A Less Volatile Crude Oil Price: Supply Rotation Control

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PURPOSE

- Smooth the crude oil price

reduce the volatility cost

APPROACH

- Find Main Source of Volatility
- Principle to Solve Problem
  (Incentive Compatibility)
- Method: Rotation Control
- Detail: Market Situation/Demand Elasticity
- Technique: Bootstrapping Method

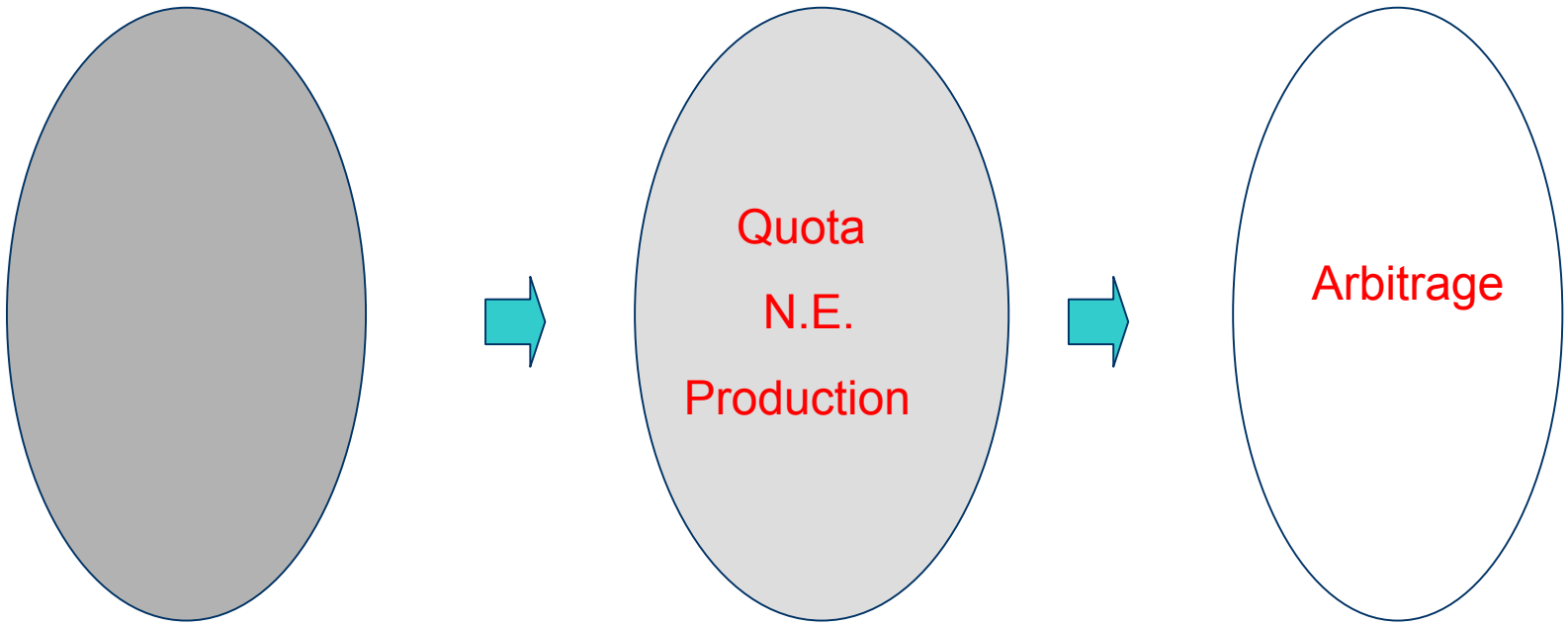
WHY PRICE VOLATILE

- Fundamental (Demand/Supply)
  (OPEC's Influence)
- Financial Market
  (Technical Analysis/Information Noise)
- WAR

CRUDE OIL PRICE FORMULAS

- P_x = Benchmark Price + Premium
- Benchmark Price
  (WTI/BRENT/DUBAI&OMAN)
- Spot price ≈ Futures price (-1)
- Futures Prices is Selected Due to Transparency
- Transparency in Futures Market Can't
  Guarantee the (Physical Market Clear)

OIL MARKET TRANSPARANCY



World market

OPEC market

Financial market

WHO SHOULD RESPONSIBLE FOR↓↑

- OPEC OR FINANCIAL MARKET PLAYERS ?

No Market Imbalance

(D/S Gaps or Info Bias)

