

***USAAE Houston Chapter
Monthly Luncheon Meeting
March 10, 2005***

**Inscrutable OPEC?
A Production Test of the Cartel Hypothesis**

**James L. Smith
Department of Finance
Southern Methodist University
Dallas, TX 75275
jsmith@mail.cox.smu.edu**

Is OPEC a Cartel?

Obviously...

1. Conspicuous, regularly scheduled meetings to discuss pricing goals.
2. Formal quota system in place since 1982.
3. Persistently large excess/underutilized capacity.

But...

1. What about "cheating"?
2. Political & economic factors undermine cooperation.
3. Who is in the "core," and who is not, and what is it?
4. "Mere interdependence" \neq collusion.
5. Show me the money... *STATISTICAL EVIDENCE???*

The "Scientific" Method: How We Learn

Question: Where's Waldo??

H_0 : Waldo is in Houston

H_a : Waldo is in Dallas

Evidence:

???

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- 1. Waldo arrived in this city by car, via IH-45.**

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- 1. Waldo arrived in this city by car, via IH-45.**
- 2. He could have flown in instead using Southwest Airlines, landing at the convenient but relatively small in-town airfield.**

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- 2. He could have flown in instead using Southwest Airlines, landing at the convenient but relatively small in-town airfield.**
- 3. Tomorrow, Waldo will visit a prominent university (sometimes known for football futility) located in a good part of town.**

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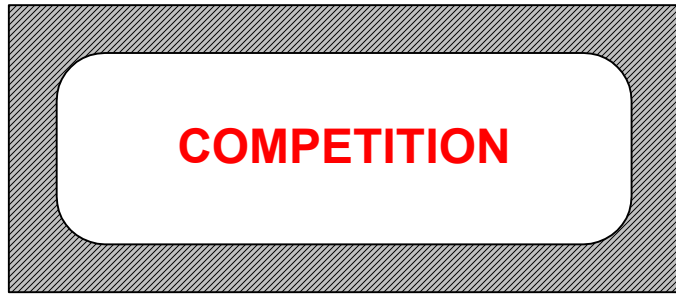
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- 5. Waldo hoped to take the controversial new commuter rail line to the airport, but it doesn't go there.**

The standard practice to date has been to reach onto the shelf of economic models, to select one, to validate its choice by pointing to selected events *not inconsistent* with the model's predictions, and then to proceed with some normative exercise.

James Griffin
American Economic Review, 1985

Indistinguishable ???



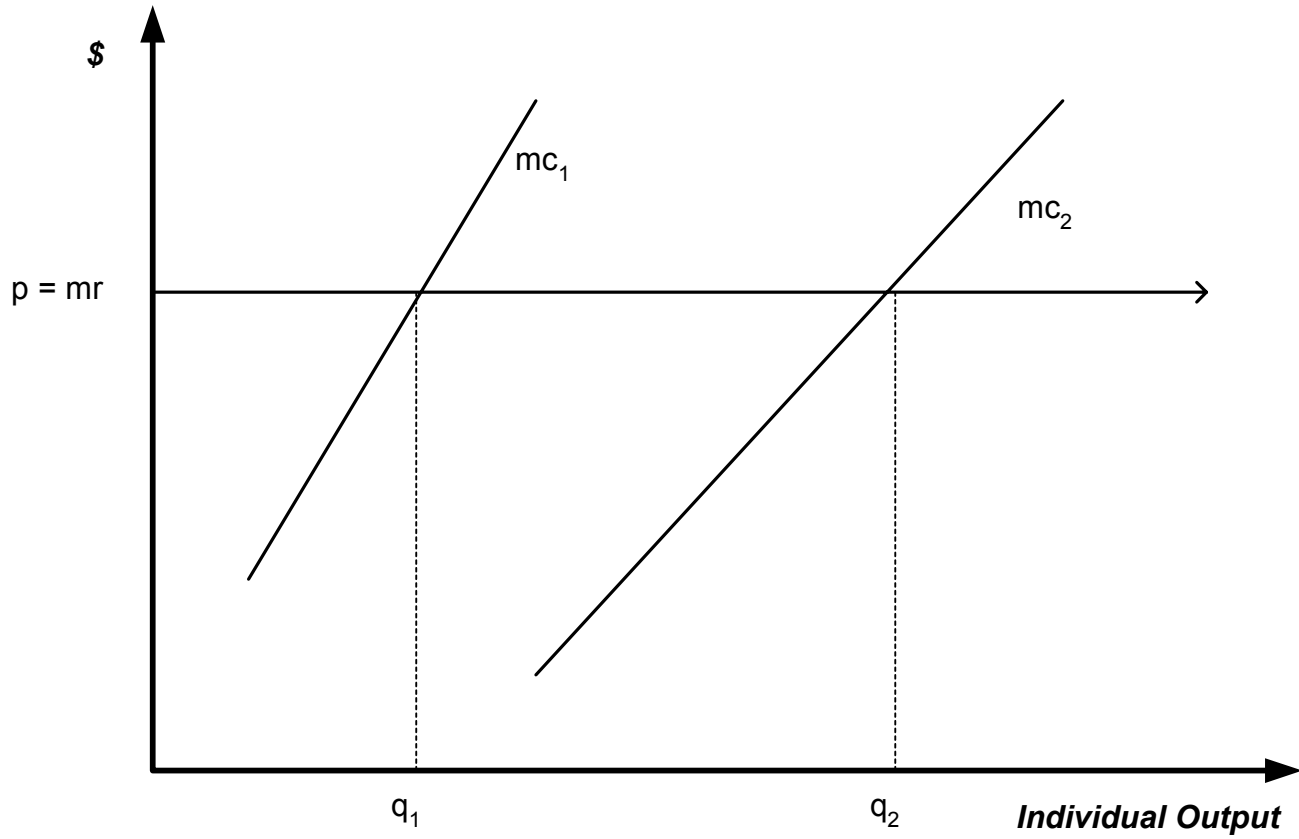
Indistinguishable ???

