How can macroeconomics inform the transition to bioeconomy?

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Student lecture at TUM Campus Straubing for Biotechnology and Sustainability, May 29

Outline and learning objectives

1. Overview on the transition to bioeconomy
2. Show how macroeconomics can be used to inform the transition to bioeconomy

Audience:

Undergraduate students

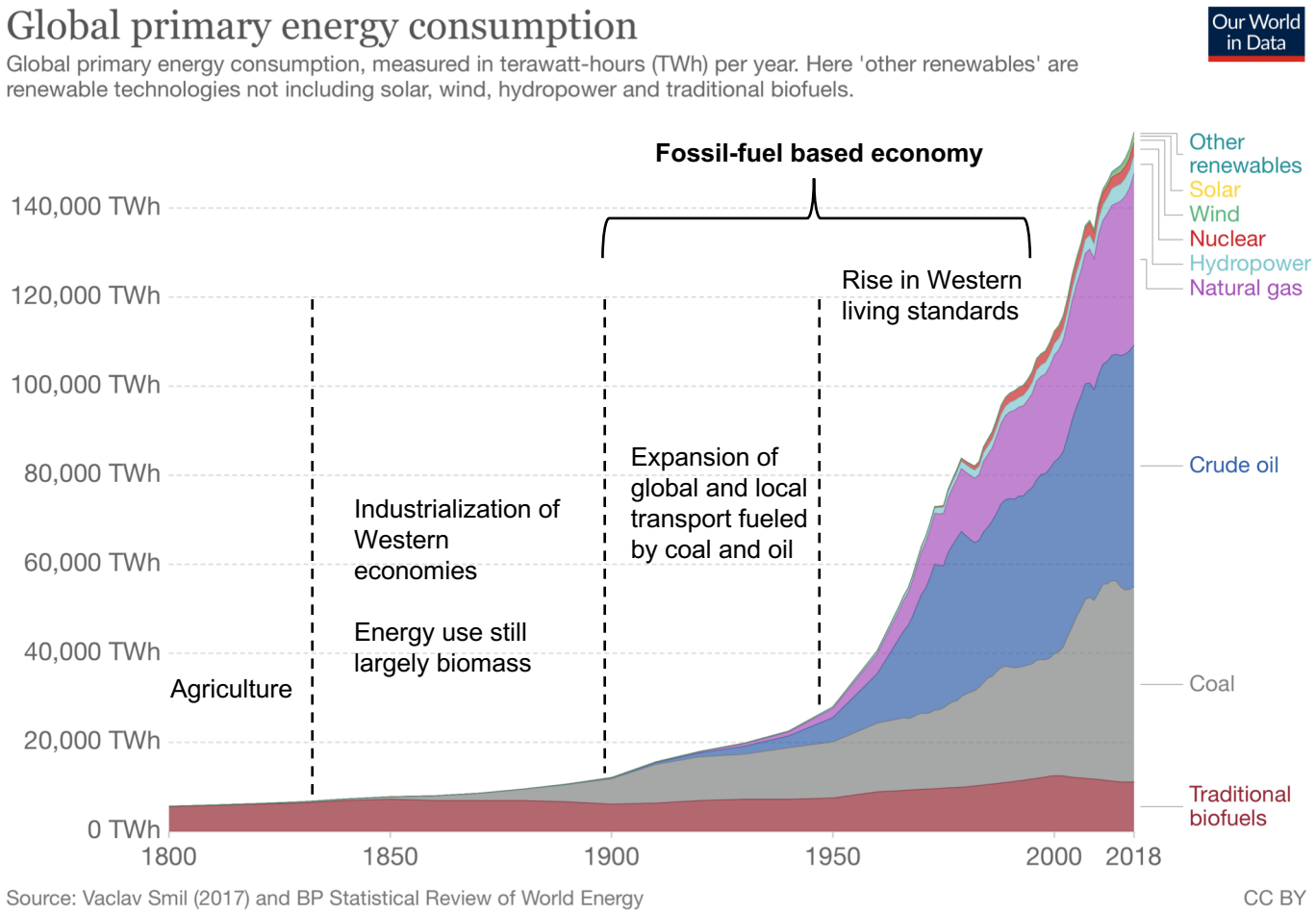
Prerequisites: basic knowledge/interest in macroeconomics/bioeconomy

Reference:

Lewandowski, I. (2018). Bioeconomy: Shaping the transition to a sustainable, biobased economy. Springer Nature.

