

## **Introduction to the Economics of Development**

### **6. Are natural resources a solution or a trap?**

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## This week

- Some facts, who exports what?
- Some (discursive) theory: Blessing or curse.
  - Dutch disease
  - Political economy
- Some empirics: Blessing or curse.
  - Selection on observables.
- What determines blessing or curse?

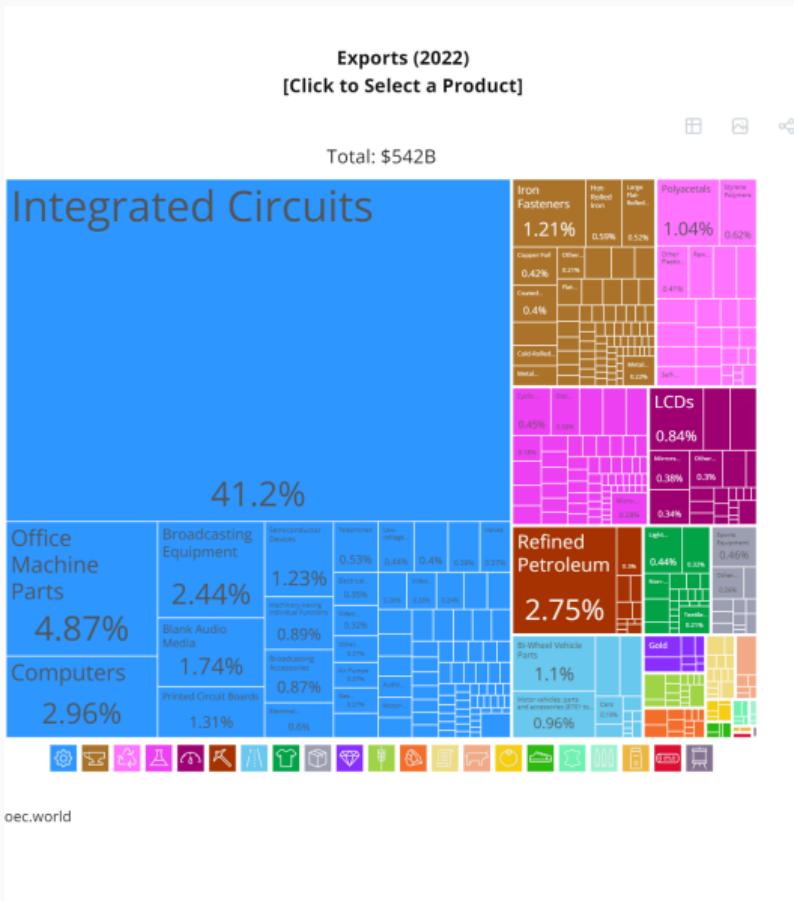
NB: This week for the main we will ignore the pollution/ climate change/ bio-diversity angle.