→ No Arbitration trade

- Better control for OPEC would help for less volatility

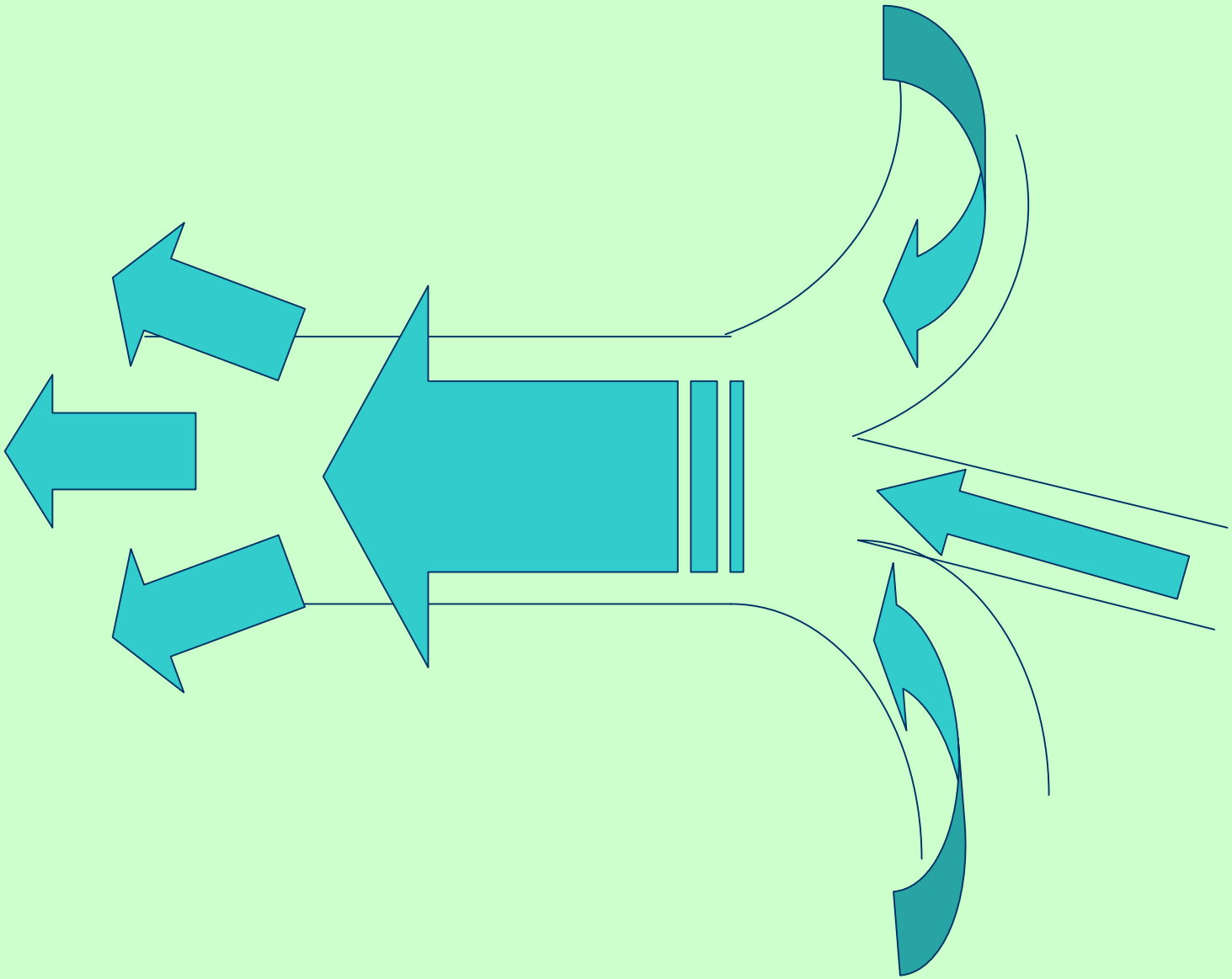
PERSUASIVE PRODUCTION (Incentive Compatibility)

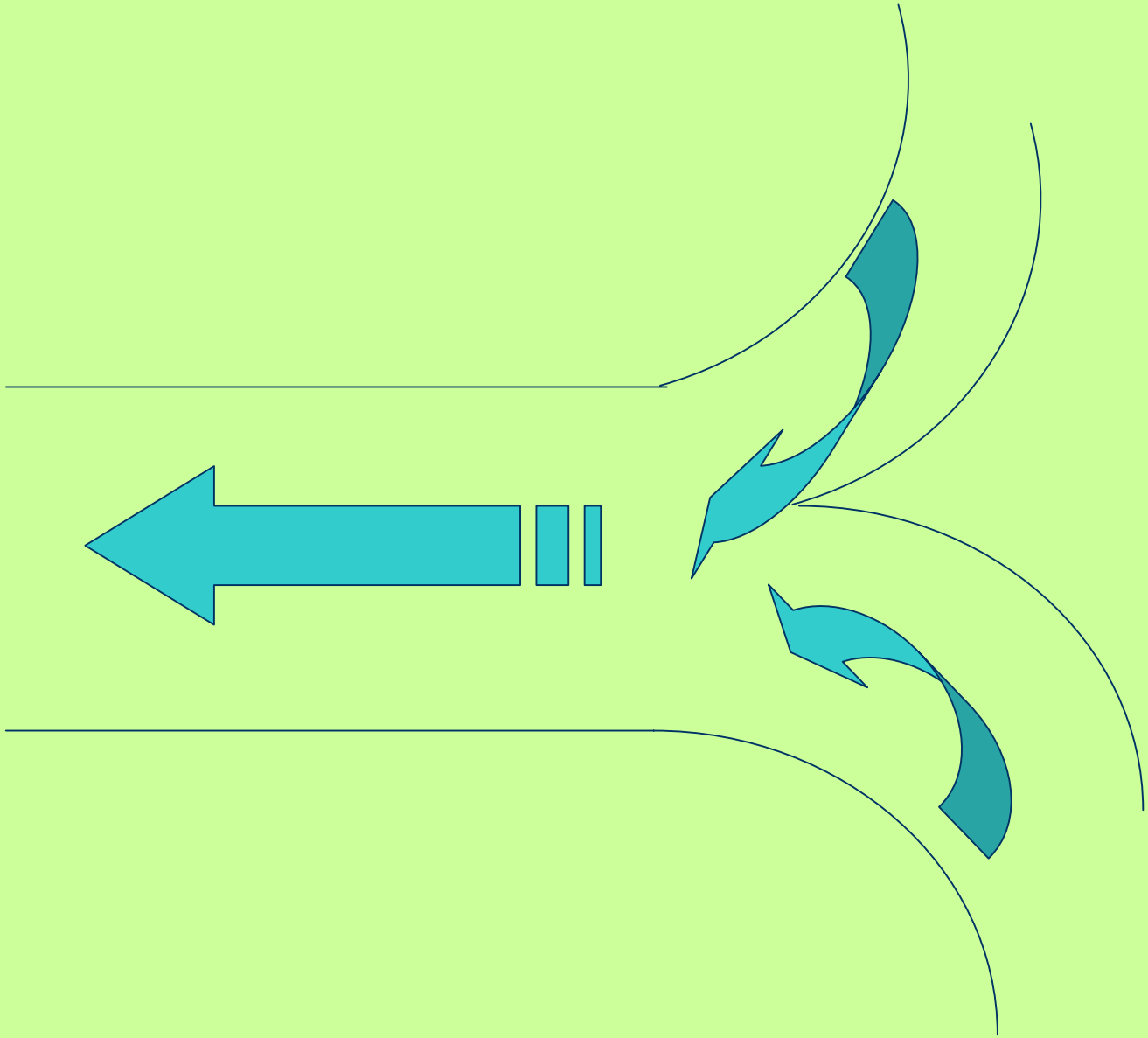
Privilege Assignment

Responsible for price if I'm the only decision maker

(Each time only 1 member/group in OPEC has privilege)