COMPETITION

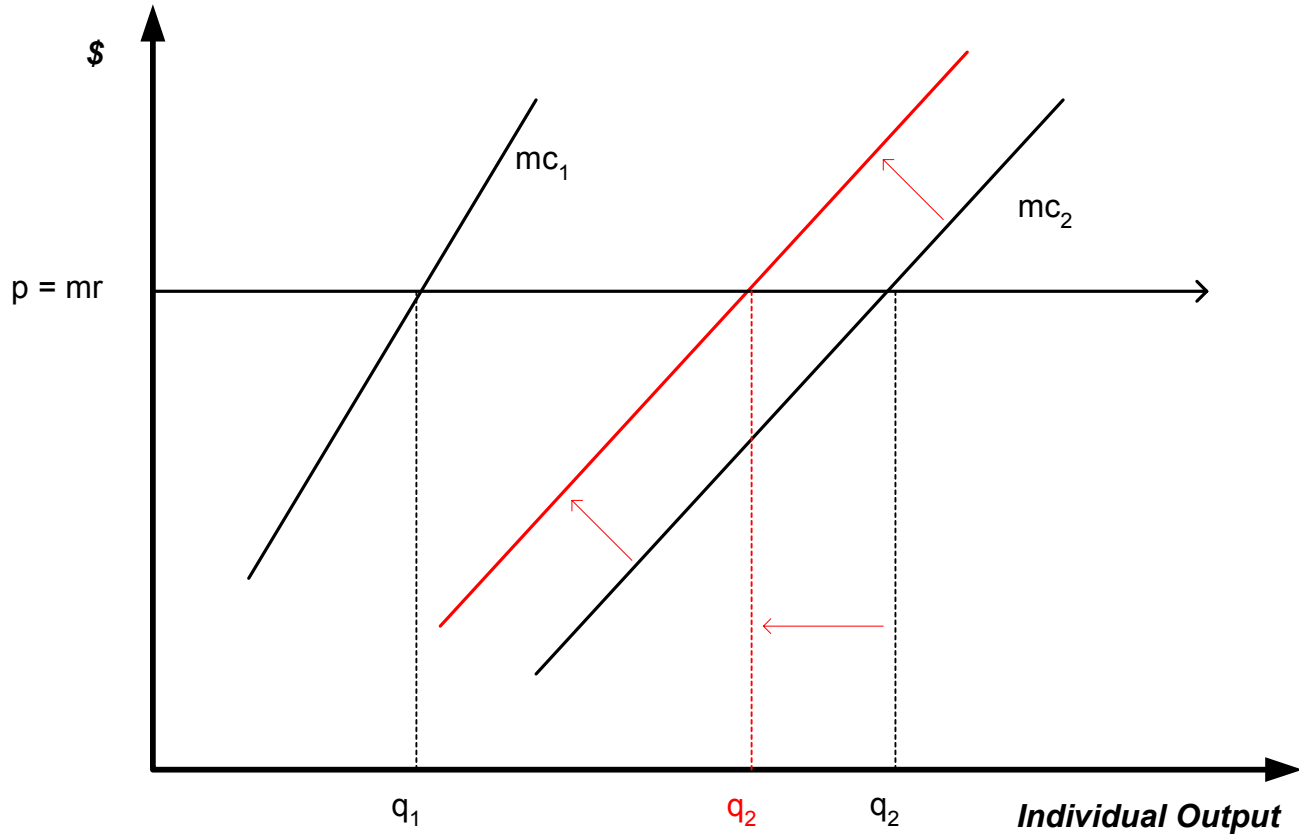
COLLUSION

... the fog of data

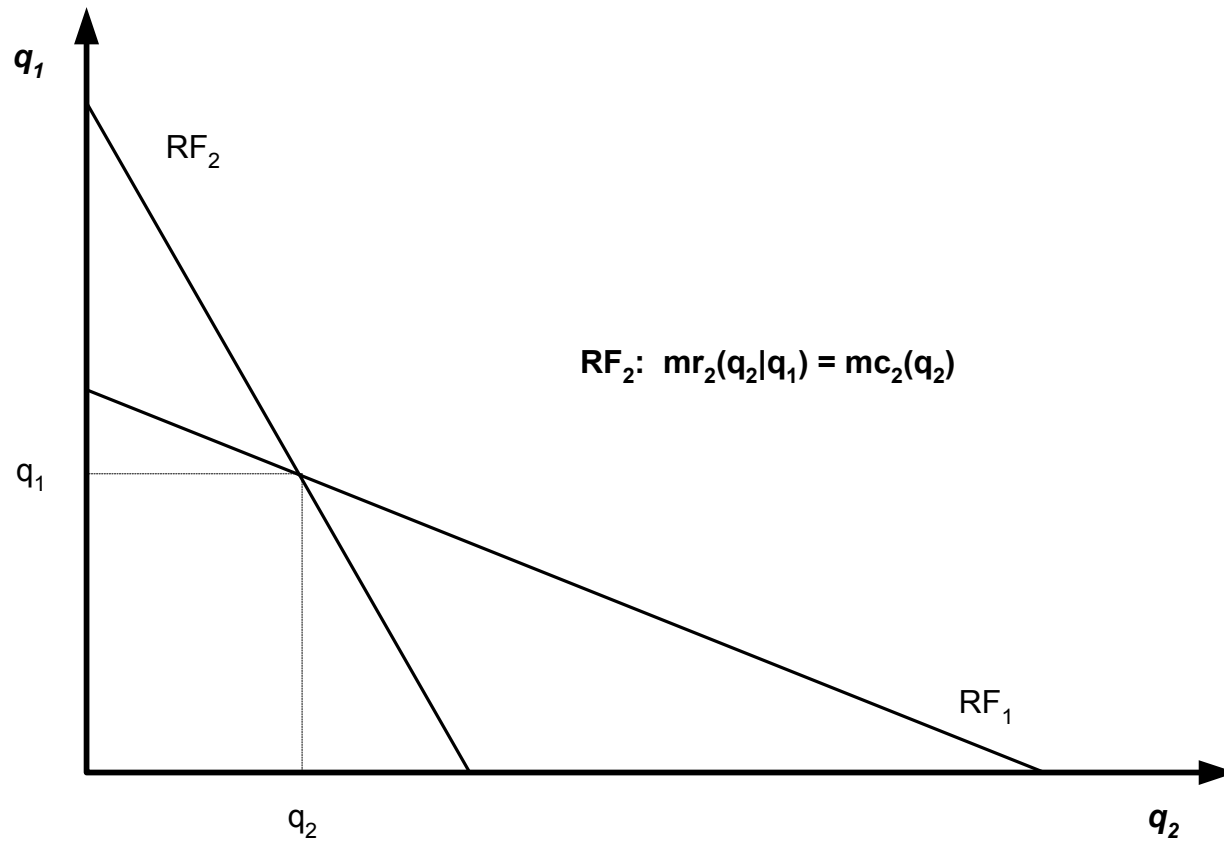
Perfect Competition