**Some facts: Who exports what?**

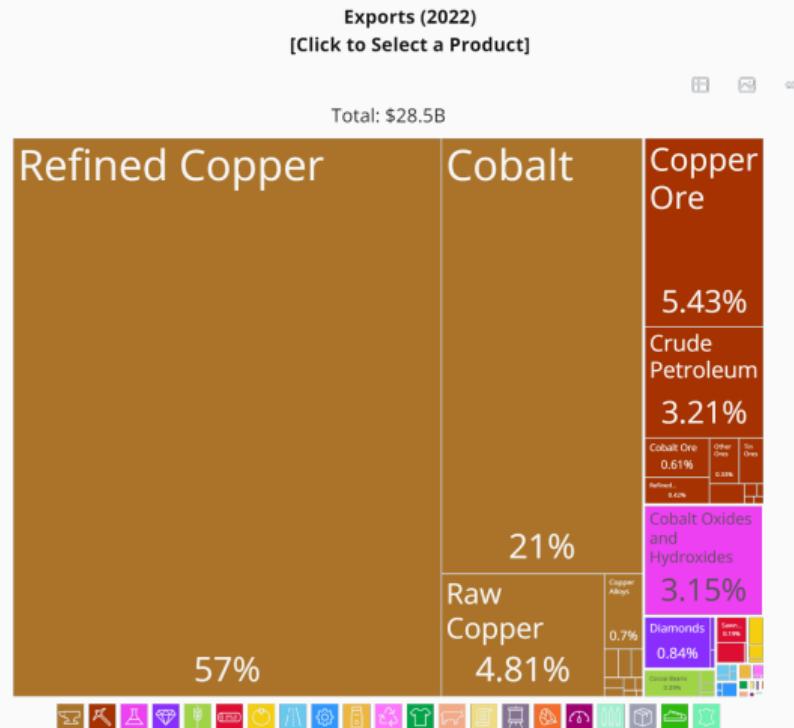
**Quick game → tradle**

<https://tradle.net/>

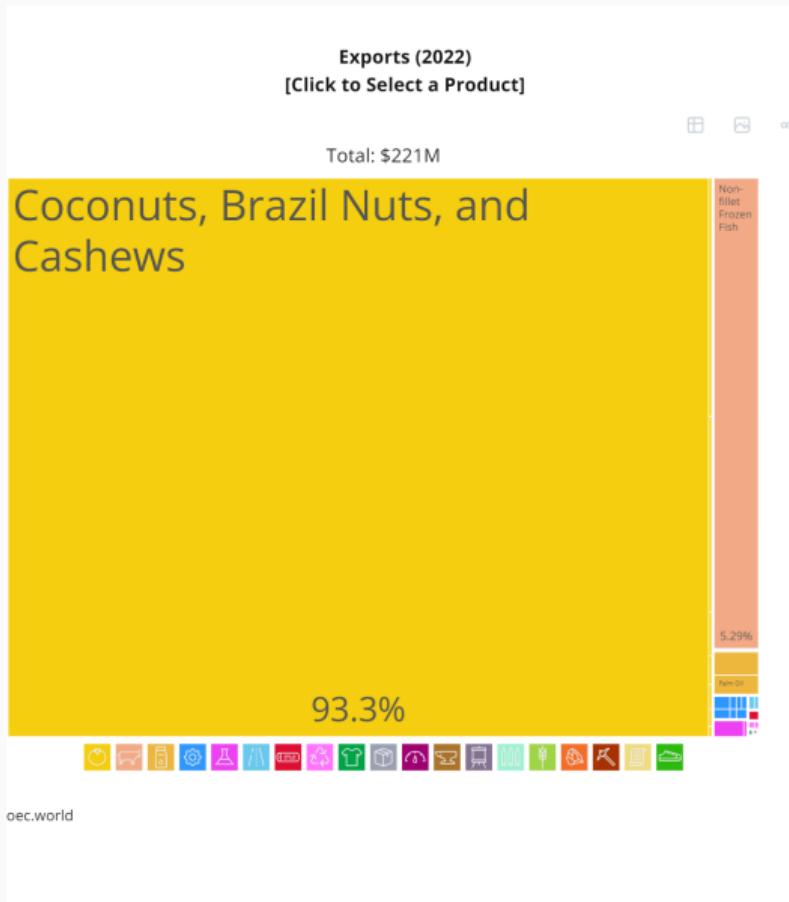
## Some curated tradle



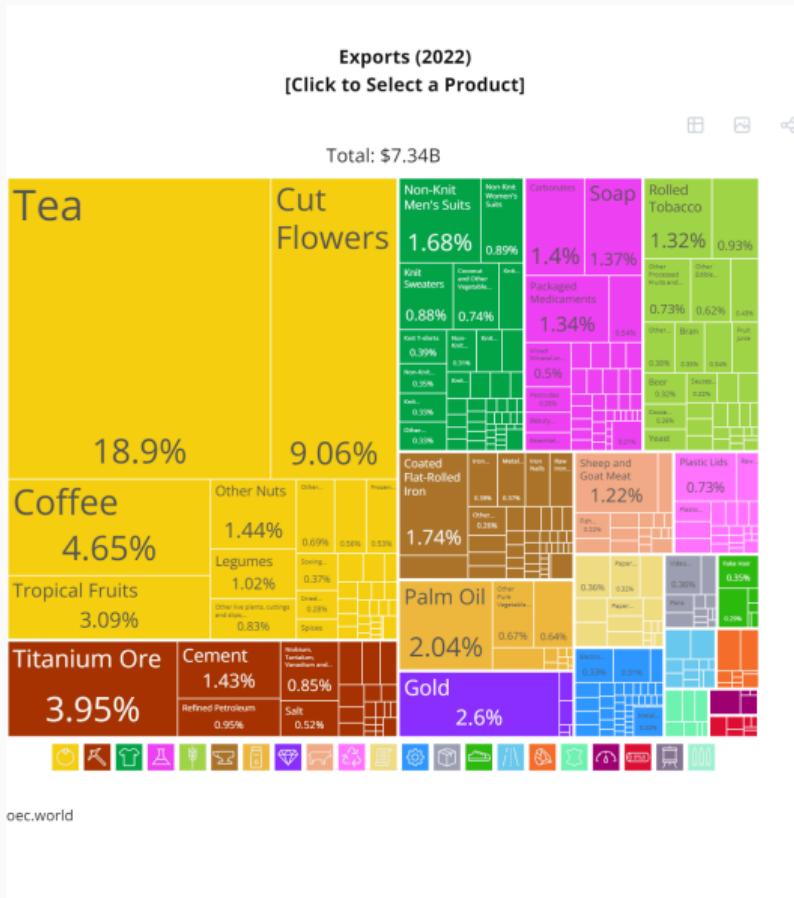
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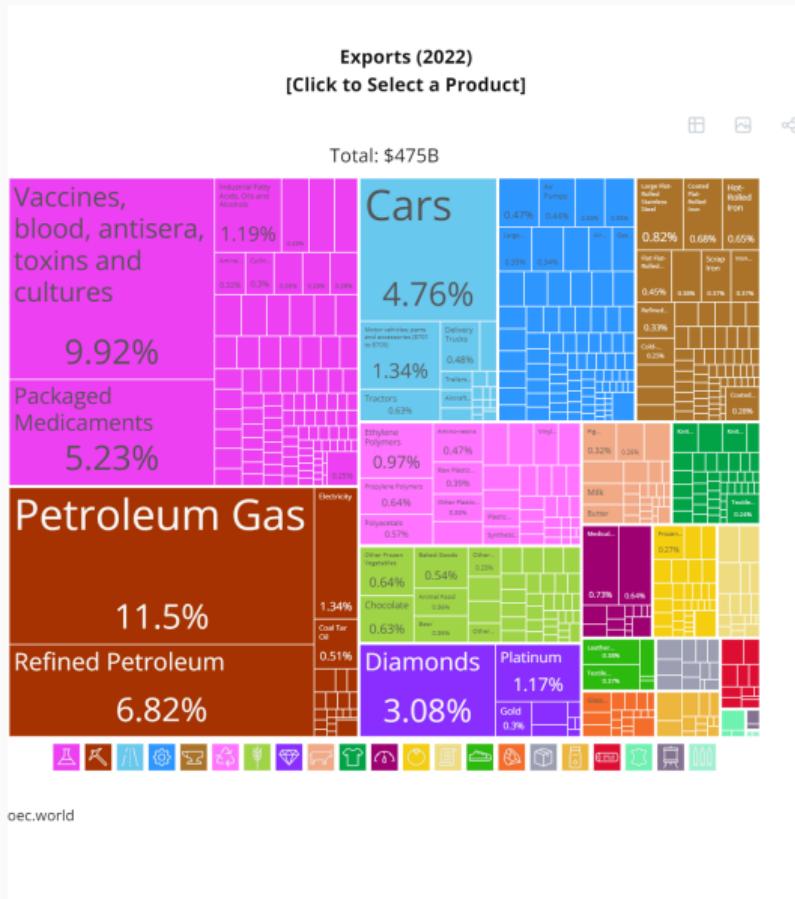
## Some curated tradle



# Some curated tradle



# Some curated tradle

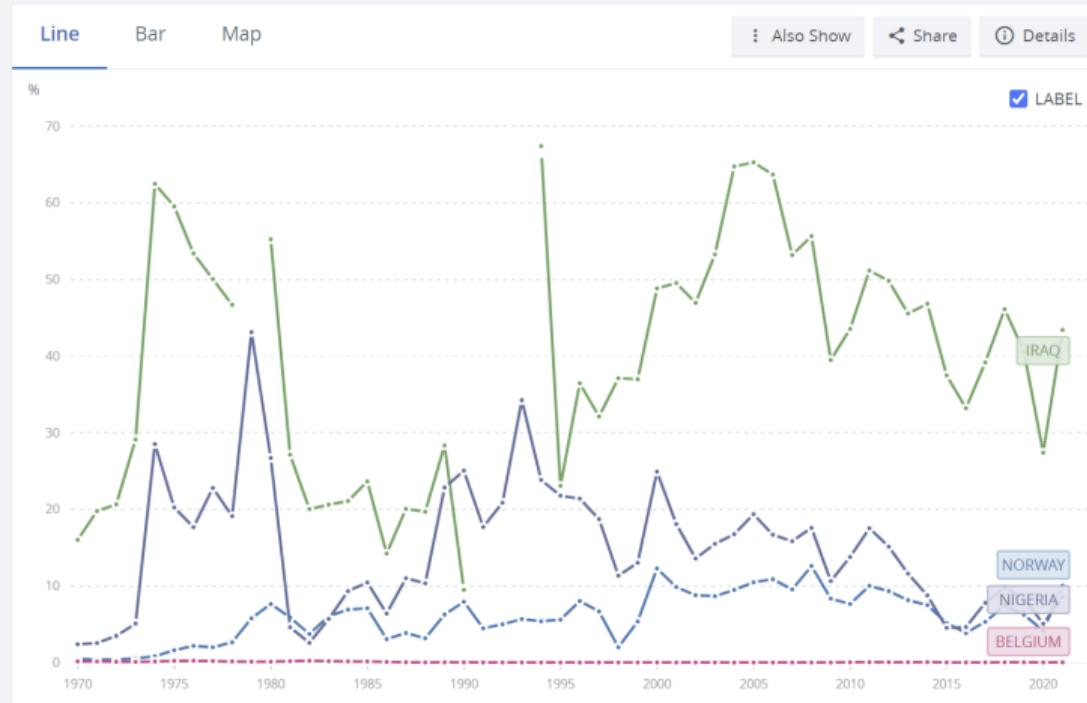


## Resource dependent vs resource rich

### Total natural resources rents (% of GDP) - Norway, Iraq, Nigeria, Belgium

World Bank staff estimates based on sources and methods described in the World Bank's The Changing Wealth of Nations.