Supply Rotation Control





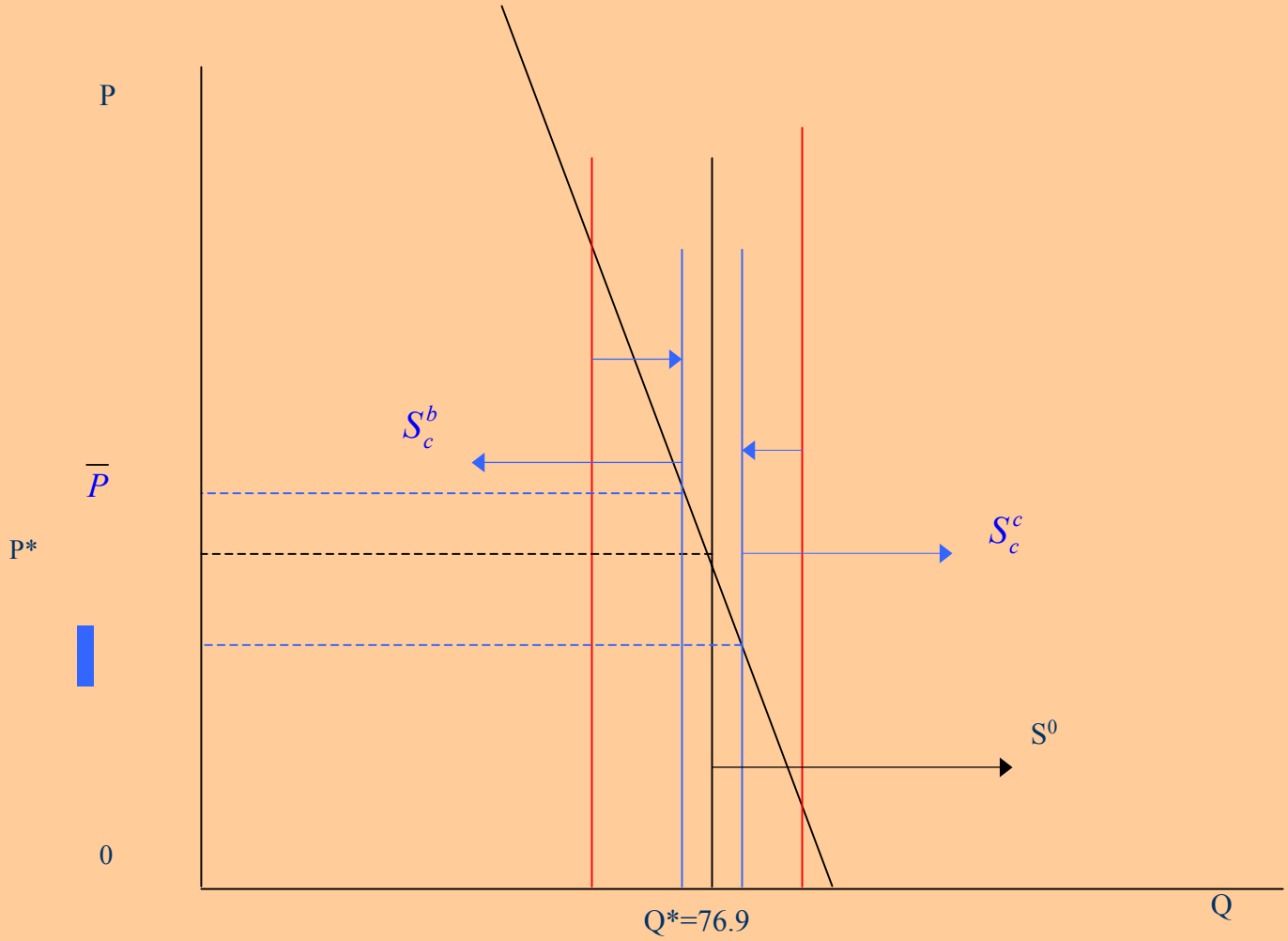


Figure 1 The determination of market price.

HOW IT WORKS

- More Stable Oil Supply Will Flow Into the Market
- More Reliable Information Is Perceived

Fewer Arbitration trade

- More Stable Oil Price

Simulation Techniques

- Bootstrapping Method
  (Market Data Distribution/Simulation)
- Real Market Situation (Inelastic demand)
- Supply Rotation Control