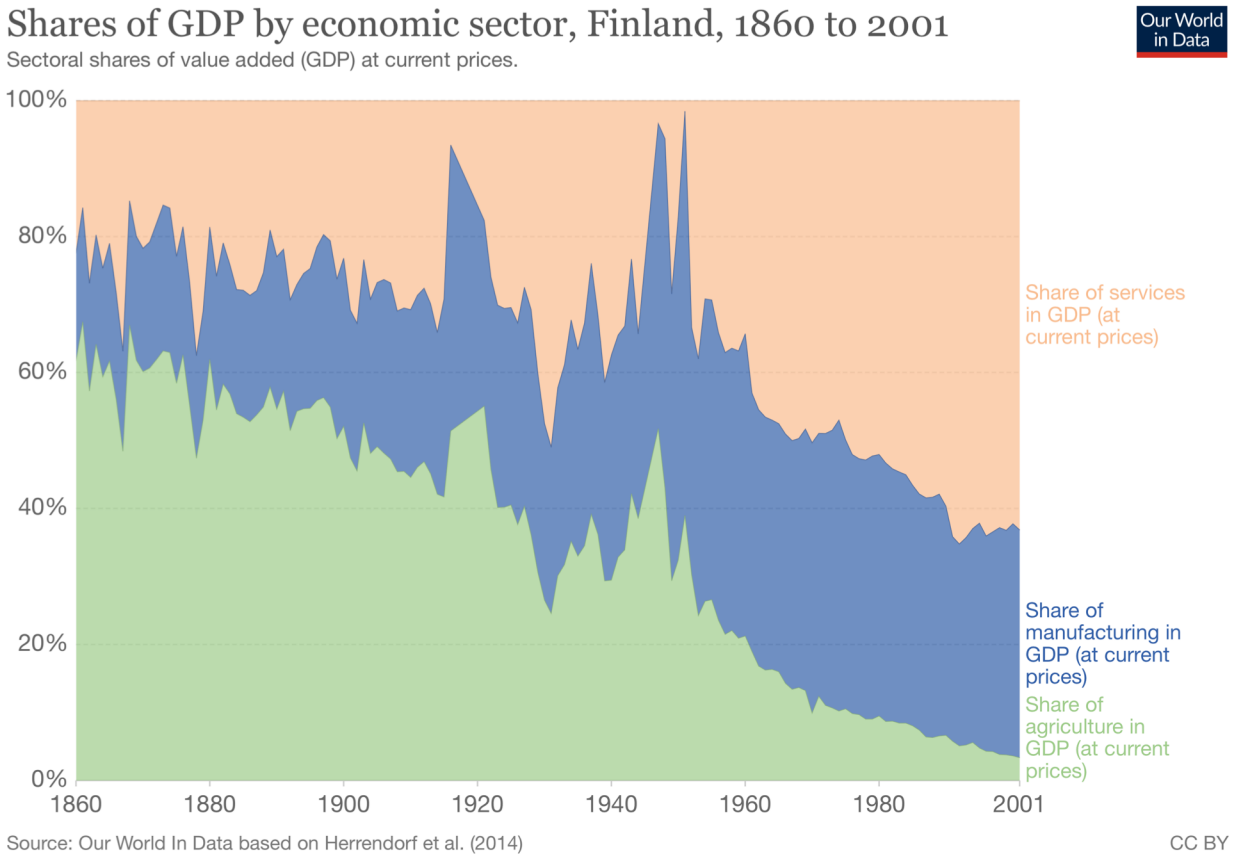
The transition to bioeconomy I

- Historical transitions: from agricultural to industrial societies
- Growth in the 20th cent. was fueled by coal and oil
- Global challenges: climate change, population growth, migration, etc.
- Increasing demand for the transition towards a more sustainable and biobased economy



