Financialization and Commodity Markets[1]

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The Role of Financialization

- Two measures of financialization
  - Open interest
  - Net financial flows from outsiders

- What is the empirical link between
  - financialization and spot price behavior?
  - financialization and futures price behavior?

- The role of futures markets: where do the data take us?

Findings

- *Spot Price Result:*
  - Little association between financialization and spot prices
  - If anything, relationship slightly negative.

- *Futures Return Result:*
  - High open interest implies high futures returns.
  - Net financial flows unrelated to futures returns.

- Where does data take us?
  - Conventional view: outsiders insure insiders.
  - Tesler (1981) "an organized futures market furnishes legitimate businessmen with a means of hedging so that they can obtain insurance against price risk."
  - Data suggests: Insiders and outsiders insure each other.

# Framework Suggested by Data

- Does Spot Price Result imply financialization irrelevant for resource allocation?

    - No.

- Framework consistent with the data implies:

    - Increased financialization stabilizes prices if outsiders' insurance needs not volatile.
    - Increased financialization destabilizes prices if outsiders' insurance needs volatile.

- Although little systematic relationship in the cross section.

    - Policy changes that lead to increased financialization can have big effects on resource allocation.

Outline

- Data and notation

- The Spot Price Result
  - Decadal Variation Approach
  - Annual Variation Approach

- The Futures Return Result

- Model

Motivation Based on Aggregates

- Commodity prices
  - since 2000, trend and volatility appear to have changed.

Figure: log(Producer Price Index: All Commodities/PCEPI)

Monthly Data
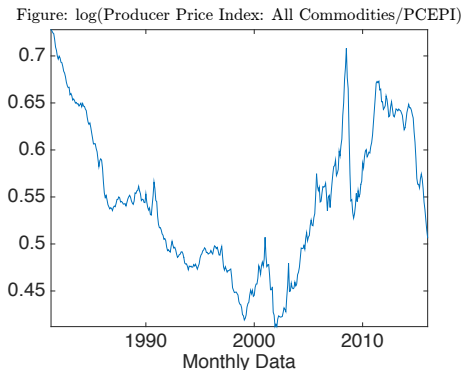
- Trade in commodity futures markets.
  - since 2000, volume of trade has increased substantially.

Question

- What is the empirical link between financialization and the behavior of commodity prices?

- Aggregate data only suggestive.

- Cross-sectional evidence may be more informative.
    - More data.
    - Allows us to remove common factors (e.g., growth in China).

Measuring Financialization

- Notation for futures markets:

  S^L : number of long positions (e.g., 'bushels of wheat')

          held by non-commercial traders ('outsiders')

  S^s : number of short positions of outsiders

  H^L : number of long positions

          held by commercial traders ('insiders')

  H^s : number of short positions held by insiders

- Data from CFTC on all trades in organized futures exchanges in the United States.

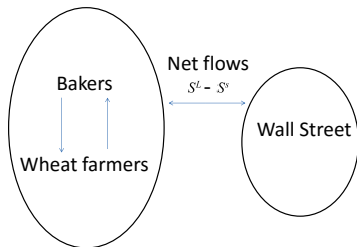# Financialization Measures

- Open interest:
$$S^L + H^L \ \left(= S^s + H^s\right)$$
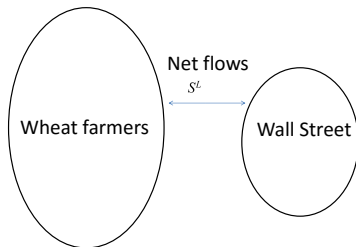
- Net financial flows:
$$S^L - S^s \ \left(= H^s - H^L\right).$$

- Each scaled by world production.

Futures trades: the data — Bakers, Wheat farmers, Net flows $S^L - S^s$, Wall Street

Futures trades: conventional model — Wheat farmers, Net flows S^L, Wall Street
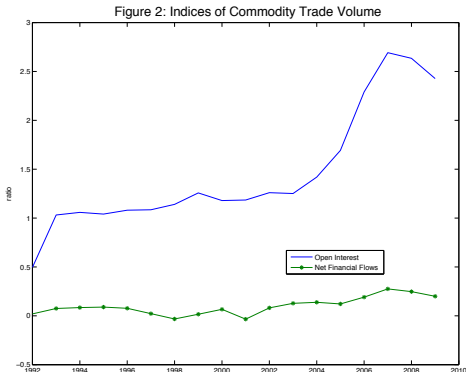
Data

- Construct panel with 131 commodities over 20 years.

