

Ringvorlesung „Wissenschaft und alternative Fakten“

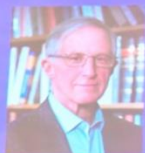
Glaskugel vs Blackbox: Über den Nutzen von Simulationsmodellen in der Politikberatung

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The Prize in Economic Sciences 2018
Ekonomipriset 2018



William D. Nordhaus

"för att ha integrerat klimatförändringar i långsiktig makroekonomisk analys"

"for integrating climate change into long-run macroeconomic analysis"



Paul M. Romer

"för att ha integrerat teknisk utveckling i långsiktig makroekonomisk analys"

"for integrating technological innovations into long-run macroeconomic analysis"



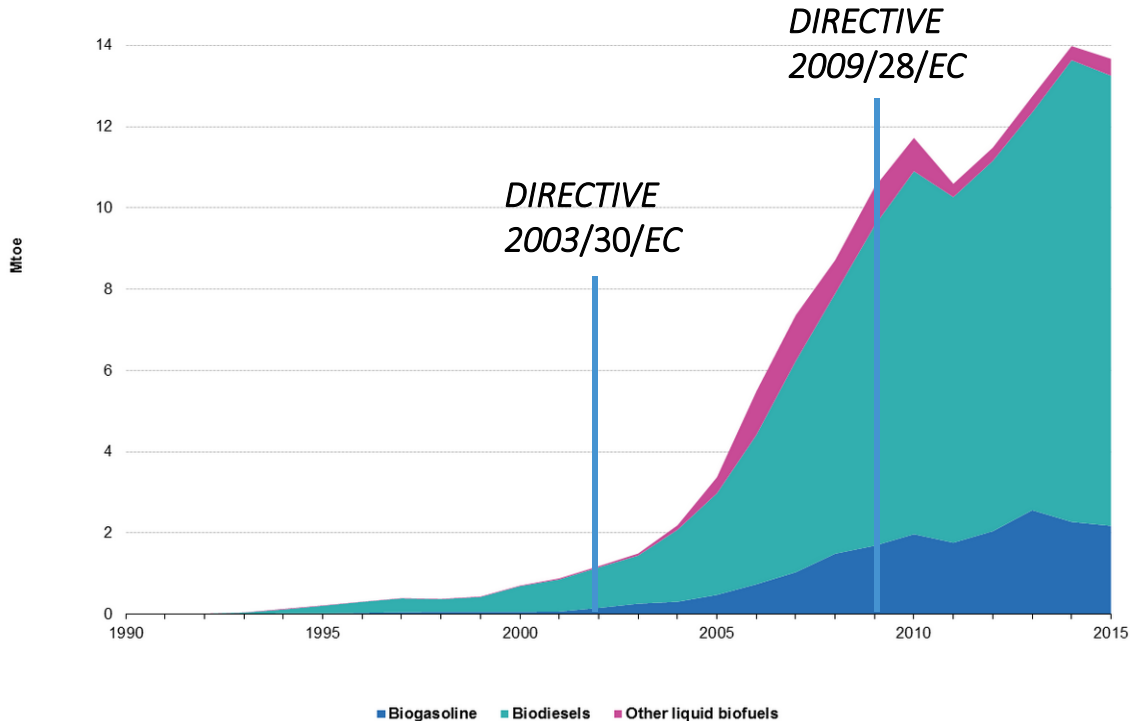
Foto: dpa

Was ist der Nutzen von ökonomischen Simulationsmodellen?

- Verständnis von Mechanismen und Wirkungszusammenhängen
- Wenn... Dann... Analysen
- Simulation von Politikoptionen -> Entscheidungsgrundlage

- Keine Prognosen

Entwicklung der Biokraftstoffproduktion in der Europäischen Union 1990 - 2015



Quelle: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Primary_production_of_liquid_biofuels,_EU-28,_1990-2015_F5.png

Debatte 1: Tragen Biokraftstoffe zum Klimaschutz bei?

ENVIRONMENT NOVEMBER 8, 2010 / 12:05 AM / 8 YEARS AGO

Biofuel worse for climate than fossil fuel: study

Pete Harrison

BRUSSELS (Reuters) - convert 69,000 square foot and accelerating c

The impact equates to:

As a result, the extra bi between 81 and 167 pe

Biofuels

Terry Macalister

@TerryMac999
Tue 25 Mar 2008 01:56 GMT



Biofuels: a solution that became part of the problem

- Alarm express
- UK food prices



▲ A worker cuts sugar cane stalks in a field in Brazil. The cane is used to produce ethanol, a biofuel.