The transition to bioeconomy II

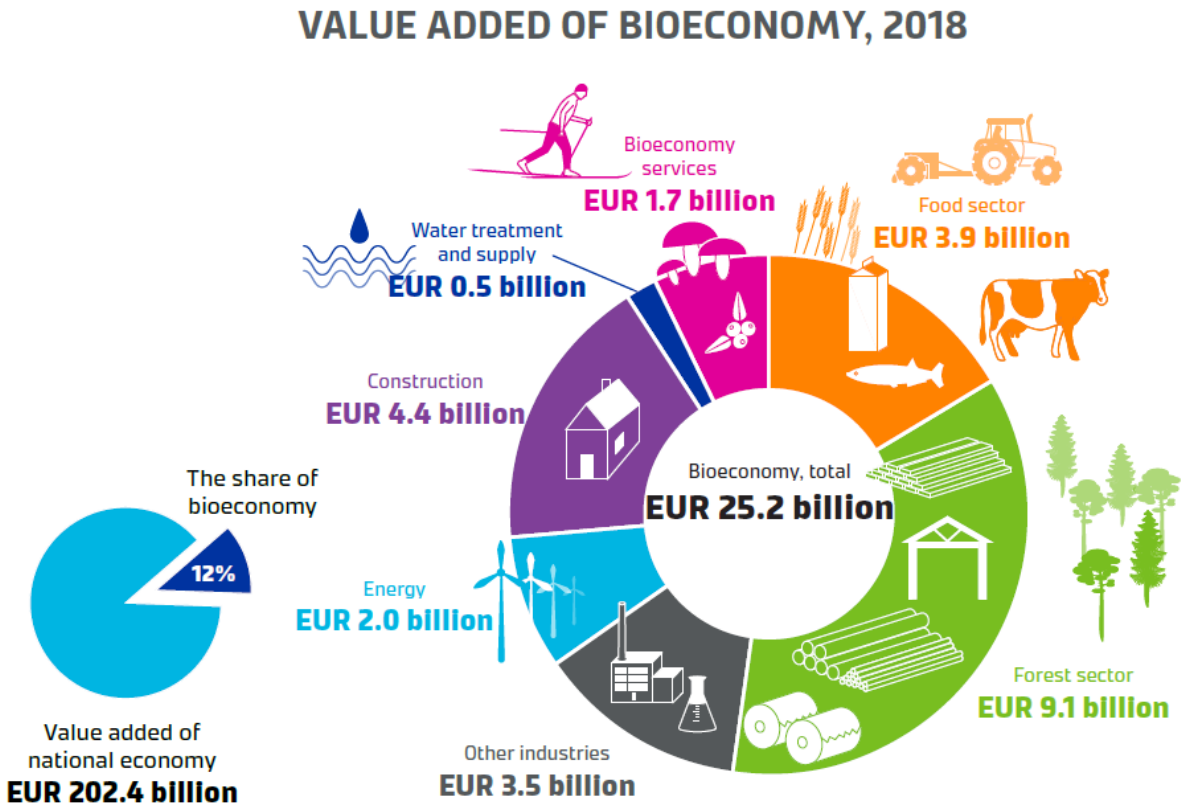
- Bioeconomy: '*sustainable production and use of biological resources, processes, and principles to provide products and services in all economic sectors'* (see Weeseler & Braun 2017)
- Economic sectors aggregate economic activities and inform about transitions in agriculture, manufacturing, and services
- **How does the transition to bioeconomy affect economic sectors and wealth of countries?**



Historical structural changes in the Finnish economy

The transition to bioeconomy III

- In 2018 bioeconomy contributes to about 12 % of GDP in Finland
- Agricultural sector is the main driver of the Finnish bioeconomy (food sector and forest sector)



Contribution of bioeconomy to the Finnish economy
(Source: Statistics Finland and Nsatural Resources Institute Finland)

Bioeconomy and macroeconomics

Key questions:

1) How does the transition to the bioeconomy affect the economy as a whole?
2) How can decision making be informed about the transition to bioeconomy?

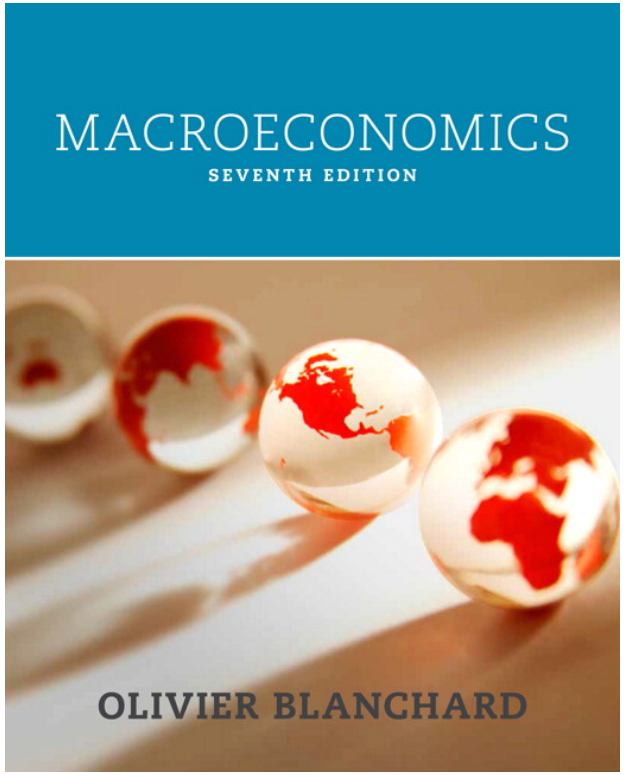
Macroeconmics provides the theory and empirics for 1) and 2)

The principles of macroeconomics (ME)

- ME studies economic interactions in society as a whole
- ME looks at aggregate variables (e.g., production, investment, employment, inflation, trade etc.)