Perfect Competition
- Shocks Don't Propagate Reactions -

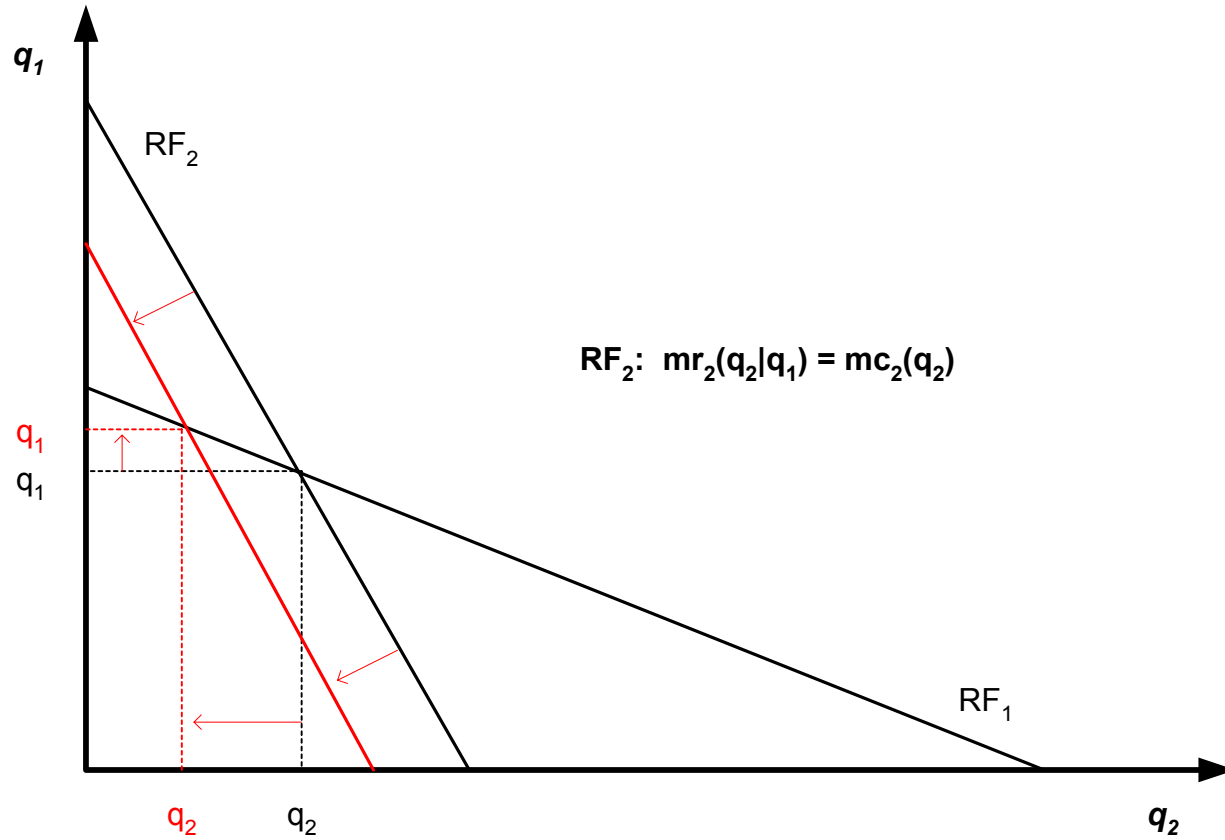


Cournot (Nash) Equilibrium

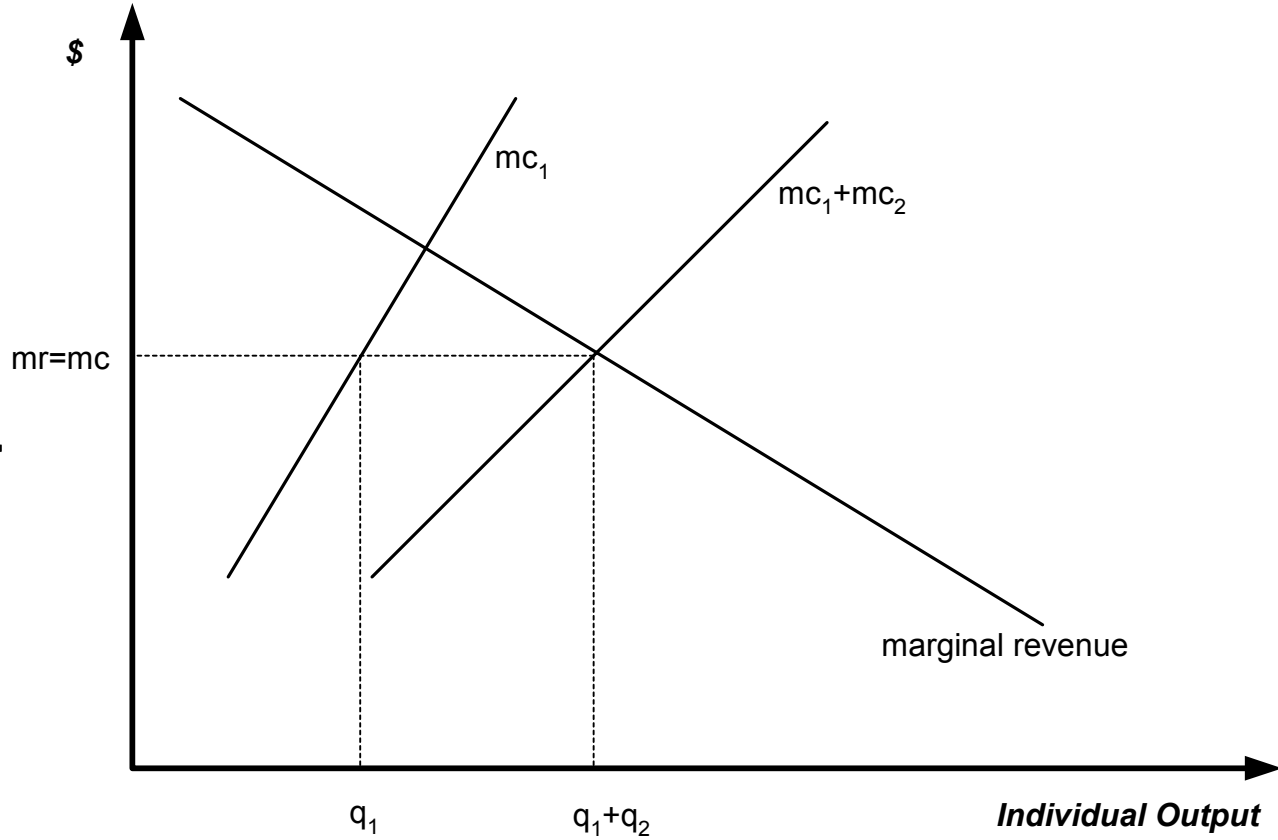


