Energy Economics and Policy
AUEB

Christos Karydas

ex: ETH Zurich – Chair of Economics / Resource Economics
now: Ernst & Young – Financial Services Risk Consulting

Lecture 7:
Non-renewable
Resources 2/2

Revision:
Story of a mine-owner

Production by a normal firm is different from mineral extraction

Trade-off/αντιστάθμιση επιλογών:

- Too high extraction now → less available for future extraction
- Letting resource in the ground → lower profits in the present

There is a specific opportunity cost/**κόστος ευκαιρίας** of extraction:

If you extract everything now, you lose the opportunity of selling next period at (maybe) higher prices → **Scarcity**

Revision:
Story of a mine-owner

Decision:

how much of the mineral to extract in each time period so as to earn maximum profits now as well as in the future

- With each year's extraction, the reserves will be reduced and eventually depleted → scarcity (έλλειψη)
- Extraction vs conservation/διατήρηση of the mineral depends on the expected future prices: price of the resource, extraction cost and the price of money (interest rates)

Revision: Hotelling rule

Hotelling rule - Optimal price evolution of a NRR

- Defines the supply curve of the resource owner
- Assume profit $\pi_t = (p_t - c_t)Q_t$. Then $M\pi_t = p_t - c_t$ and Hotelling rule is

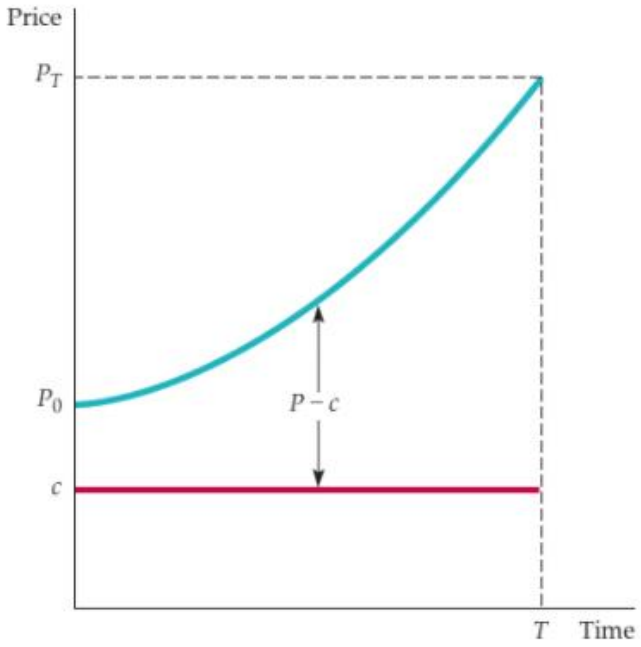
$$\frac{M\pi_{t+1}}{M\pi_t} = \frac{p_{t+1} - c_{t+1}}{p_t - c_t} = 1 + r$$

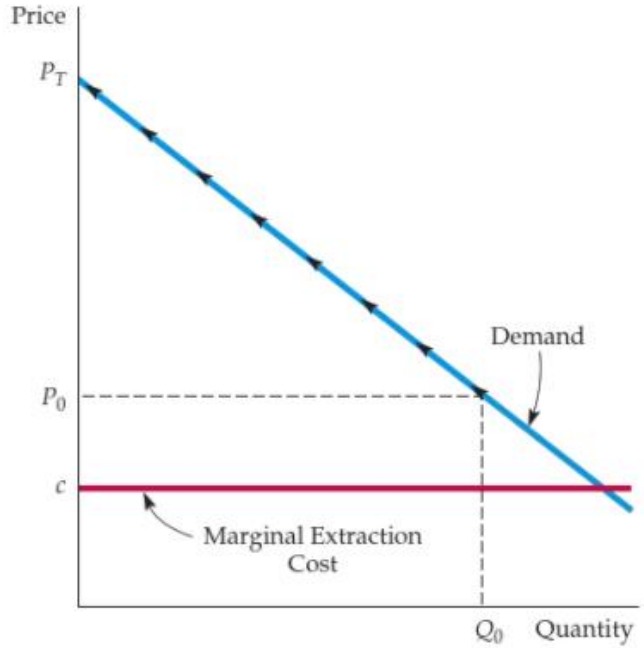
- If there are no extraction costs $M\pi_t = p_t$

$$\frac{M\pi_{t+1}}{M\pi_t} = \frac{p_{t+1}}{p_t} = 1 + r$$

Revision: Depletion path

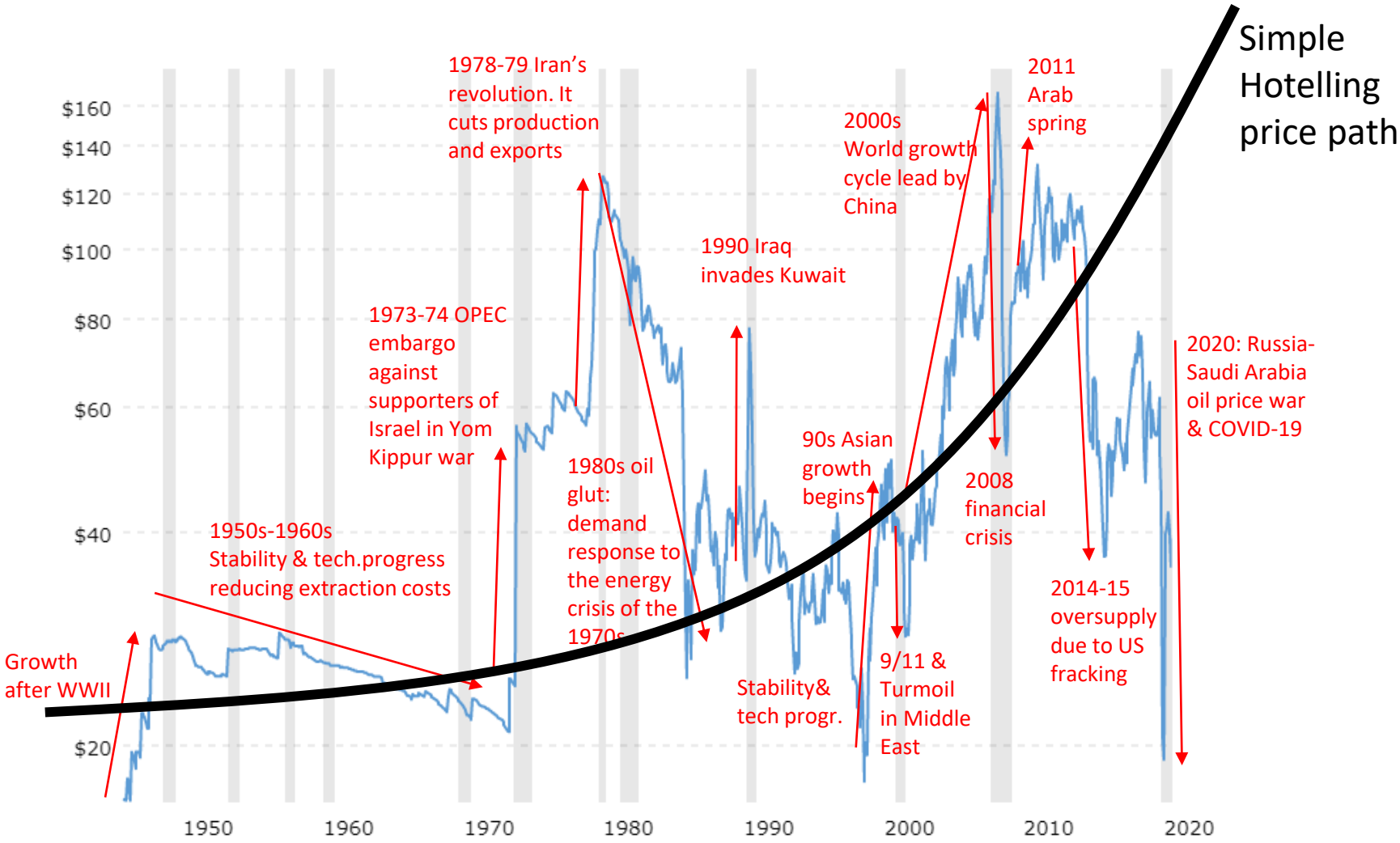
- Hotelling rules comes from the optimization of producer profits → supply curve
- But equilibrium values $\{Q_0, Q_1, Q_2, \dots\}$ depend also on the market demand for the resource (see below)
- Basic (micro-) economic principle: inverse relation between Q and p (demanded quantity decreases as price increases)
- Hence, since prices keep rising, the optimal depletion path features decreasing extracted quantities: $Q_0 > Q_1 > Q_2 > \cdots$ → depletion inevidable





Revision: Hotelling rule doesn't seem to apply

But actually price behaves correctly when we include various exogenous factors…



https://www.macrotrends.net/1369/crude-oil-price-history-chart

Revision: What shapes the price of NRR?

Factors that influence prices of mineral resources:

- **Technical progress** that reduces extraction cost → decreasing Hotelling path
- **Interest rates** → If r increases, opportunity cost increases; price drops now since sooner extraction is more attractive and oversupply is warranted
- **New discoveries** → higher supply reduces prices
- **New backstop technologies** → good substitute technology; choke price is the price of the non-renewable resource at which the backstop technology becomes profitable ($p=MC_{backstop}$)
- **Changes in consumer behaviour** → e.g. price elasticity of demand
- **Market power** → monopoly, cartels
- **Political/Economic shocks** → wars, embargoes etc.
- **Geology constraints** → influences extraction cost
- **Policy** → what could happen in the price of oil if the government pre-announced a very high tax on carbon emissions?