The aim of ME is two-fold:

- to *explain* levels of aggregate variables and their movement over time (short-run vs. long-run)
- to provide foundations for *economic policy*



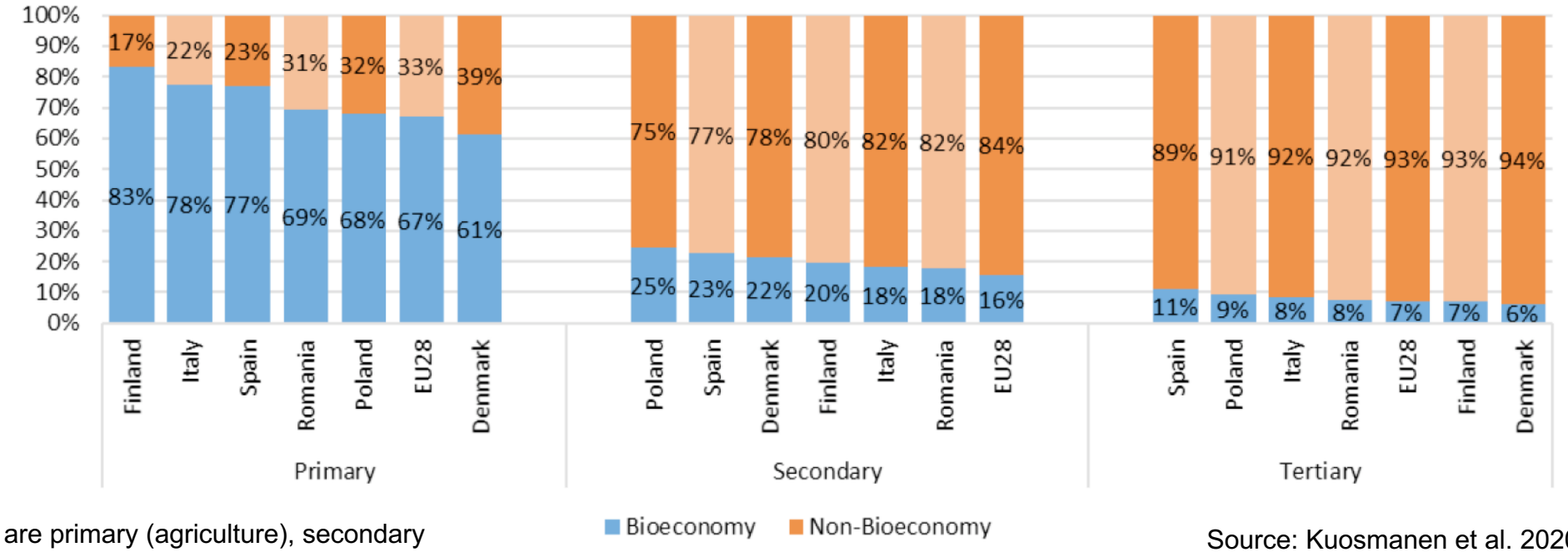
Source: Blanchard, 7th Edition

How can ME inform about bioeconomy?

Bioeconomy asks…	Macroeconomics informs…
a. What is the monetary value of biobased goods and services in an economy?	a. Gross Domestic Product (GDP): monetary values of all goods and services
b. How does the transition to bioeconomy affect the economy as a whole?	b. Analyze the effects of the bioeconomy on economic sectors, employment, investment and trade balances by using general equilibrium models
c. How does the transition to bioeconomy affect specific economic sectors (e.g., agriculture or energy)?	c. Analyze the sectoral impacts of the bioeconomy (other parts of economy are secondary) by using partial equilibrium models