- CFTC
  - Volume of futures trades.
  - For each CFTC commodity, we identify measure of world production.

- Indices of World Production and Prices.
  - Fuels: British Petroleum.
  - Minerals: US Geological Survey.
  - Food and softs: Food and Agriculture Organization of United Nations (FAOSTAT).

- Huge variation in futures markets across commodities
  - Many commodities not traded at all in futures markets.
  - Among traded commodities, much variation in trade volume.

Is Volume Data Consistent With Conventional Model?

- Indices of open interest and net flows
  - open interest jumped from on average one-half of world production to 2.5 times world production.
  - net financial flows rose only a tiny bit.

Figure 2: Indices of Commodity Trade Volume

Source of Increase in Open Interest

- Most of the higher volume is increased intra-group trade within outsiders and within insiders.

$$\frac{\Delta S^L}{\Delta oi} = 0.27 \quad \frac{\Delta H^L}{\Delta oi} = 0.73$$

- Outsiders' share of open interest is growing, but it's small

	1992	2009
$\frac{S^L}{oi}$	0.12	0.24

Outline

- Data and notation (X)

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  - Annual Variation Approach

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Decadal Variation Approach

- For each commodity, regress log real spot price on time trend with a break in 2000.
  - Calculate the change in
    - the slope coefficient.
    - the standard deviation of the regression residual.

- Also calculate change in variance of commodity price growth.

- Relate above to change in:
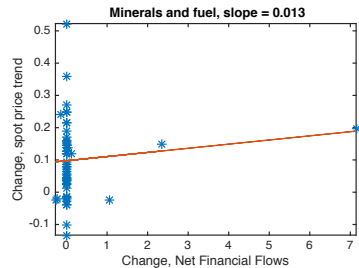 - open interest
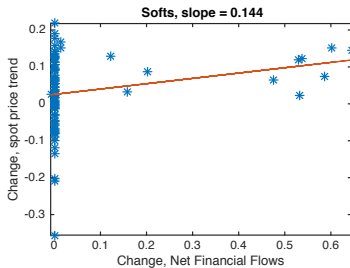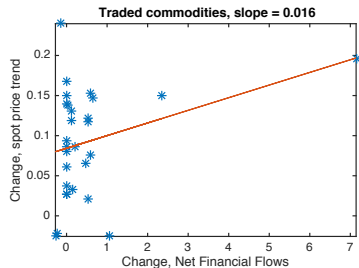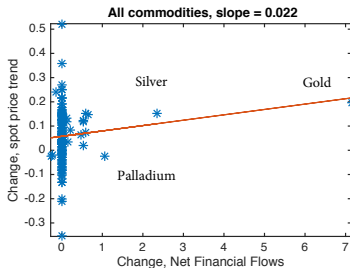 - net financial flows.

Figure 4b: Change in Trend and Net Financial Flows

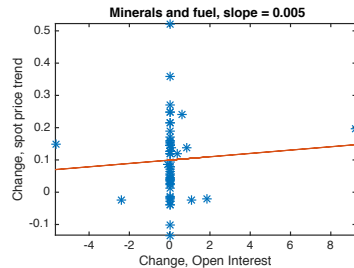Figure 4a: Change in Trend and Open Interest
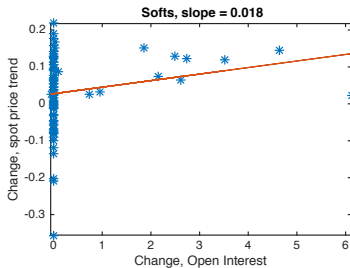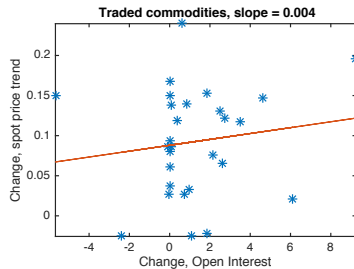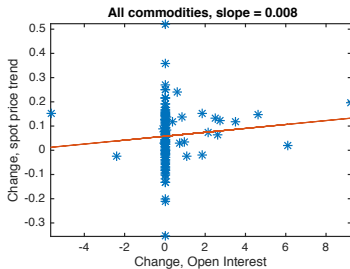
	Table 2: Change in Commodity Inflation Dynamics, 1990s to 2000s, as a Function of Change in Financialization		
	P-value on β when financialization measured with nff (*P* –value with oi)		
	change in commodity inflation dynamics$_t$ = α + β ×change in financialization+u_t		
variables in analysis	change in variance of residual from time trend	change in slope coefficient on time trend	change in variance
all commodities	64 (66)	11 (15)	39 (48)
indexed	76 (89)	14 (50)	39 (47)
non-indexed	20 (18)	62 (14)	17 (18)
traded	72 (78)	12 (21)	44 (56)
softs	12 (32)	2 (4)	2 (9)
minerals and fuels	76 (68)	24 (32)	67 (68)