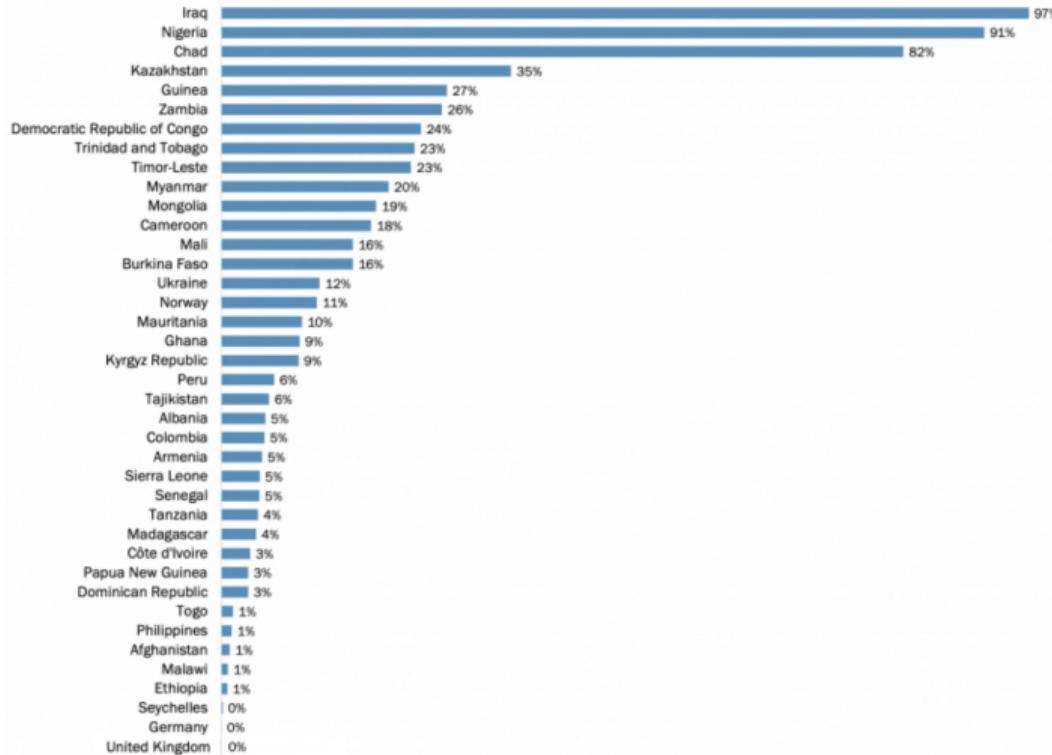
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# Resource dependent vs resource rich

Extractive revenue as percentage of total government revenue (%)

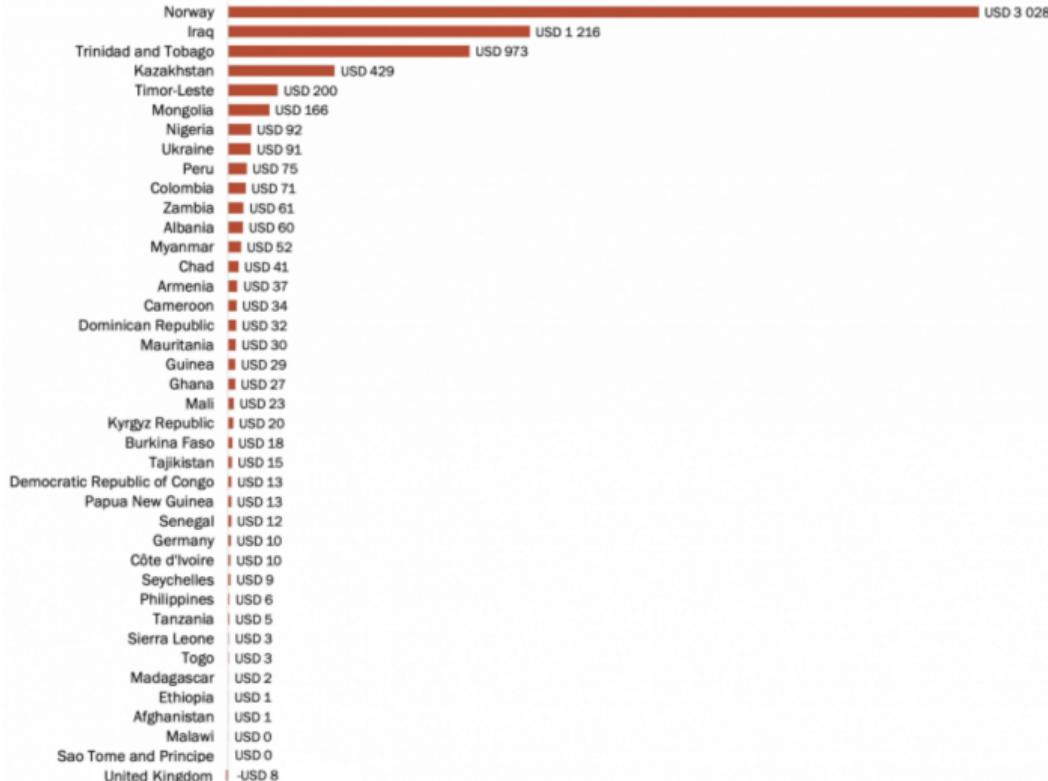
Year: 2016



# Resource dependent vs resource rich

Government extractive revenue per capita (USD)

