Discussion on "Misallocation, Market Power, and Global Oil Extraction" by Asker et al. (2019)

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Introduction

- The paper measures production misallocation of global oil market by comparing actual and (counterfactual) optimal supply curves.
- Efficient allocation: supply is ordered according to the marginal cost. The lowest-cost oil fields are extracted first.
- One source of misallocation: market power of oil fields with low costs.

Analytical Framework

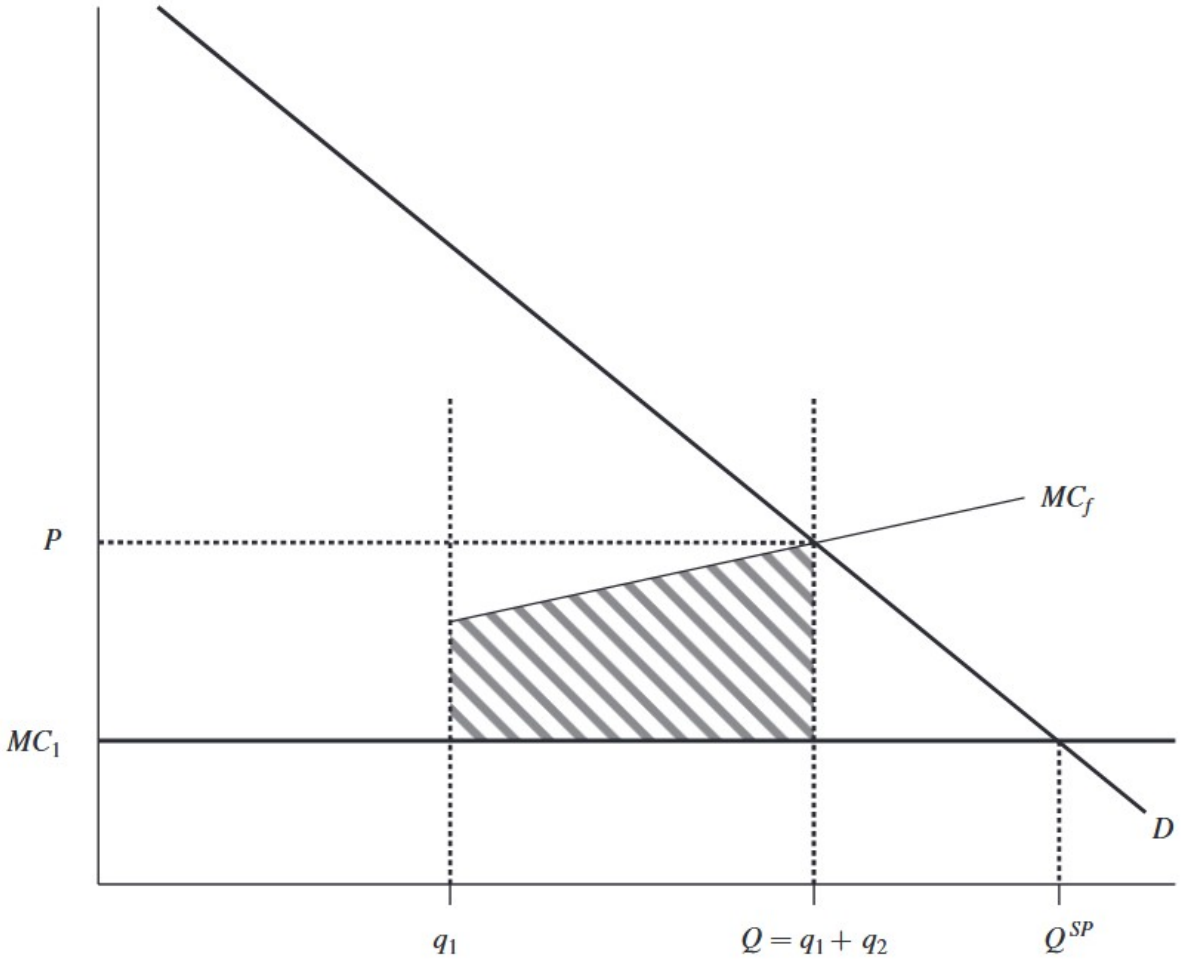

FIGURE 1. PRODUCTION MISALLOCATION (RESULTING FROM MARKET POWER)

