Creating a sustainable economy in the UK— a case study of macroeconomic and socio-economic consequences of “green” policies in the energy supply sector

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Agenda

1. Research context
2. Research question & objectives
3. Scope of the study
4. Model
5. Next steps
Research context
Climate change and political challenges in the UK context

1. In the “Climate Change Act 2008”, the UK committed to a 80% reduction of Greenhouse gases until **2050** against 1990 baseline (UK Government, 2008);

2. The **fifth ”carbon budgets”** commits the UK to limit its carbon emissions by 57% until **2030** on 1990 levels (Climate Change Committee, 2016);

3. At the same time, the UK aims at generating a high **GDP**, high **employment** and **low inequality**, and at staying **internationally competitive**;

4. Current analytical tool give only to a **limited extent information** on how and at **what “costs”** those targets can be reached.

*There is currently a demand among policymakers for analytical tools that give answers how and at what financial and non-financial “costs” these various targets can be reached.*
Research context
Current modelling approaches

1. CGE-models (e.g. UK MACRO MARKAL model, HRMC CGE-model):
   a) This type of models generally involves restrictive assumptions such as, the assumption of **cleared markets** in the long-run (equilibrium assumption), and **rational** and **perfectly informed agents**.

2. Econometric macro-models (e.g. E3ME from Cambridge econometrics based on a Post-Keynesian perspective):
   a) Forecasts are based on **historical data**; and hence behaviour in the future can not go beyond observed behaviour in the past.

3. Both approaches focus on **linear correlations**, rather than on causal links (underlying structure), **non-linearity** and **feedback loops** btw. different systems (complexity).

A different modelling approach (system dynamics) can bring complementary additional insights, that are useful for policy implementation.
Research question and objective

In 2014, the energy supply sector was the single largest source greenhouse gases, accounting for 31% of the total emitted emissions in the UK (DECC, 2016).

Research questions related to the political context:

1. Which climate policy (e.g. emission taxes, regulations, risk-free interest rates) for the UK energy supply sector lead to reaching the stated UK climate targets for the energy supply sector and maximize at the same time “social welfare” (as defined in this study) in the UK?

2. What are the macroeconomic and the socio-economic consequences of the “efficient/best” climate policy in the UK energy supply sector?

Methodological research question:

1. What are the implications of some of the assumptions (e.g. equilibrium-assumptions, perfect foresight) inherent in the Classical General Equilibrium (CGE) Macro MARKAL model on the recommendation of climate policies and consequently on “social welfare”?
Limitations

*The study does not include an analysis about ...*

1. ... the optimal level btw. economic output and emission reduction based on damage costs;
2. .... avoided costs due to climate damage;
3. ... ... the measurement of social welfare (well-being) and the usefulness of GDP (used as an economic performance indicator);
Consumption sector:
- Consumption (by sector)
- Savings

Production sector:
*Demand led, but restricted by available production inputs*
- GDP (by sector)
- Desired Labour, Capital and Energy
- Price sub-sector (CPI)
- Emission calculation sub-sector

Labour market sector:
- Employment / Unemployment
- Wage rate
- Population chain (working age population)

Model

Interest rate

Money supply (savings)

Interest rate / Av. capital

Money demand

Energy demand

Energy Prices

Energy demand

Energy Prices

Central bank policy

Perceived risks for new and established technologies

Different energy supply technologies

Investments per energy supply technology

Endogenous technological change by simulating learning by doing

Orders

Goods 

&

services

Labour supply

Wages

Desire Labour

Wages
The finance gap of “green” energy infrastructure

- What is the “green finance gap”? 
- Current modelling approaches

The “green” finance gap of energy infrastructure in the UK:

- The implementation of a “low-emission” strategy for the UK power sector requires additional finance of sustainable energy production capacity (DTI, 2007);
- DECC (2012) estimates required investments of £77 bn (or £110 bn if transmission & generation are included) by 2020 and £140bn by 2030;
- Traditional sources of capital (e.g. project finance, infrastructure funds) are not enough;
- Additional funding sources, e.g. from institutional investors (e.g. pension funds, insurance companies) or private investors (e.g. mainstream investors) is required to cover the „green“ finance gap (OECD, 2016; Irena, 2016).
The finance gap of “green” energy infrastructure

• However, currently private and institutional investors are not investing into „green“ energy infrastructure due the following barriers (e.g. Jones, 2015; OECD, 2016; Irene, 2016):
  • Policy and regulatory risk
  • Limited experience in the sector
  • Limited financial and technical advice
  • Availability of investment-ready projects
  • Limited access to capital (and relatively high up-front costs of renewable construction projects)
  • Insufficient investment size and high transaction costs
  • Financial regulations restraining illiquid and riskier investments
Modelling the finance gap of “green” energy infrastructure

Current modelling approaches:
- CGE-modelling: Money supply is fixed and interest rates given by the central bank;
- All current models: The financial sector is missing; there is not yet an approach to model the perceived project risks by investor and the credit-worthiness of projects
  - However, those factors determine the interest rates and availability of capital!

„The key aspect that needs improvement in both models (E3ME-FTT; GEM-E3-FIT) is to represent the perception of risk and the perceptions of future markets by investors and financial institutions in different types of ventures (e.g. low-carbon vs. high-carbon), and how the cost of finance varies across the types of investments.

(European Commission, 2016)

This PhD intents to closing the modelling gap by simulating investor decision from a behavioural and bottom-up approach.
Next steps

• Development of the financial sector from a “bottom-up” perspective:
  • Analysis of the most important investor-types that are especially appropriate for investing in “green” energy infrastructure;
  • Trying to understand the “mental” model of those investor types;
  • Setting up a survey and investors to ask about their reasons for investing in certain project, but not in others (such as “green” energy infrastructure).
Overview

What

Out of equilibrium system dynamics model grounded on a micro level firm and supply chain management theory and focus the transition of the UK energy supply system, and implication for “social welfare”.

Purpose of the model

1. Determining efficient policy recommendations (e.g. taxes vs. regulations) for the "green" transition of the UK energy supply system;
2. Evaluation of consequences of green policies aimed at the sustainable transition of the UK energy supply system.

Key assumptions

• It takes emission targets for the UK energy supply sector as given; and assumes that they are not affected by the “Brexit”;
• This study takes different assumptions on how to measure social welfare through quantitative indicators;
• No environmental damages are taken into consideration.

Model boundary

• Traditional macroeconomic sectors
• Energy supply sector (from a bottom-up perspective)
• Finance sector
• Simulation time horizon 2032 (and 2050)
Thanks for the attention!

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