Year: 2016

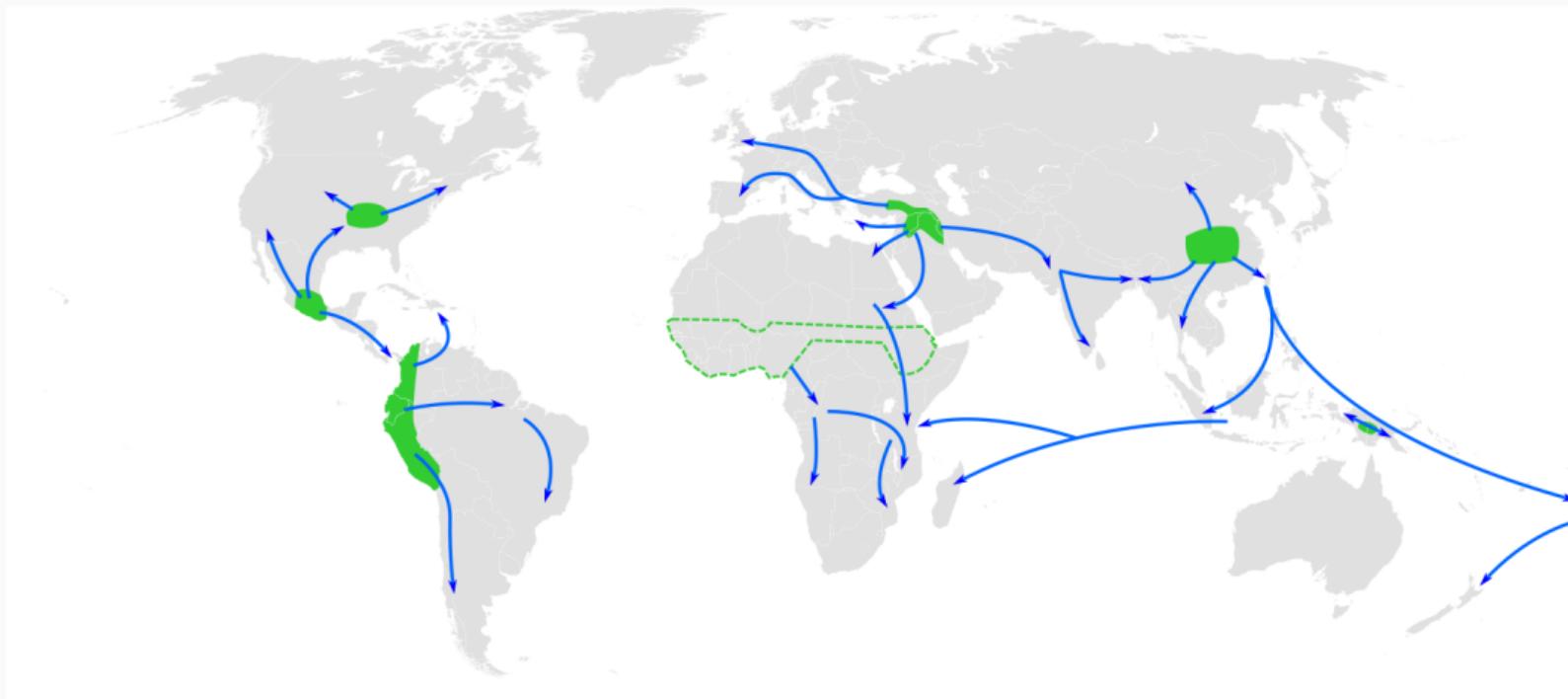


**Some theory: A blessing or a curse**

## First the blessings

- The intuition is painfully simple.
- Natural resources = higher productivity and/or greater export income.
- Woop woop.

## Historical examples



## More recent examples

- Norway
  - Third largest exporter of natural gas.
  - Highest HDI in the world.
- Canada
  - 3rd largest proven oil reserves in the world.
  - 3rd largest producer of diamonds (by value).
  - HDI rank 12th
- Botswana
  - Largest diamond mine in the world.
  - One of only two SSA countries categorised as having "high human development".

## Trouble in paradise — curse

*All in all, I wish we had discovered water*

Sheik Ahmed Yamani, Oil minister, Saudi Arabia

## Curse: Some examples

- Nigeria
  - 2nd largest proven oil reserves in Africa (BP, 2019)
  - Natural gas, gold, iron ore,...
  - Life expectancy 53.9 (UN, 2019)
  - 53.5% of the population live on less than 1.9 USD a day (UN, 2019).
- Democratic Republic of Congo
  - 51.8% of global cobalt reserves + copper, coltan, ...
  - Fragile state (WB, 2019)
  - Life expectancy 60 (UN, 2019)
  - 77.1% live on less than 1.9 USD a day (UN, 2019).

## **Why might natural resources be a curse**

1. Volatility
2. Dutch disease
3. Crowding out human capital
4. Political economy concerns

**Some theory: A blessing or a curse**

**Volatility**

## **Volatility i.e. uncertainty is bad**

- Market instability and uncertainty  $\Rightarrow$  can't plan for the long-term.
- Government revenue is liable to fluctuate causing damaging boom and bust cycles.
- Leads to myopic behavior.
- Resources dry up!

## Volatility

Inflation-adjusted world crude oil price per barrel.



## **Some theory: A blessing or a curse**

### **Dutch disease**

## Why the name?

- First used by the economist in 1977.
- In 1959 2.8trn cubic meters of natural gas were discovered in the Netherlands.
- Dutch exports soared. Yay!
- But...
  - Value of the Guilder increased by 17%
  - Decline in manufacturing exports
  - Investment dwindled
  - Unemployment rose from 1.1% to 5.1% between 1970 and 1977

Dutch Disease!

## What is going on?

Intuition:

- Discover natural resources YAY.
- What happens in the economy?
  1. To spending.
  2. To resource (labor) allocation.
  3. To our currency.

## A short digression into monetary economics

- Currencies are not special, they are just like any other asset.
- You can buy and sell them!
- ... and if more people want to buy your currency its price rises.
- “Price” can be thought of as “how many dollars do I need to buy one euro”.
- So, if more people want euros the number of dollars needed to buy a euro increases.
- Real exchange rate **appreciates**.
- If I am in America and buying Belgian chocolate do I now buy more or less?

## What happens to our currency

- Export lots of natural resources.
- For people to buy our resources they first have to buy our currency.
- Demand for our currency increases.
- So our exchange rate appreciates.
- Now it is more expensive for those with other currencies to buy any of our goods.

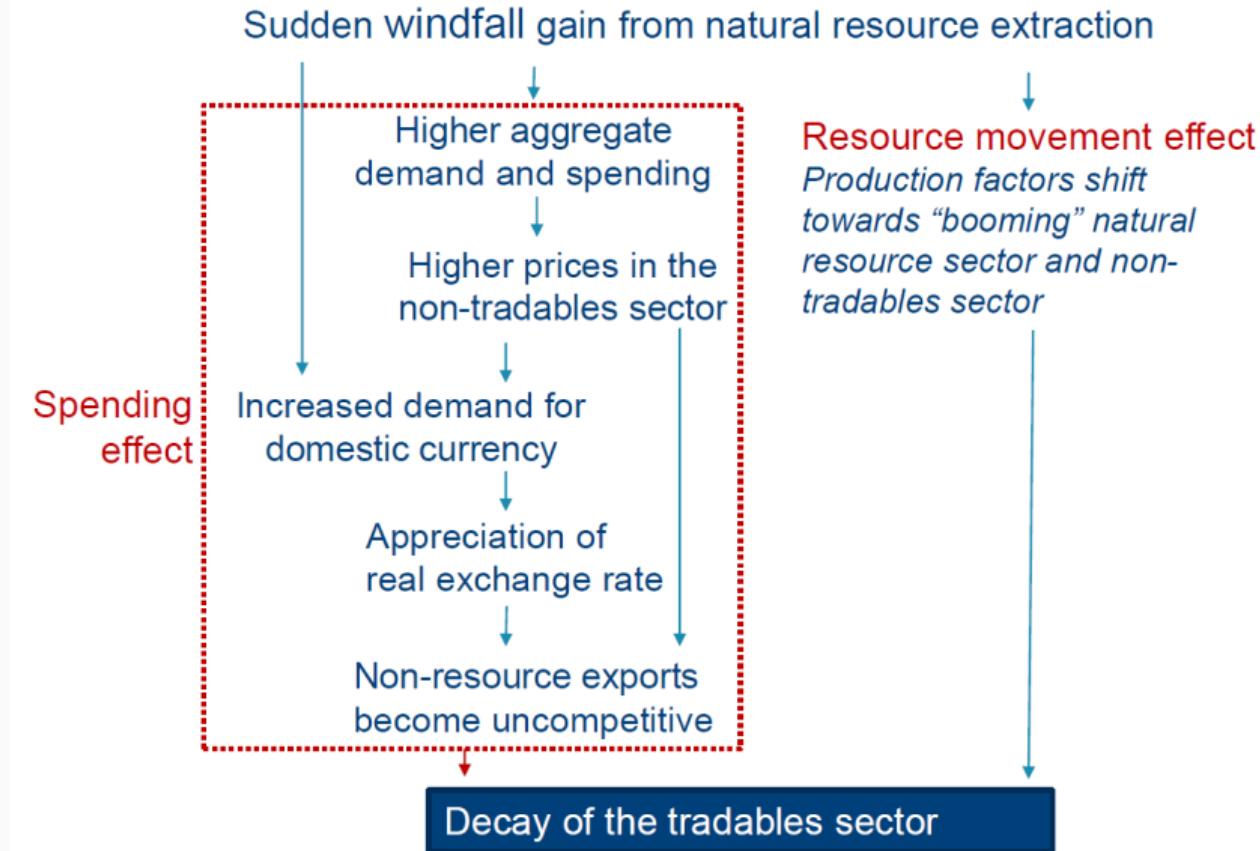
## What happens to spending?

