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Analysis

Modelling Multi-regional Ecological Exchanges: The Case of UK and Africa

Eunice Oppon^{a,b,*}, Adolf Acquaye^c, Taofeeq Ibn-Mohammed^{a,b}, Lenny Koh^{a,b}^a Centre for Energy, Environment and Sustainability, University of Sheffield, Sheffield S10 1FL, UK^b Advanced Resource Efficiency Centre, University of Sheffield, Sheffield S10 1FL, UK^c Kent Business School, University of Kent, Canterbury CT2 7PE, UK

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ABSTRACT

As environmental impacts continue to rise, the need to identify and quantify the underlying causes of these impacts has prompted important research questions. This is heightened by the fact that the production of goods and services is becoming increasingly global with countries relying on each other through trade. As such, it is important to have a mechanism in place to understand the environmental burden shifts from one country to another. To this end, this paper exploits a paradox in global environmental analysis, which stems from a false decoupling between economic and production systems as observed in most developed nations, which results in improved territorial emissions of these developed countries at the expense of developing countries.

Ecological unequal exchange is one such contemporary ecological economic concept that is used to highlight such asymmetric transfer of embodied natural resources and biophysical indicators between countries. Attempts at environmental impacts reduction efforts has largely focused on carbon emissions but given the complex supply chain created through globalisation and international trade, it is important to consider other important metrics such as land and water use alongside carbon emissions to drive environmental policies that will historically address ecologically unequal exchanges. For developing countries in Africa where the dependence on land use and water use for agricultural activities are crucial to the development of national economies and in combating poverty, an assessment of these metrics has become even more paramount.

Against this backdrop, the current work draws upon the theoretical constructs of multi-regional input-output (MRIO) framework to trace country specific sectorial-level flows of the aforementioned metrics between a representative developed nation, UK, and 27 African regions in order to fully examine their ecological exchanges. Key findings in the study suggest that for water consumption and land use, there is a net externalisation of these impacts for all the 27 African regions by the UK. It was also determined that the extent of the imbalance between the UK and the African region is exceedingly far greater for water consumption. It is recommended that in formulating a robust multi-national environmental policy where so many factors are at play, country specific and industry targeted approach to ecological unequal exchange between nations provides better and improved insight into addressing ensuing environmental issues.

1. Introduction

The leakage of carbon emissions as well as the deficit created due to the consumption of natural resources by one country in another as a result of international trade and the flow of goods and services can be described as an imbalance in the ecological exchange between the participating countries. This has been described in the literature as ecological unequal exchange (Emmanuel, 1972; O'Connor and Martinez-Alier, 1998; Jorgenson et al., 2009; Howell et al., 2013; Moran et al., 2013). Indeed, as a result of globalisation and the consequent shift in productions systems mainly from developed to developing and emerging economies, there has been a global increase in

embodied emissions from the production of internationally traded goods and service. The World Resource Institute, WRI (2016) recently reported that 21 countries; mainly developed and Western nations are reducing carbon emissions whilst witnessing growth in their gross domestic product (GDP). For instance, in the UK, between 2000 and 2014, there was a 20% reduction in carbon emissions with a corresponding increase in GDP by 27% within the same period (WRI, 2016). These figures highlight a case of false decoupling that is usually created between economic and production systems in most developed nations. This is because of the tendency of developed countries shifting the polluting aspects of their production system to countries where environmental legislations are less stringent thereby improving the

* Corresponding author at: Centre for Energy, Environment and Sustainability, University of Sheffield, Sheffield S10 1FL, UK.
E-mail address: epoppon1@sheffield.ac.uk (E. Oppon).

environmental profile of the developed nations at the expense of the developing ones (Koh et al., 2016).

Contemporary research on ecological unequal exchange is growing and it seeks to inform international environmental policies (Lachapelle and Paterson, 2013; Yu et al., 2014). In particular, national and the international community has placed a lot of emphasis on it, in relation to anthropogenic GHG emissions because of its direct linkage to climate change (IPCC, 2014). This paper however argues that within the very complex global supply chain created by globalisation and international trade, ecologically unequal exchange extends far beyond carbon emissions alone and that for a holistic environmental policy to developed, other important metrics such as land use and water consumption must be measured alongside carbon emissions. This notion of multi-metric measurement strategy is particularly important in the context of developing countries in Africa where the dependence on land use and water consumption for agricultural activities are crucial to the development of national economies and in combating poverty and improved livelihood.