Notes: (i) two measures of financialization - net financial flows (nff) and open interest (oi). (ii) p-value is the probability, under the null distribution that $\beta = 0$, of getting a value of β higher than its empirical realized value. For details, see the appendix.

Finding : (except for softs: corn, lumber, etc.) there is no significant relationship between a structual break in price dynamics and change in financialization.

Annual Variation Approach

- Compute a rolling standard deviation of the growth rate of commodity prices (5-point moving average).

- Regress volatility time series on financialization measures.

- Done only for commodities for which there is a non-zero volume of trade in each time period.

- Dispersed effects and small on average.

Figure 8: Response of Volatility to Two Measures of Volume
(results based on individual traded commodities)

mean response of volatility to Net Financial Flows = −0.24

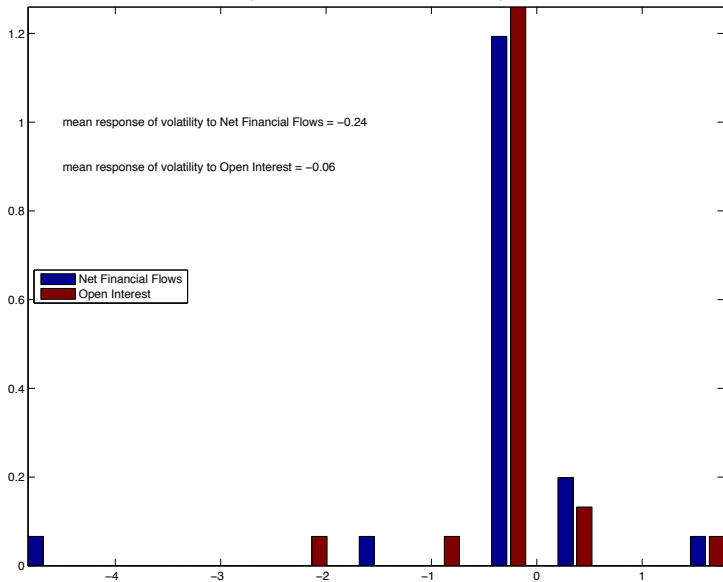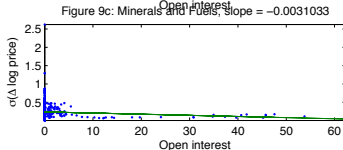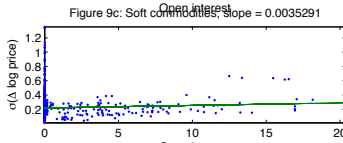mean response of volatility to Open Interest = −0.06

Net Financial Flows
Open Interest

Figure 9: Spot Price Volatility and Volume
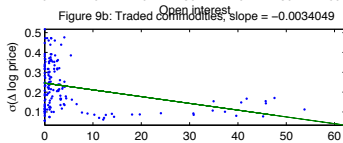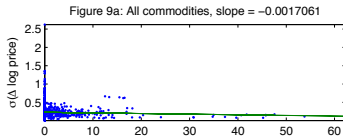
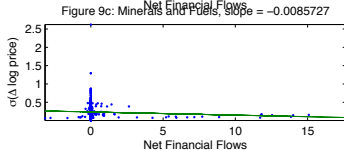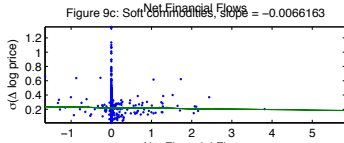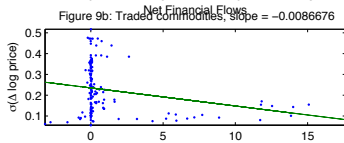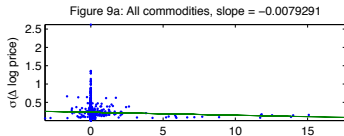| Table 3: Regression, Volatility of Commodity Prices on Intensity of Financialization		
	$volatility_t = \alpha + \beta \times intensity_t$	
	intensity measure	
	net financial flows	open interest
group of variables	$\hat{\beta}$ (95% conf interval)	$\hat{\beta}$ (95% conf interval)
all commodities	-0.008 (-0.012,-0.002)	-0.002 (-0.003,-0.000)
traded	-0.007 (-0.011,-0.001)	-0.001 (-0.003,0.000)
softs	-0.007 (-0.028,0.028)	0.004 (-0.003,0.008)
minerals and fuels	-0.009 (-0.015,-0.004)	-0.003 (-0.005,-0.002)