Revision: (No) limits to growth

Importance of accumulative inputs and technol. progress

- Physical, human, knowledge capital can substitute diminishing natural resources and avoid diminishing output
- Hartwick rule of investment (this lecture)

Effect limited by substitution possibilities

- Good substitution between inputs important for sustainability
- Good substitution possible in the long-run
- High enough technological progress can lead to sustained growth even for low substitution

Revision: Elasticity of substitution

Measures the relative change of the factor input ratio in response to relative change in factor price ratio

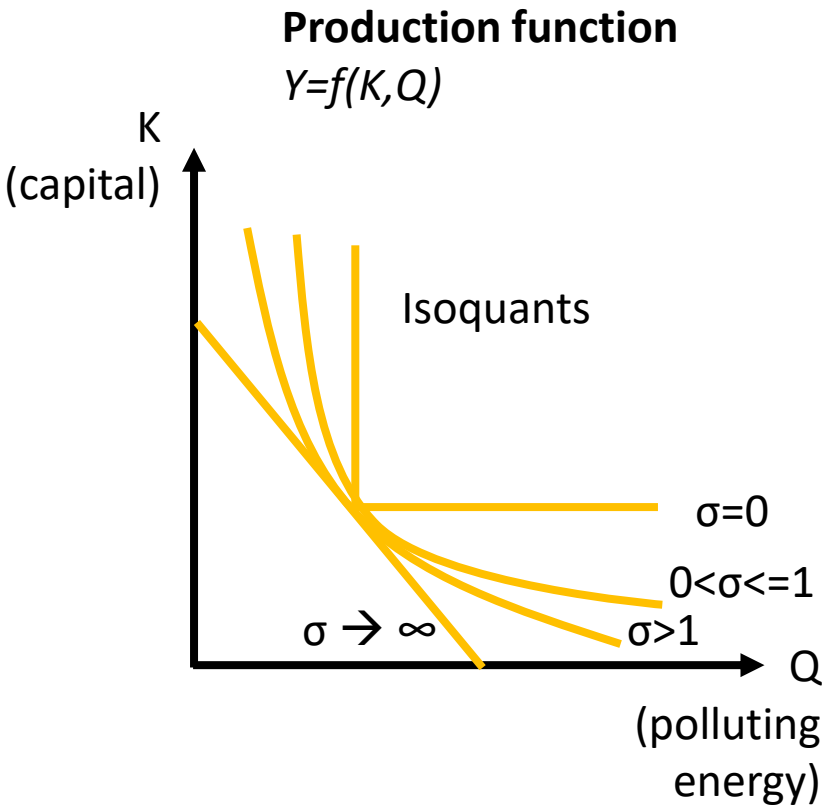
Let $Y = Y(K, Q)$ with p_K, p_Q prices of inputs K, Q , then

$$\sigma = -\frac{\frac{\Delta(K/Q)}{K/Q}}{\frac{\Delta(p_K/p_Q)}{p_K/p_Q}}$$

σ tells us *"how much percent less of K relatively to Q the firm will use if K becomes* $\frac{\Delta(p_K/p_Q)}{p_K/p_Q}$ *percent more expensive, keeping output constant"*

Important parameter of sustainability: How easily can we substitute polluting non-renewable resources with non-polluting capital (e.g. renewables)?

Revision: Elasticity of substitution



$\boldsymbol{\sigma = 0}$ (no substitution)
K, Q perfect complements (e.g. shoes and shoe laces) – K and Q in equal ratios. Q essential for production (if Q=0, then Y=0)

$\boldsymbol{0 < \sigma < 1}$ (poor substitution)
K, Q complements (Q is essential for production)

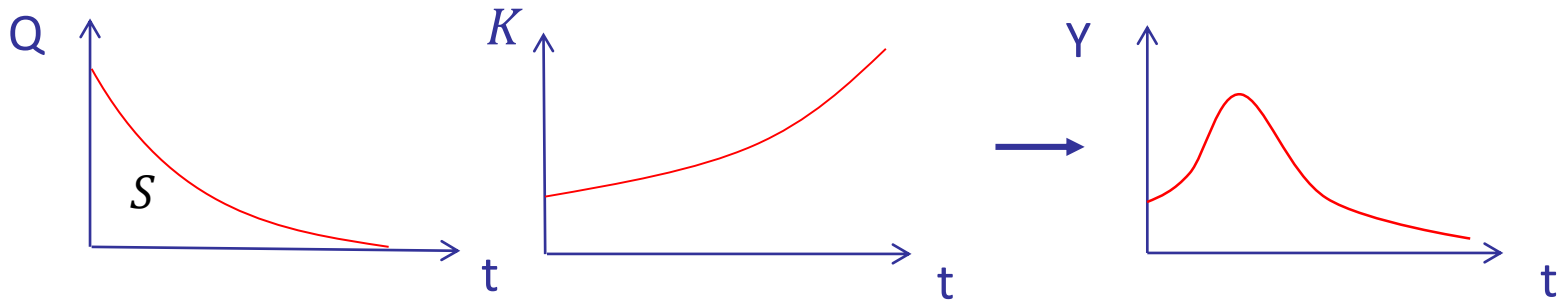
$\boldsymbol{\sigma > 1}$ (good substitution)
K, Q substitutes (Q not essential for production

$\boldsymbol{\sigma \to \infty}$ (perfect substitution)
K, Q Perfect substitutes

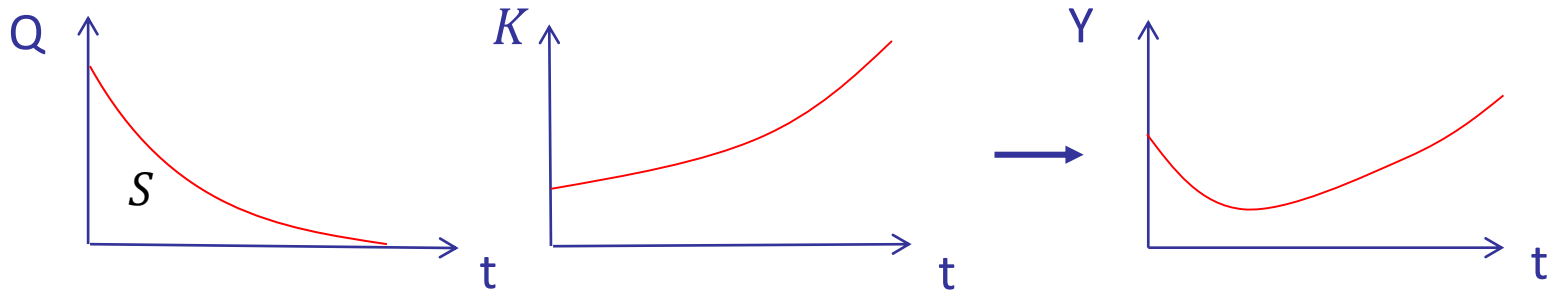
Revision: Substitution between inputs

Possible output profiles

Assume poor substitution $(0 < \sigma < 1)$:



Assume good substitution $(\sigma > 1)$:



Revision: Substitution

What is the empirically-relevant value of σ?

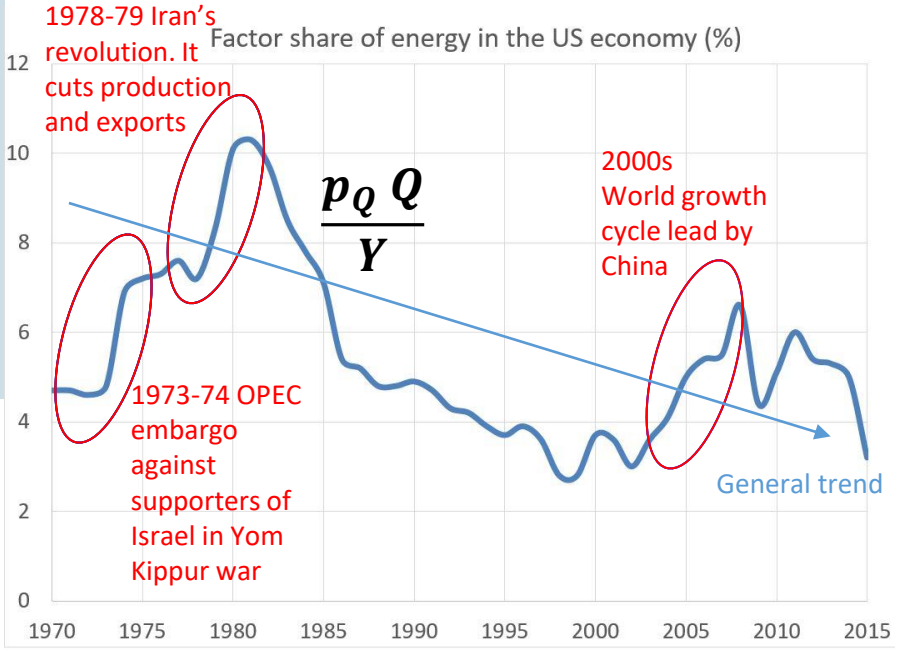
- $\sigma \approx 0$ in short run, $\sigma \geq 1$ in the long-run plausible (Hassler et al. 2012)
- $\sigma \geq 1$ between clean & dirty energy inputs (Papageorgiou et al. 2017)
- $2 < \sigma < 3$ between clean & dirty energy (Jo, 2020)

→ **$\sigma \leq 1$ for the short-run; $\sigma \geq 1$ for the long-run**

Revision: Example to support σ>1

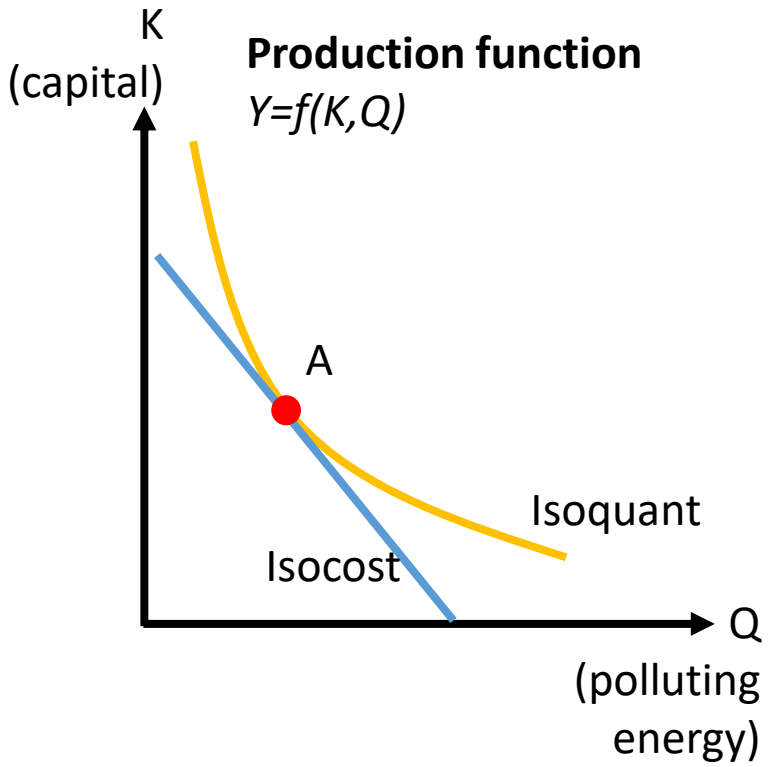
Declining factor share of energy

$$\theta = \frac{p_Q Q}{Y} = \frac{energy\ expenditure}{total\ output}$$



Source:www.eia.gov/aer

Revision: Example to support σ>1



- $Y = f(K,Q) = \left(\alpha\, K^{\frac{\sigma-1}{\sigma}} + (1-\alpha)\, Q^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$

→ $K = \left(\frac{1}{\alpha}\, Y^{\frac{\sigma-1}{\sigma}} - \frac{1-\alpha}{\alpha}\, Q^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$ (isoquant)

- $Cost = p_K K + p_Q\, Q$

→ $K = \frac{Cost}{p_K} - \frac{p_Q}{p_K} Q$ (isocost)

Profit maximization of the firm (isocost tangent/εφαπτεται to isoquant) leads to:

$$\theta = \frac{p_Q\, Q}{Y} = (1-\alpha)\left(\frac{Q}{Y}\right)^{\frac{\sigma-1}{\sigma}}$$

Since $\frac{Q}{Y}$ is empirically decreasing, share θ is decreasing as observed only if $\sigma > 1$

Revision: Technical progress

$$Y = \left(\alpha\, K^{\frac{\sigma-1}{\sigma}} + (1-\alpha)\,(\boldsymbol{A_Q}\, Q)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$$

What is the role of technology $\boldsymbol{A_Q}$ that improves the energy efficiency of polluting non-renewable resources?