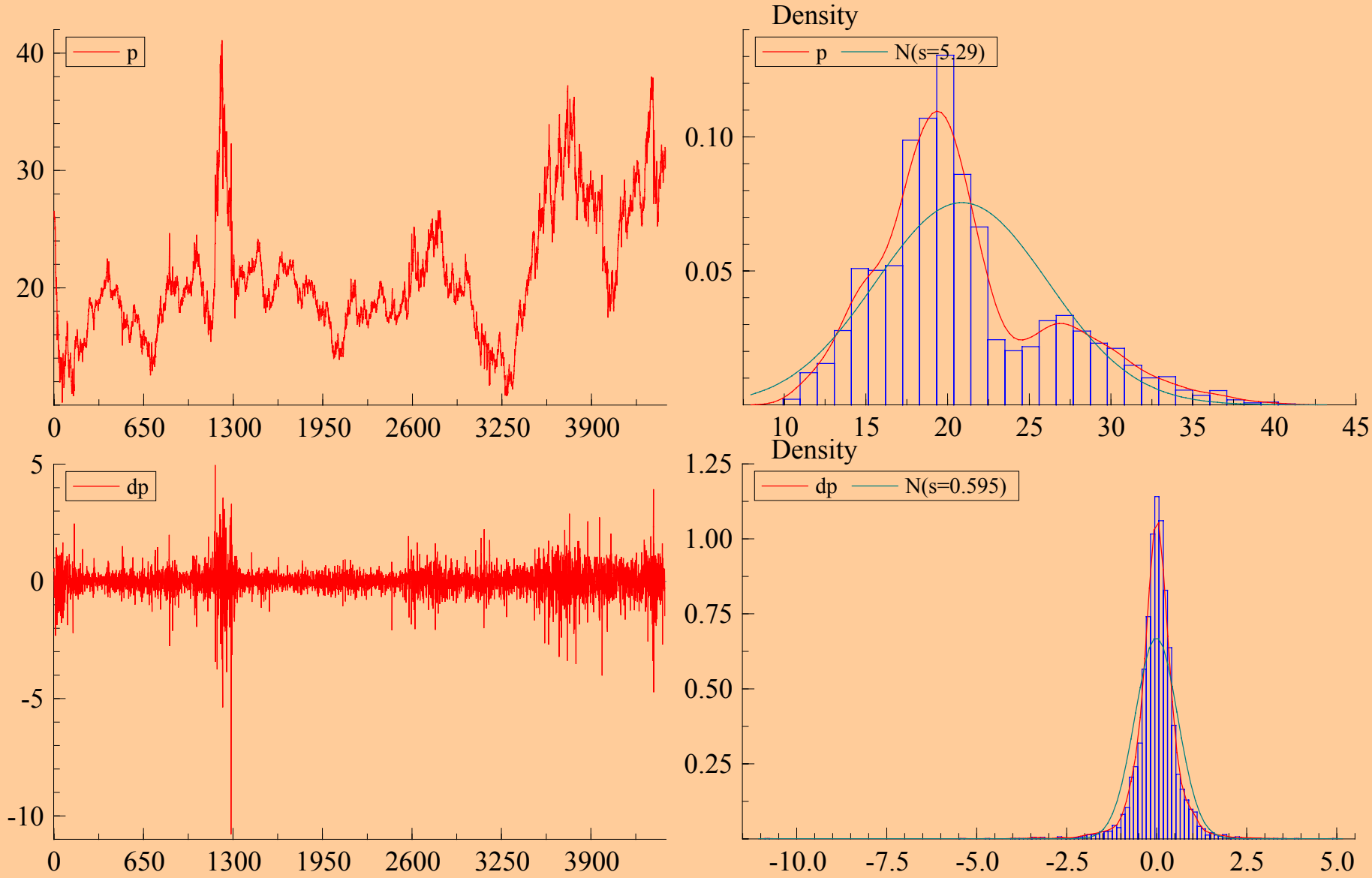


Figure 2 Historical WTI Price Trend (p, Δp)

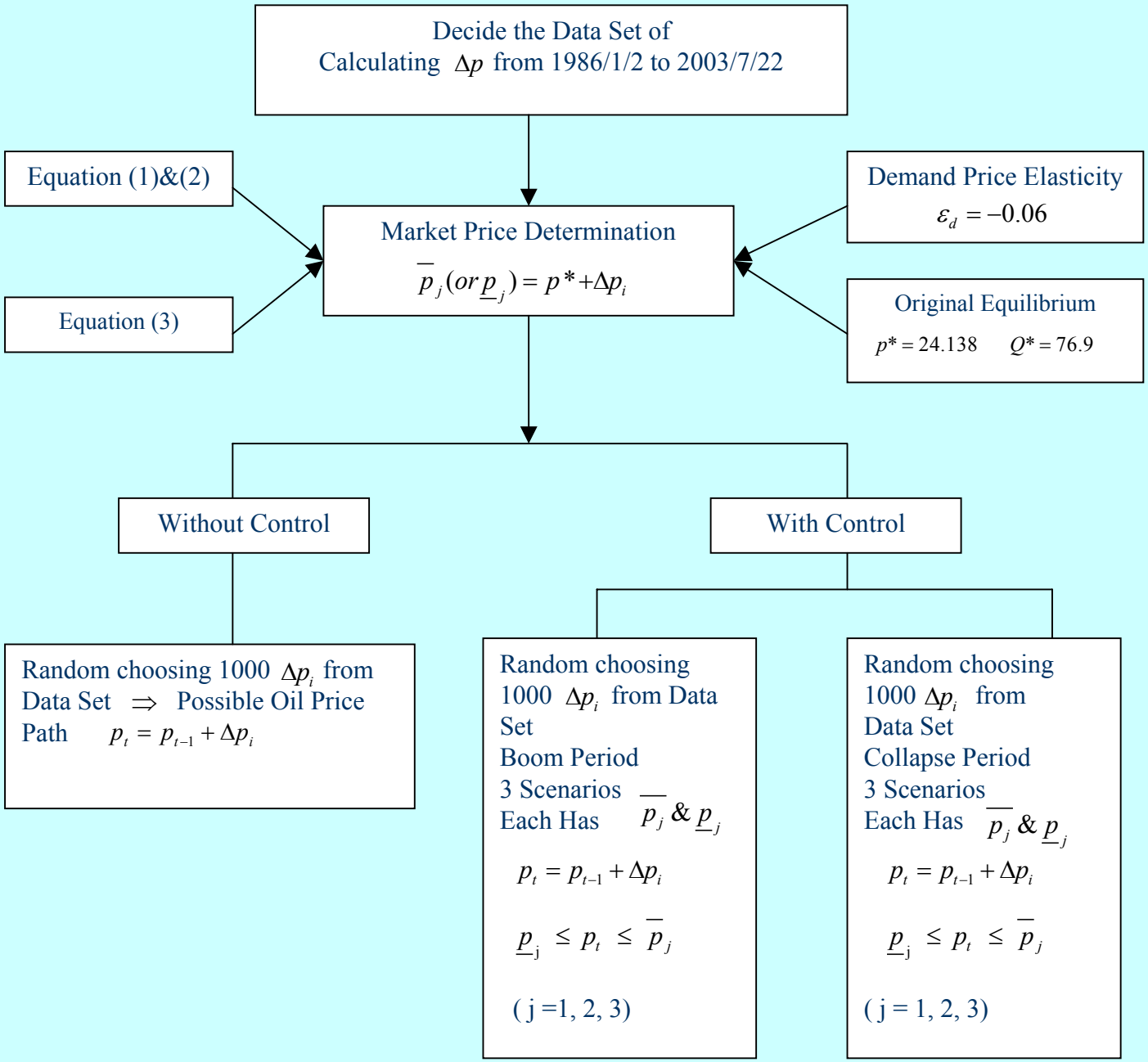
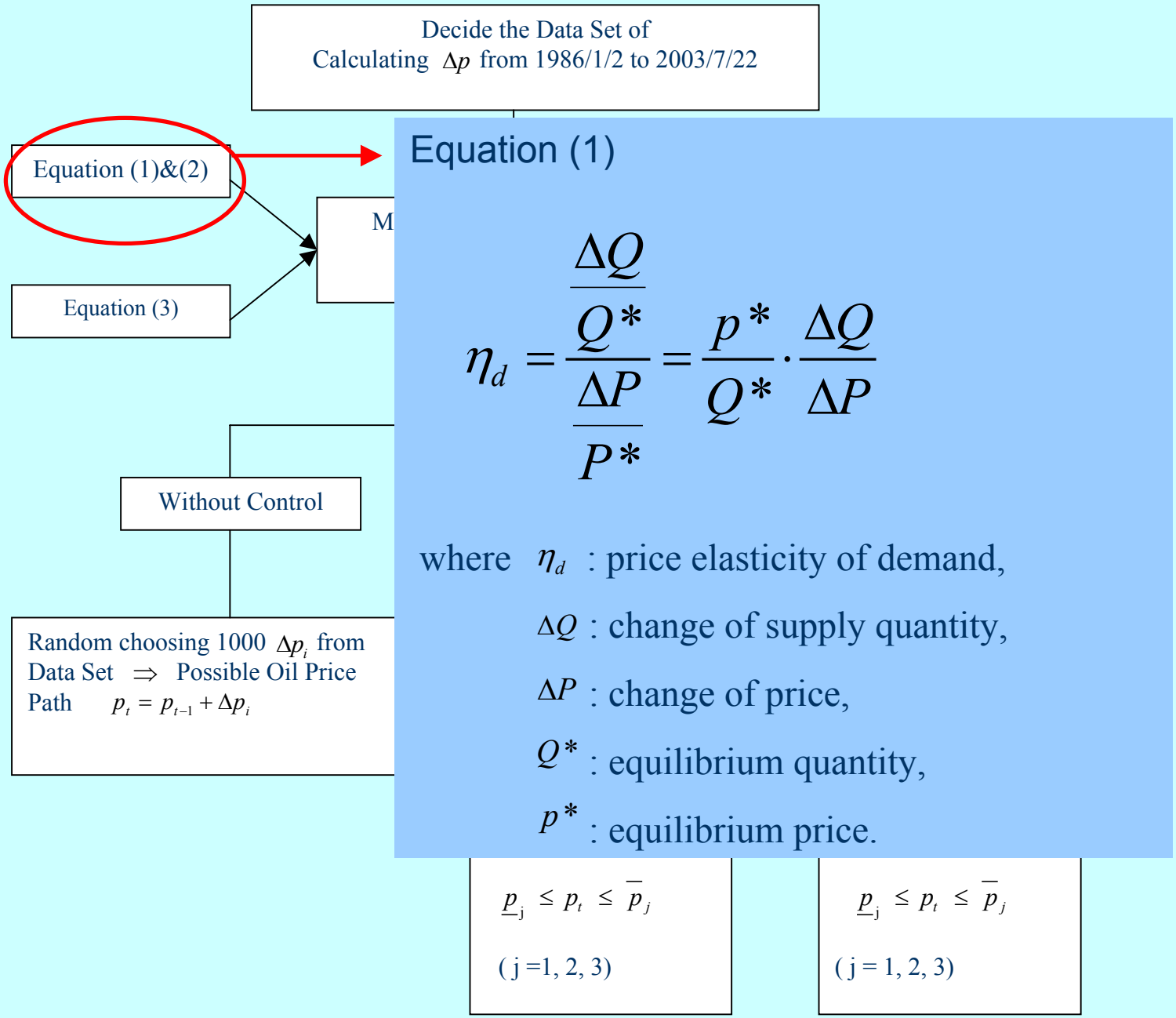