Cournot (Nash) Equilibrium

- Shocks Propagate Moderate Reactions -

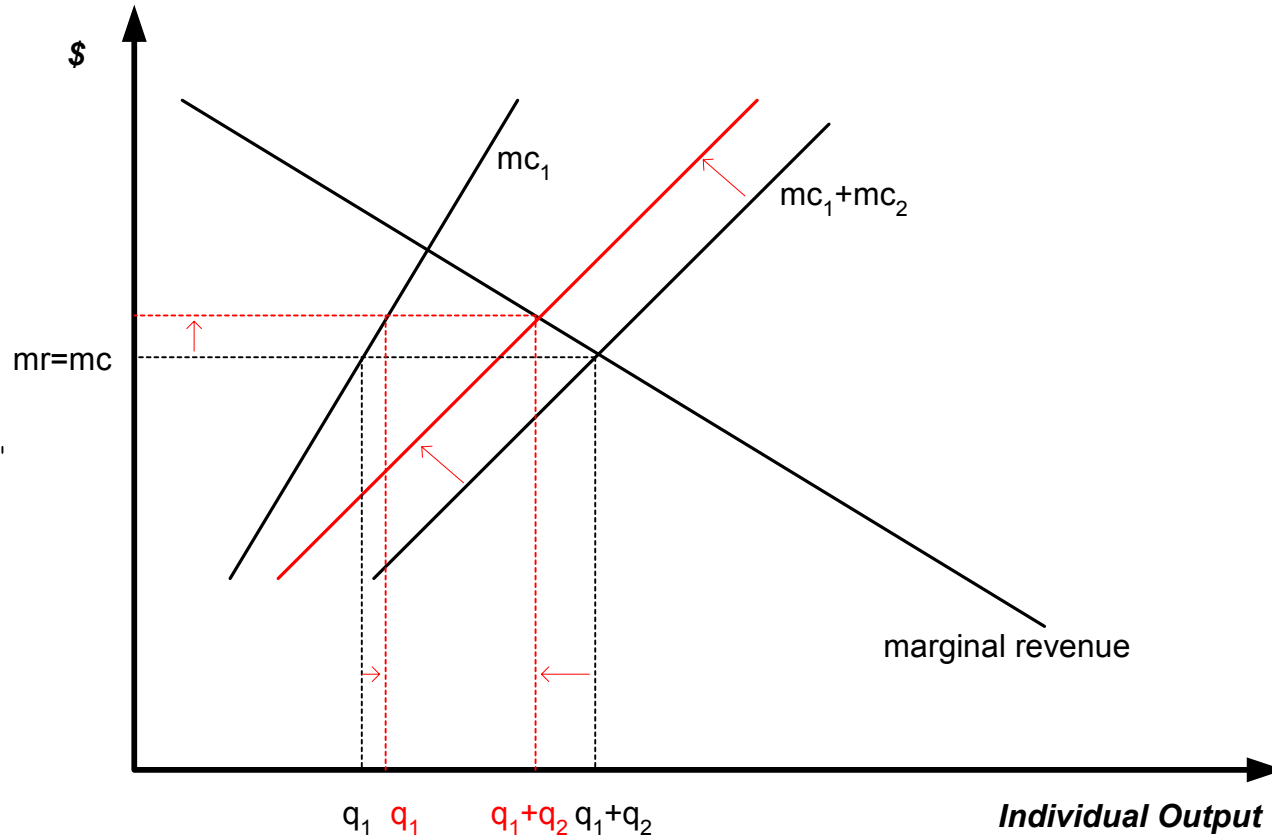


Perfect Cartel (Multi-Plant Monopoly)