Profit maximization of the firm → $\theta = (1-\alpha)\left(\frac{\boldsymbol{A_Q}\, Q}{Y}\right)^{\frac{\sigma-1}{\sigma}}$

Tech. progress (growth in technology)
$g_Q = (A_{Q,t+1} - A_{Q,t})/A_{Q,t} = \Delta A_{Q,t+1}/A_{Q,t}$ helps in both directions:

- explain decreasing θ even for $\sigma < 1$
- sustained growth of output despite resource depletion

→ If g_Q sufficiently high, θ can be decreasing even for $\sigma < 1$
→ High rate of tech. progress compensates for depleting resources Q

Sustainable development

This lecture

- Resource curse = κατάρα των πόρων
- Explanations behind the resource curse
  - Dutch disease
  - Political economy reasons
- Sustainable practices of resource extraction

Wealth of a nation

stocks of assets that can generate future income and well-being

- Physical capital – machines, buildings...
- Human capital – skills, education...
- Natural capital – forests, minerals (fuels) fish stocks...
- Intellectual property – innovations, databases, patents...
- Social capital – quality of institutions

Resource curse

Lower development in spite of (or due to) resource abundance

Economic explanation

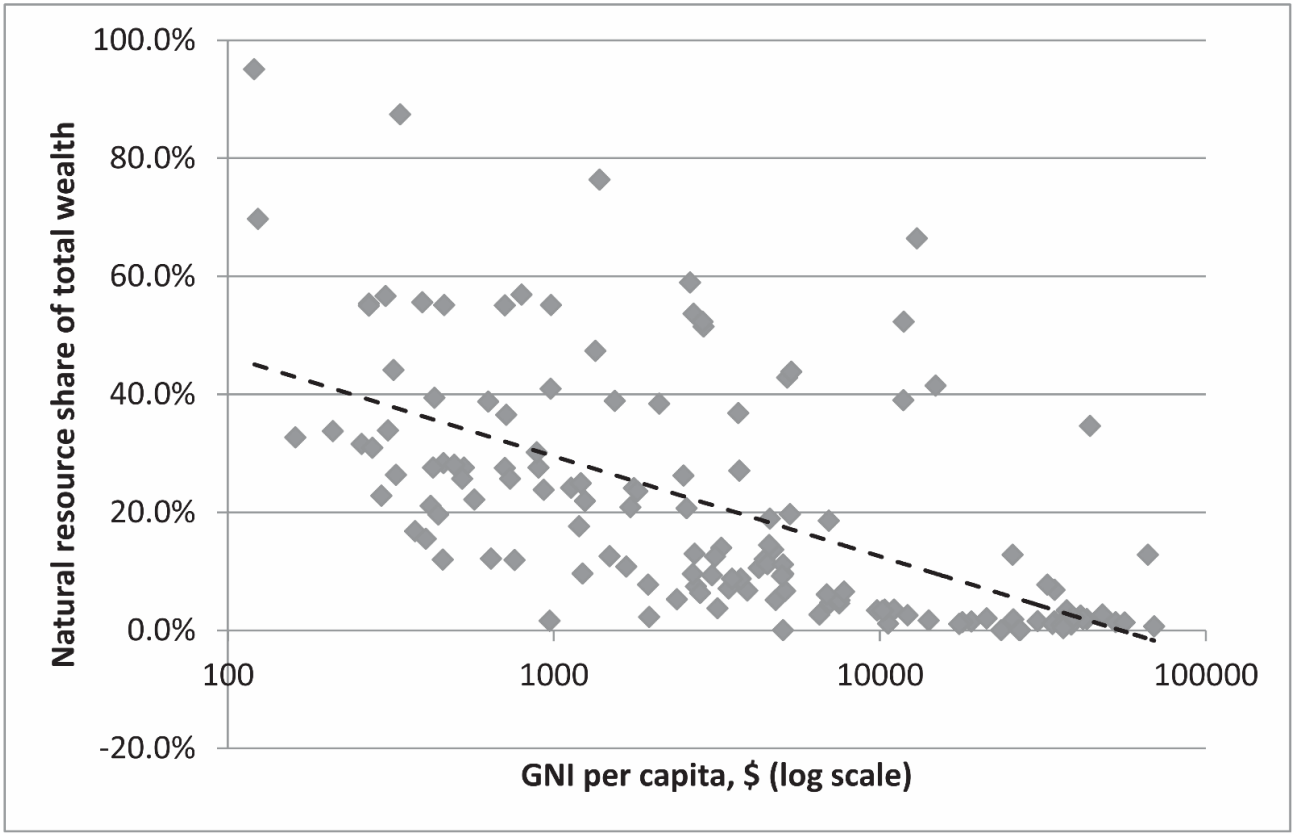
- Dutch disease
- Poor capital accumulation and diversification

Political / institutional explanation

- Rent seeking
- Patronage
- Unequal distribution of resources

Resource curse

Resource abundance leads (?) to lower economic development (measured by Gross National Income GNI)



Dutch disease

Negative economic consequences of anything that gives rise to a sharp inflow of foreign currency, such as:

- Large natural resource discovery
- Sudden rise of international price of an exportable commodity
- Large foreign aid / capital inflows

Dutch disease

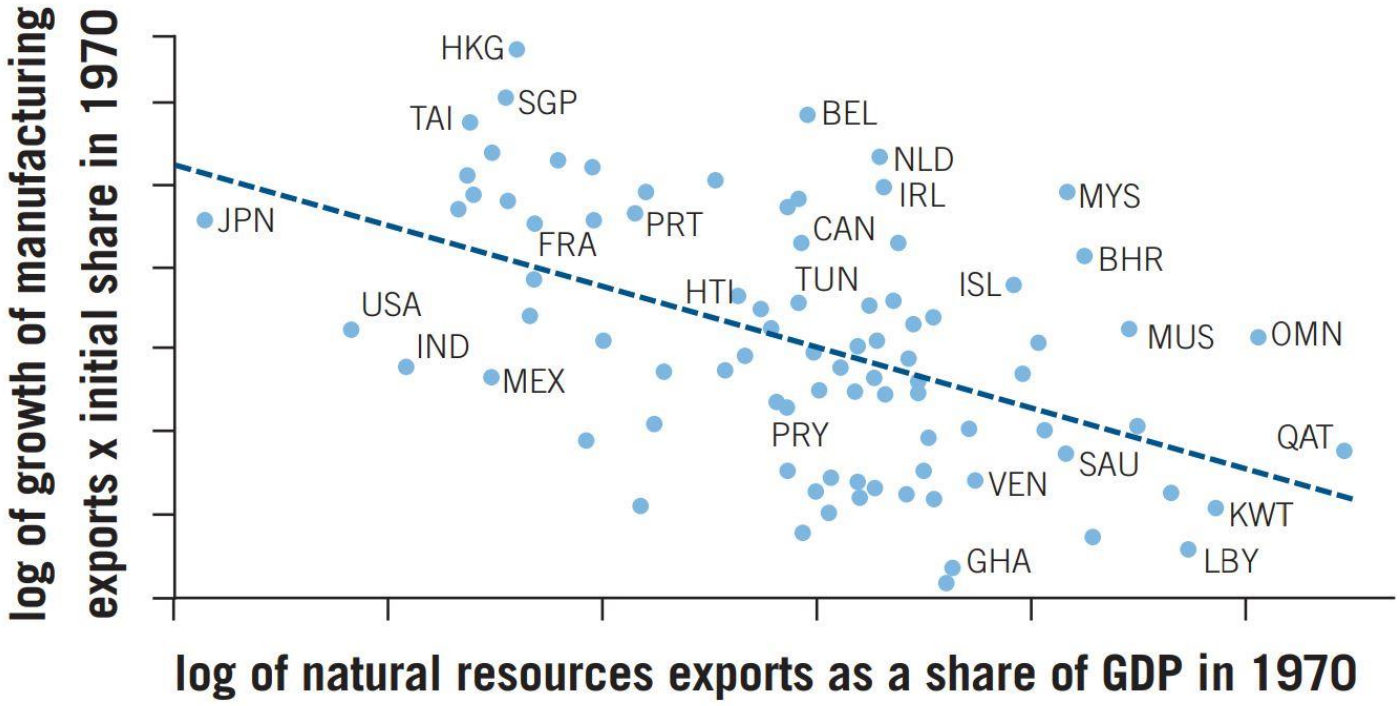
- Conceived by The Economist in 1977
- Netherlands ’60s, UK ‘70s – North Sea gas and oil

- Poor management of large foreign demand for the resource:
  - fast appreciation of the national currency
  - stagnation of manufacturing
  - high inflation / unemployment
  - negative economic development

Inevidable resource exhaustibility → Economic collapse

Dutch disease

Resource dependence → low competitiveness of other sectors



Source: Sachs and Warner (2001)

Dutch disease

Corden and Neary (1982)

- Three economic sectors:
  - (Booming) traded resource → π.χ. Εξόρυξη
  - (Lagging) traded manufacturing → παραγωγή
  - Non-traded goods and services → εγχώριες υπηρεσίες
- Resource boom affects the economy through two mechanisms:
  - resource movement effect → μετακίνηση συντελεστών παραγωγής
  - spending effect → επίδραση στις δαπάνες

Inevidable resource exhaustibility → Economic collapse

Dutch disease

- Resource movement effect / Direct de-industrialization
  - Shift of production factors (labor, capital) towards booming sector
  - Decline in production of non-tradables sector → excess demand

  → Relative price increase of local goods (inflation)

