting markup.
- **Fairness.** Kahneman et al. (1986), Rotemberg (2005, 2011), Eyster et al. (2021).
  - Similar structure: outsider tries to evaluate whether price is justified.
  - Fairness binds more on price increases than decreases. But estimates of $\phi$ symmetric.

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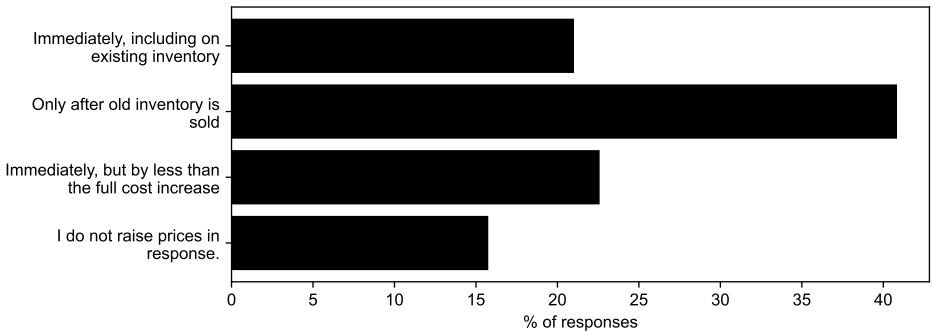
# Survey evidence

1. Many firms report waiting to raise prices until inventory at old cost is exhausted.
2. Pass-through of changes in overhead costs.
3. Limited pass-through of expected future costs.

# Survey evidence

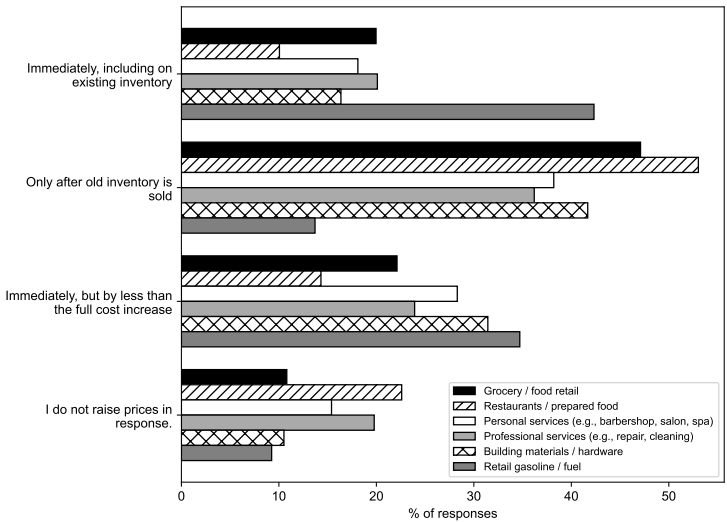
- “Suppose your input cost rises today, but you still have inventory bought at lower cost. When do you raise your sales price?”




Note: Survey of 400 firm price-setters by Schoenle (2026).

- Not about uncertainty about future costs!

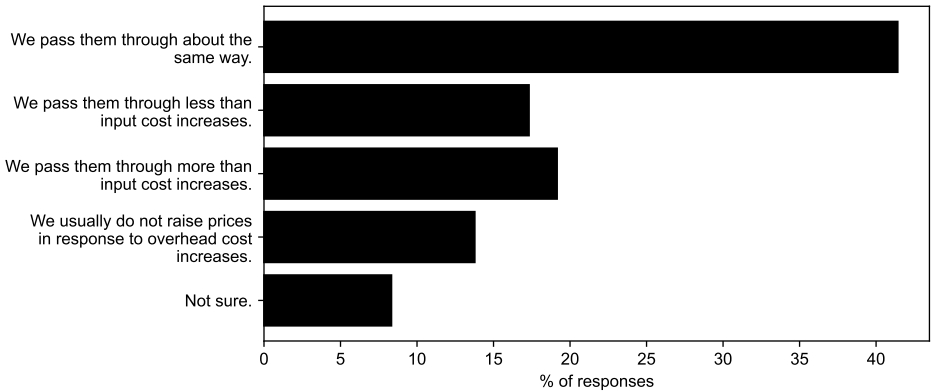
# Exceptions




- Exception: gas stations.
- “The exceptions that occur to me arise when processed raw materials are sold on auction markets, as in the case of flour or soybean meal.” (Okun 1981).
- (Anecdotal) exception: sellers of gold/silver jewelry.