Perfect Cartel (Multi-Plant Monopoly)

- Shocks Propagate Strong Reactions -



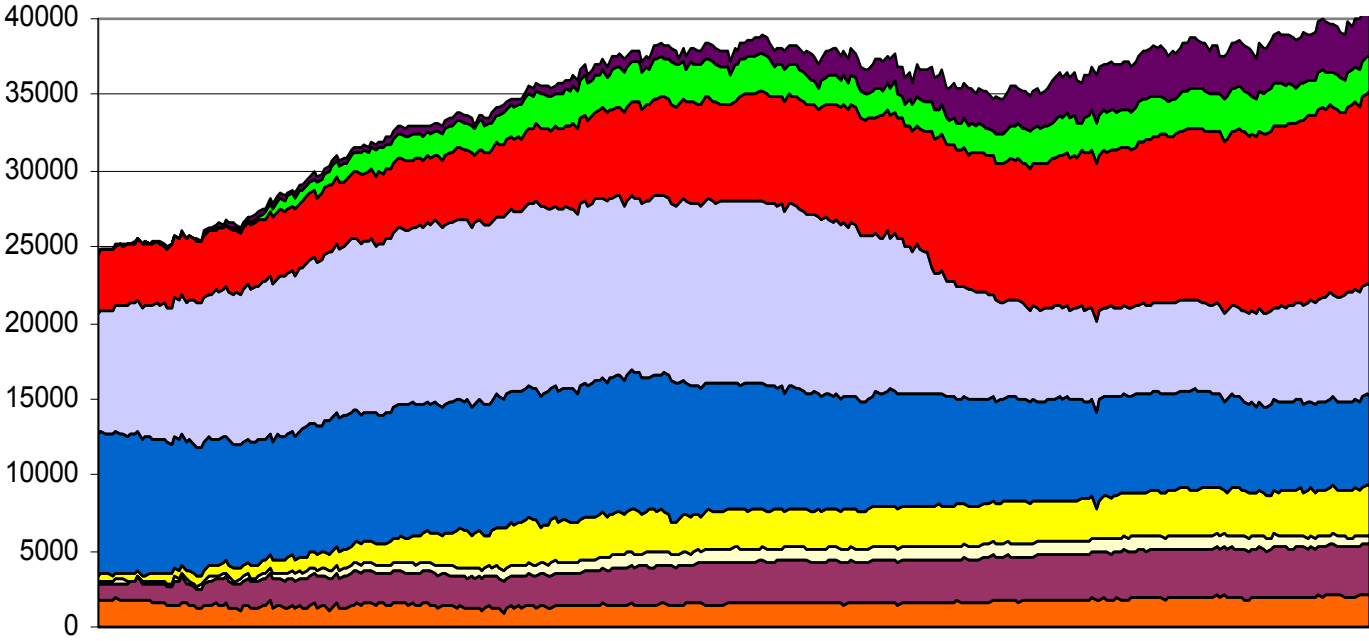
**Testable Hypotheses from Oligopoly Theory:
Correlations Among Individual Production Changes**

$$\rho_{cartel} < \rho_{bertrand} < \rho_{stackelberg} < \rho_{cournot} < \rho_{perfcomp} = 0$$