Using plant-based fuels heralded as the end of diesel fuels

But the alarm e government's h

ENVIRONMENT

Biofuels Deemed a Greenhouse Threat

By ELISABETH ROSENTHAL FEB. 6, 2008

Almost all biofuels used today cause more greenhouse gas emissions than conventional fuels if the full emissions costs of producing these "green" fuels are taken into account, two studies being published Thursday have concluded.

The benefits of biofuels have come under increasing attack in recent months, as scientists took a closer look at the global environmental cost of their production. These latest studies, published in the prestigious journal *Science*, are likely to add to the controversy.

These studies for the first time take a detailed, comprehensive look at the emissions effects of the huge amount of natural land that is being converted to cropland globally to support biofuels development.

The destruction of natural ecosystems — whether rain forest in the tropics or grasslands in South America — not only releases greenhouse gases into the atmosphere when they are burned and plowed, but also deprives the planet of natural sponges to absorb carbon emissions. Cropland also absorbs far less carbon than the rain forests or even scrubland that it replaces.

Together the two studies offer sweeping conclusions: It does not matter if it is rain forest or scrubland that is cleared, the greenhouse gas contribution is significant. More important, they discovered that, taken globally, the

Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change

Timothy Searchinger,^{1*} Ralph Heimlich,² R. A. Houghton,³ Fengxiu Dong,⁴ Amani Elobeid,⁵ Jacinto Fabiosa,⁶ Simla Tokgoz,⁶ Dermot Hayes,⁶ Tun-Hsiang Yu¹

Most prior studies have found that substituting biofuels for gasoline will reduce greenhouse gas emissions because biofuels sequester carbon through the growth of the feedstock. These analyses failed to count the carbon emissions that occur as farmers worldwide respond to higher oil prices by converting forest and grassland to new cropland to replace the grain (or cropland) used to produce biofuels. By using a worldwide agricultural model to estimate emissions from land-use change, we find that substituting ethanol, instead of producing a 20% savings, nearly doubles greenhouse gas emissions over 30 years and increases greenhouse gases for 167 years. This study mandates that biofuel production be limited to lands that are already in cropland and highlights the value of using

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29 FEBRUARY 2008 VOL 319 SCIENCE www.sciencemag.org

in the case of cropland, carbohydrates, proteins, and fats), dedicating land to biofuels can potentially reduce GHGs only if doing so increases the carbon benefit of land. Proper accountings must reflect the net impact on the carbon benefit of land, not merely count the gross benefit of using land for biofuels. Technically, to generate greenhouse benefits, the carbon generated on land to replace fossil fuels (the carbon uptake credit) must exceed the carbon storage and sequestration given directly or indirectly by changing land uses (the emissions from land-use change) (Table 1).

Many prior studies have acknowledged but failed to count emissions from land-use change because they are difficult to quantify (1). One prior quantification lacked formal agricultural modeling and other features of our analysis (1, 10). To estimate land-use changes, we used a worldwide model to project increases in cropland in all major temperate and sugar crops by country or region (as well as changes in dairy and livestock production) in response to a possible increase in U.S. corn ethanol of 56 billion liters above projected levels for 2016 (11, 12). The model's historical supply and demand elasticities were updated to reflect the higher price regime of the past 3 years and to capture expected long-run equilibrium behavior (1). The analysis identifies key factors that determine the change in cropland.

1) New crops do not have to replace all corn diverted to ethanol because the ethanol by-product, dry distillers' grains, replaces roughly one-third of the animal feed otherwise diverted.