The contribution of bioeconomy to GDP by sectors in the EU

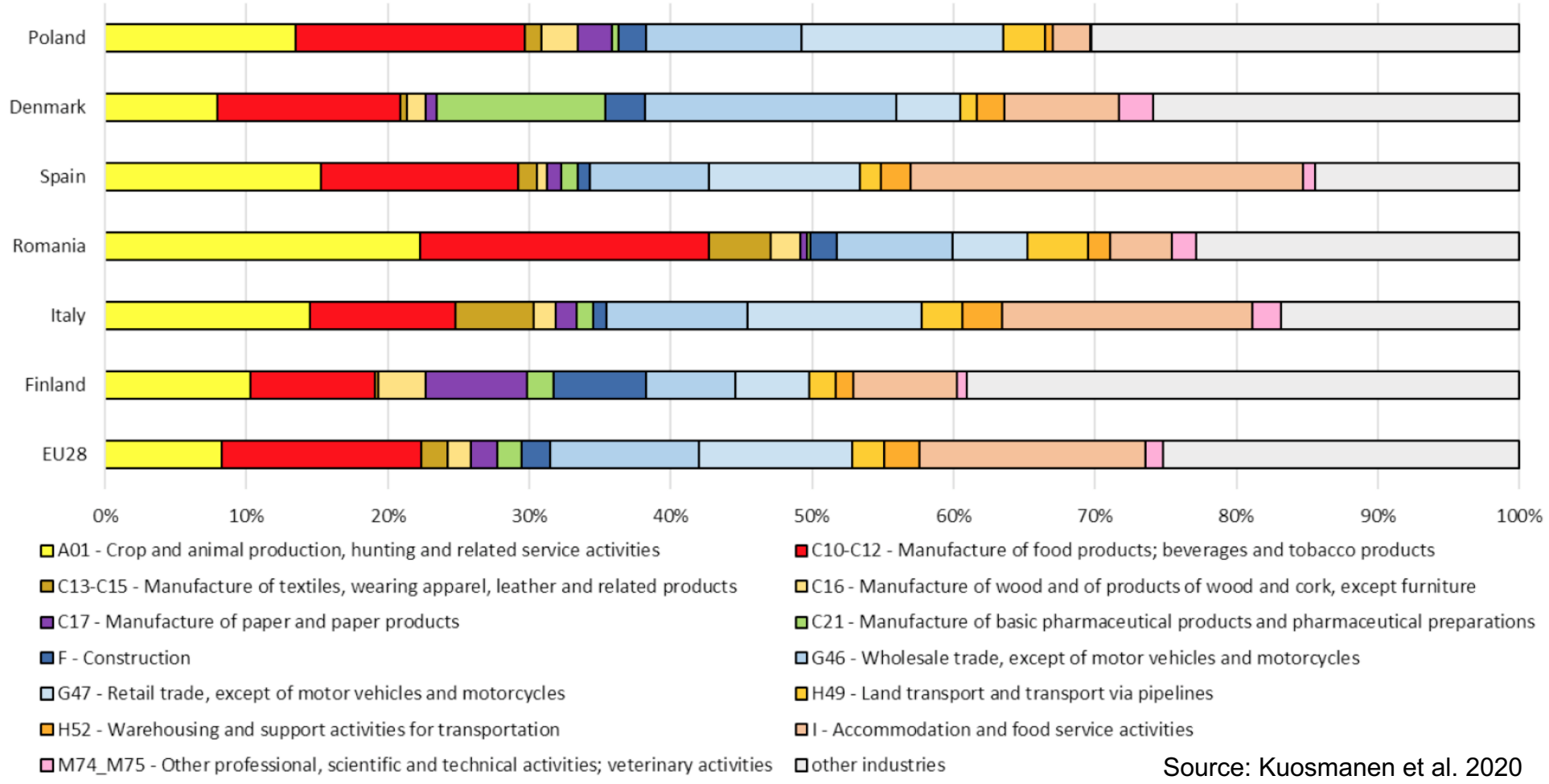
- The GDP approach allows comparisons of the transition to bioeconomy across countries
- Bioeconomy contributes to about 11 % of GDP in the EU (1.5 billion Euro)



Notes: sectors are primary (agriculture), secondary (manufacturing) and tertiary (services)