Drawing on the assessments and analysis made in this paper, it is argued that for developing countries in Africa, carbon intensive products do not dominate exported products and services to developed nations. As such, the paper reveals that implications of ecological unequal exchange in terms of land use and water consumption far outweighs that of carbon to African regions and that this must be reflected in the national policies of developed nations. This paper is further driven by the fact that although research on international trade and associated environmental impacts such as on embodied carbon emissions (Marques et al., 2013; Ren et al., 2014; Ibn-Mohammed et al., 2013), land use (Weinzettel et al., 2013; Kastner et al., 2014), water consumption (Chen and Chen, 2013; Tamea et al., 2014), and in some limited instances a combination of these environmental impacts, has been demonstrated (Wiedmann et al., 2015; Acquaye et al., 2017a, 2017b). However, these studies are not usually specifically targeted at vulnerable regions such as Africa. Rather, they are very often focused on emerging economies such as China (Yu et al., 2014) and in limited cases only cumulative environmental impacts on Africa as a single region are reported from global studies (Moran et al., 2013). This limits the policy formulation insights that can be garnered from such studies. More research with a focus on Africa in terms of carbon trading, unequal exchanges and other related issues that stems from the impact of climate change is therefore required. This view is echoed by Reddy (2011), p21 who submitted that “Africa is currently marginal to the carbon market, and the carbon market has been irrelevant to the continent’s efforts to tackle climate change”. At present, only a few benefits has been gained by Africa in terms of economic globalisation and this is further worsened by the fact that the continent’s economies continue to rely on a handful of primary goods and services whose prices are determined externally. This unequal allocation of resources, access and development extends to policies pertaining to climate change given that Africa’s interests have remained peripheral to their implementation (Reddy, 2011).

Against this backdrop, an in-depth analysis focusing on individual countries and regions in Africa with respect to their individual sectoral entities is therefore pertinent. Such active research on the aforementioned themes can facilitate and improve the understanding and role in the context of Africa whilst offering assistance in constructing effective and viable solutions to the problem of climate change. It will also put into perspective the extent to which the Africa continent is performing regarding climate change issues with the view to encourage its participation in the global economy as producers of good and services for which other countries (e.g. the UK in this case) benefit from. This is important given that at the moment, the marginalisation of the continent as producers and consumers of goods reveals a relatively low per capita resource use, which translates into low ecological and carbon footprints. This assertion is in line with the study by Moran et al. (2013), who reported that the ecologically unequal exchange

phenomenon usually occurs as a result of the extraction of natural resources from resource-rich but cash-poor countries (as is the case in Africa) used to provide goods to satisfy consumer demand in wealthy countries.

To undertake these developments, this paper draws on the theoretical constructs of multi-regional input-output (MRIO) framework (Miller and Blair, 2009); a model which has been widely used for environmental sustainability accounting (Ibn-Mohammed et al., 2014; Acquaye et al., 2017a, 2017b) to trace country specific sectoral level flow of carbon, land use and water consumption embodied in goods and services between a developed nation (exemplified by using the UK in this case) and 27 African regions. This allows for a full-scale examination of ecological exchanges between the regions. The detailed analysis presented shows that in multi-national environmental policy where so many factors are at play, country specific and industry targeted approach to ecological unequal exchange between two nations provides better insight into addressing ensuing environmental issues.

In light of the above, the rest of the paper is organised as follows: in Section 2, a succinct review is presented by exploring the relevant extant literature on international trade and ecological unequal exchanges. Section 3 highlights the methodological framework and data sources adopted for the analysis presented in this study. In Section 4, the results of the ecological unequal exchange modelling processes are presented alongside policy implications leading to the concluding remarks in Section 5.

2. Literature Review

2.1. Global Supply Chain Networks

Due to globalised production and consumption patterns, supply chains networks have become multi-regional in nature (Coe et al., 2008) because they constitute an integrated economic system, cutting across multiple national boundaries (Johnson and Noguera, 2012). The global production network involves the flow of resources and the consumption of goods and services produced in a given country and consumed in another country. The implication of this from an ecological economics point of view is that there are ecological (e.g. material, water, land use, etc.) exchanges between countries which may result in imbalance in environmental impact, a phenomenon that is collectively termed ecological unequal exchange (Emmanuel, 1972, O’Connor and Martinez-Alier, 1998, Jorgenson et al., 2009, Howell et al., 2013, Moran et al., 2013).

Although ecological economics theory and practice emphasise the fact that economic and production systems cannot be separated from the environment (Costanza, 1984; Harte, 1995; Asafu-Adjaye, 2000), it has been acknowledged that in most developed nations, there is a false decoupling created between economic and production systems and the environment (Peters et al., 2011a, 2011b). This is because, the production systems of most developed nations which are sometimes energy and resources intensive have been shifted to developing countries, resulting in a corresponding shift in environmental burden and ecological damage. This is a case of environmental injustice and has prompted the Department of Environmental, Food and Rural Affairs (DEFRA) to submit that for a country such as the UK to achieve sustained growth, it will require a decoupling of its economic growth from its environmental impacts, both at the national and global level (Foster et al., 2007).

Drawing on Peter Drucker; the American management guru’s saying that “What gets measured gets managed”, we argue that, the measurement of the UK’s ecological exchange with one of the world’s most sustainable vulnerable regions, Africa, can inform its environmental policy towards actualising its long term sustainable development goal. Per the principles of Positive Accounting Theory (Watts and Zimmerman, 1986) applied within the context of environmental disclosure and accountability (Setyorini and Ishak, 2012), the UK should also be reporting on such indirect environmental impacts as it will put it

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