- Spending effect / Indirect de-industrialization
  - Increased domestic income from booming natural resource
  - Higher spending by public and private sector
  - Increased demand for local services increases prices (inflation)
  - Production for lagging sector becomes more expensive

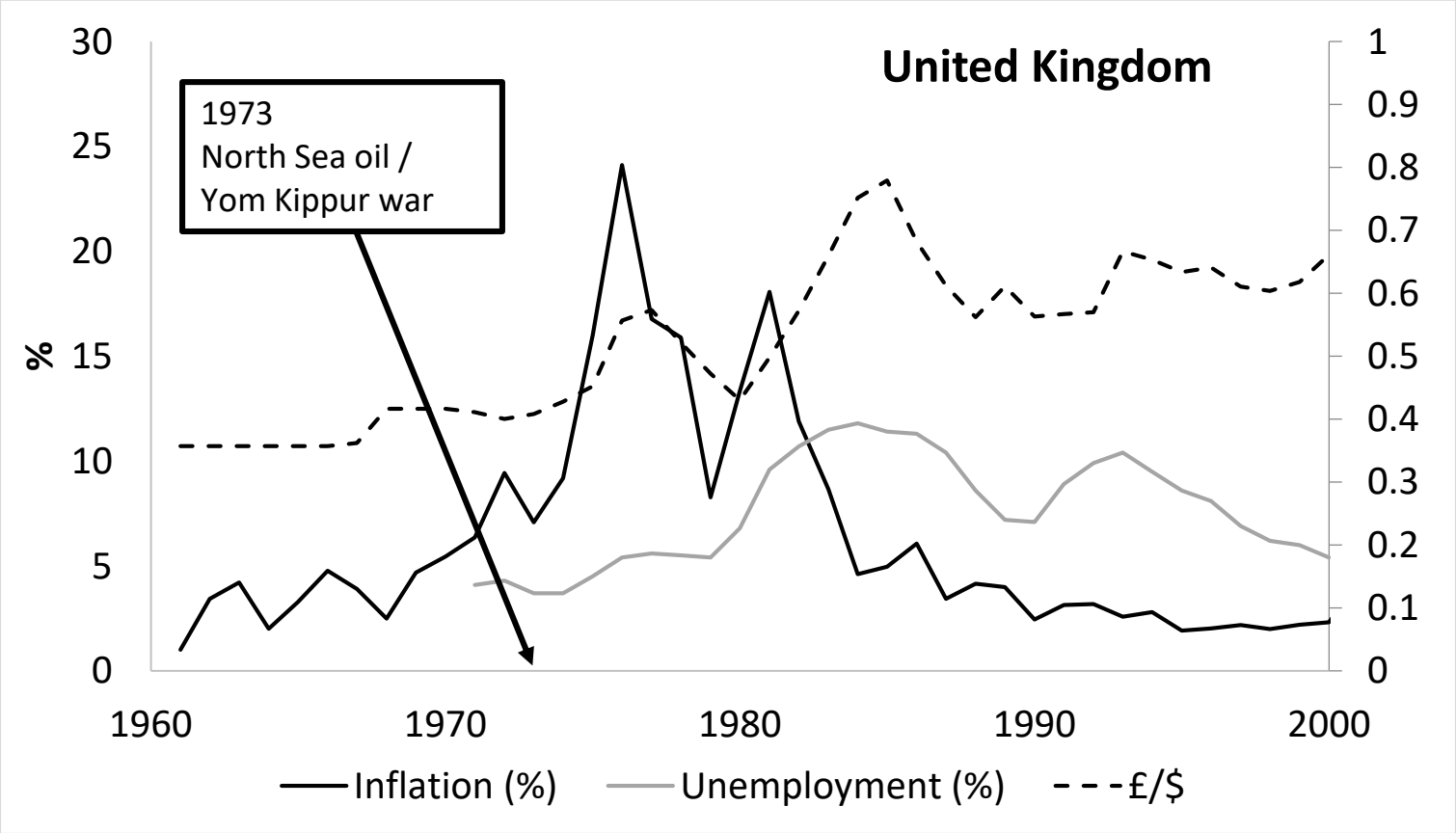
Both effects result in a fall of production of lagging traded sector, real exchange rate appreciation and inflation

Dutch disease

Increased demand for tradable commodity:

Result	Problem
Local currency appreciates	Exports become more expensive and Manufacturing shrinks → Unemployment
Labor and capital investment move to (booming) resource sector	
Extra revenues from booming sector spent on non-tradable goods e.g. local services	Non-tradable sector benefits (services) Inflation and higher cost of living (think of people in lagging sectors) → Social inequality
High inflation	Usually followed by recession
Poor diversification	Price volatility of the resource can lead to economic collapse

Dutch disease – oil in the UK



Source: Own calculations using World Bank Indicators and UK Office for National Statistics

Dutch disease – Way out

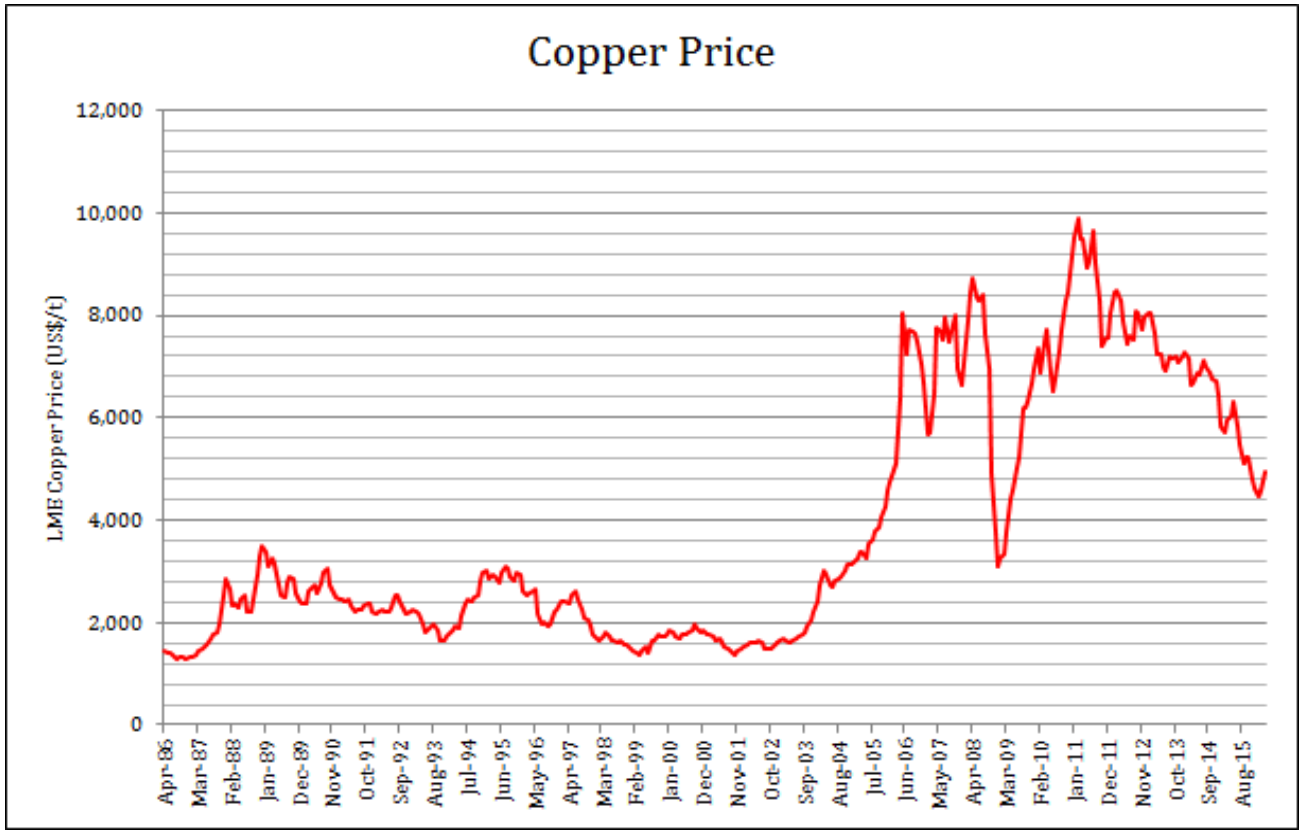
Fiscal / Monetary Policy

- Constraint Spending (and thus limit inflation)
  - Countercyclical public spending with resource prices
  - Adjust private spending by taxation, interest rates
  - Save in funds: stabilization agaist volatility, invest for future growth
- Constraint currency appreciation
  - Invest part of resource revenues abroad
  - Increase holding of foreign currency in central bank

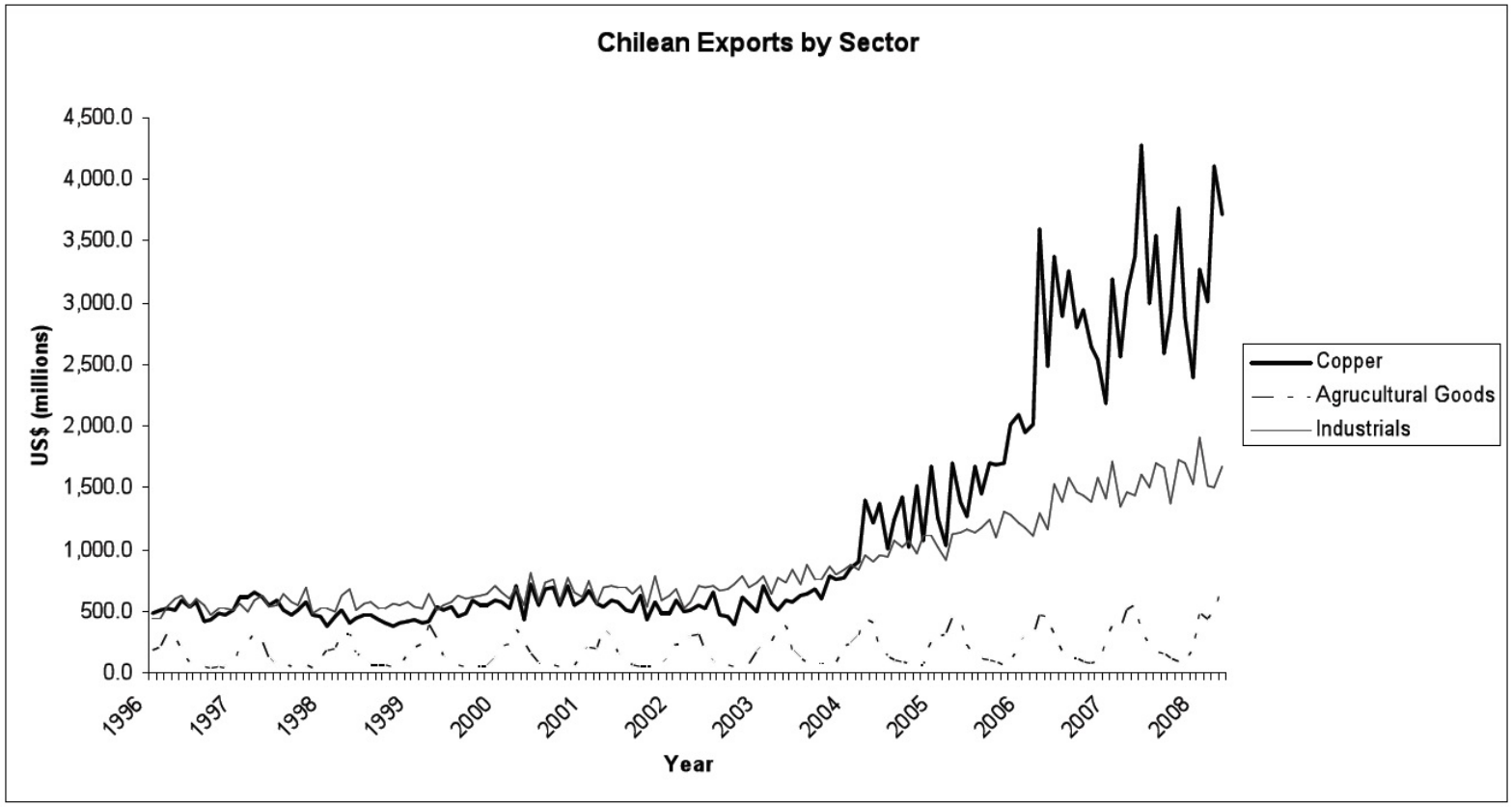
Boost competitiveness of lagging tradable sectors