Source: Kuosmanen et al. 2020

Contribution of each sector to the bioeconomy's GDP in the EU



Source: Kuosmanen et al. 2020

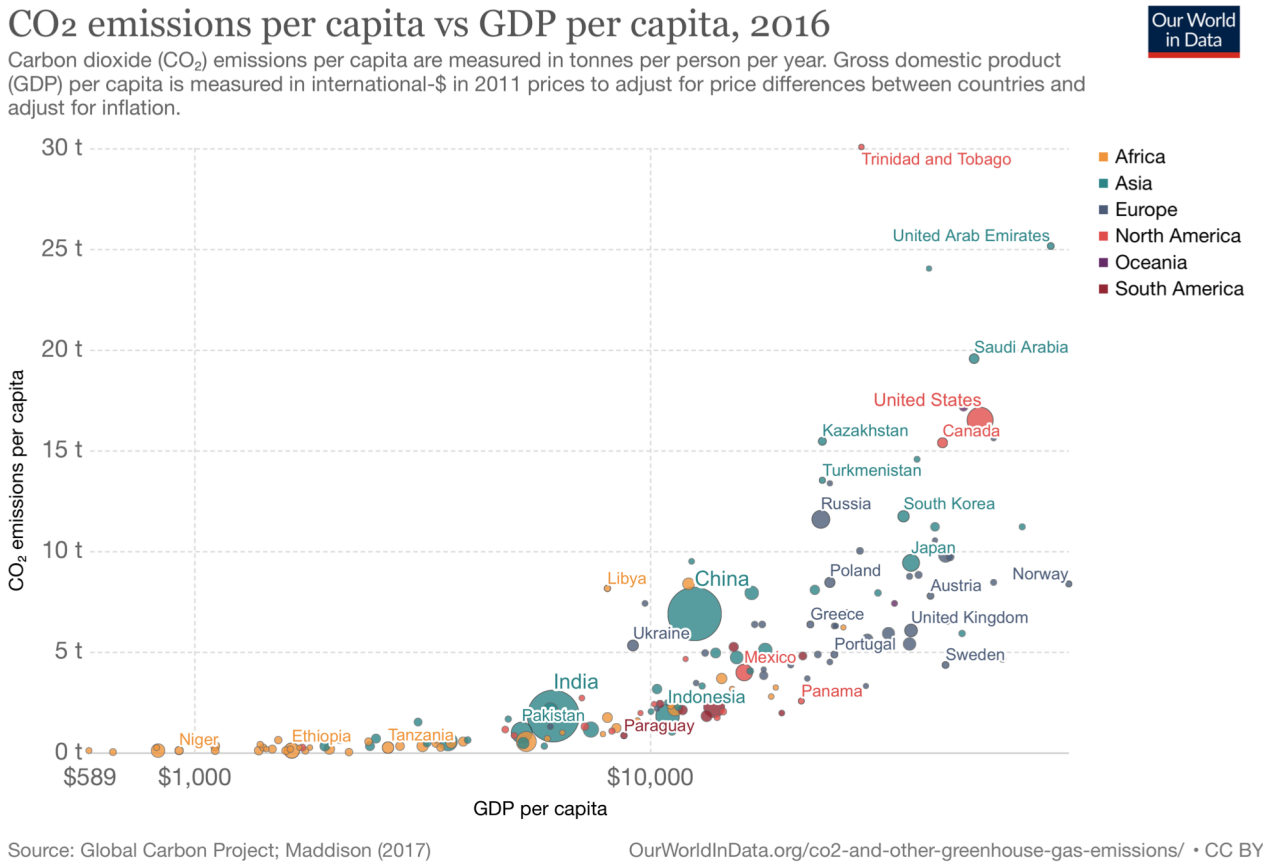
Challenges and alternatives to GDP

Methodological challenges

- Different national concepts make it hard to identify contributions of the bioeconmy
- Need to find coherent methodology

Alternatives to GDP

- GDP ignores social and environmental aspects
- Happiness/Life Satisfaction
- UN Development Index
- …



Concluding remarks

Recap learning objectives using PINGO:

Visit https://pingo.coactum.de/687154 or scan QR-code using your mobile device

Follow activities on twitter:

@biooeonomieDE, @OfficeBECouncil, @EUBioeconomy, @CircularImpacts @RebuildMacro, @OurWorldInData

Slides are available at:

https://github.com/flashponi/Macro-and-Bioeconomy

References

Books

- Blanchard, O. J. (2016). Macroeconomics. 7th Global edition.
- Lewandowski, I. (2018). Bioeconomy: Shaping the transition to a sustainable, biobased economy. Springer Nature.

