Lessons from the recent pandemic regarding the Extraction, Management and Use of Natural Resources

Gerhard Toews
New Economic School

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Roadmap

1. the recent pandemic and facts versus opinions (25%)
2. introduction to natural resource economics (75%)
Opinions versus Facts

Opinions are not facts!

Definition of a fact in science: objective and verifiable observations, which are systematically collected and analysed to provide empirical evidence.

In science this typically contrasts with a hypothesis and a theory, which is either used to motivate the collection of empirical evidence or ex-post rationalise empirical evidence.

The two above go hand in hand when research is done well!

Often, many iterations between the two above are needed before we arrive at a fact.
How to develop "facts" as a researcher

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4. derive predictions form the theory ⇒ next time the oil prices goes up, price for taxis will also go up in case of full employment
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5. test empirically the predictions ⇒ collect information on prices from taxi drivers and test whether your predictions turn out to be correct
How to develop "facts" as a researcher

Ideally, this is extended to other regions, time periods, circumstances (high unemployment) until there is little doubt that there is a strong relationship between oil prices and local good prices.
Opinions versus Facts

Opinions are not facts!

Definition of an opinion: a subjective and often non-verifiable belief. ⇒ God created the world in seven days. To the best of my knowledge there is no way to verify this.

Unfortunately, in some discussions opinions and facts seem to receive equal weights in a debate.

BUT, facts trump opinions in a debate about the real world since facts aim at providing an objective description of the world and, thus, are essential for decision making.
TIMELINE OF THE PANDEMIC

January 1: WHO requested information on the reported cluster of atypical pneumonia cases from the Chinese authorities.

January 2: WHO tweeted that there was a cluster of pneumonia cases in Wuhan, China.

January 10-12: WHO published a comprehensive package of guidance documents for countries, covering topics related to the management of an outbreak.

January 29: WHO published advice on the use of masks in public.

April 16: WHO issued guidance on considerations in adjusting public health and social measures, such as large-scale movement restrictions.
While imperfect, due to the rapid speed of the outbreak, most advice was based on research conducted in relation to the outbreak.

April 3: "Respiratory virus shedding in exhaled breath and efficacy of face masks" was published in Nature.

June 5: "Pandemics depress the economy, public health interventions do not: Evidence from the 1918 flu" was put online as a working paper.

There is still lots of uncertainty surrounding the evidence on policy decisions. Nevertheless, we should discount opinions and try to rely on facts as much as possible.
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Connection

Link to the exploitation and use of natural resources:

Many people question the exhaustion of natural resources and its potential consequences.

Many people questions the existence of climate change and its potential consequences.
LITERATURE

Overview:
- Yergin (1991)
- Diamond (2005)

Classics (1800 - 2000):
- Malthus (1826)
- Jevons (1865)
- Pigou (1920)
- Hotelling (1931)
Natural Resources

We differentiate raw materials on the basis of the time they need for reproduction:

Non-renewable resource: → does not renew itself at a sufficient rate for sustainable use:
  ▶ Fossil fuels
  ▶ Minerals

Renewable resource: → does (!) renew itself at a sufficient rate for sustainable use:
  ▶ Timber
  ▶ Fisheries
Main Concerns

Two issues which people seem to be concerned about when talking about resources:

- Running out of a Resource
- Pollution and Climate Change
Thomas Robert Malthus (1766-1834)
Malthusian Catastrophe

\[ \text{Population} \]

\[ \text{Resources}^{1} \]

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\(^{1}\)Slow technological progress (i.e. slow growth in generation of renewable resources) constraints population growth: increases in population must necessarily be followed by sharp decreases.
HAS THIS EVER HAPPEN WITH RENEWABLES?
Easter Island
Easter Island
Example: Timber

Easter Island (Diamond, 2005):

- deforestation problem between 1200 and 1500
- exploitable use of forest: use faster than reproduction
- estimate population density is < 50/1sqkm (controversial)
- committed ecocide
Is this inevitable?
JAPAN
Example: Timber

Japan (Diamond, 2005):
- deforestation problem between 1500 and 1600
- exploitable use of forest: use faster than reproduction
- by 1570 Japan had a population of < 50/1sqkm
- solution: forest management based on cooperation
Example: Timber

How did Japan managed to avoid complete deforestation (Diamond 2005):

- After a large fire of the capital 1657 (Great fire of Meireki) they realised the issues of timber shortage.
- Started regulating: governmental regulations can limit the amount of a common good that is available for use by any individual.
- Essentially they specified who could do what, where, when, how, and how much!
- Later, the government introduced incentives to increase supply by planting trees.
Has this ever happen with Non-Renewables?
Nauru
Example: Phosphate

Republic of Nauru
- Highest GDP per capita in the world in 1975
- Large phosphate deposits due to bird feaces
- Complete extraction and bad investment choices
- Today: GDP per capita app. 10000$ PPP and dependent on Australian aid
Is this inevitable?
Botswana
Example: Diamonds

Botswana

- One of the lowest GDP per capita in the world in 1966
- discovery of large diamond reserves
- revenue wisely invested
- Today: GDP per capita reaching 20000$ PPP (close to Belarus)
How did Botswana managed to avoid a collapse:

- Essentially, the monarch of Botswana (Seretse Khama) was consulted by a group of trusted advisers.
- Botswana would naturally follow the idea which would become knowns as the Hartwick Rule (1977).
- To offset the depletion of resources, revenues from extracting the resource should be invested in other types of capital: Education, Health, Infrastructure and the creation of Savings.
Main Concerns

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Carbon Cycle

- Plants take in carbon dioxide for photosynthesis (creation of energy)
- Animals consume plants to get this energy
- Plants and animals release carbon dioxide as they decompose or burn
  - carbon dioxide returns to the atmosphere, where it can be taken in by more plants

⇒ Theoretically, increasing the concentration of carbon dioxide in the atmosphere should have some impact on the carbon cycle.
The temperature increased in the last 100 years by 0.8 degrees celsius. This is not debatable, this is a fact!

In fact, as we have seen this winter, it appears to be the case that the temperature in Moscow has increased.
LINEAR FIT

![Graph showing linear fit for minimum temperature in December in Celsius over years from 1940 to 2020.](image-url)
Moscow Temperature

Has there been a structural break in the development of Moscow’s temperature?

Structural break: an unexpected change in the relationship between two variables.
Structural Break
Evidence suggests that:

- there is no change in Temperature across years until 1960
- since 1960 the temperature has been increasing by 3/4 degree Celsius every decade
- adds up to roughly 4.5 degree Celsius since 1960 (from -8 to -3.5)
Did the change in climate ever lead to a collapse of a civilization?
Climate Change Example: Norse
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Colonization of North America began in the late 10th century AD when Vikings explored the regions ⇒ extinct by late 15th century.

Current evidence suggests that climate change in combination with deforestation caused the extinction.
Is this inevitable?
CLIMATE CHANGE EXAMPLE: MOCHE
The Moche civilization flourished in northern Peru with its capital near present-day Moche, Trujillo, Peru from about 100 to 700 AD.

Current evidence suggests that this civilization adjusted to climate change by relocating. ⇒ currently, this is not an option for global climate change
Conclusion

History has provided us with examples of economic collapses caused by mismanagement of natural resource and the inability to adjust to changes in the local environment.

But it also has provided us with examples of success stories!

A necessary condition for a successful management of such crises is the acknowledgement of facts!