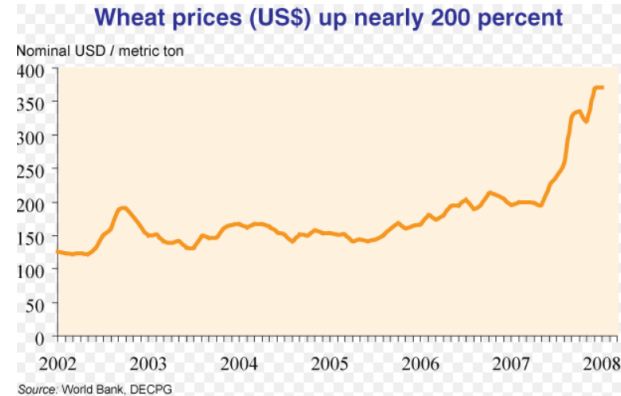
2) As fuel demand for corn increases and soybean and wheat lands switch to corn, prices increase by 40%, 20%, and 17% for corn, soybeans, and wheat, respectively. These increases modestly depress demand for meat and other grain products besides ethanol, so a small percentage of diverted grain is never replaced.

3) As more American croplands support ethanol, U.S. agricultural exports decline sharply (compared to what they would otherwise be at the time) (corn by 62%, wheat by 31%, soybeans by 28%, pork by 18%, and chicken by 12%).

4) When other countries replace U.S. exports, farmers must generally cultivate more land per ton of crop because of lower yields. Farmers would also try to boost yields through improved irrigation, drainage, and fertilizer (which have their own environmental effects), but reduced crop rotations and greater reliance on marginal lands would depress yields. Our analysis assumes that present growth trends in yields continue but

Downloaded from www.sciencemag.org on March 31, 2010

Debatte 2: Haben Biokraftstoffe die Ernährungskrise 2008 verursacht?



<http://siteresources.worldbank.org/DEC/Images/84796-1179761045903/wheat-prices-lg.gif>



<https://hungermath.wordpress.com/2012/11/03/a-repeat-of-the-2006-2008-food-crisis/>

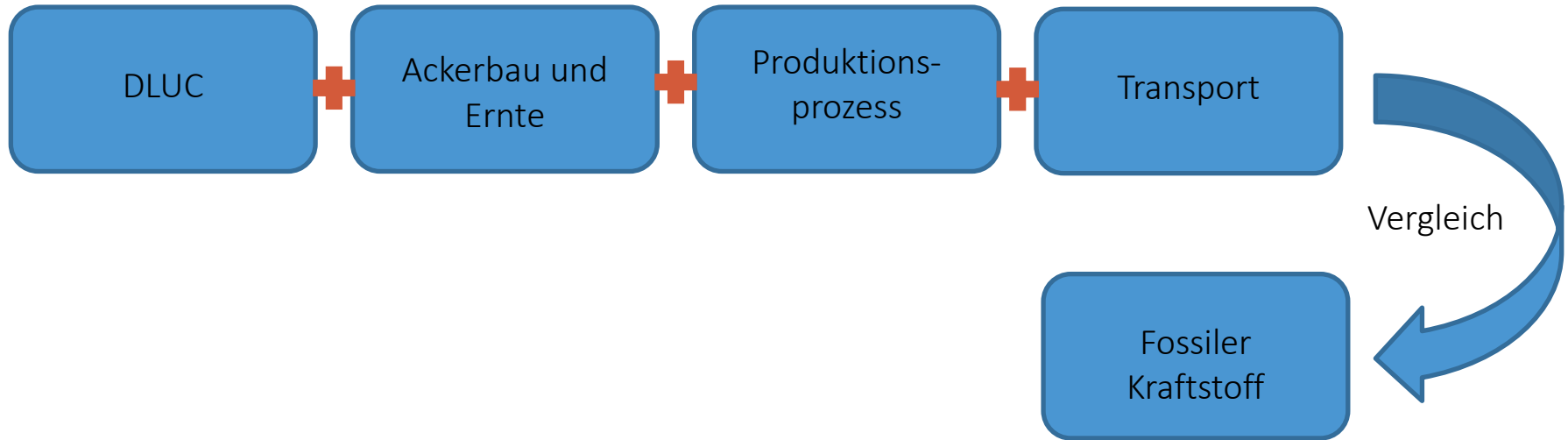
Nachhaltigkeitskriterien in der Europäischen Biokraftstoffpolitik

- Fokus auf Landnutzungswirkung und auf die gesamte Emissionsbilanz.
- Biokraftstoffe dürfen nicht von Flächen stammen, die zuvor einen hohen Kohlenstoffgehalt (Wälder und/oder Moorböden) oder eine hohe Biodiversität aufgewiesen haben.
- Stichtag ist Januar 2008
- Für alle anderen Flächen müssen Hersteller von Biokraftstoffen nachweisen, dass entlang der Wertschöpfungskette mindestens 35% Emissionen eingespart wurden im Vergleich zu fossilen Kraftstoffen.
- Es muss also eine komplette Emissionsbilanz erstellt werden, die auch Emissionen aus direkten Landnutzungsänderungen berücksichtigt.