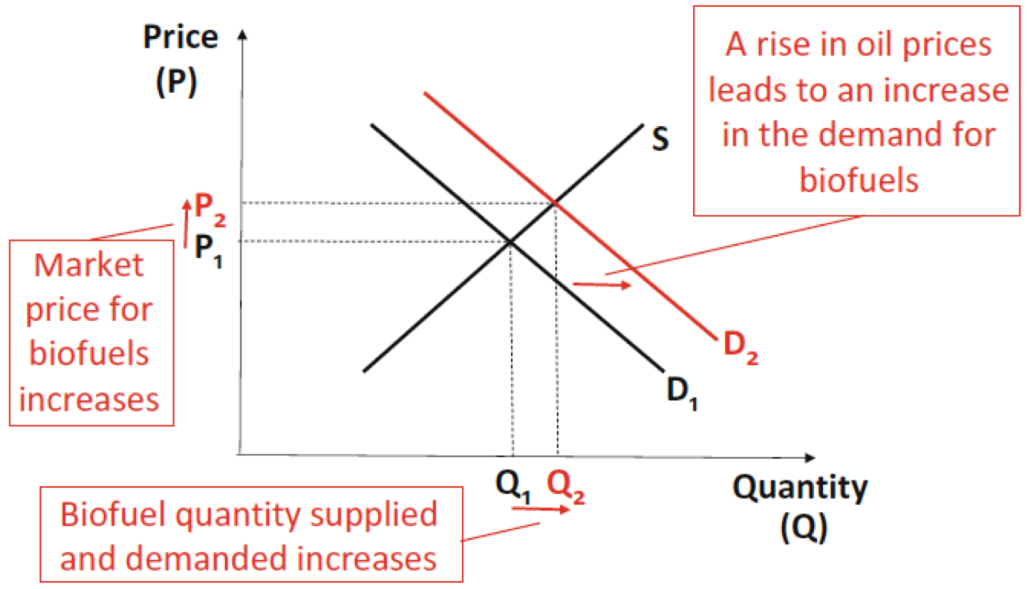
Research Articles and Reports

- Kuosmanen, T., Kuosmanen, N., El-Meligli, A., Ronzon, T., Gurria, P., Iost, S., M'Barek, R., *How Big is the Bioeconomy? Reflections from an economic perspective*. EUR 30167 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-17858-3, doi:10.2760/144526, JRC120324.
- Wesseler, J., & von Braun, J. (2017). Measuring the bioeconomy: Economics and policies. *Annual Review of Resource Economics*, *9*, 275-298.

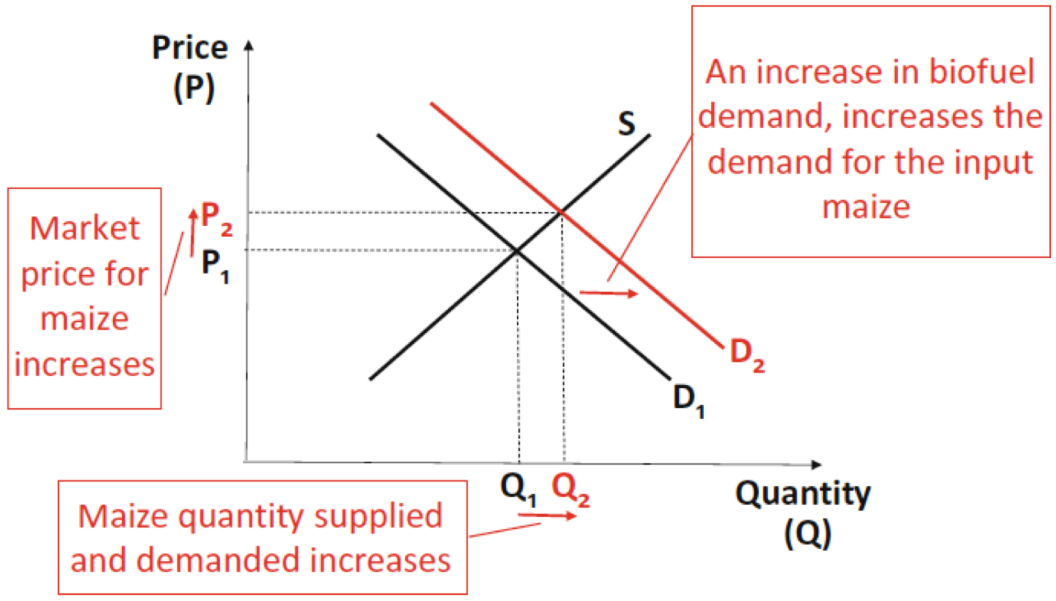
Supply and demand effects on the resource market

Fossil oil and biofuels are substitutes
Figure a) and b) show the demand effects of a rise in the oil price for biofuels and maize markets