  - Invest in education and infrastructure – <u>diversification</u>

Copper in Chile



Copper in Chile



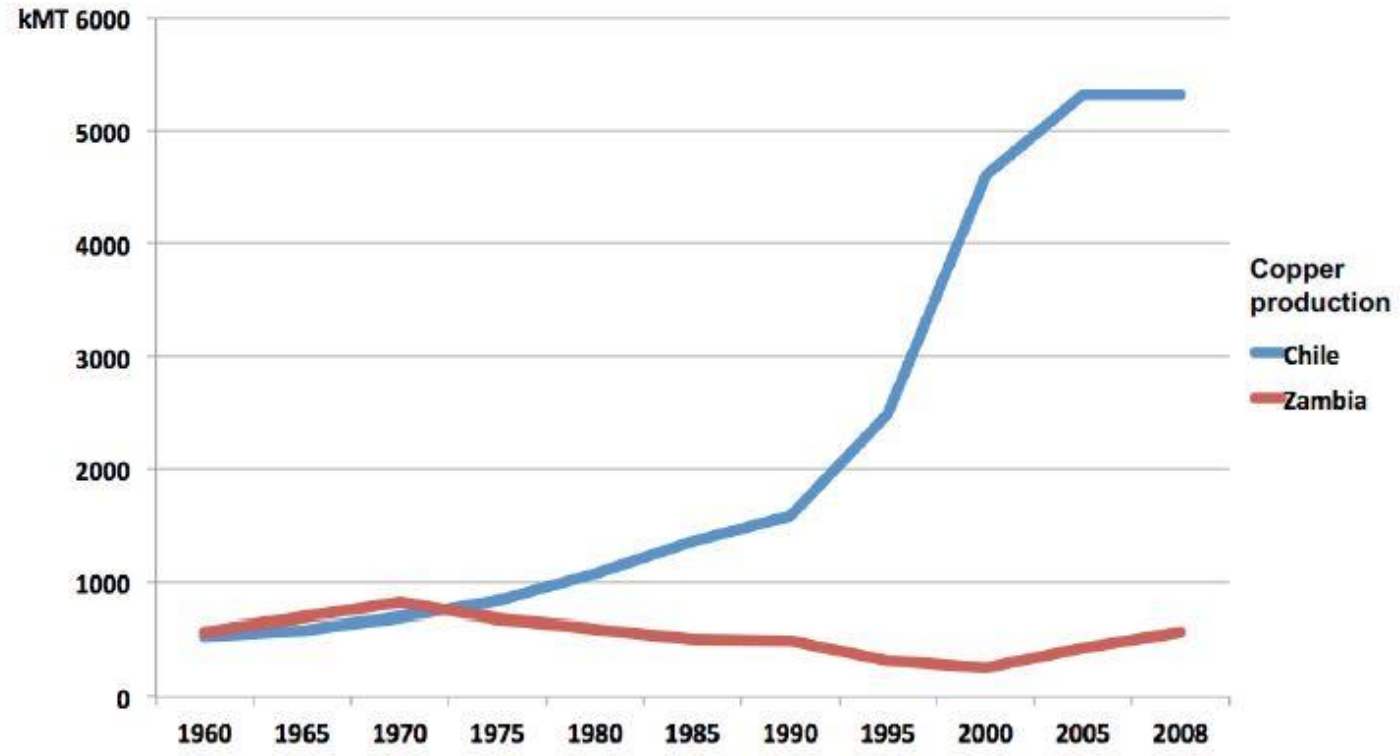
Chile vs. Zambia

Chilean economy pulled through:

- Increased imports → limited Exch. Rate appreciation
- Fiscal - monetary discipline and revenue management:
  - Countercyclical public spending
  - Sovereign wealth fund (Economic and Social Stabilization Fund and Pension Reserve Fund)
  - Inflation targeting using the interest rate as a tool
  - Increasing international reserves held in the Central Bank
  - Invest additional copper revenues overseas
- What about Zambia?

Chile vs. Zambia

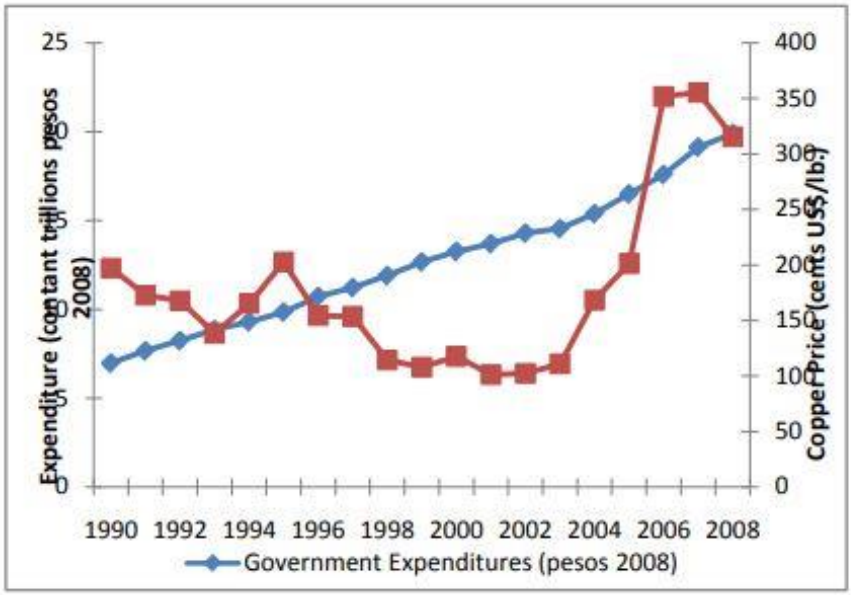
Similar starting point different evolution

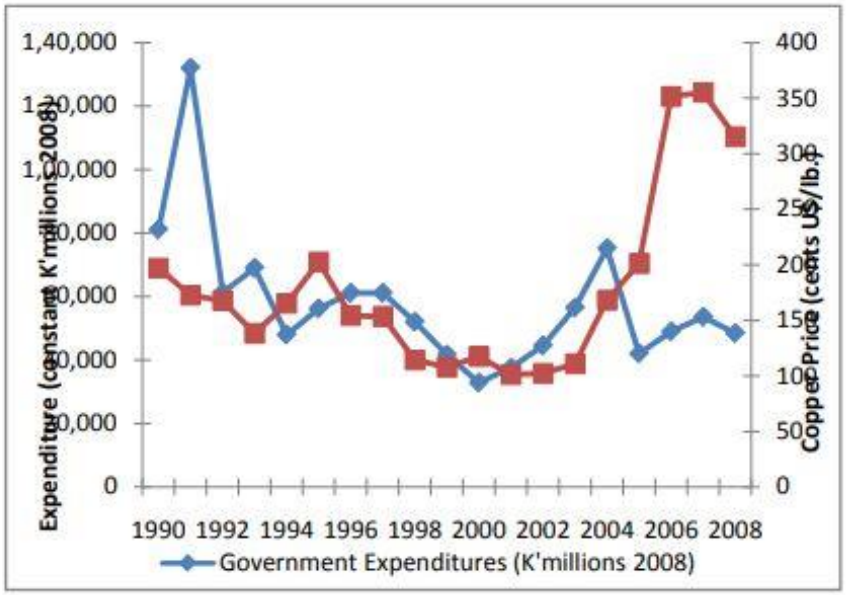


Source: Meller (2011) - Role of Copper in the Chilean & Zambian Economies

Chile vs. Zambia

Fiscal and monetary discipline is key to benefit from resource boom. Chile (left) follows a stable spending plan while Zambia (right) increases spending when income from copper is high