and

$$\rho_{cartel} < \rho_{bureaucratic\ syndicate}$$

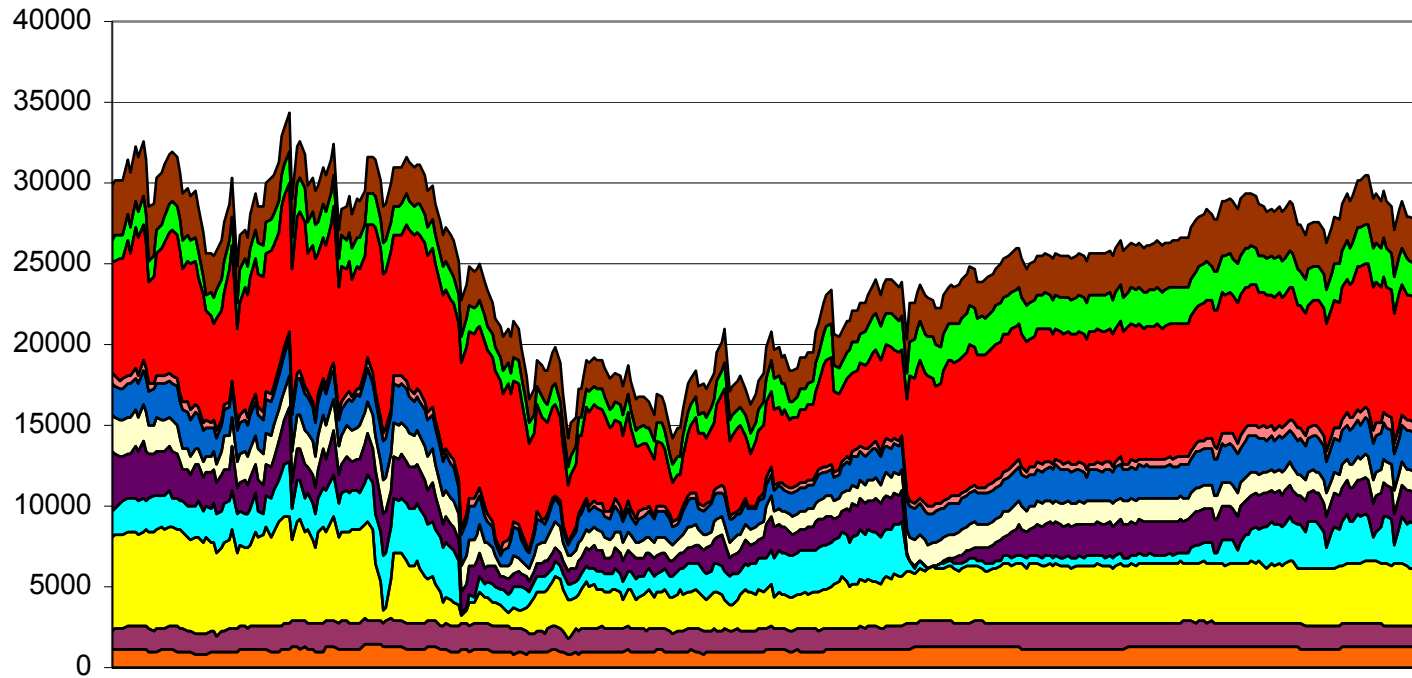
Non-OPEC Oil Production (mb/d)



monthly, 1973-2002

- Canada
- China
- Egypt
- Mexico
- US
- Russia
- Other
- UK
- Norway

OPEC Oil Production (mb/d)