- Increases YAY.
- Econ 101 demand up implies...
- Prices up.
- Goods become more expensive.
  - Especially non-tradeable goods.
- Makes our goods even more expensive from abroad.

## What happens to resource (labor) allocation?

- Lots of money in the natural resource sector.
- Many people want in!
- Resources shift to extraction.
- Labor demand increases, wages rise...
- Producing other goods becomes more expensive as other sectors try to compete with higher wages in the natural resource sector.

## Putting it all together



## Real exchange rate in a little more detail

$$\text{Real exchange rate} = \text{nominal exchange rate} \times \frac{\text{domestic prices}}{\text{foreign prices}}$$

Increase demand for domestic currency  $\Rightarrow$  nominal exchange rate appreciates.

Increased prices  $\Rightarrow$  domestic prices increase.

Both channels spell bad news for exports.

## Dutch disease: The bottom line

- The discovery of natural resources can make the tradeable sector less competitive and attractive leading to its decline.
- Why is this such an issue? Because we < 3 exports, and in particular manufacturing exports.
- If you are interested in the theory see Corden and Neary (1982; 1984) who develop a model. What key ingredients would a model of Dutch disease need?
- Why might a model be useful?

**Some theory: A blessing or a curse**  
**Crowding out human capital**

## Human capital: A primer

- A somewhat vulgar phrase
- Basically means how productive is your work force, often associate with education.
- An increase in relatively low-skill labor demand in the extractive sector.
- ⇒
- Fewer people invest in skills.
- ⇒
- Human capital falls.
- + why would the government bother wasting money investing in education?

**Some theory: A blessing or a curse**

**Political Economy**

## Resource Wealth and Political Regimes in Africa

[Jensen and Wantchekon 2004]

*"The results illuminate the fact that post–Cold War democratic reforms have been successful only in resource-poor countries such as Benin, Mali, and Madagascar. The authors argue that resource-rich countries such as Nigeria and Gabon can become democratic only if they introduce strong mechanisms of vertical and horizontal accountability within the state."*

Why might resource wealth be associated with a lack of democracy?

## We will focus on three main elements

1. Rentier state theory & state accountability
2. Corruption
3. Conflict

## Some empirical evidence

- Data
  - Sample: 46 SSA countries from 1960 to 1995.
  - Panel data!
  - Dependent variable: Democracy on a 20-point scale.
  - Independent variable: Measure of resource dependency (fuel, mineral and metal exports as a percentage of total exports) scaled from 1 (low) to 4 (high). Less than 25% exports = 1, 25% to 50% = 2 etc.
- The model:  $Dem_{it} = \alpha + \beta RD_{it} + \gamma X_{it} + \varepsilon_{it}$

## Results

Table 1  
*Dependent Variable: Democracy*

Log of GDP per capita	2.847*** (10.956)	1.995*** (6.266)
GDP growth	0.091** (2.305)	0.076** (2.176)
Resource dependence	-0.530*** (-5.945)	-0.364** (-3.779)
Dummy for the 1970s	-0.717 (-1.424)	-0.887** (-2.021)
Dummy for the 1980s	-0.538 (-1.093)	-0.699* (-1.679)
Colony dummy: Belgium		-1.566*** (-2.782)
Colony dummy: France		-1.605*** (-2.638)
Colony dummy: Portugal		-1.825*** (-2.564)
Colony dummy: United Kingdom		2.305*** (2.774)
Constant	-13.661*** (-7.972)	-7.751*** (-4.789)
Number of observations	690	690
Number of countries	39	39
$\chi^2$	202.63	1,246.26
Hauseman test	3.67	1.89

Note: GDP = gross domestic product.

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$ .

## Some theory: 1. Rentier state theory & state accountability

- Rentier state = state that derives most of its income from foreign individuals, entities, or governments.
- And crucially little of its income is from domestic taxation.
- Why is this a potential issue?

## Some theory: 1. Rentier state theory & state accountability

- When states gain income from taxing their citizens incentives are aligned.
  - Richer citizens ⇒ greater state income.
- When states gain income from taxing their citizens they are held accountable.
  - The state is using my money! I should have a say in how it is used.
  - Bargaining between states and citizen groups creates inclusive institutions (democracy).
  - “Unearned” state income creates a disconnect between citizens and governments.
  - With unearned income there is little need to create an efficient bureaucracy or civil service.

## Some theory: 2. Corruption

- Relatively easy and lucrative to siphon off resource income for personal gain.

### *Petrobras Oil Scandal Leaves Brazilians Lamenting a Lost Dream*



Comperj, a giant refinery and petrochemical complex in Brazil. The unfinished project was originally planned to cost \$50 billion. Andre Villela for The New York Times

### Zimbabwe regime accused of stealing \$2bn in diamonds

Report claims that revenue from Marange fields has been channelled into 'parallel government' loyal to Robert Mugabe



### Mexico's oil workers gather at the Plaza of Wailing to bemoan corruption and unpaid wages

Worries over changes to the state-run oil giant Pemex see grievances rise on the streets of Ciudad del Carmen

### Nigeria: how to lose \$35bn

Nuhu Ridabu's report into billions squandered by oil industry reads like a guide to how to mismanage public resources



Nigerians protesting against government corruption in January. Photograph: Akintunde Akinleye/Reuters

## Some theory: 2. Corruption

- Large barriers to enter in resource extraction sector  $\Rightarrow$  uncompetitive.
- Elites can capture a large share and then use it to maintain power with an in-group.
- Availability of large potential profits encourages rent-seeking behavior.

## Some theory: 3. Conflict

- Natural resources provide a motive for conflict.
  - Insiders want to capture rents.
  - Note: The threat of civil strife can further incentivize corrupt behavior.
  - Outsiders want some of the pie.
- Empirical example: Berman et al. (2017) use variation in world commodity prices to study the relationship between conflict and mineral prices in Africa.
  - Find a rise in mineral prices may explain  $\sim 25\%$  of the average level of violence across African countries from 1997 to 2010.
  - Is endogeneity a concern in this study?