# Firms' reported pass-through of fixed costs

- "Suppose your overhead costs go up, for example on rent, insurance, salaried staff or equipment leases. How do increases in such overhead costs affect your pricing—compared to increases in per-unit input costs on materials, wholesale goods, shipping per item, or hourly labor per job?"



# Prices don't incorporate expected cost changes, but not b/c firms uninformed

- Fed Atlanta BIE survey: Firms' price changes incorporate realized, past cost changes but not expectations of future cost changes.
- Not because firms inattentive: Expectations predict future cost changes.

| | *Realized Price Change*$_t$ | | *Realized Cost Change*$_{t+12}$ | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\mathbb{E}_t$[Cost Change$_{t+12}$] | −0.082 | −0.169 | 0.354** | 0.294** |
| | (0.204) | (0.182) | (0.090) | (0.083) |
| Realized Cost Change$_t$ | 1.272** | 0.979** | −0.050 | −0.040 |
| | (0.305) | (0.233) | (0.055) | (0.048) |
| Firm FEs | Yes | Yes | Yes | Yes |
| Date FEs | Yes | | Yes | |
| Date-Sector FEs | | Yes | | Yes |
| $N$ | 3493 | 3480 | 1415 | 1410 |
| $R^2$ | 0.48 | 0.56 | 0.65 | 0.73 |

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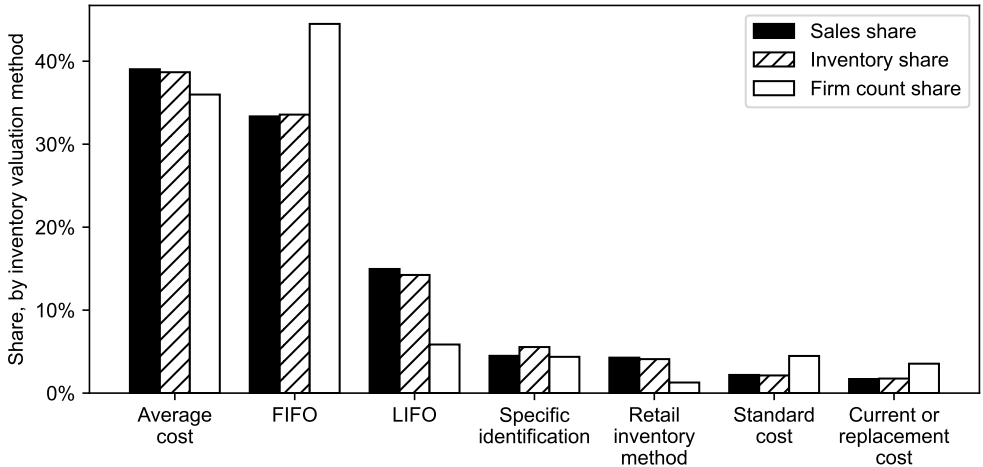
# Calculating accounting costs

- In two-period setting, book value of inventory is unambiguous (*hl*).
- In dynamic setting, depends on how firm apportions cost across past purchases. E.g.,
  - Average acquisition cost (AAC).
  - First-in-first-out (FIFO).
  - Last-in-first-out (LIFO).
- Under all three, COGS reflects historical purchase costs. Methods differ in the weight they place on recent vs. more distant periods.
- $\Rightarrow$ Connection between accounting cost pricing and canonical sticky-price models.