Analytical Framework

- A price-taking producer solves:

$$\max_{\{q_{ft}\}} \quad \sum_{t=0}^{T} \delta^t (p_t - c_{ft}) q_{ft} \quad \text{s.t.} \quad R_{f0} \geq \sum_{t=0}^{T} q_{ft}, \quad 0 \leq q_{ft} \leq \theta R_{ft}$$

- The lowest-cost fields are extracted first. When low-cost fields are not being exploited prior to higher-cost fields coming on line, this is the presence of market distortions.
- *Sorting Algorithm*: Given the demand in each year (Q_t) and sorting the field from lowest to highest marginal cost c_{ft}, the optimal supply structure is the index i such that $\sum_{j=1}^{i} q_{jt} = Q_t$, where q_{jt} satisfies $q_{jt} = \theta R_{ft}$.
- Data: $\{c_{ft}, R_{f0}, Q_t\}$.

Data

- Upstream oil industry: extraction.
- Data source: Rystad Energy, an energy consultancy based in Norway that covers the global oil industry.
- The data record global oil fields from 1970 through 2014.
- For each field, the data contains annual production, reserves, operating and capital costs, characteristics including location,geology, and climate zone.
- Sample: 13,248 fields that were active at some point between 1970 and 2014.

Model Parameterization

- The paper quantifies misallocation between 1970 - 2100.
- Q_t: aggregate production is observed in each year from 1970 - 2014. After 2014, assume to grow at a reate of 1.3 percent per year.
- R_{f0}: the actual production from 1970 to 2014 plus the P50 value at an oil price of \$70 a barrel in 2014. (P50: the quantity to be recovered with a 50 percent probability).

Model Parameterization

- From data: $c_{ft} = \frac{\text{Total Expenditure}}{q_{ft}}$.
- $c_{ft} = c_f \mu_{st} \exp(\epsilon_{ft})$. In the model, the marginal cost is $c_f \mu_{st}$.

  μ_{st} is the technology-year cost shifter, s indexes onshore or offshore technology.
- μ_{st} is estimated as the weighted average of cost

$$\hat{\mu}_{st} = \sum_{f \in s} \kappa_{ft} \ln c_{ft}$$

  where $\kappa_{ft} = q_{ft} / \sum_{f \in s} q_{ft}$
- c_f is estimated as

$$\ln c_{ft} - \hat{\mu}_{st} = \ln \hat{c}_f + \epsilon_{ft}$$

Quantifying Misallocation

- Compute the counterfactual path of extraction and compare the net present value of the costs of production from the observed cost to that from the counterfactual path.
- To project the path of "actual" production after 2014, we compute the competitive solution, taking the stocks in each country at the end of 2014 as initial state variables.
    - No new distortion. Only difference is the initial state variable in 2014.