Figure 3 Flow Chart of Simulation Process



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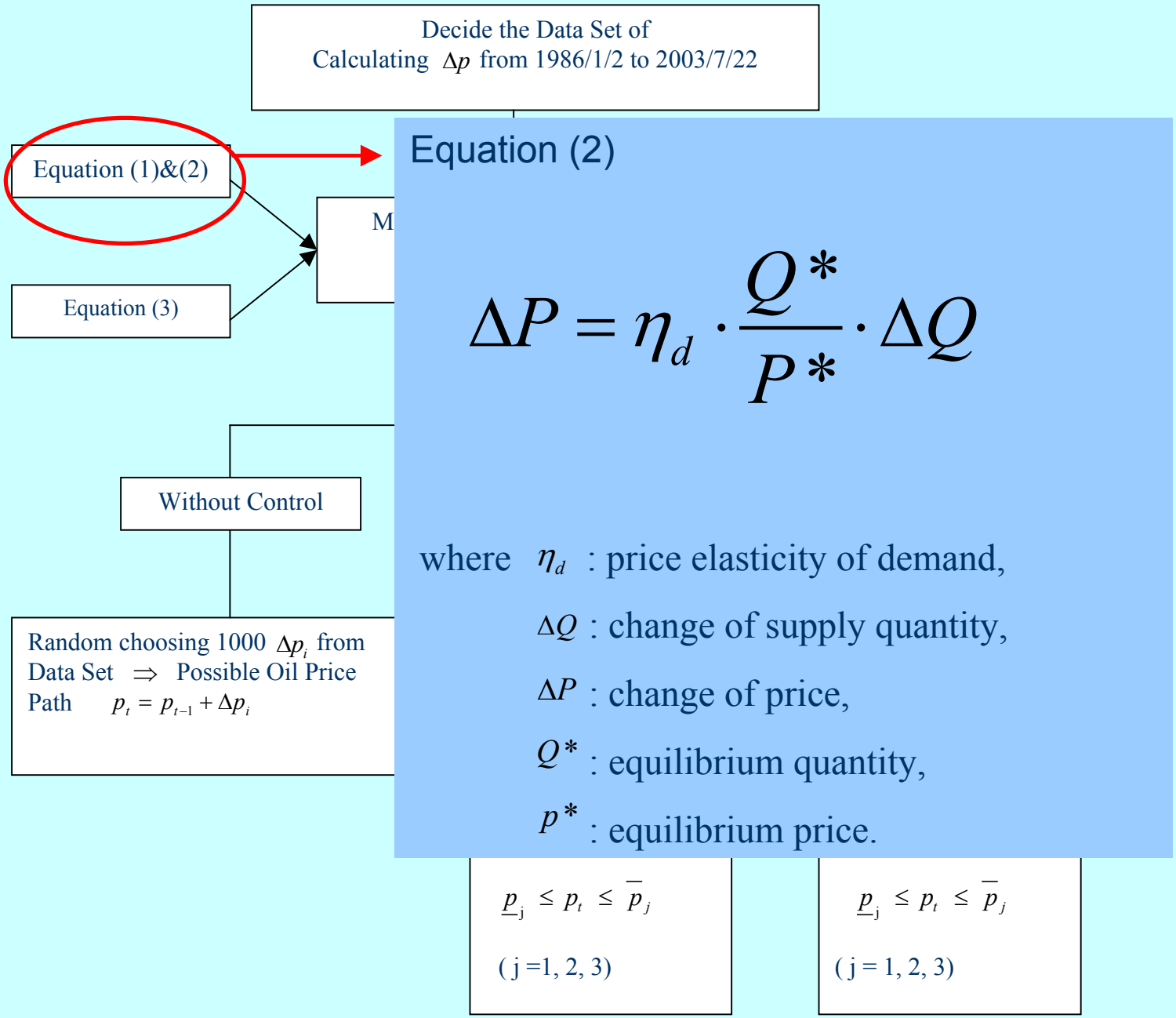