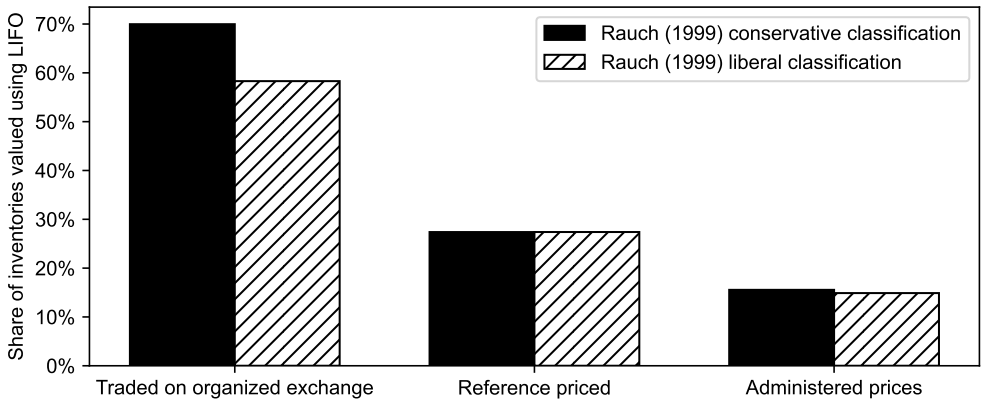
# AAC and FIFO most common inventory valuation methods

- Valuation methods used by inventory-carrying public firms over 2010–2025:



# AAC/FIFO more common among firms likely to price off accounting costs

- LIFO concentrated in markets with highly homogeneous outputs (organized exchanges) or inputs (reference-priced), where we expect less accounting cost pricing.



# Price dynamics under average acquisition cost (AAC)

- Law of motion for inventories:

$$I_t = I_{t-1} - D_t + Y_t.$$

- Average acquisition cost (AAC) accounting:

$$h_t I_t = \left(I_{t-1} - D_t\right) h_{t-1} + Y_t c_t.$$

  $\Rightarrow h_t$ is average of $h_{t-1}$ and $c_t$, weighted by leftover inventory vs. new purchases.

- Log-linearizing around steady state with shipment-inventory ratio $\delta = D^{ss}/I^{ss}$,

$$\hat{p}_t = \hat{h}_t = (1-\delta)\,\hat{h}_{t-1} + \delta \hat{c}_t.$$

- Recursive formulation for prices looks familiar...!

# Price dynamics under average acquisition cost (AAC) vs. Calvo

- Given a path of cost deviations from steady-state $\{\hat{c}_t\}_{t=-\infty}^{\infty}$,

$$\hat{p}_t^{\text{AAC}} = \delta \sum_{k=0}^{\infty} (1-\delta)^k \hat{c}_{t-k},$$

$$\hat{p}_t^{\text{Calvo}} = \theta \sum_{k=0}^{\infty} (1-\theta)^k \hat{c}_{t-k} + \underbrace{\theta [1-\beta(1-\theta)] \sum_{k=0}^{\infty} \sum_{s=0}^{\infty} \beta^s (1-\theta)^{k+s} \mathbb{E}_{t-k} [\hat{c}_{t+s-k} - \hat{c}_{t-k}]}_{\text{Due to forward-looking reset prices}},$$

  - AAC: $\delta$ is steady-state shipment-inventory ratio.
  - Calvo: $\theta$ is fraction of firms able to reset prices each period, and $\beta$ is discount factor.

- Paths of prices coincide if $\delta = \theta$ and either $\beta = 0$ or $\mathbb{E}_{t+s}[\hat{c}_{t+s}] = \hat{c}_t$ for all $t, s$.

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- AAC pricing behaves like “myopic Calvo” (Minton and Wheaton 2022).
- Not because of inattention, but because prices synchronized with accounting costs.
- Rate of decay determined by shipment-inventory ratio, not length of price spells.

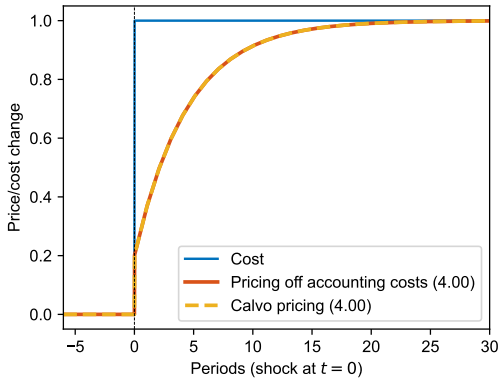
# Differences in AAC vs. Calvo price dynamics

- Besides the fact that lags come from shipment-inventory ratios $\delta$ rather than price stickiness $\theta$...

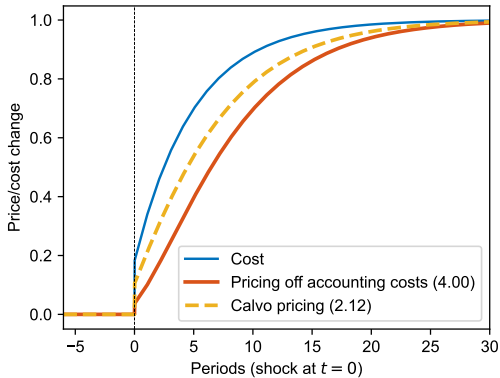
1. More delayed adjustment to slow-moving shocks.
2. Amplification of delays in supply chains.
3. Increased response to transitory shocks.
4. Delayed response when firms stock up before cost increase.

# #1: More delayed adjustment to slow-moving shocks

- Set $\delta = \theta = 0.2$. Shock path, unexpected before $t = 0$: $\hat{c}_t = 1 - \rho^{t+1}$.



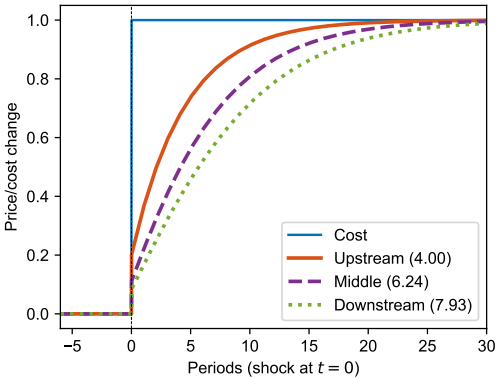

(a) Immediate shock ($\rho = 0$).



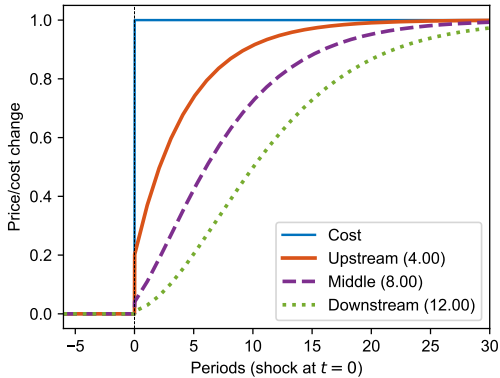

(b) Slow-moving shock ($\rho = e^{-0.2}$).

# #2: Amplification of delays in supply chains

- Each firm turns cost shock into slower-moving shock for downstream firm.

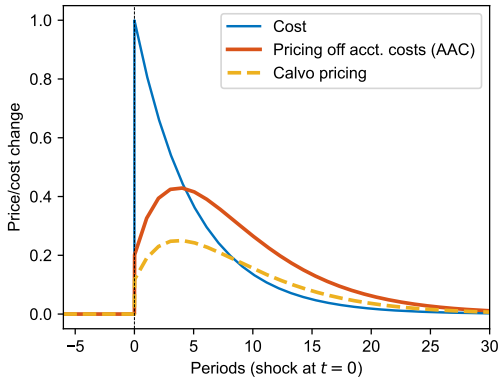



(a) Calvo.

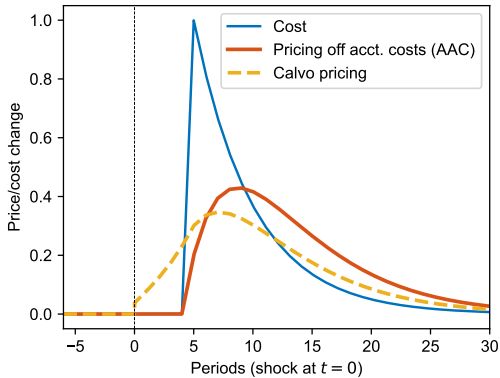



(b) Pricing off accounting costs (AAC).

# #3: Increased responsiveness to transitory shocks




(a) Unanticipated cost increase at $t = 0$.




(b) News at $t = 0$ about cost increase at $t = 5$.

# #4: Forward buying delays pass-through of cost increases

- First-order approximation for prices did not require keeping track of inventory stocks:

$$\hat{p} = (1-\delta)\hat{h}_{t-1} + \delta\hat{c}_t.$$

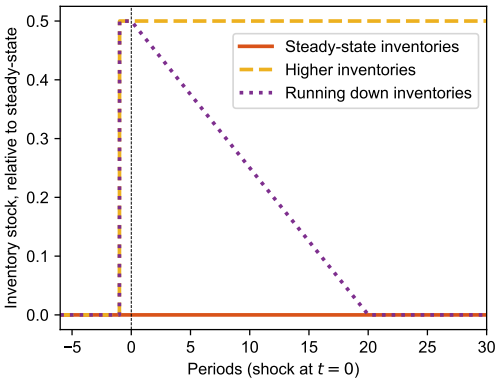
- Effects of stocking up on inventories show up at second-order:

$$\hat{h}_t = \underbrace{(1-\delta)\,\hat{h}_{t-1} + \delta\hat{c}_t}_{\text{First order}} + \underbrace{\frac{1}{2}\delta\,(1-\delta)\,(\hat{c}_t - \hat{h}_{t-1})^2}_{\text{Second-order correction}} + \underbrace{\delta\,(\hat{c}_t - \hat{h}_{t-1})\,(\hat{Y}_t - \hat{I}_t)}_{\text{Effect of inventories / purchases}}.$$

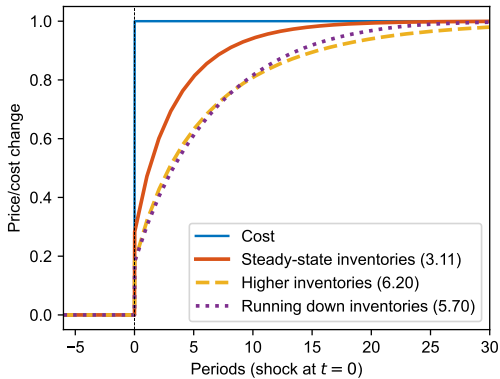
- If purchases low relative to inventory stock when replacement costs rise $\Rightarrow$ lower price.

# #4: Forward buying delays pass-through of cost increases

- Illustrate with exogenous inventory paths in second-order approximation:




(a) Inventory paths.

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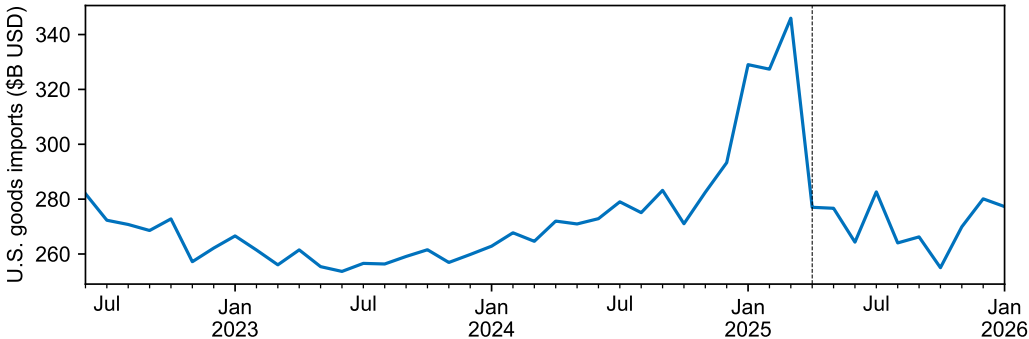
# #4: Forward buying delays pass-through of cost increases




- Sticky prices: Need “myopic expectations” to amplify delays. Minton and Wheaton (2022).
- But firms clearly stocking up in anticipation! Not myopic.
- Accounting cost pricing + forward buying delays pass-through.

# FIFO and LIFO

- Given a path of cost deviations from steady-state $\{\hat{c}_t\}_{t=-\infty}^{\infty}$,

$$\hat{p}_t^{\text{FIFO}} = \hat{c}_{t-1/\delta},$$
$$\hat{p}_t^{\text{LIFO}} = \hat{c}_t,$$

# FIFO and LIFO

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$$\hat{p}_t^{\text{LIFO-}\delta} = \delta \sum_{k=0}^{1/\delta-1} \hat{c}_{t-k}, \qquad \text{[Firms buy inventory every } 1/\delta \text{ periods.]}$$

# FIFO and LIFO

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$$\hat{p}_t^{\text{FIFO}} = \hat{c}_{t-1/\delta},$$
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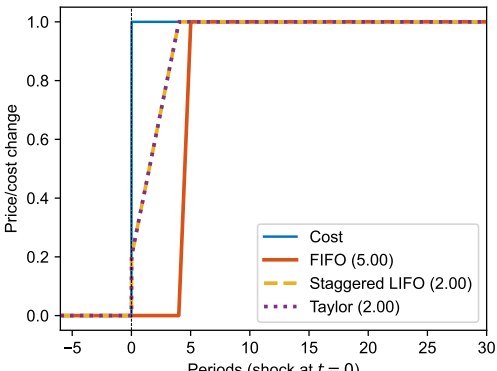
$$\hat{p}_t^{\text{LIFO-}\delta} = \delta \sum_{k=0}^{1/\delta-1} \hat{c}_{t-k}, \qquad \text{[Firms buy inventory every } 1/\delta \text{ periods.]}$$
$$\hat{p}_t^{\text{Taylor}} = \frac{1}{N}\sum_{k=0}^{N-1} \hat{c}_{t-k} + \underbrace{\frac{1}{N}\frac{1-\beta}{1-\beta^N}\sum_{k=0}^{N-1}\sum_{s=0}^{N-1}\beta^s \mathbb{E}_{t-k}\left[\hat{c}_{t+s-k} - \hat{c}_{t-k}\right]}_{\text{Due to forward-looking reset prices}}.$$

  - LIFO w/ intermittent purchases (LIFO-$\delta$): Firms stock up on inventory every $1/\delta$ periods.
  - Taylor: Firm resets price every $N$ periods, and $\beta$ is discount factor.

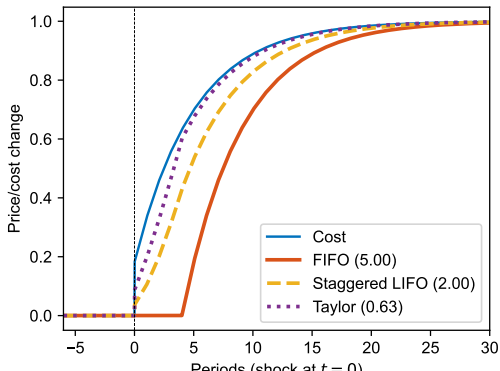
- LIFO-$\delta$ and Taylor coincide if $\delta = 1/N$ and either $\beta = 0$ or $\mathbb{E}_{t+s}[\hat{c}_{t+s}] = \hat{c}_t$ for all $t, s$.

# FIFO, LIFO, and Taylor pricing

- Similar intuitions as AAC vs. Calvo.




(a) Immediate shock.




(b) Slow-moving shock.

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# Accounting cost pricing $\Rightarrow$ macro rigidity?

- "Industry experts estimate it takes at least nine months for raw bean prices to filter through to coffee drinkers [....] because U.S. roasters typically hold about two to three months' worth of bean stocks on average and need another two to three months to roast and package their products." — *Reuters, Dec 19 2025*

- "Cocoa—the key ingredient in chocolate—has been steadily falling in price from its all-time high in 2024. [...] But that drop hasn't trickled down to what consumers are paying. [...] The reason: The Easter chocolate on shelves today was produced using cocoa purchased at its extreme high." — *CNN Business, Apr 5 2026*

- "It is reasonably predictable that today's changes in cattle prices will show up on the supermarket counter only after a lag; the butcher does not keep changing price tags in pace with changes in some putative replacement cost."

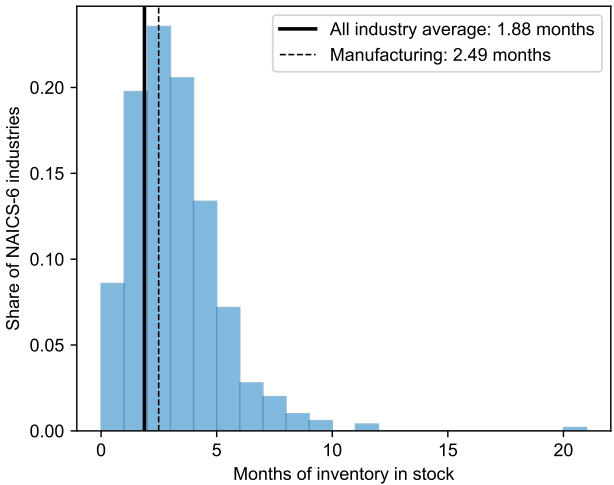
— Okun (1981), *Prices and Quantities*

# Quantitative input–output model of U.S. economy

| Variable | Description | Source |
|---|---|---|
| $\Omega$ | Input–output matrix | BEA 2017 405-industry input-output table |
| $\beta$ | Discount factor | $(0.96)^{1/12}$ |
| $\theta_i$ | Frequency of price change | Pasten et al. (2020) |
| $\delta_i$ | Shipment-inventory ratios | Economic Census 2017 COGS / Inventories |

- Benchmark input–output model with price rigidities á la Rubbo (2023).
- Inventories for mining (21), manufacturing (31–33), wholesale (42) & retail (44–45).
- “Hybrid” model where these industries have accounting cost pricing, rest have Calvo.
- Compare CPI response to commodity shocks to benchmark Calvo model.

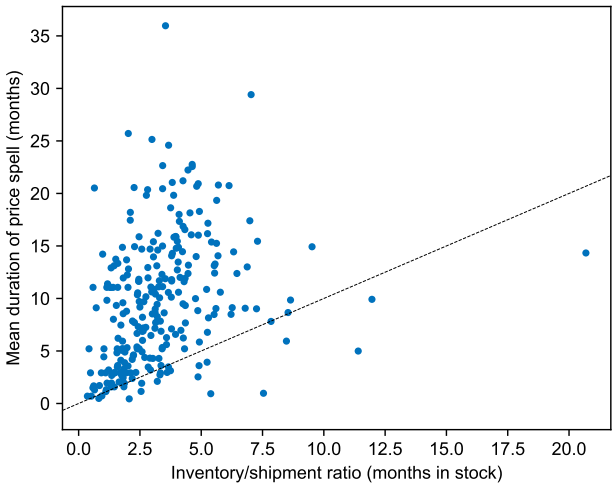
# Inventory–shipment ratios from Economic Census




Industries with largest inventory–shipment ratios:

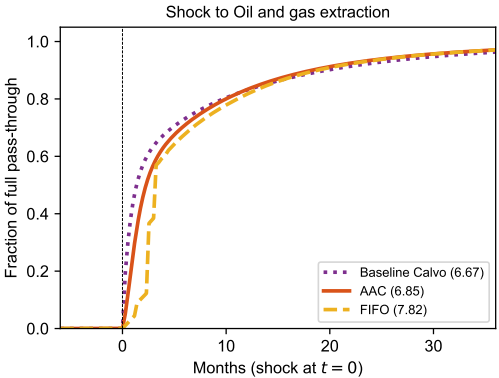
- Wineries.
- Biological product mfg.
- Aircraft mfg.
- Distilleries.
- Aerospace products and parts mfg.

# Inventory–shipment ratios from Economic Census

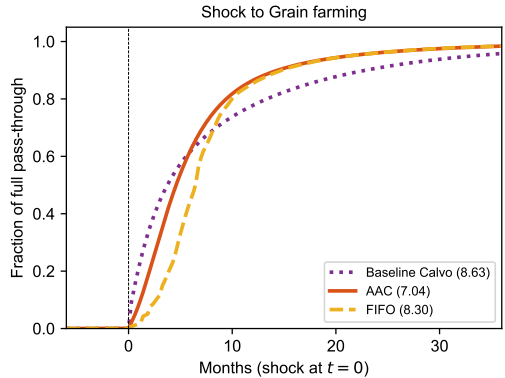



- For most industries, $1/\delta_i < 1/\theta_i$ from Pasten et al. (2020).
- Two factors help accounting cost pricing.
- 1. Forward-looking reset prices under Calvo.
- 2. Reroute I–O table to account for margin industries.

# Effects of commodity industry shocks on CPI




(a) Oil and gas extraction.




(b) Grain farming.

- Measure cumulative pass-through delay, $\sum_{t=0}^{\infty}(1 - \hat{p}_{\text{CPI},t}/\hat{p}_{\text{CPI},\infty})$.

# Effects of commodity industry shocks on CPI

- Despite $1/\delta_i < 1/\theta_i$, accounting cost pricing generates similar delays in price adjustment to benchmark Calvo model.
- AAC or FIFO generate larger cumulative pass-through delay in about 1/2 of cases.

| Industry description | Long-run pass-through (%) | Cumulative delay Calvo | AAC | FIFO |
|---|---|---|---|---|
| Petroleum refineries | 4.35 | 5.70 | 5.59 | 6.21 |
| Electric power generation, transmission, and distribution | 2.56 | 7.34 | 5.74 | 5.97 |
| Animal (except poultry) slaughtering and processing | 1.78 | 3.41 | 4.34 | 4.84 |
| Other basic organic chemical manufacturing | 1.53 | 13.25 | 10.99 | 11.82 |
| Beef cattle ranching and farming | 1.35 | 4.75 | 4.95 | 5.89 |
| Grain farming | 1.27 | 8.63 | 7.04 | 8.30 |
| Plastics material and resin manufacturing | 1.02 | 16.00 | 11.40 | 12.38 |
| Iron and steel mills and ferroalloy manufacturing | 0.87 | 18.37 | 12.10 | 13.15 |
| Paperboard container manufacturing | 0.80 | 13.55 | 9.89 | 10.68 |
| Fruit and tree nut farming | 0.79 | 6.05 | 5.98 | 6.91 |

# Conclusion

- Widespread reports that firms set prices using past inventory purchase costs.
- We develop a model of accounting cost pricing.
- Synthesizes other pricing puzzles:
  - Use irrelevant info: Hedging gains/losses, changes in fixed costs.
  - Neglect relevant info: Demand shocks, replacement costs, anticipated future costs.
- Extent of accounting cost pricing.
  - 60–80% overall, 85–100% for firms with administered prices.
- Can resemble sticky-price models and generate similar delays in macro adjustment.

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# The Standard Theory: Firm Problem

- Given inventory $I_{t-1}$ and current replacement cost $c_t$, firm value is:

$$V(I_{t-1}, c_t) = \max_{p_t, Y_t} \{p_t D_t - c_t Y_t + \beta \mathbb{E}[V_{t+1}(I_t, c_{t+1})]\},$$

  where

$$I_t = I_{t-1} - D_t + Y_t. \qquad \text{(Inventory law of motion)}$$
$$mr_t(p_t) = D_t + p_t(dD_t/dp_t). \qquad \text{(Marginal revenue)}$$

- FOCs: Set marginal revenue = marginal cost = current replacement cost:

$$mr_t(p_t) = \beta \mathbb{E}\left[\frac{\partial V_{t+1}}{\partial I_t}\right] = c_t.$$

- Some (unsatisfactory) directions: $Y_t \geq 0$, $D_t \leq I_{t-1}$, perishable inventory, convex inventory carrying costs, borrowing constraint.

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