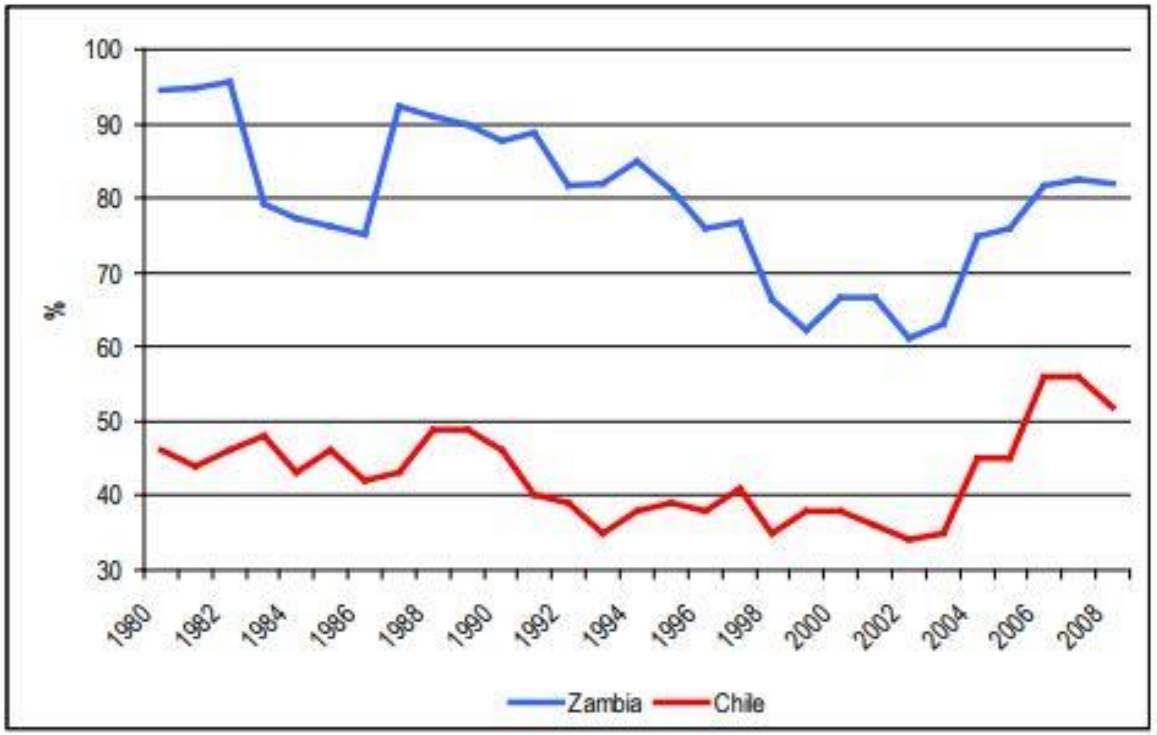




Source: Meller (2011)

Dutch disease – Chile vs. Zambia

Poor diversification (Graph shows % of copper exports in total exports)



Source: Meller (2011)

Collier and Hoeffler (2000), “the extend of primary commodity exports is the largest single influence on the risk of conflict” (p.26)

Sustainable Development

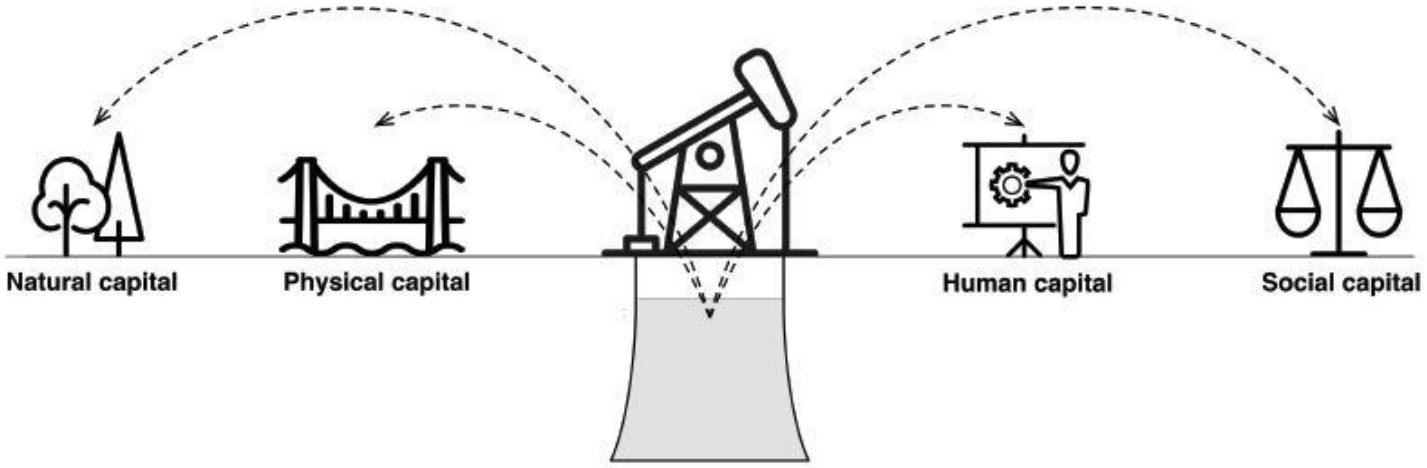
The **Brundtland report** defines sustainable development as…

"…the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations, 1987)

Sustainable Investment

Hartwick rule of sustainable investment

- We saw the <u>importance of Diversification</u>
- This was proved formally by John Hartwick in the 70s:
  - Invest rents from non-renewable resources in other forms of capital
  - Drawback: assumes good access to capital for investment
- Adjusted Net Savings (ANS) as indicator of sustainable development



Sustainable Investment

Adjusted Net Savings - Indicator of sustainability created by the World Bank

ANS = + Investment in capital formation (incl. depreciation)
- Energy / Minerals / Forest depletion
+ Education expenditure
- Damages from global pollution
- Damages from local particulate emissions

Source: World Bank

Adjusted Net Savings

Dis-saving increases with the share of resource rents!

Hartwick rule - Application

% of Gross National Income	Dem. Republic of Congo	Norway
Gross savings (+)	22.0	35.2
Consumption of fixed capital (-)	14.1	14.5
Education expenditure (+)	2.5	6.0
Energy depletion (-)	59.6	10.2
Mineral depletion (-)	0.0	0.0
Net forest depletion (-)	0.0	0.0
CO2 damage (-)	0.2	0.1
PM damage (-)	0.9	0.0
ANS	**-49.8**	**16.4**

Source: World Bank

What's more?

Besides diversifying the economy what else do we need?

Invest in funds:

- Equal treatment of future generations
  - Intergenerational sovereign fund – e.g. Norway
  - After depletion use fixed amount every year (interest on invested resource rents)
- Protect against price volatility
  - Precautionary buffer / Liquidity fund to hedge against resource price shocks

Resource curse – on the news

Bloomberg Opinion

Markets

How a New Venezuela Can Avoid the Oil Curse

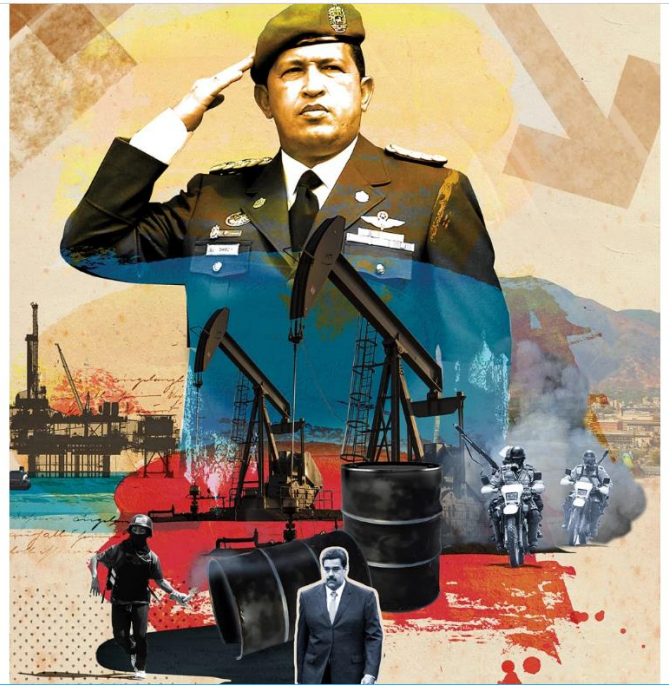
Reforming Chavez-era petroleum laws can revive a formerly varied and vibrant economy.

By Ellen R. Wald
January 30, 2019, 11:00 AM GMT+1

FP

REGISTER/SIGN IN

FEATURE: How Venezuela Struck It Poor



FEATURE

HOW VENEZUELA STRUCK IT POOR

The tragic — and totally avoidable — self-destruction of one of the world's richest oil economies.

BY KEITH JOHNSON
ILLUSTRATIONS BY SARAH HANSON FOR FOREIGN POLICY
JULY 16, 2018, 8:00 AM

Resource curse – on the news

Bloomberg

Politics

Maduro Says Oil Price Crash Is 'Brutal Blow' to Venezuela

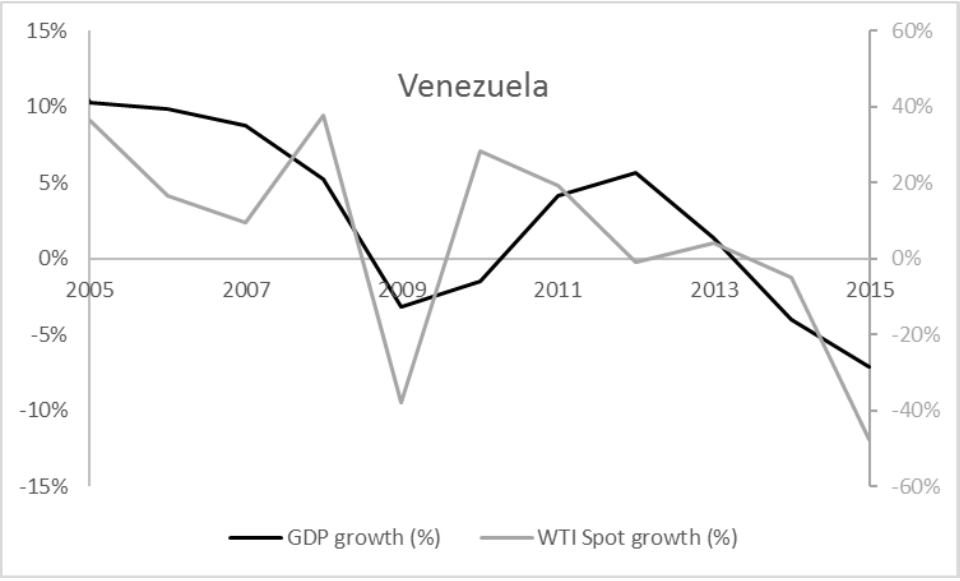
By Fabiola Zerpa

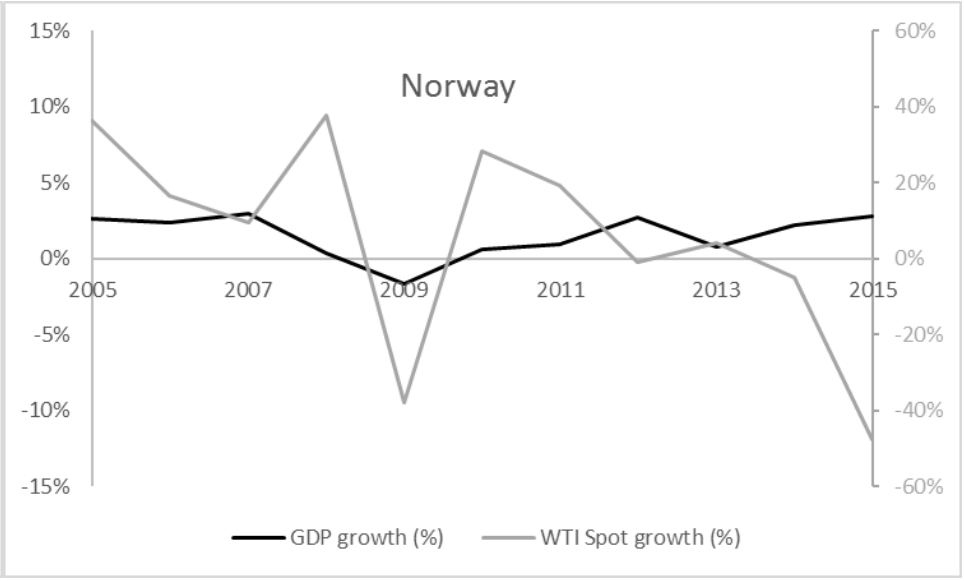
March 12, 2020, 8:40 PM GMT+1

Example – Norway vs. Venezuela

- Correlation between GDP growth and WTI Spot growth
  Venezuela 0.71 Norway 0.09

- Oil rents (% of GDP – on average)
  Venezuela 24% Norway 9%





Example – Norway vs. Venezuela

Questions:

1. What is an explanation in the economic performance of these countries?

2. How could have Venezuela done better in…
   …investing the rents from oil?
   …order to cope with the high oil price volatility?