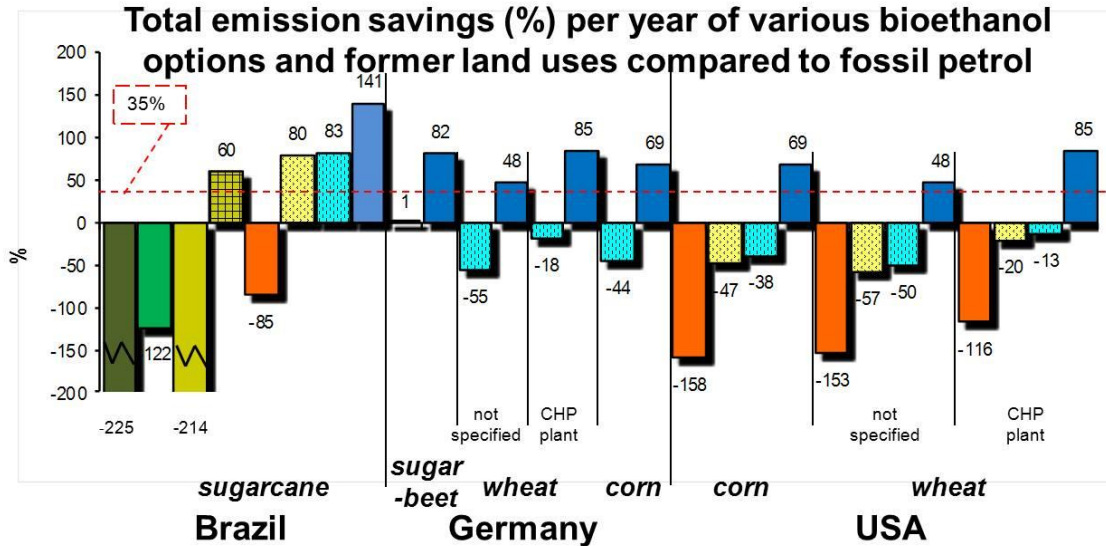
Nachhaltigkeitskriterien in der Europäischen Biokraftstoffpolitik II

- Direkte Landnutzungsänderungen: Umwandlung von Flächen für die Produktion von Rohstoffen für die Biokraftstoffproduktion Flächen umgewandelt werde, die zuvor nicht für den Ackerbau genutzt wurden.
- Dabei entstehen Emissionen aus der zerstörten Biomasse und durch die Bearbeitung des Bodens.

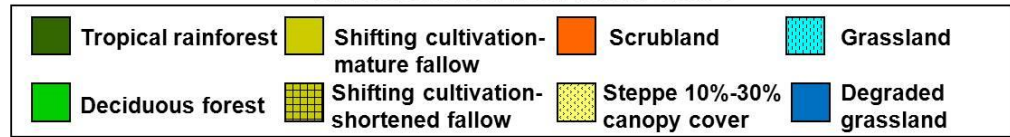
Mindsteinsparungen von Treibhausgasemissionen



Emissionsbilanzen im Vergleich



Different former land uses



(Lange 2011 Energy Policy 39 p.2337-2385)

Zusätzlich Emissionen durch “Indirekte Landnutzungsänderungen”

- Verursacht durch Prozesse auf globalen Märkten verursacht
- Beeinflusst durch: regionales Angebot und Nachfrage, Politiken, lokale Infrastruktur, Landverfügbarkeit und -qualität.