a) Market for biofuels



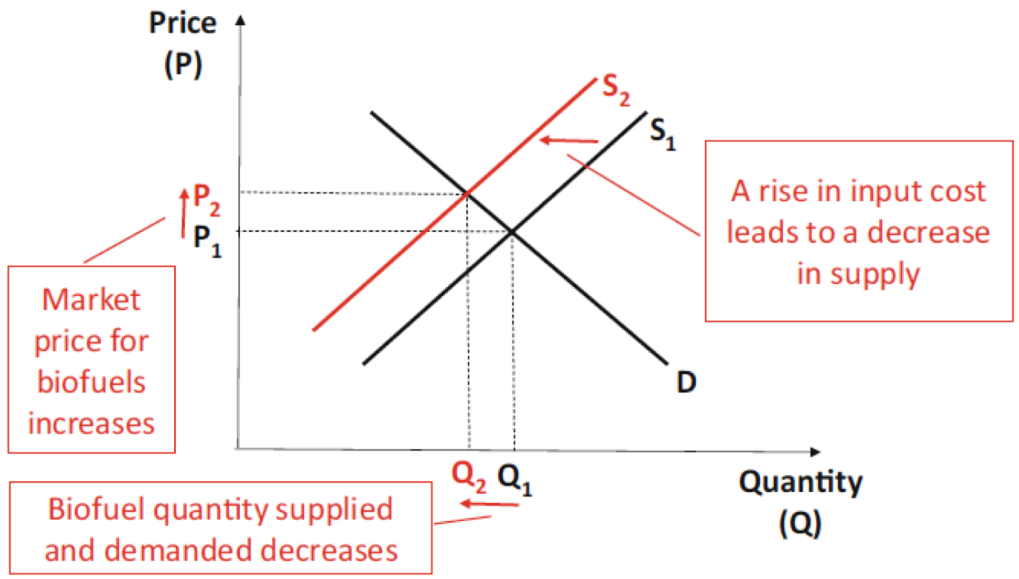
b) Market for maize



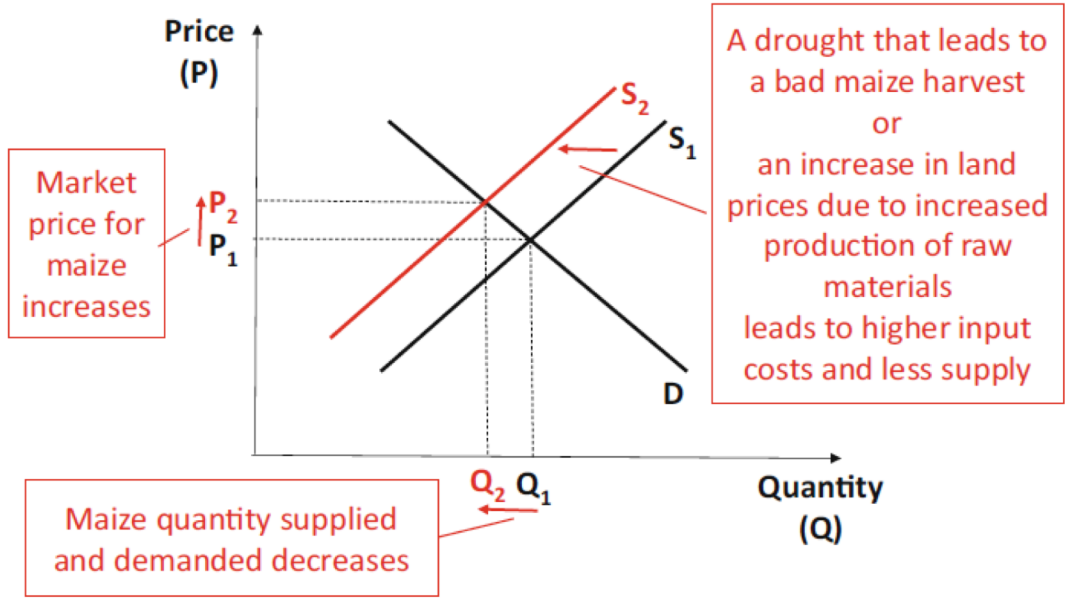
Supply and demand effects on the resource market

A drought leads to a bad maize harvest – input for biofuels is more expensive
Figure a) and b) show the supply effects of a rise in the oil price for biofuels and maize markets

a) Market for biofuels



b) Market for maize



CGE models

- CGE models have often been used for analyzing the agricultural market adjustments and land-use change at global scale, thanks to the Global Trade Analysis Project (GTAP) research consortium that provides a general global CGE framework and database (Narayanan & Walmsley, **2008**).
- A key insight from CGE studies into biofuels is the strong impact of the use of first-generation biofuels on national and international food markets, and the associated total net impacts on land use and greenhouse gas emissions. Biofuels increase the link between energy and agricultural market prices that may affect welfare and trade patterns (Bouet *et al* ., **2010**; Hertel & Beckman, **2010**; Hertel *et al* ., **2010**). For example, domestic production of biofuels can decrease foreign oil imports, while the use of crops for biofuels may lead to lower exports of agricultural products. Results from CGE models also show that the effects on land use will depend on trade policy scenarios.
- The principle strength of CGE-based studies is their comprehensiveness in terms of key economic relationships, including market price adjustments and associated changes in terms of trade, market balances, and factor markets. The CGE models are ‘deep’ structural models in that they explicitly solve the maximization problem of consumers and producers, assuming utility maximization and profit maximization with production/cost functions that include factor inputs [see Robinson *et al* . (**2014**)].

PE models

- Partial equilibrium models are economic models following the same neo-classical framework as CGE models, but in which not all economic sectors and factors are represented. PE models are often adopted to address questions specific to some sectors (e.g., agriculture and energy) and for which interrelation with others parts of the economy are secondary. As for CGE models, the main characteristic of PE models is the assumption that markets are at equilibrium and return to equilibrium after an economic shock, i.e. at any time, demand price adjusts to equal marginal producer cost. The simplest form of PE models is the stylized single product demand–supply model generally used to analyze welfare and other impacts of a policy or technology change. PE models have largely been used to analyze first-order effects of policy intervention on a feedstock market when developing bioenergy [see, for example, De Gorter & Just (**2009**) for corn ethanol and Babcock *et al* . (**2011**) for second generation].