3. What is the financial instrument used by Norway to ensure sustainable investment of oil rents?

What have we learned so far?

Governments have, in theory, the appropriate policy tools to…

- … invest in the productivity of their resource sector and diversify exports or tax exports and subsidize non-booming sectors
- … keep resource windfalls in foreign currency to keep currency from appreciating
- … buffer economies against world price volatility by using price stabilization funds
- … counteract Dutch disease by tight fiscal / monetary policies
- … invest for future generations by using sovereign wealth funds

So why is this not happening?

Why not sustainable investment?

Explanations of the resource curse

Economic explanation

- Dutch disease
- Poor diversification

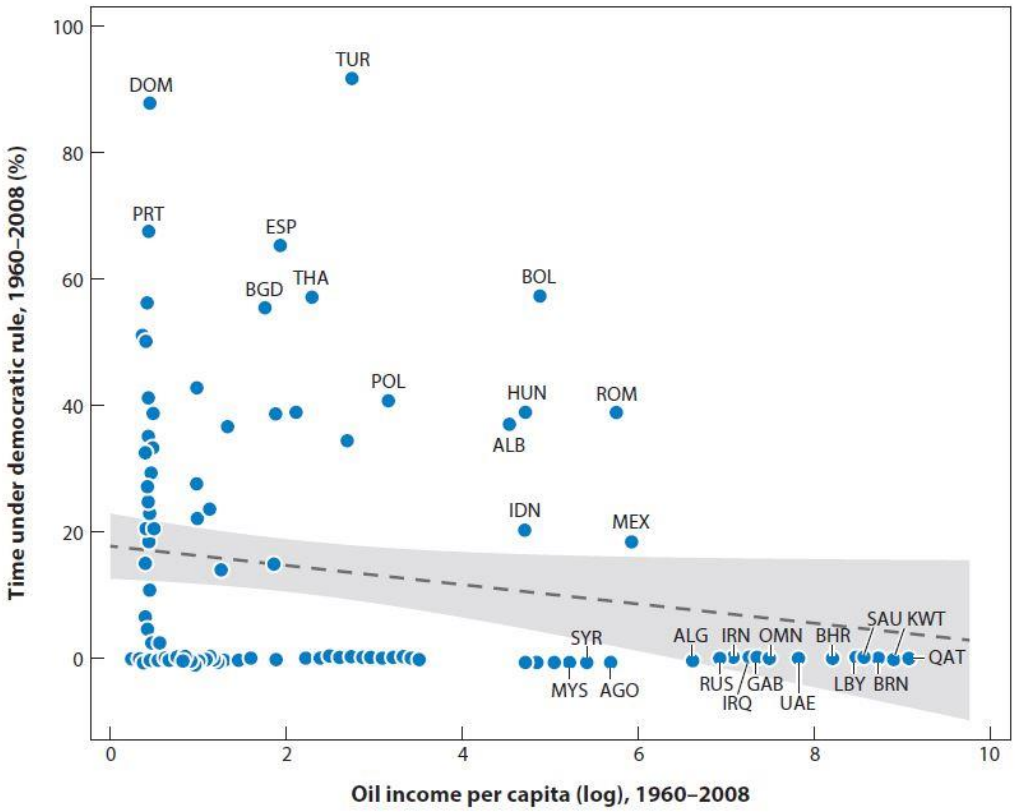
Political / Institutional reasons

- **Rent seeking**
- **Patronage**

→ misallocation of resource rents within the economy

Resource wealth and democracy

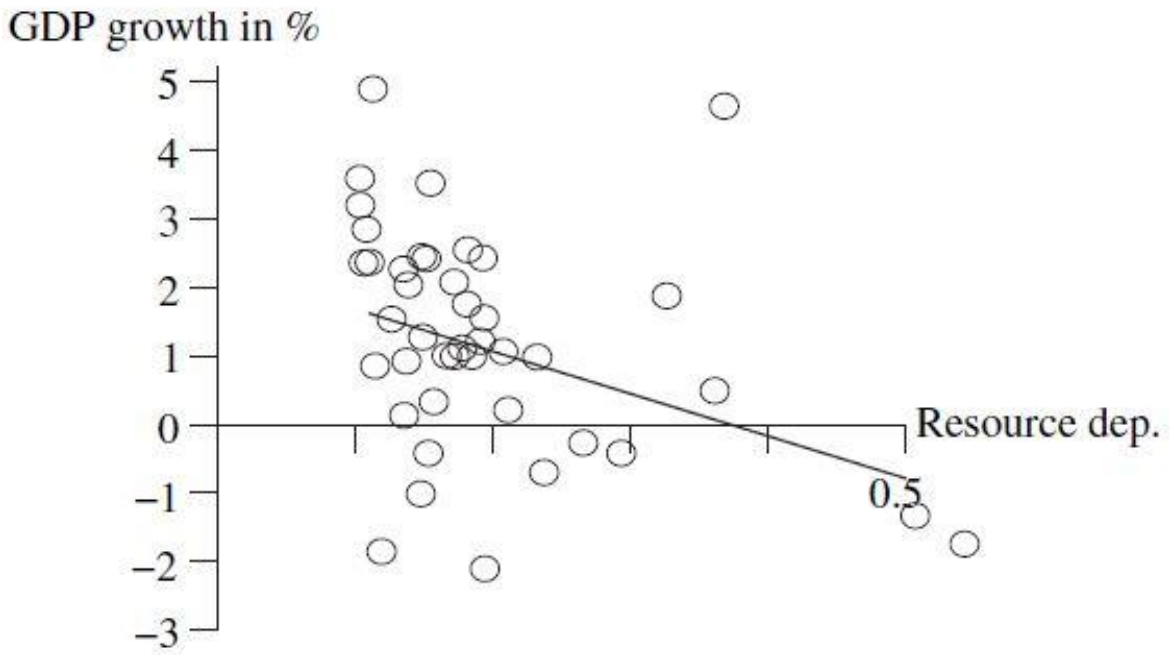
- Democracies are more likely to attract foreign investments
- But more mineral wealth is associated with less democracy
- Also abundance of nat. resources is likely to worsen corruption



Resource curse revisited

Negative relationship GDP growth vs resource dependence (sl. 20)

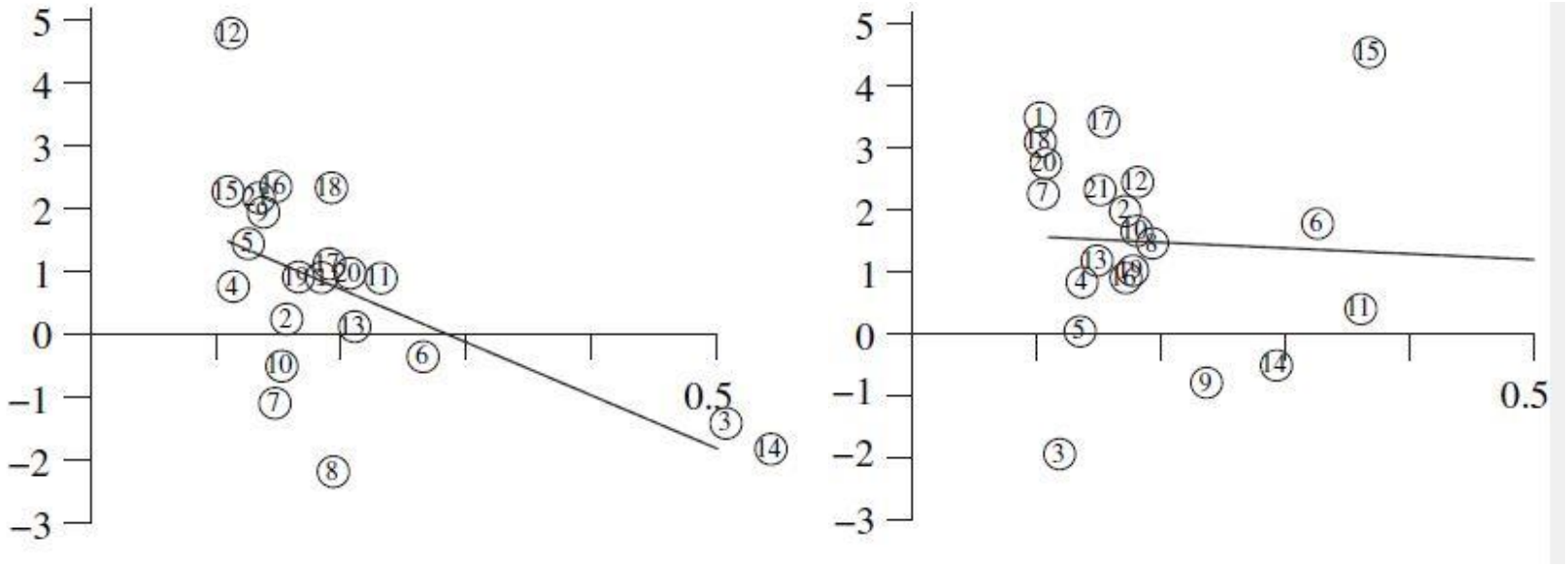
(Dependence = more than 10% of resource exports in GDP)



Source: Mehlum et al. (2006)