Voraussetzungen für eine korrekte Abbildung:

- Feldspezifische Identifizierung welche Nahrungs- und Futtermittel verdrängt werden
- Ökonomische Analyse der globalen Marktreaktionen dieser Verdrängungseffekte
- Feldspezifische Identifizierung von nicht genutzten Landflächen auf denen Früchte, die durch Biokraftstofffrüchte verdrängt wurden nun angebaut werden

Assessing the Land Use Change Consequences of European Biofuel Policies

Final Report

October 2011

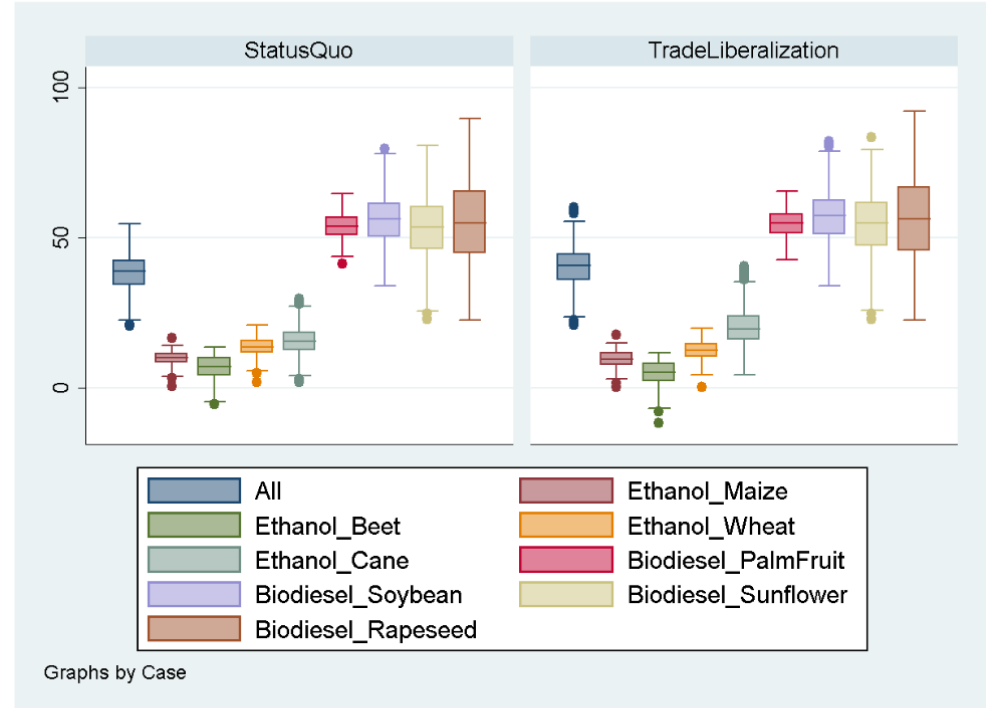
This report has been prepared by:

David Laborde (IFPRI)

ATLASS Consortium

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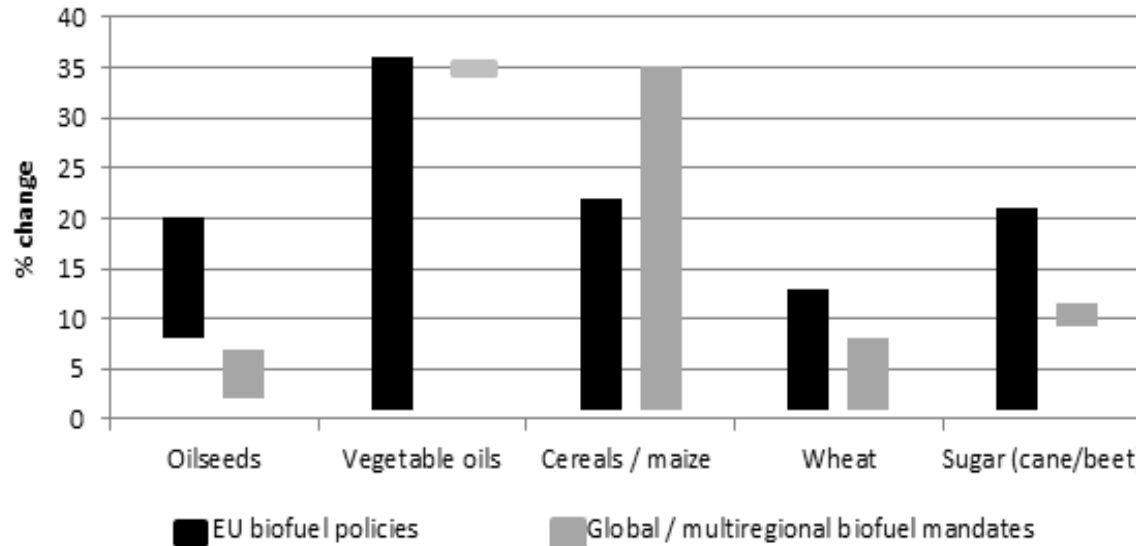
Figure 18 LUC emission coefficients, grCO₂eq/MJ, Monte Carlo results



