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Extended Abstract

Various environmental footprint concepts have been developed and applied in sustainability research over the past two decades (see, e.g., Hoekstra and Wiedmann 2014 for a literature review). However, in case of resource-related footprint indicators, most publications remained restricted to ex post analyses until now. Referring to the multitude of published ex post assessments of international material flows by means of Multi-Regional Input-Output (MRIO) databases (see, e.g., Bruckner et al. 2012, Wiebe et al. 2012, Wiedmann et al. 2015 or Wood et al. 2015 for some selective recent applications in this regard) we might at least annotate that scientific evidence of the prospects for future resource consumption remained rather limited by now (but, see e.g., European Commission 2014 or Schandl et al. 2016 for recent examples in this regard).

This is somewhat amazing as the sustainability research community as well as international decision makers do indeed share the conviction that, akin to the challenges of climate policy, a great transition will be needed in order to decouple human wellbeing from resource use over the next decades (European Commission 2011, Hoekstra and Wiedmann 2014, UNEP 2011, UNEP 2014). Our paper is therefore intended to advance this branch of research by a presentation of key scenario insights from MRIO-based ex ante simulation studies.

GINFORS is an environmentally extended dynamic economic simulation model. The current GINFORS version, which is based on the WIOD dataset (Dietzenbacher et al. 2013, Timmer et al. 2015), has been re-engineered over the last couple of years and facilitates simulation studies with a detailed mapping of 38 national economies and a rest of world region until the year 2050. The model is soundly rooted on an endogenous mapping of detailed national economic structures and international economic interrelationships due to globalized trade patterns. Income effects resulting from (i.a.) diversified investment expenditures, induced efficiency improvements or sustained shifts in consumption patterns are explicitly modelled. Hence, each simulation run accounts for potential macroeconomic rebound effects (Sorrell and Dimitropoulos 2008, Sorell et al. 2009) in a variety of ways.

Concerning environmental questions, the modelling of the economic system is consistently interlinked with subsystems that explain energy use, electricity production, air emissions and material extractions in physical terms. Concerning the later, GINFORS is also able to map quantitative indicators of material extractions embedded in regional consumption activities over global supply chains. Current GINFORS applications therefore feature medium to long term projections of national material footprint indicators like Raw Material Consumption (RMC).

Our presentation focuses on the future prospects of international CO_2-emissions and abiotic material consumption patterns. To this, we highlight key findings from four quantitative scenario assessments: A "Business-As-Usual" scenario, assuming only modest progress of environmental policy measures within the EU in absence of any further developments of climate and resource policy measures in Non-EU countries. A "Global Cooperation" scenario, assuming the establishment of globally harmonized economic and regulatory policy instruments in order to advance decarbonisation developments and to foster the transition towards a resource-efficient global economy. An "EU Goes Ahead" scenario, with the EU advancing the development of a low-carbon,

resource-efficient economy through strong EU-level economic and regulatory policy instruments in absence of any further developments of climate and resource policy measures in Non-EU countries. And a "Civil Society Leads" scenario, where European citizens/consumers and businesses push resource-efficiency and decarbonisation trends through voluntary changes in preferences and behaviour.

Our results indicate that humanity has to strive for global implementations of ambitious climate and resource policy measures. Otherwise, planetary boundaries will be offended by far.

In case of European Member States this development would also be accompanied by dampened economic growth, less acceptable social conditions and growing risks for financial markets. Further key policy lessons which can be inferred from our findings can be summarized as follows:

1)	An attainment of ambitious global environmental targets does not have to be accompanied by net economic costs. Instead, positive income and employment effects might be induced by coordinated policy actions. But this requires an international agreement on a comprehensive policy mix, which contains information instruments, economic instruments and regulations.

2)	If global agreements cannot be realized there remains the option EU Goes Ahead. The EU is able to attain own environmental targets even in absence of comparable global environmental policy approaches. In addition, the EU would economically benefit from first mover advantages.

3)	Structural change of consumption patterns accompanied by reductions of total consumption levels initiating from intrinsic behavioural change can exhibit substantial impacts on resource use. If these developments were accompanied by increased shares of part time employment contracts a zero growth economy would generate additional jobs.

References

Bruckner, M., Giljum, S., Lutz, C., Wiebe, K. (2012). Materials embodied in international trade - Global material extraction and consumption between 1995 and 2005. Global Environmental Change, 22(3), 568–576.

Dietzenbacher, E.; Los, B.; Stehrer, R.; Timmer, M. & de Vries, G. (2013), The Construction of World Input-Output Tables in the WIOD Project. Economic Systems Research, 25, 71–98.

European Commission (2011), A Roadmap for moving to a competitive low carbon economy in 2050. European Commission document: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, 8.3.2011, COM(2011) 112 final.

European Comission (2014), Study on modelling of the economic and environmental impacts of raw material consumption. Technical report 2014-2478. http://ec.europa.eu/environment/enveco/studies_modelling/ index.htm.

Hoekstra, A., Wiedmann, T. (2014), Humanity's unsustainable environmental footprint. Science 344, 1114–1117.

Schandl, H., Hatfield-Dodds, S., Wiedmann, T., Geschke, A., Cai, Y., West, J., Newth, D., Baynes, T., Lenzen, M., Owen, A. (2016), Decoupling global environmental pressure and economic growth: scenarios for energy use, materials use and carbon emissions. Journal of Cleaner Production, 132, 45–56.

Sorrell, S., Dimitropoulos, J. (2008), The rebound effect: Microeconomic definitions, limitations and extensions. Ecological Economics, 65, 636–649.

Sorrell, S., Dimitropoulos, J., Sommerville, M. (2009), Empirical estimates of the direct rebound effect: A review. Energy Policy, 37, 1356–1371.

Timmer, M., Dietzenbacher, E., Los, B., Stehrer, R., de Vries, G. (2015), An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production. Review of International Economics, 23, 575–605.

UNEP (2011), Decoupling Natural Resource Use and Environmental Impacts from Economic Growth. United Nations Environment Programme, Nairobi.

UNEP (2014), Decoupling 2: Technologies, Opportunities and Policy Options. In: A Report of the Working Group on Decoupling to the International Resource Panel. Keny United nations Environment Program, Nairobi.

Wiebe, K. S.; Bruckner, M.; Giljum, S.; Lutz, C. & Polzin, C. (2012), Carbon and Materials Embodied in the International Trade of Emerging Economies A Multiregional Input-Output Assessment of Trends Between 1995 and 2005. Journal of Industrial Ecology, 16, 636-646.

Wiedmann, T. O.; Schandl, H.; Lenzen, M.; Moran, D.; Suh, S.; West, J. & Kanemoto, K. (2015), The material footprint of nations. Proceedings of the National Academy of Sciences of the United States of America. 112, 6271-6276.

Wood, R.; Stadler, K.; Bulavskaya, T.; Lutter, S.; Giljum, S.; de Koning, A.; Kuenen, J.; Schuetz, H.; Acosta-Fernandez, J.; Usubiaga, A.; Simas, M.; Ivanova, O.; Weinzettel, J.; Schmidt, J. H.; Merciai, S. & Tukker, A. (2015), Global Sustainability Accounting-Developing EXIOBASE for Multi-Regional Footprint Analysis. SUSTAINABILITY, 7, 138-163.