Notes: (i) standard deviation based on centered, 7 point moving average of commodity price growth; (ii) data combines all observations on the group of commodities listed in left column; (iii) bootstrap confidence intervals described in text.

	(1)	(2)
	Measure of financialization	Measure of spot price dynamics
	12 month average oi growth	centered, 6 month moving average standard deviatio
	2nd quartile	interquartile range associated with column (1) quarti
lower bound	-1.499	4.471
mean (median)	-0.369 (-0.343)	7.426 (6.400)
upper bound	0.690	9.062
	3rd quartile	
lower bound	0.692	4.818
mean (median)	1.875 (1.831)	7.857 (6.876)
upper bound	3.178	9.573

Table 4: Another Way to See that Financialization Has Little Impact on Spot Price Volatility

So Far

- Spot Price Result:

  – Little evidence of a systematic relationship between financialization and commodity price behavior.

Outline

- Data and notation (X)

- The Spot Price Result (X)
  - Decadal Variation Approach
  - Annual Variation Approach

- The Futures Return Result

- Model

Futures Return Result

- Open interest helps to predict futures returns.

- Net financial flows do not help to predict futures returns.

- Consistent with findings of Hong and Yogo (2012).

Futures Return Result

- Consider returns to following strategies:
  - In month t, look at recent volume of trade in each commodity.
  - Go long in a basket of commodities with highest volume of trade (*hot strategy*).
  - two measures of 'volume of trade':
    - net financial flows
    - open interest growth.

- Compare:
  - **hot net financial flow strategy**;
  - **hot open interest growth strategy**;
  - **random strategy**.

Cumulative returns from 3 futures contract strategies
NOTE : Shaded areas represent 90 percent confidence interval

Legend:
- Mode, random futures market strategy
- Hot net financial flow strategy
- Hot open interest growth strategy

histogram of Sharpe Ratios for random strategy, p-value nff = 0.442, p-value oi = 0.006

Sharpe Ratio, hot oi: 0.13
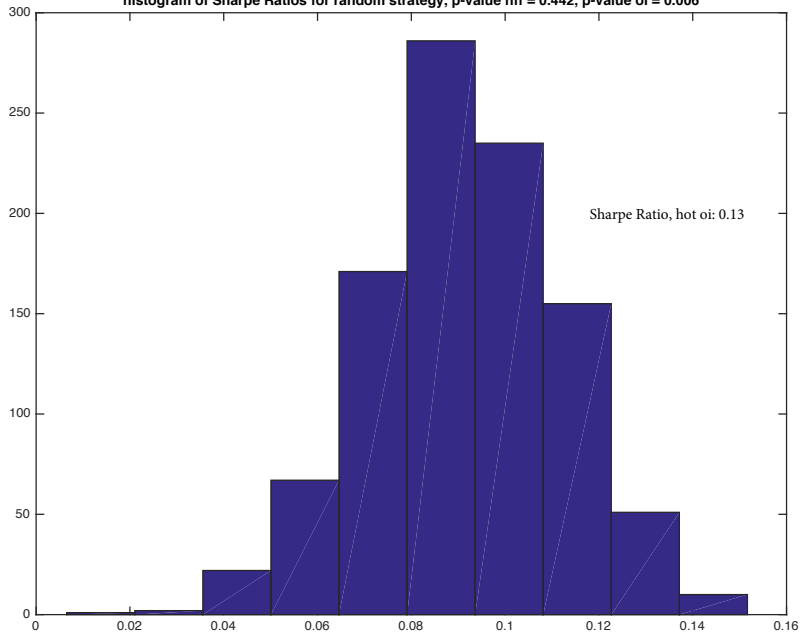
Sharpe ratio, hot net financial flows: 0.09

Summary So Far

- Spot Price Result.