Results: Misallocation

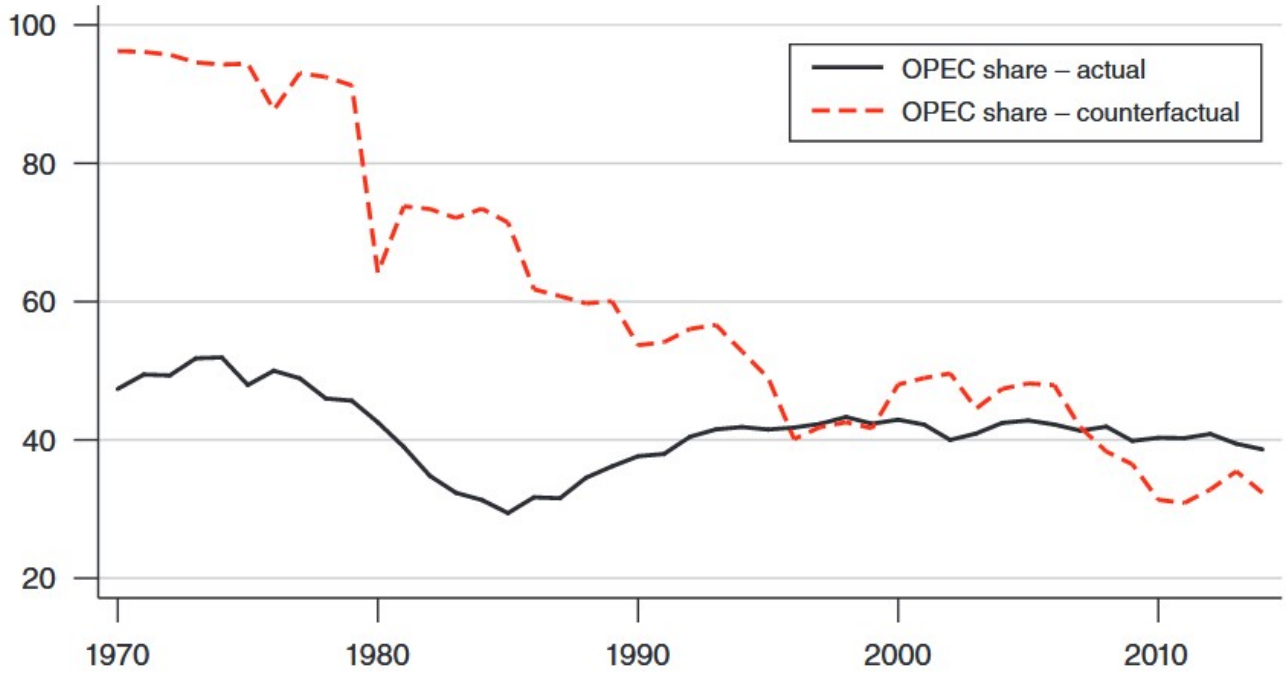

FIGURE 5. OPEC MARKET SHARE, 1970–2014

Note: OPEC share – counterfactual presents the share of production accounted for by OPEC.

Results: Misallocation

TABLE 5—DYNAMIC COUNTERFACTUAL RESULTS (NPV OF COSTS IN BILLIONS OF 2014 US$)

	Timespan			
	1970–2014		1970–2100	
Actual (A)	2,184	(125)	2,499	(130)
Counterfactual (C)	1,268	(76)	1,756	(79)
Total distortion (A − C)	916	(124)	744	(112)
Decomposition of total distortion				
Within country (non-OPEC)	329	(80)	284	(41)
Within country (OPEC)	192	(46)	157	(72)
Across country (within non-OPEC)	163	(18)	139	(17)
Across country (within OPEC) (X)	85	(22)	58	(21)
Between OPEC and non-OPEC (Y)	148	(29)	105	(25)
Production distortion due to OPEC market power				
Upper bound (X + Y)	233	(42)	163	(38)
Lower bound (Y only)	148	(29)	105	(25)

Decomposition

- Identify the part of misallocation attributable to market power, which is held within OECD countries and the OECD as a whole.
- Constrained social planner problems:
  - (i) Holding each country's production level fixed.
  - (ii) Total non-OPEC and OPEC production each year must be that observed in the data: misallocation between OPEC and non-OPEC.
  - (iii) Holding OPEC production fixed.

Results: Decomposition

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Market power: 13.9 % / 21.6 %

Conclusion

- Contribution: a new approach to compute the misallocation. The approach is more data-driven.
- The misallocation from 1970 - 2010 from oil extraction is $ 744 billion (US 2014), 30% of the realized cost of extraction.
- An economically significant proportion of this is due to market power: 14 and 21 percent.

Reference I

Asker, J., Collard-Wexler, A., and De Loecker, J. (2019). (mis) allocation, market power, and global oil extraction. *American Economic Review*, 109(4):1568–1615.