monthly, 1973-2002

Algeria Indonesia Iran Iraq Kuwait Libya Nigeria Qatar Saudi UAE Venezuela

**Table 1:
Correlations Between Monthly Production Changes**

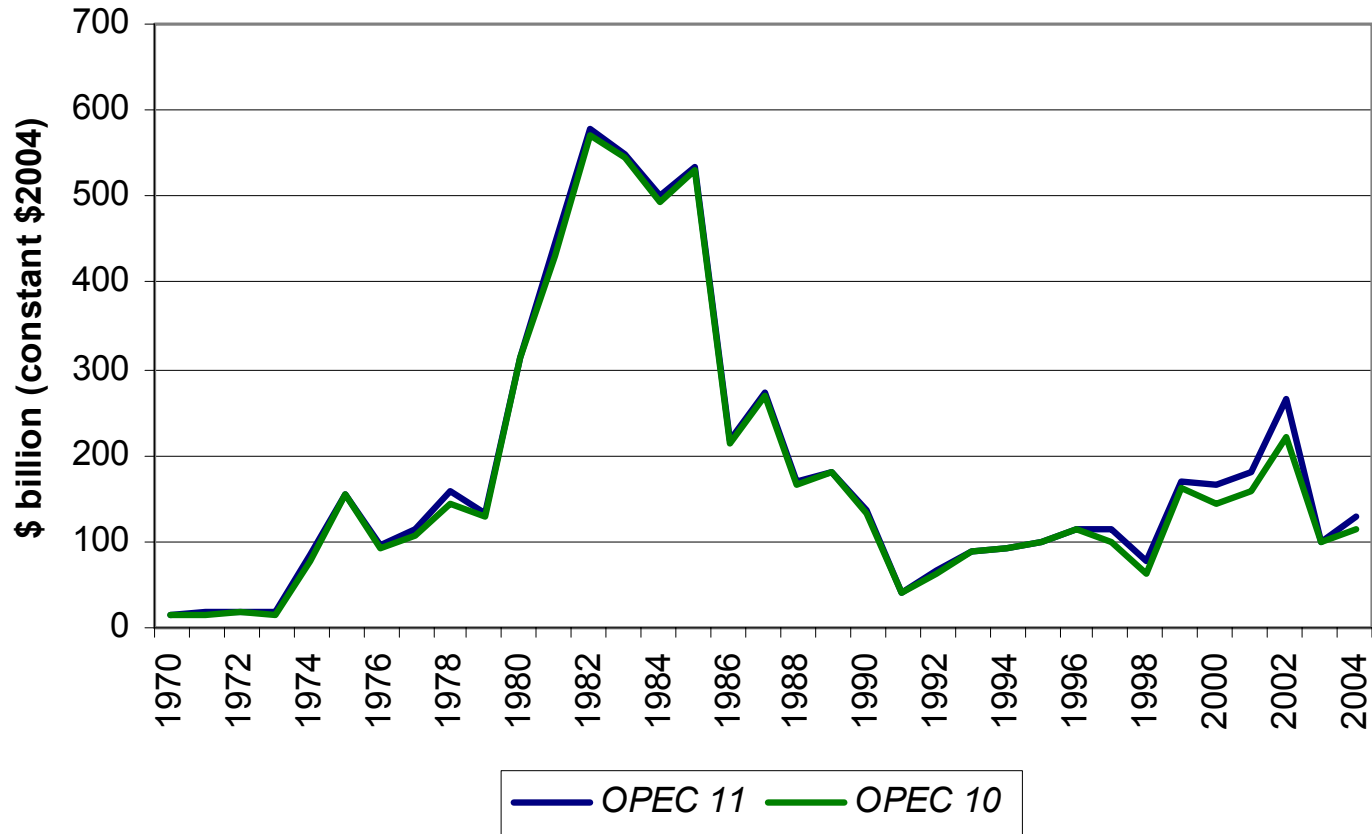
... vs. Rest of OPEC	correlation	H1: $\rho > 2.4\%$ test statistic
Algeria	12.3%	1.85 *
Indonesia	20.4%	3.40 **
Iran	18.3%	2.99 **
Iraq	11.4%	1.68 *
Kuwait	44.4%	8.41 **
Libya	27.5%	4.79 **
Nigeria	21.8%	3.67 **
Qatar	10.9%	1.59
UAE	38.4%	7.07 **
Venezuela	18.5%	3.03 **
Saudi Arabia	27.7%	4.83 **
OPEC average	22.9%	
... vs. Non-OPEC	correlation	
Canada	-5.3%	-1.42
China	1.8%	-0.11
Egypt	-1.0%	-0.63
Mexico	-8.8%	-2.08
Norway	17.3%	2.80 **
Russia	-3.6%	-1.11
UK	13.0%	1.98 *
US	5.6%	0.60
Non-OPEC avg.	2.4%	
<p>** significant at 1% level. * significant at 5% level.</p> <p>Note: "Rest of OPEC" consists of all OPEC production, less the production of any OPEC country to which it is compared. "Non-OPEC" consists of worldwide production net of OPEC and the production of any Non-OPEC country to which it is compared.</p>		

Conclusions

1. Most traditional hypotheses are clearly rejected by production tests
... competitive, Cournot, Stackelberg, multi-plant monopoly, etc.
2. OPEC is much more than a non-cooperative oligopoly...
... but less than a frictionless cartel.
3. OPEC is weighed down by transactions costs (consensus building)
... therefore partially impaired in pursuit of the "common good."
4. Quota system (1982) raised transactions costs & altered behavior.
5. Mixed (weak) evidence that Saudis have acted as "swing producer."

Market Value of Capacity Withheld by OPEC

(Source: EIA and author's calculations)



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