- Futures Price Result

- Puzzle:
  - How could open interest have a systematic relationship with futures returns but not spot prices?

Outline

- Data and notation (X)

- The Spot Price Result (X)
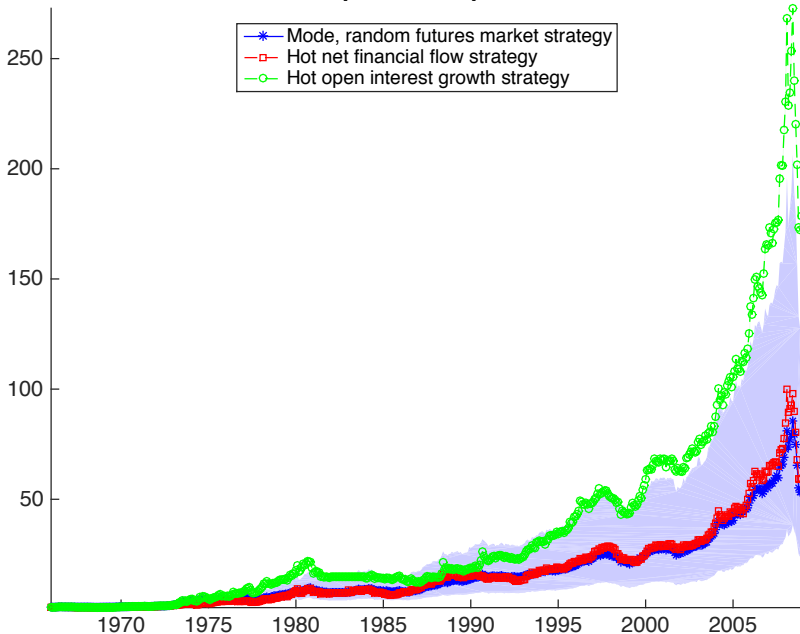 - Decadal Variation Approach
  - Annual Variation Approach

- The Futures Return Result (X)

- Model

Commodity Market: Shocks

Source of uncertainty for insiders:
Demand for bread –

Θ + ε

Realized at the end

Known at beginning

Bakers

Outsiders

Farmers

Source of uncertainty for outsiders:
s=cov(outside income, ε).

Timing and Decisions

- Beginning of period
  - θ and $s \equiv cov\,(\text{outsider income}, \varepsilon)$ realized
  - futures market for wheat meets, price: F.
  - farmers choose wheat production, q.

- End of Period
  - ε and outsider income realized.
  - Bakers buy wheat for price, P, and produce bread, $Q = f(q)$.

- Induced demand for wheat: $P = D\,(q, \theta + \varepsilon)$.

- All have mean-variance utility, so demand for long contracts:

$$= \text{hedging demand} + \overbrace{\frac{E\,(P - F)}{\alpha var\,(P - F)}}^{\text{speculative demand}}$$

Commodity Market: Hedging Motives

Bakers

Hedging motive:
Uncertainty in price of wheat, P.
Want to buy long in futures market.
Hedging need limited because bread price is a natural hedge.

Outsiders

Hedging motive:
$s = cov(outside\ income, \epsilon)$.

Farmers

Hedging motive:
Uncertainty in P.
Want to sell short in futures market.

Commodity Market

Bakers
buy wheat,
bake bread

Outsiders
No direct participation
in production or use
of commodity

Net financial
Flows, n_{ff}:
Net purchases of long
contracts by outsiders.