Resources and institutions

This relationship breaks down when we divide the sample according to the quality of institutions (left bad – right good)



Source: Mehlum et al. (2006)

Institutional indicators

Institutions define the “rule of the game” – incentives

Security and enforcement of contracts / property rights

- Expropriation risk – state confiscating private ownership
- Repudiation risk – distrusting the government makes people distrust one another
- Rule of law – peaceful mechanisms for clearing disputes
- Bureaucratic quality
- Ability of government to provide basic security
- Corruption in government

Good institutions create an investment-friendly environment and are key to sustainable development

Political explanations

Main argument: Quality of institutions and social characteristics indicate whether the existence of a natural resource will be a blessing or a curse

Three (similar) explanations:

- Rent-seeking model
  - (Potential) entrepreneurs use their efforts to undertake rent-seeking activities, instead of productive activities
- Patronage model
  - Resource rents offer officials opportunities and incentives to bribe political supporters to stay in power
- Unequal distribution of resource rents model
  - Resource rents not evenly distributed leads to the economy reducing manufacturing and learning-by-doing (source of growth)

Thinking of causality

Case 1

Resource abundance leads to a deterioration of institutional quality in turn lowering economic growth

- Sachs and Warner (1995) dismiss this channel in favour of the Dutch disease explanation (economic explanation of resource curse)

Case 2

Bad institutions create a misallocation of rents from natural resources within an economy which leads to inferior growth

- Mehlum et al. (2006) – rent-seeking
- Acemoglu et al. (2004), Robinson et al. (2006) – patronage
- Behzadan et al. (2017) – inequality in resource rent distribution

Experiences among countries

Countries with superior institutions do not experience the resource curse – e.g. low corruption. Acemoglu et al (2002):

- Botswana – 40% of GDP stems from diamonds
- Norway – very poor in 1900 but now one of the richest

Countries with inferior institutions experience the resource curse – e.g. high corruption, rent-seeking and patronage

- Nigeria, Venezuela, Mexico, Congo

Rent-seeking

The Economic Journal, **116** (*January*), 1–20. © Royal Economic Society 2006. Published by Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

INSTITUTIONS AND THE RESOURCE CURSE*

Halvor Mehlum, Karl Moene and Ragnar Torvik

Countries rich in natural resources constitute both growth losers and growth winners. We claim that the main reason for these diverging experiences is differences in the quality of institutions. More natural resources push aggregate income down, when institutions are grabber friendly, while more resources raise income, when institutions are producer friendly. We test this theory building on Sachs and Warner's influential works on the resource curse. Our main hypothesis – that institutions are decisive for the resource curse – is confirmed. Our results contrast the claims of Sachs and Warner that institutions do not play a role.

Rent-seeking

Hypothesis to be tested

The quality of institutions among resource-rich countries determines whether resource abundance leads to higher development or not

Two types of institutions

- Production friendly institutions, that lead to specialization in modern – more efficient – production practices, creating higher national income

- Grabber-friendly institutions, that lead to specialization in grabbing of resource rents, do not foster entrepreneurial activity - production stays outdated and inefficient, which is bad for development

Rent-seeking

Empirical estimation

- Sachs and Warner (1995) dismiss rent-seeking in favour of Dutch disease explanation
- Hypothesis to be tested: resource curse arises only if institutions are weak; good enough institutions can eliminate the resource curse
- Challenges the prediction of Sachs and Warner in favour of the Dutch disease

Rent-seeking

Empirical estimation

Dependent variable: GDP growth.

		Regression 1	Regression 2	Regression 3	Regression 4
Initial income level	*I*	−0.79*	−1.02*	−1.28*	−1.26*
		(−3.80)	(−4.38)	(−6.65)	(−6.70)
Openness	*O*	3.06*	2.49*	1.45*	1.66*
		(7.23)	(4.99)	(3.36)	(3.87)
Resource abundance	*R*	−6.16*	−5.74*	−6.69*	−14.34*
		(−4.02)	(−3.78)	(−5.43)	(−4.21)
Institutional quality	*IQ*		2.2*	0.6	−1.3
			(2.04)	(0.64)	(−1.13)
Investments	*IV*			0.15*	0.16*
				(6.73)	(7.15)
Interaction term	*R*IQ*				15.4*
					(2.40)
Observations		87	87	87	87
Adjusted R^2		0.50	0.52	0.69	0.71

Note: The numbers in brackets are t-values. A star (*) indicates that the estimate is significant at the 5-% level.

Source: Mehlum et al. (2006)

Rent-seeking

Empirical estimation

Hypothesis to be tested: resource curse arises only if institutions are weak; good enough institutions can eliminate the resource curse

- Regression 4:

$$GDP\ growth = -1.26\ I + 1.66\ O - \mathbf{14.34}\ \boldsymbol{R} - 1.3\ IQ + 0.16\ IV + \mathbf{15.4}\ \boldsymbol{R} \times \boldsymbol{IQ}$$

- Interaction term $\boldsymbol{R} \times \boldsymbol{IQ}$ tells us what is the effect of resource abundance on growth through the institutional channel

$$\frac{\Delta(GDP\ growth)}{\Delta R} = -14.34 + 15.40 \times IQ$$

Threshold for $\frac{\Delta(GDP\ growth)}{\Delta R} \geq 0 \ \rightarrow IQ^* = \frac{14.34}{15.40} = 0.93$

- Countries with IQ below IQ* are prone to have bad quality institutions such that a resource discovery may in fact harm the economy!

Rent-seeking

Empirical estimation

Source: Mehlum et al. (2006)

COUNTRY	IQ
BOLIVIA	0.23
HAITI	0.26
EL SALVADOR	0.26
BANGLADESH	0.27
GUATEMALA	0.28
GUYANA	0.28
PHILIPPINES	0.30
UGANDA	0.30
ZAIRE	0.30
NICARAGUA	0.30
MALI	0.30
SYRIA	0.31
NIGERIA	0.31
PERU	0.32
HONDURAS	0.34
TURKEY	0.53
COLOMBIA	0.53
GABON	0.54
MEXICO	0.54
SIERRA LEONE	0.54
ECUADOR	0.54
COSTA RICA	0.55
GREECE	0.55
VENEZUELA	0.56
KENYA	0.56
GAMBIA	0.56
CAMEROON	0.57
CHINA	0.57
INDIA	0.58
NIGER	0.58
U.K.	0.93
JAPAN	0.94
AUSTRALIA	0.94
AUSTRIA	0.95
GERMANY. WEST	0.96
NORWAY	0.96
SWEDEN	0.97
NEW ZEALAND	0.97
CANADA	0.97
DENMARK	0.97
FINLAND	0.97
BELGIUM	0.97
U.S.A.	0.98
NETHERLANDS	0.98
SWITZERLAND	1.00

Patronage

ELSEVIER

Journal of Development Economics 79 (2006) 447–468

JOURNAL OF Development ECONOMICS

www.elsevier.com/locate/econbase

Political foundations of the resource curse☆

James A. Robinson [a,*], Ragnar Torvik [b], Thierry Verdier [c]

[a] *Harvard University, Department of Government, Littauer, 1875 Cambridge St., Cambridge, MA 02138, USA*
[b] *Department of Economics, Norwegian University of Science and Technology, N-7491 Trondheim, Norway*
[c] *DELTA-ENS, 48 Boulevard Jourdan, Paris 75014, France*

Abstract

In this paper we argue that the political incentives that resource endowments generate are the key to understanding whether or not they are a curse. We show: (1) politicians tend to over-extract natural resources relative to the efficient extraction path because they discount the future too much, and (2) resource booms improve the efficiency of the extraction path. However, (3) resource booms, by raising the value of being in power and by providing politicians with more resources which they can use to influence the outcome of elections, increase resource misallocation in the rest of the economy. (4) The overall impact of resource booms on the economy depends critically on institutions since these determine the extent to which political incentives map into policy outcomes. Countries with institutions that promote accountability and state competence will tend to benefit from resource booms since these institutions ameliorate the perverse political incentives that such booms create. Countries without such institutions however may suffer from a resource curse.

Patronage

- Natural resource rents offer governments opportunities and incentives to bribe political supporters to stay in power
- Political elite uses public resources to secure power
  - Employ supporters in the public sector
  - Invest in projects with political but not economical payoff
- Politicians have short time horizons
  - Discount the future by the probability of remaining in power
  - Can lead to inefficient over-extraction of resources

Social characteristics
Inequality of resource rents

ELSEVIER

Journal of International Economics

Volume 106, May 2017, Pages 104-118

Does inequality drive the Dutch disease? Theory and evidence ☆

Nazanin Behzadan [a] ✉, Richard Chisik [b] ✉, Harun Onder [c] ✉, Bill Battaile [d] ✉

Abstract

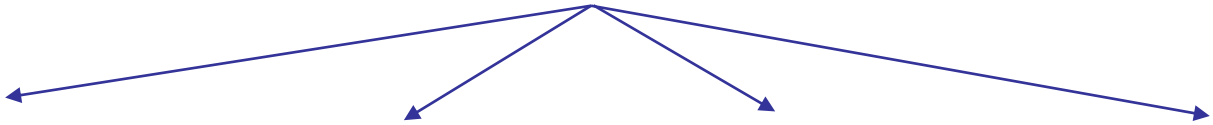
In this paper we show that the Dutch disease can arise solely from inequality in the distribution of natural resource rents. Given two otherwise identical countries that differ only in the ownership shares of the natural resource rents, the country with the less equal distribution will have less production of manufacturing goods and less development of learning-by-doing in this sector. As opposed to conventional models, where income distribution has no effect on economic outcomes, an unequal distribution of the resource wealth can generate the Dutch disease dynamics even in countries with an initial comparative advantage in manufacturing. We also provide a range of empirical tests of our model, including both difference and system GMM estimators in a dynamic panel. To disentangle the effects of inequality and institutional quality we purge our inequality measure of any linear or higher order correlations with institutional quality and repeat our system and difference GMM estimations. Our empirical analysis supports the hypothesis that inequality indeed plays a significant role in whether being resource-rich is a blessing or a curse for a country. The more unequal is the distribution of natural resource rents, the stronger is the disease.

Summary

Resource curse

Negative economic development despite (or due to) resource abundance

Problem: Poor capital accumulation - diversification, misallocation of resources



Dutch disease	**Rent-seeking**	**Patronage**	**Inequality**
Key problems:			
Productivity loss due to currency appreciation and contraction of manufacturing	Resource abundance creates incentives for unproductive activities (grabbing)	Patronage leads to inefficient employment and inefficient investments	Inequality in distribution of resource rents can generate manufacturing sector stagnation and lower long-run growth