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Research project: Centre for the Understanding of Sustainable Prosperity (CUSP) – ESRC funded

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Title

Feedback and network system modelling of Annex Parties for addressing structural inequality and role of climate finance towards global sustainability

Extended Abstract

The role of climate finance in the transition towards a sustainable global economy has taken more and more importance in the last decades as demonstrated within the various Conference of Parties till COP23 in Bonn 2017. Global system models based on feedback and networks have the capability of addressing the needs of the United Nations Framework Convention on Climate Change (UNFCCC) at the macro-level, particularly based on the representation of Annex parties and inequality among those. In particular, 49 parties classified as the least developed countries by the United Nations are considered having limited capacity to respond to climate change as well as non-sufficient resources to adapt effectively to it (UNFCCC 2017). Annex I and Annex II parties, and the emergent Brazil, China, Russia, South-Africa are called to provide such resources through international aids. However, models able to address the effectiveness of such investments have to be developed to facilitate such a global scale transition.

Within the Centre for the Understanding of Sustainable Prosperity (CUSP) we are engaged in the development of simulations models which foundations is on the use of feedback loop concept to study macro-economic dynamics and transitions towards a sustainable and prosperous world. With particular focus on structural inequality, social policies, climate change, resources limits and trade, the models aim at supporting the definition of narratives that can be brought under discussion at the UK government level by mean of the newly formed Limits to Growth All Parties Parliamentary Group (CUSP 2017, Jackson 2016).

The conceptual model presented in here is a specific one which allows for the modelling of the global economy, based on the flexible representation of macro-regions (groups of countries in aggregated form) connected as system networks to analyse systemic risk dynamics emerging from their interaction. Each generic macro-region will rely on the system dynamics economic-resource model

that will be available in Pasqualino and Jones in early 2018. There exist several combinations of macro-regions that can allow for the assembling of a full global economy. In the conceptual model of Climate Finance proposed in here, we use a variant of the UNFCCC Annex Parties to the Convention Division. In particular, we represent the world as composed of three macro-regions: (i) Annex I countries, (ii) Brazil, Russia, China, and South-Africa, and (iii) the rest of the world which include the less developed countries which are resource limited to face climate change effectively. The final aim is to provide policy makers with a systemic risk assessment tool that can support the evaluation of various economic stresses and possible cascading impact on the rest of the economy.

The methodological foundations of the within macro-region model rely on the System Dynamics National Model framework as proposed by Forrester during 1970s (Forrester 1976, