



Inventory Method Choice and Product Market Competition

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Background

- **Early 1970s through early 1980s: high inflation in U.S.**
- **Some U.S. public companies adopt LIFO for tax purposes.**
- **Book-tax conformity requires use of LIFO for financial reporting purposes.**
- **Renewed interest because IFRS does not allow LIFO.**



How will adopting LIFO affect firm value?

- **Two perspectives**
- **LIFO should have a positive effect due to tax savings.**
- **LIFO should have a negative effect due to lower reported earnings.**



LIFO Puzzles

- **Why didn't all firms adopt LIFO?**
- **Why was it so difficult to find a positive stock price response to LIFO adoption (e.g. Ricks 1982; Biddle & Lindahl 1982)?**
- **Despite considerable research, still no satisfactory answer to why a lot of firms did not adopt LIFO.**
- **The standard answer: the cash flow benefit from lower tax payments was less than the cost of adoption.**



LIFO and Cash Flows

- **Prior LIFO research assumed that the cash flow effects of LIFO adoption were:**
- **Lower tax payments**
- **Higher recordkeeping costs**
- **Lower earnings affecting costs of accounting-based contracts**
- **Our study provides a new theory about how LIFO can affect cash flows**



Model

- **N identical firms compose an industry facing a demand curve with demand parameter d and price elasticity of demand ε .**
- **Interest rate r , inflation rate $\pi < r$, tax rate τ .**
- **Per unit production cost on date j is $c(1 + \pi)^j$.**
- **Firms compete in quantities (Cournot) to maximize firm profits.**
- **All firms chooses either FIFO or LIFO.**



Equilibrium Proposition 1

- **Firm profits under LIFO**

$$\Pi_i^L = \left[\frac{(1+\pi)^{j+1}}{\varepsilon N(1+r)} \right] \left[\frac{d(1-\tau)}{N} \right]^\varepsilon \left[\frac{(\varepsilon N - 1)(1+\pi)}{\varepsilon c(1+r-\tau-\tau\pi)} \right]^{\varepsilon-1}$$

- **Firm profits under FIFO**

$$\Pi_i^F = \left[\frac{(1+\pi)^{j+1}}{\varepsilon N(1+r)} \right] \left[\frac{d(1-\tau)}{N} \right]^\varepsilon \left[\frac{(\varepsilon N - 1)(1+\pi)}{\varepsilon c(1+r-\tau)} \right]^{\varepsilon-1}$$



- **Each firm's profits are higher under FIFO than under LIFO if demand curve is inelastic ($\varepsilon < 1$).**
- **Why? Each firm pays higher taxes under FIFO than under LIFO.**
- **But firms also produce less under FIFO because marginal revenue = marginal cost and FIFO raises marginal costs.**



- **Choosing FIFO moves production closer to the level that maximizes industry pretax profits (e.g., monopolist output.)**
- **If demand is inelastic, the price effect more than offsets the tax effect, so FIFO increases industry profits.**
- **Intuition is similar to Katz & Rosen (1985), a tax on factor inputs can increase firm profits if demand is inelastic.**



Inventory choice problem

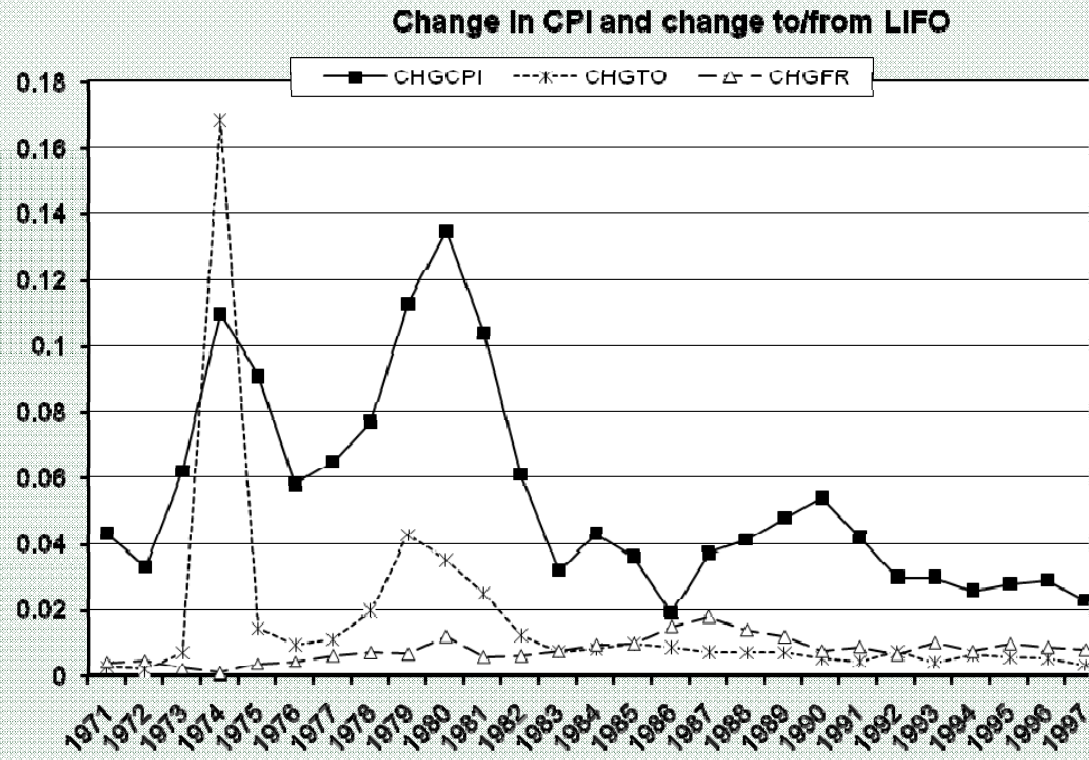
- **Why would firms choose an inventory method to maximize industry profits instead of firm profits?**
- **Firm bears tax cost of FIFO, while all firms in the industry share benefits of reduced production.**
- **But inventory methods are observable via financial statements.**



- **In a repeated Prisoner's Dilemma, every firm chooses FIFO as long as every other firm chooses FIFO.**
- **All firms switch to LIFO if any firm switches to LIFO.**
- **Every firm should continue to choose FIFO if $\varepsilon < 1$ and the industry is sufficiently concentrated.**
- **Empirical implications: A FIFO firm is more likely to be in a concentrated industry that faces an inelastic demand curve.**



Time Period





Data

- **Sample consists initially of all Compustat firms with data for assets, sales, inventory, and inventory method.**
- **For 1976, our sample consists of 4,492 firms in 407 industries.**
- **We consider a firm to be a LIFO firm if the first digit of the Compustat inventory code is "2", and a non-LIFO firm if the first digit is any other number.**



Industry concentration measure

- **Industry concentration = Herfindahl index**
- **Sum of the squared shares of all firms in an industry.**
- **Each firm's share is equal to the firm's sales divided by the total sales for the industry.**
- **Definition of an industry based on Compustat's four-digit SIC codes.**



Price elasticity measure

- We use industry *elasticity of substitution* estimates related to imported products for a number of industries at Christian Broda's website.
- We use elasticity of substitution as a proxy for the price elasticity of demand.
- When we measure elasticity at 2-digit level we have matches for 176 industries.



Examples of data

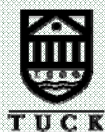
Sample industry composition for 1976

Industry Name	SIC	Concentration	Number of firms			Elasticity
			Total	LIFO	Non-LIFO	
TELE & TELEGRAPH APPARATUS	3661	0.646	27	1	26	1.045
DENTAL EQUIPMENT & SUPPLIES	3843	0.532	10	1	9	1.702
FABRICATED RUBBER PRODUCTS	3060	0.136	16	12	4	6.875
STEEL WORKS & BLAST FURNACES	3312	0.105	36	23	13	9.911



Empirical specification

- **Logit regression with inventory method (LIFO = 1) as the dependent variable.**
- **$INV = \alpha + \beta_1 \text{CONC} + \beta_2 \text{ELAST} + \beta_3 \text{CONTROLS} + \varepsilon$**
- **Control variables are size, leverage, inventory/assets, and COGS/inventory.**
- **Estimate separate cross sectional regressions each year because inventory choice is not independent over time.**



Results

Table 4

Logit results; dependent variable equals 1 if LIFO is primary inventory method, 0 otherwise

	Including elasticity estimates						
	1976	1977	1978	1979	1980	1981	1982
Intercept	-1.517***	-1.475***	-1.575***	-1.555***	-1.302***	-1.776***	-1.844***
	0.241	0.267	0.274	0.275	0.274	0.251	0.243
CONC	-0.733**	-0.836**	-0.704**	-0.876***	-0.738**	-0.525*	-0.617**
	0.308	0.339	0.340	0.345	0.332	0.317	0.305
ELAST	0.216***	0.273***	0.272***	0.322***	0.260***	0.303***	0.232***
	0.072	0.072	0.074	0.073	0.071	0.071	0.071
SIZE	0.405***	0.402***	0.432***	0.414***	0.393***	0.421***	0.430***
	0.029	0.029	0.029	0.029	0.027	0.027	0.027
PCTINV	-1.585***	-1.717***	-1.845***	-1.823***	-1.966***	-1.510***	-1.314***
	0.501	0.508	0.497	0.487	0.463	0.456	0.460
LEVER	-1.981***	-2.027***	-2.098***	-1.748***	-1.682***	-1.445***	-1.307***
	0.303	0.303	0.319	0.303	0.282	0.277	0.251
INVTO	-0.005	-0.004	0.002	-0.001	-0.001	0.000	-0.001
	0.009	0.008	0.005	0.004	0.002	0.003	0.003
n=	2,320	2,276	2,205	2,153	2,151	2,125	2,223
pseudo R ²	0.135	0.145	0.162	0.168	0.168	0.174	0.178



Summary of results

- **Industry concentration is negatively associated with using LIFO, as predicted.**
- **Price elasticity of demand is positively associated with using LIFO, as predicted.**
- **Size (+), inventory/assets (–), and debt/assets (–) were also significant.**



Conclusions

- **Despite tax advantages of LIFO, an equilibrium exists in which it is optimal for all firms in an industry to choose FIFO if the industry faces an inelastic demand curve and the industry is concentrated.**
- **For the period 1976 – 1982, LIFO use is negatively related to industry concentration and positively related to a proxy for price elasticity of demand.**