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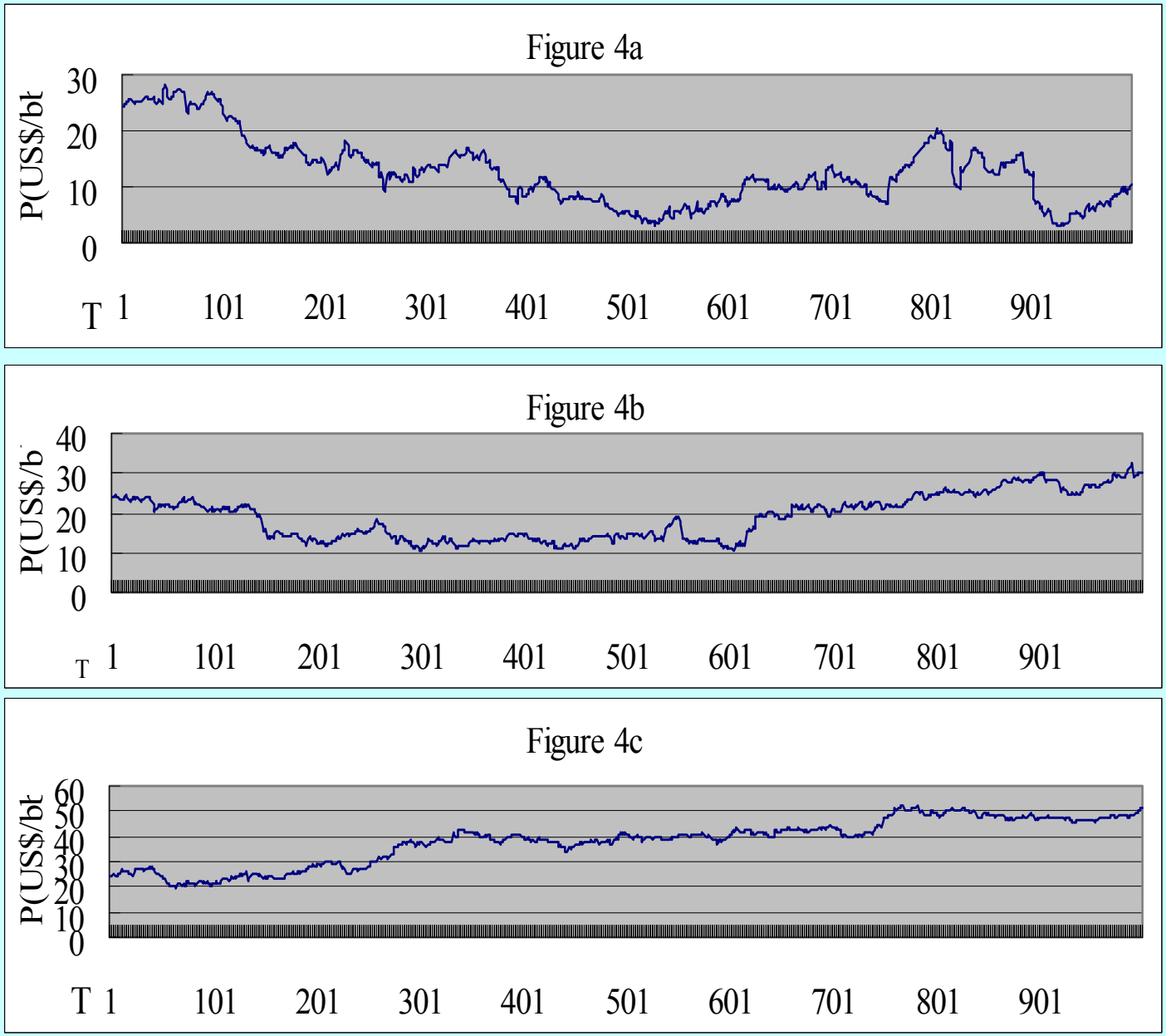


Figure 4 Possible Crude Oil Price Path (without any control)

Table2 Price boom in less production with control **US$/bbl**

Scenario (mb/d)	Max Price	Min Price	Average Price	Standard error	Figure
Constraint (**Loss1** /0.779)	28.698	20.708	25.533	1.638	Figure 5a
Constraint1 (**Loss2** /1.888)	33.923	20.088	25.497	3.015	Figure 5b
Constraint4 (**Loss3** /3.138)	41.228	20.688	29.242	5.394	Figure 5c

Note: Loss : the Total Loss Production of oil from OPEC.
Loss1: Iraq excess capacity=0, Other Member loss 20%, Nigeria loss 40%, Venezuela loss 10%.
Loss2: Iraq excess capacity=0, Other Member loss 20%, Nigeria loss 50%, Venezuela loss 25%.
Loss3: Iraq excess capacity=0, Other Member loss 25%, Nigeria loss 90%, Venezuela loss 40%.