## Theory: Summary

- We have presented a discursive theory as to why natural resources may be a blessing or a curse.
- Blessing
  - Kinda obvious...
- Curse
  - Volatility
  - Dutch disease
  - Crowding out human capital
  - Political economy concerns (rentier state theory, corruption, conflict).
- So it could be either... its an **empirical question**.

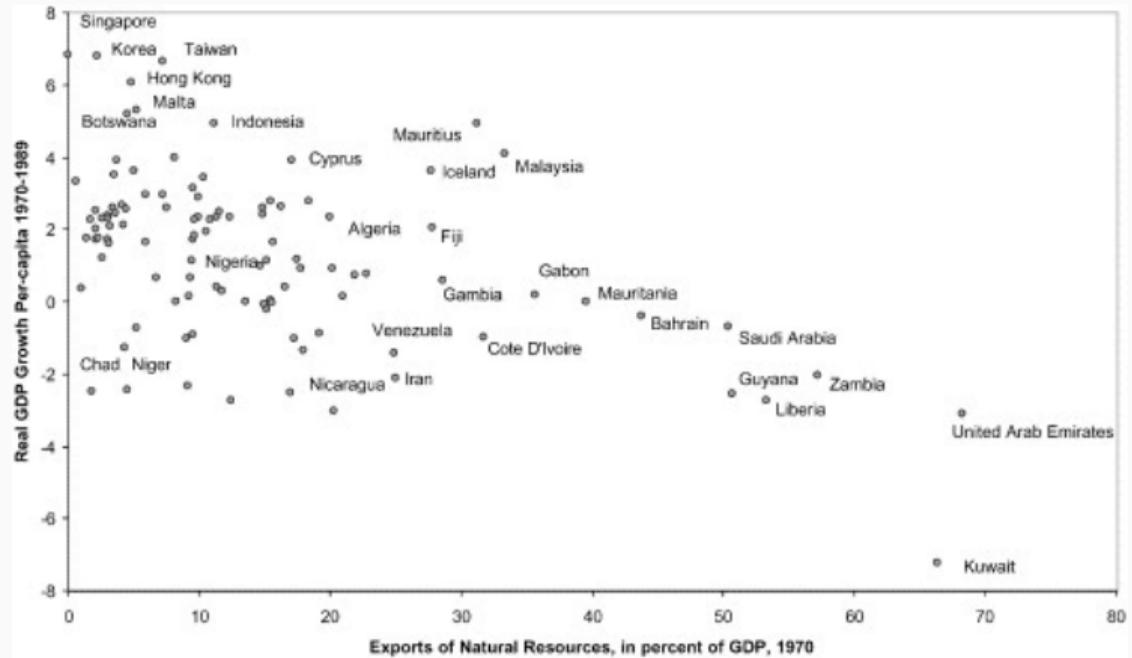
**Empirical question**

## We will mainly follow Sachs and Warner 2001

- Seminal (6,600 cites) piece of work that was instrumental in turning the previously received wisdom that natural resources = good, on its head.
- Quite an old paper, but also a good example of a very common way of overcoming the endogeneity problem — “selection on observables”.
- Paper attempts to do two things:
  1. Find evidence for the “curse”.
  2. Find evidence on the specific channel the curse operates through.

NB: Jeffrey Sachs has some *interesting* views on Russia's invasion of Ukraine, COVID origins, and many disagree with his economics also (“disaster capitalism”).

## Empirical evidence



## Potential problems with this evidence

- Ask yourself: What else could be causing this negative relationship?
- Omitted variable bias: There could be some other variable causing high natural resource exports and low GDP growth.
- Mechanical correlation. Countries with low GDP will have high exports of natural resources (as a % of GDP). If low GDP in the past is correlated with low growth today this will cause a spurious correlation.

## First look at the mechanical correlation issue

- General way to solve this: Control for previous GDP growth.

Table 1

Regression of economic growth on natural resource abundance, 1970–1990, controlling for growth in the 1960s<sup>a</sup>

Log GDP 1970	-1.8 (8.87)
Natural resource abundance	-9.9 (6.50)
OPEN	1.3 (3.2)
Log investment	0.8 (2.4)
Rule of law	0.4 (3.8)
Terms of trade change	0.1 (2.1)
Growth 1960–1969	0.02 (0.2)
R <sup>2</sup>	76%
N	69

Dep var: per-capita PPP adjusted GDP growth. Indep var: natural resource exports as % of GDP.

## Omitted variable bias

What could be a plausible candidate omitted variable?

## Evidence on the channel

Possible channels

1. Volatility.
2. Dutch disease.
3. Crowding out human capital.
4. Political economy concerns.

## Dutch disease

Chain of logic: NR  $\Rightarrow$  higher price  $\Rightarrow$  manufacturing is less profitable  $\Rightarrow$  manu sector falls which is bad for growth.

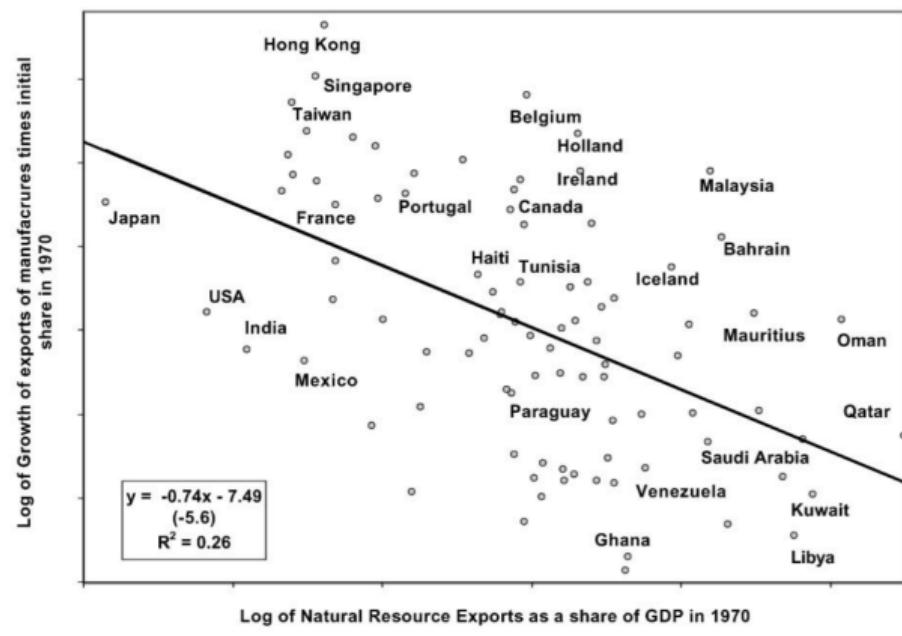
Evidence:  $NR \Rightarrow P \uparrow$ .

$N = 99$ ,  $R^2 = 66\%$

## Dutch disease

Chain of logic: NR  $\Rightarrow$  higher price  $\Rightarrow$  manufacturing is less profitable  $\Rightarrow$  manu sector falls which is bad for growth.

Evidence: NR  $\Rightarrow$  manu export  $\downarrow$ .