Farmers
Plant seeds,
grow wheat

Commodity Market: Futures Return Result

Bakers
buy wheat,
bake bread

Outsiders
No direct participation
in production or use
of commodity

Farmers
Plant seeds,
grow wheat

Data: Cov ($P\text{-}F$, n_{ff}) = 0

Futures return, $P - F$

Commodity Market: Futures Return Result

Bakers
buy wheat,
bake bread

Outsiders
No direct participation
in production or use
of commodity

Farmers
Plant seeds,
grow wheat

Data: Cov $(P\text{-}F, n_{ff}) = 0$

Futures return, $P - F$

Rise in nff caused by:
  outsider hedging shock, $s \longrightarrow P - F$ down
  insider hedging demand shock, $\theta \longrightarrow P - F$ up.
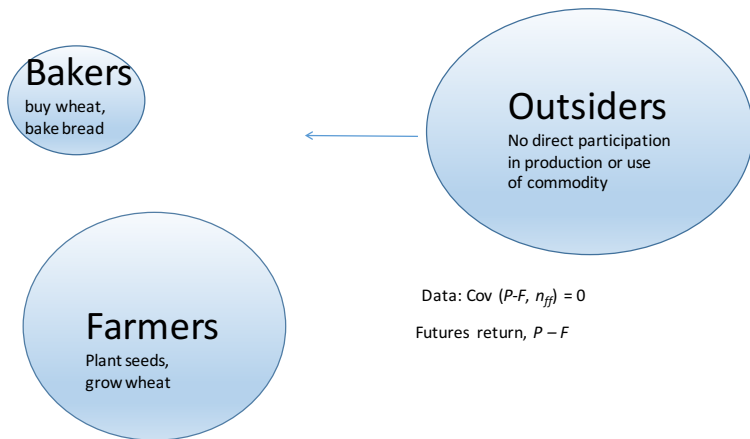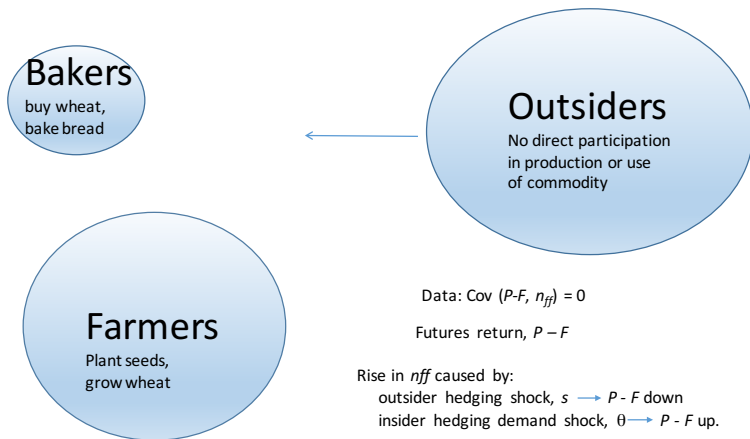
Futures Price Result

- Assume (consistent with the data) bakers and outsiders are long and farmers, short.
  - Immediate: $oi =$ sum of all longs $=$ bakers' position $(H^b) + nff$.
  - Result: $Cov\,(oi, P - F) > Cov\,(nff, P - F)$
- Consider θ shock.
  - raises P, q; increases risk to insiders.
  - even without outsiders, $P - F \uparrow$ to compensate for higher risk.
  - $Cov\,(H^b, P - F) > 0$.
- Consider s shock.
  - raises F, raises q, lowers P, so $P - F \downarrow$
  - $H^b \downarrow$ because insiders must absorb outsiders' longs
  - $Cov\,(H^b, P - F) > 0$.

Our Model Can Produce the Spot Price Result

- *Exogenous* increase in outsider participation in a particular market.

  - Reduces spot price volatility if main hedging shocks are to insiders.
  - Increases spot price volatility if main hedging shocks are to outsiders.

- Suppose markets vary enough in size of shocks.

- If variation in outsider participation random across markets, get spot price result.

Exogenous Variation in Outsider Participation

- Key efficiency condition, producers of wheat:

$$F = c'(q)$$

- Market in which main hedging shocks are to insiders.
  - Positive shock to θ drives up expected P.
  - Outsiders and go long, driving up F.
  - Production, q, rises. **Rise in P moderated**.
  - More outsiders, stronger moderating effect: $Var(P) \downarrow$

- Market in which main hedging shocks are to outsiders.
  - Positive shock to outsiders' desire to go long, drives up F.
  - Production, q, rises. **Price, P, falls**.
  - More outsiders, stronger P response: $Var(P) \uparrow$.

The Spot Price Result with Endogenous Participation

- Assume outsiders pay a fixed cost to enter a futures market.
- Measure of outsiders in each market determined by market characteristics.
- Spot price result strengthened with endogenous participation.
- Example: suppose insiders' hedging demand shocks relatively small.
  - small increase in insider hedging demand volatility:
  - direct effect: raises price volatility.
  - entry effect: by increasing outsider participation, stabilizes price volatility.
  - net effect: ambiguous.

Conclusion

- Two empirical findings:
  - *Spot Price Result*
  - *Futures Return Result*

- Data suggests:
  - Outsiders' hedging needs are important.
  - Futures markets more valuable than in conventional model.

- Spot Price Result consistent with important role for policy.