Source: Mirage-Biof Simulations

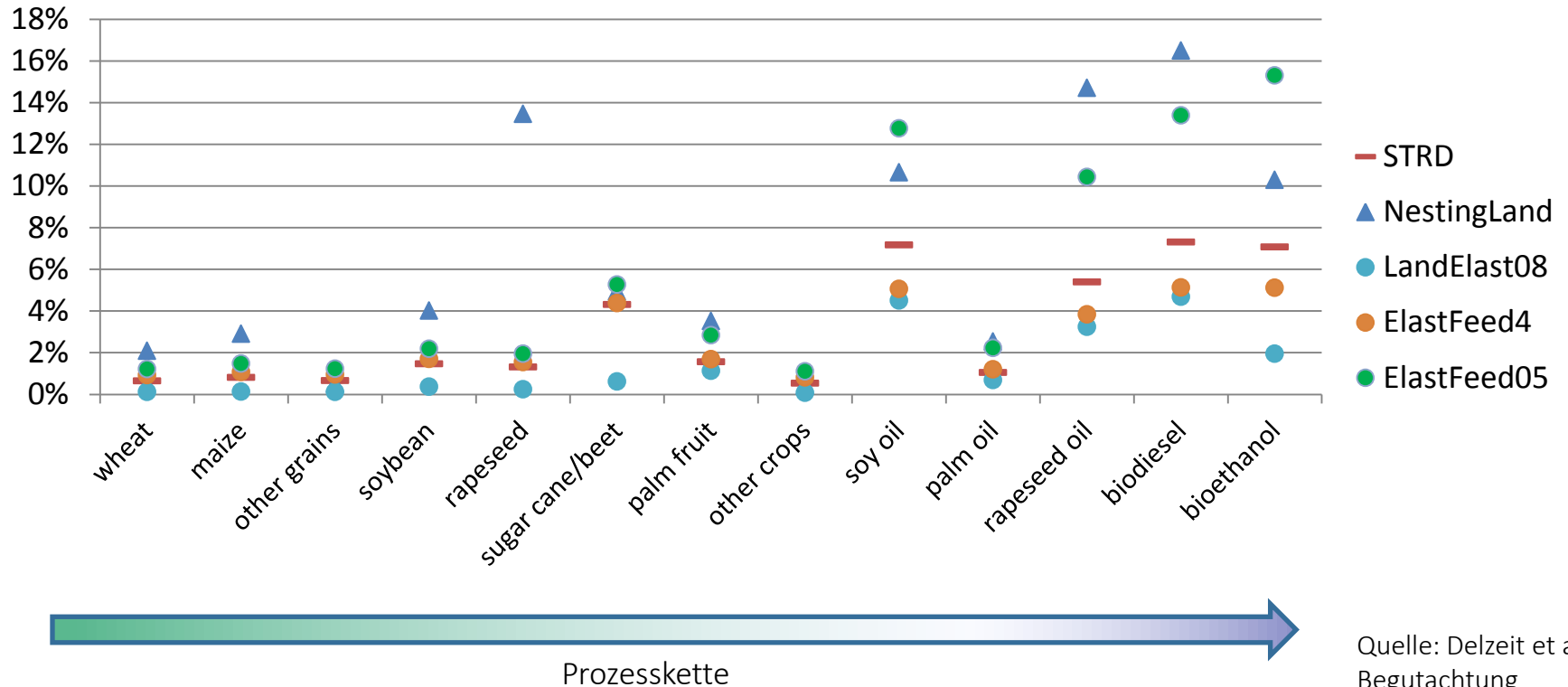
Note: The bold line within the box shows the median value, the box define the 25th-75th percentile, and the upper and lower horizontal lines describe the upper and lower adjacent limits. The dots indicate extreme values.

Bandbreite an Preisänderungen in 2020 durch Biokraftstoffe in verschiedenen Studien



Quelle: Calzadilla et al. 2017. Fig. 1. Overview on price effects of different studies (2020). Source: Compiled from Kretschmer et al. 2012. Note: there is only one study on price effects of global mandates on vegetable oils and sugar (cane/beet).