**What determines blessing or curse**

## Blessing or curse

- From the last section it seems as if the curse is set in stone.
- But recall the earlier consensus: Natural resources = good. This was also built on (historical and fairly anecdotal) evidence.
- However, it is true that some countries seem to benefit from their natural resource abundance (e.g. Norway).
- The big question: Why do some (seemingly) gain, whereas most lose?

## Institutions

TABLE 5  
MARGINAL EFFECTS OF DIFFERENT RESOURCES ON GROWTH FOR VARYING INSTITUTIONAL QUALITY

	Primary exports share of GDP	Ores and metals exports as share of GDP	Mineral production as share of GNP	Production of gold, silver and diamonds as share of GDP
Worst institutions	-0.548	-0.946	-1.127	-1.145
Average institutions	-0.378	0.425	0.304	0.279
Average + one s.d. institutions	-0.288	1.152	1.062	1.183
Best institutions	-0.228	1.629	1.560	1.776

*Note:* Institutional quality is an average of the indexes for bureaucracy, corruption, rule of law, risk of expropriation of private investment and repudiation of contracts by government.

*Source:* Boschini et. al. (2007).

## Institutions example: Sovereign wealth fund

- Norway's Petroleum Fund (Government Pension Fund Global).
- Size: 1.7trillion USD, 307,000 USD per-Norwegian, 1.5% of all the worlds listed companies.
- Avoids boom-bust spending overcomes volatility issues, prevents Dutch disease if assets are held outside the country's monetary system, and if invested well could overcome human capital overcrowding issues and political economy concerns.
- Requires strong institutions.

## Other possible mediating factors

- Electoral competition. No resource curse in democracies with a parliamentary government (Andersen and Aslaksen, 2008).
  - Parliamentary government provides citizen accountability?
- Human capital. Natural resource curse only occurs in countries with low levels of human capital (Bravo Ortega and De Gregorio, 2005).
- Only point-source natural resources (mines, oil, etc.) cause problems, not diffuse resources (trees, fertile land, etc.).

**Cross-over: natural resources, urbanisation and growth, Gollin et al. 2016**

- We will take this as a case study.
- Broad idea:
  - Industrialisation is often associated with urbanisation
  - As cities are more productive, this further increases GDP
  - But in many developing countries we see urbanisation without industrialisation
  - Is this urbanisation less productive, or is it another potential path out of the resource curse?
- The paper: Model, data and facts, causal estimation, discussion of consequences and policy implications.

# Model

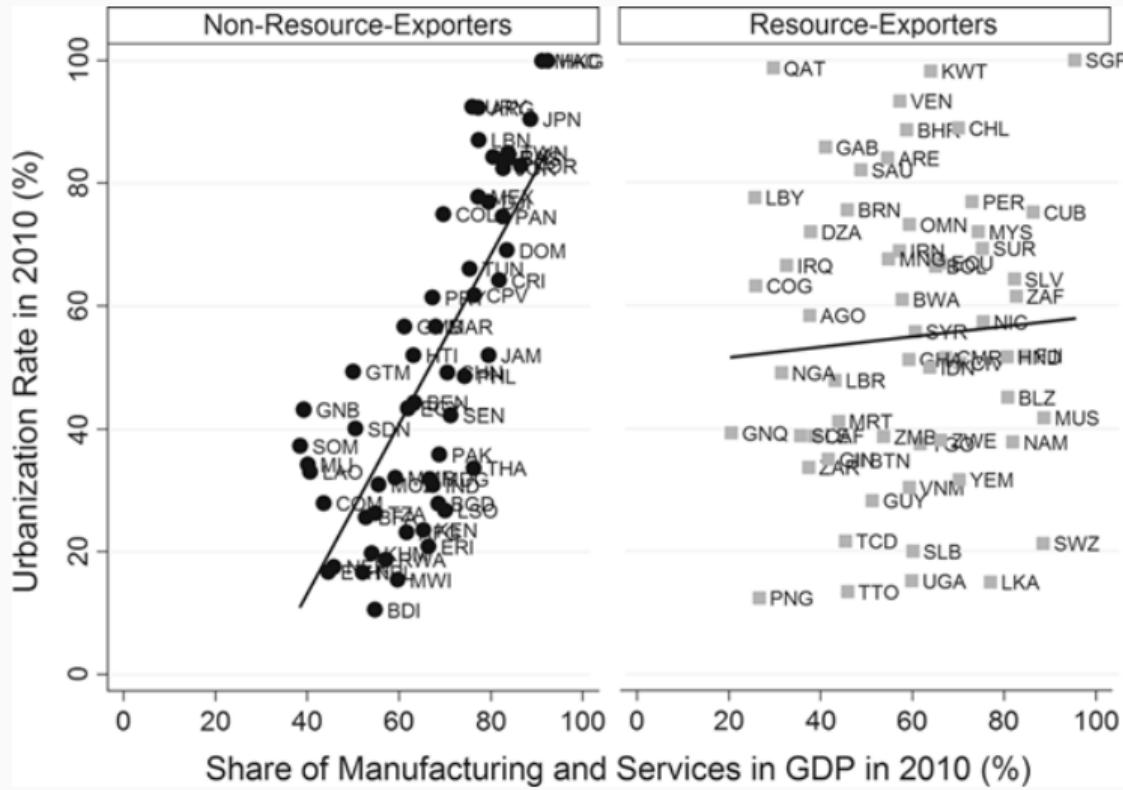
## Model

We will skip for today...