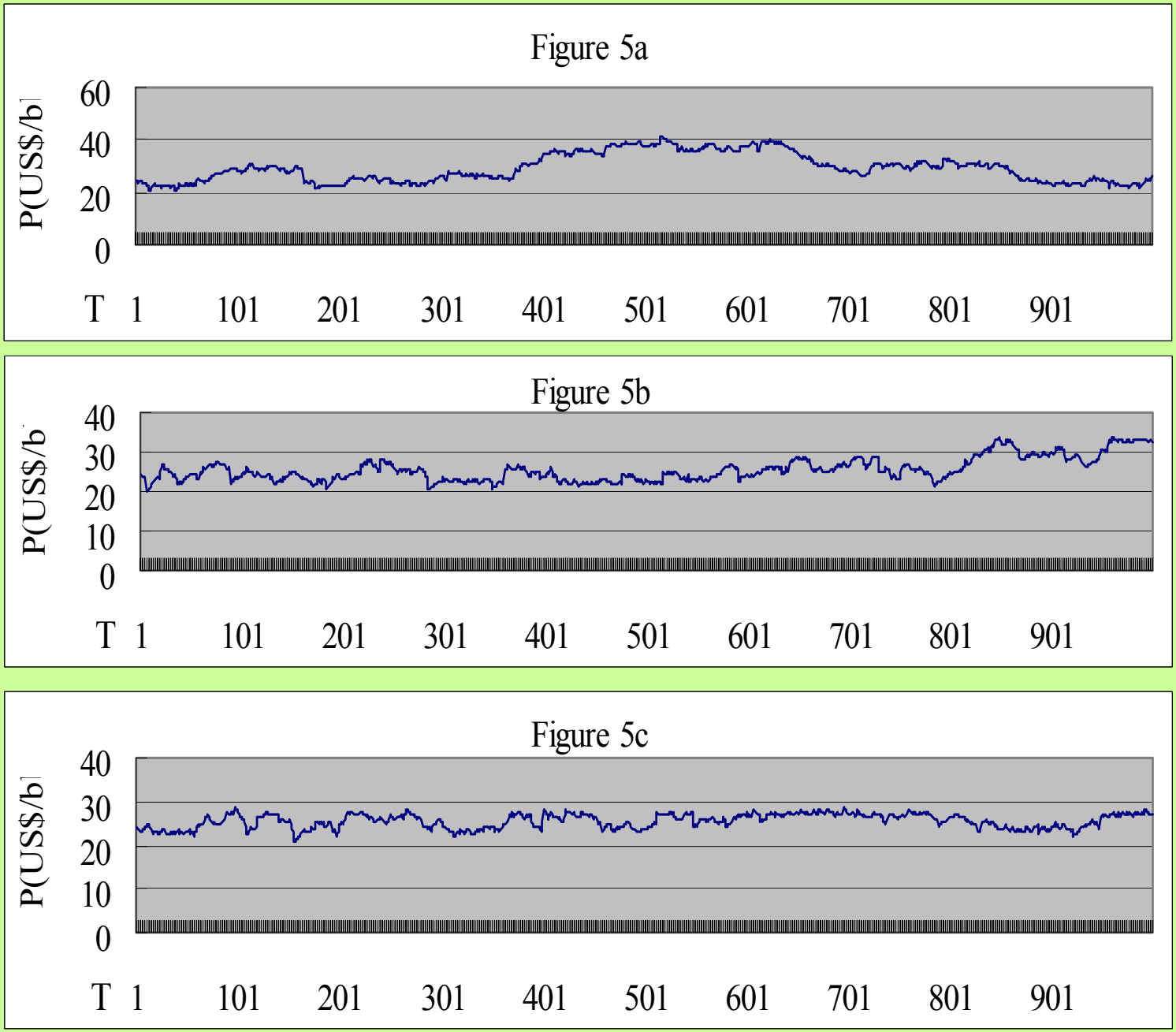


Figure 5 Possible Crude Oil Price Path in Boom Period (with control)

Table3 Price collapse in more production with control US$/bbl

Scenario (mb/d)	Max Price	Min Price	Average Price	Standard error	Figure
Constraint (EC1 /1.075)	27.528	17.998	23.722	1.688	Figure 6a
Constraint (EC2 /2.150)	25.948	10.503	19.466	4.533	Figure 6b
Constraint (EC3 /3.101)	25.518	7.898	15.066	3.809	Figure 6c

Note: EC : the Total Excess capacity from OPEC.

EC1: Iraq production capacity=2.5mb/d, and quota=2, total OPEC quota=25.401(2003/6/1 level), Total OPEC excess capacity=5.376, but all used 20%, 1.075mb/d.

EC2: Iraq production capacity=2.5mb/d, and quota=2, total OPEC quota=25.401(2003/6/1 level), Total OPEC excess capacity=5.376, but all used 40%, 2.150mb/d.

EC3: Iraq can't take over, so he's excess capacity=0, and total OPEC quota=25.401mb/d, Total OPEC excess capacity=3.101mb/d, all used.