Preisänderungen unter verschiedenen Modellannahmen



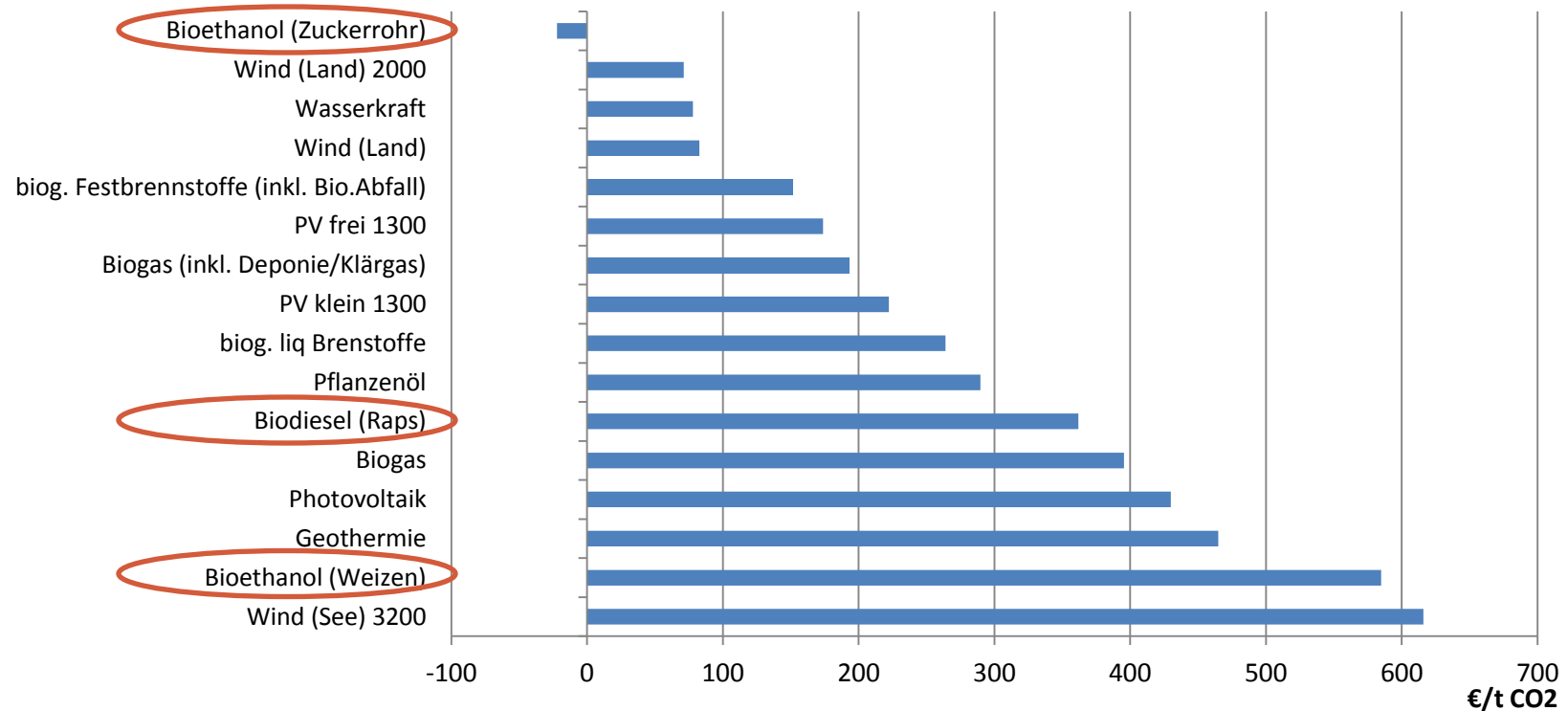
Quelle: Delzeit et al. In Begutachtung

Schlussfolgerungen

- Für Transparenz in Modellannahmen sorgen (z.B. durch transdisziplinäre Forschung)
- Klar die Möglichkeiten und Grenzen aufzeigen
- Interpretation
- Komplexe Ergebnisse erklären können
- Anerkennen, dass es nicht immer einfache Antworten gibt

Zusatzinformationen

Vermeidungskosten verschiedener erneuerbarer Energien



Quelle: BMU Leitstudie 2010; Meo Consulting