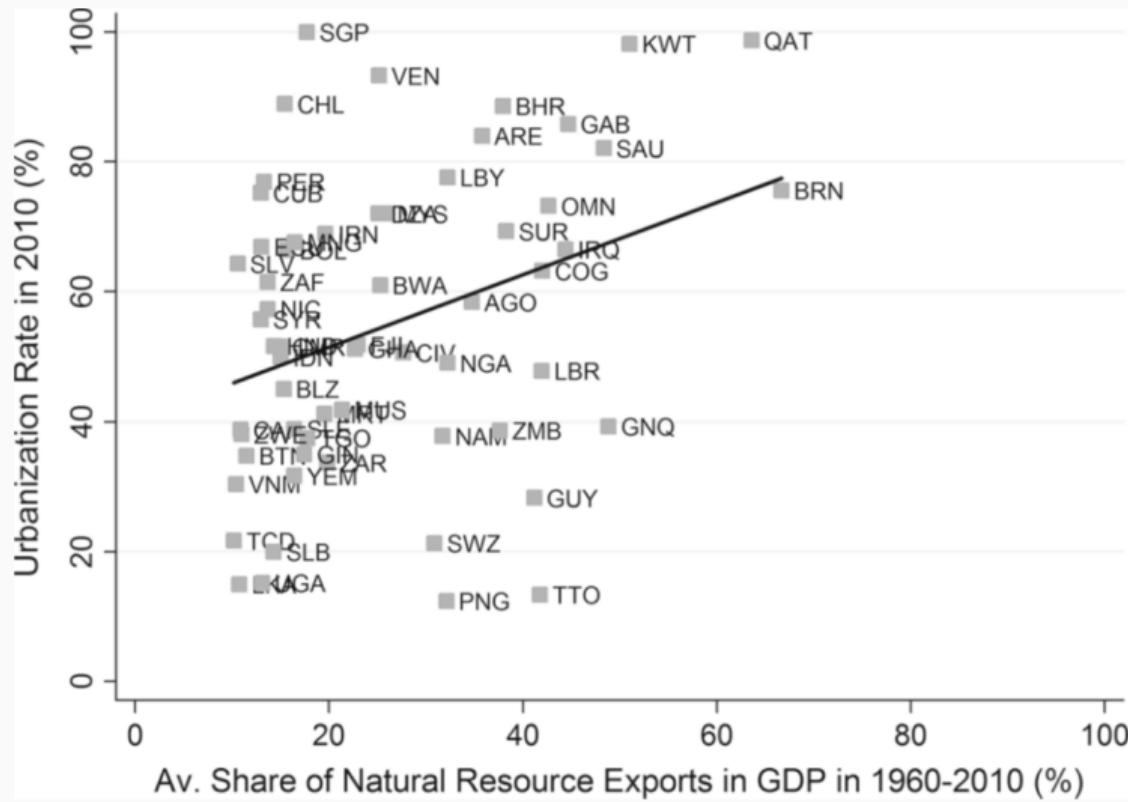
## Data

- 116 countries from 1960 to 2010
- Data on urbanisation and natural resource exports as a % of total exports (from the UN) every decade
- Data on other exports also

## Stylised facts. 1. In resource exporting countries the link between industrialisation and urbanisation is broken



## Stylised facts. 2. There is a positive relationship between urbanisation and natural resource exports



## Causality

- Are these correlations causal?
- Take three approaches
  1. Cross section with controls for the main potential confounding factors
  2. Look at within-country variation using panel data
  3. Take an instrumental variables approach

## Cross sectional regression

$$U_{c,2010} = \alpha + \beta R_{c,1960-2010} + \gamma I_{c,2010} + \delta X_{c,2010} + \varepsilon_{c,2010}$$

- $U_{c,2010}$  is the urbanisation rate
- $R_{c,1960-2010}$  is average share of natural resources in GDP from 1960 to 2010
- $I_{c,2010}$  is industrialisation
- $X_{c,2010}$  are the controls

## Controls

What would you want to control for?

## Controls

What would you want to control for?

- Fixed effects for world region (Asia, LAC, SSA, MENA)
- Time-invariant controls. Rural density 2010, population growth rate, droughts, civil war indicator, polity score, primacy rate, country area, country population, island dummy, landlocked dummy.
- Initial conditions in 1960. Level of urbanization and share of natural resource exports.
- Region fixed effects (13).

## Results

**Table 1** Multivariate cross-sectional analysis, main stylized fact

Dependent variable	Urbanization rate in 2010 (%)				
	(1)	(2)	(3)	(4)	(5)
Natural resource exports (% of GDP, Average in 1960–2010)	1.77*** (0.28)	1.32*** (0.22)	0.99*** (0.14)	1.02*** (0.24)	0.85** (0.18)
Manufacturing & services (% of GDP, in 2010)	1.38*** (0.22)	1.03*** (0.27)	0.59*** (0.14)	0.46** (0.17)	0.38*** (0.12)
Area FE (4)	N	Y	Y	Y	Y
Time-invariant controls	N	N	Y	Y	Y
Control for initial conditions 1960	N	N	N	Y	Y
Region FE (13)	N	N	N	N	Y
Observations	116	116	116	116	116
R-squared	0.48	0.63	0.85	0.92	0.95

## Panel estimates

Out controls pick up many things, but unobserved country-specific characteristics could still be confounding the relationship. To overcome this will turn to panel data and include country fixed effects.

$$U_{c,t} = \alpha + \beta R_{c,t-1} + \gamma I_{c,2010}xt + \kappa M_{c,t-1} + \theta_c + \gamma_t + u_{c,t}$$

Have to use  $\gamma I_{c,2010}xt$  as time-varying data on industrialization is sparse.

What does including country fixed effects do?

## Results

**Table 3** Multivariate panel analysis, main stylized fact

Dependent variable	Urbanization rate in year $t$ (%)				
	(1)	(2)	(3)	(4)	(5)
Natural resource exports (% of GDP, in year $t-1$ )	0.16** (0.07)	0.17** (0.08)	0.14* (0.07)	0.18*** (0.06)	0.15** (0.06)
Manuf. & serv. in 2010 $\times$ time trend $t$ (% of GDP)	0.02 (0.03)	0.02 (0.03)	-0.01 (0.03)	0.03 (0.03)	0.02 (0.03)
Manufacturing exports (% of GDP, in year $t-1$ )	0.35* (0.21)	0.35 (0.23)	0.27* (0.15)	0.23 (0.15)	0.08 (0.11)
Country and year FE (112; 5)	Y	Y	Y	Y	Y
Area-year FE (4 x 5)	N	Y	Y	Y	Y
Time-varying controls	N	N	Y	Y	Y
Initial conditions 1960 $\times$ time trend $t$	N	N	N	Y	Y
Region-year FE (13 x 5)	N	N	N	N	Y
Observations (112 $\times$ 5)	560	560	560	560	560
Adj. R-squared	0.95	0.95	0.96	0.97	0.98

Why might the coefficient be smaller than in the cross-sectional regression?

## Instrumental variables

We will skip for today :)

## Consequences of resource-led urbanisation

- We have established that resource abundance leads to urbanisation to a similar degree as industrialisation leads to urbanisation.
- So maybe, if urbanisation is such a good thing, resource abundance isn't so bad.
- Key question: are resource-led and industrial-led urbanisation the same phenomenon?
- Empirical strategy: estimate the effect of resource exports on outcomes controlling for urbanisation. Thus estimate the effect of resource exporting on the characteristics of cities created by the urbanisation that resources bring.

## Results

We've seen enough tables for one day.

- Cities import more.
- Lower share of workers in manufacturing.
- Higher share of workers in commerce and personal services.
- Lower output per worker.
- Higher inequality between rural and urban (Gini coefficient).
- Higher poverty headcount.

## Conclusion of Gollin et al. 2016

"Resources lead to urbanization, but this urbanization is of a different type than that found in non-exporters. Resource-led urbanization appears to create what we term "consumption cities". These cities tend to be composed of workers in non-tradable services. Imports of various kinds are more prevalent in these countries, consistent with workers being skewed towards non-tradable services while resource rents pay for imported goods. "Consumption cities" also appear to offer poorer living conditions than cities in non-exporters, despite being formed by similar shocks to income. Non-exporters, in comparison, appear to urbanize through what we term "production cities." These cities are made up more heavily of manufacturing and workers in the tradable service sector. Production cities import fewer goods and tend to have more access to urban improvements."

## **Conclusion**

## Some questions

- Are natural resources a solution or a trap?
- What do you think is the main mechanism behind the trap (assuming it exists)?
- What do you think is the main reason why some countries benefit and some do not?

## This week summary

- Q: Are natural resources a solution or a trap?
- Main theory: Rentier state theory, and dutch disease.
- Main empirics: Simple but powerful cross-country regressions, selection on observables, fixed effects.
- Main readings: Sachs and Warner (2001), Jensen and Watchekon (2004), Gollin et al. (2016).

For more theory: Corden and Neary (1982).

## Next week

Can we manufacture prosperity?