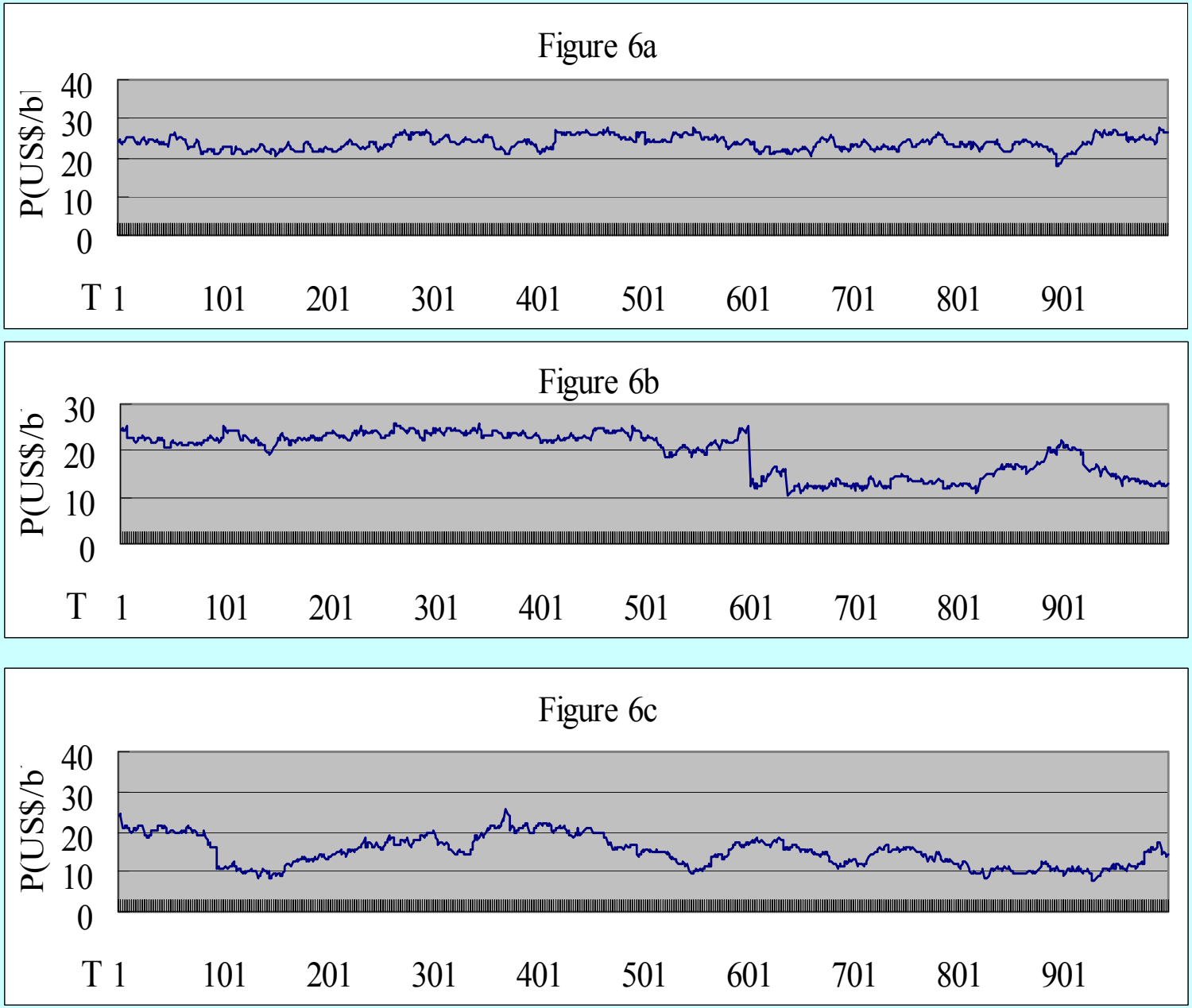
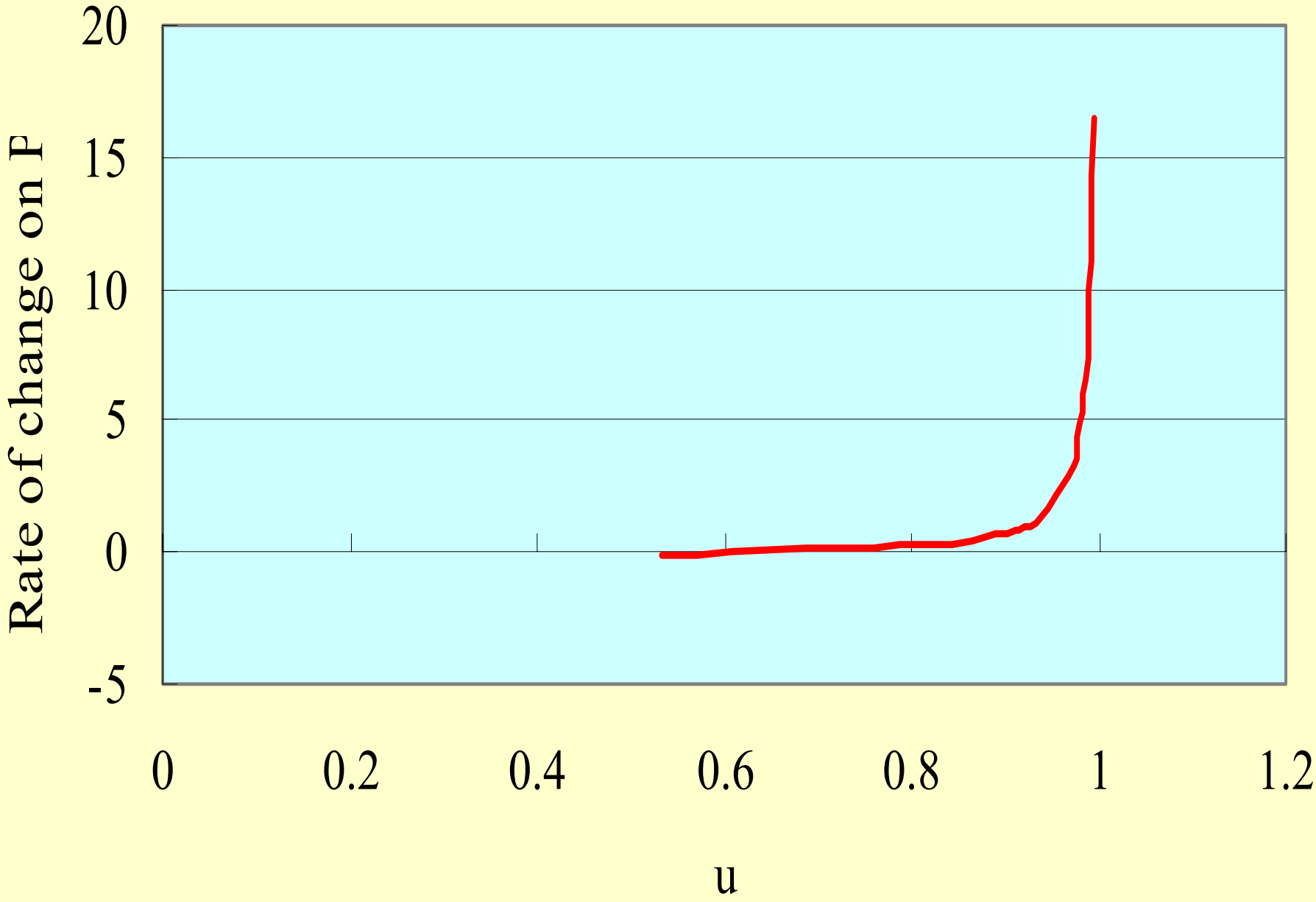


Figure 6 Possible Crude Oil Price Path, in collapse period with Control

Conclusion

- Price Around Fair Price
- Supply Rotation : Privilege Assignment
- Less Volatile Price is Expected
- Further Research

(capacity utilization in Bootstrapping simulation)


20
15
10
5
0
-5
Rate of change on P
0
0.2
0.4
0.6
0.8
1
1.2
u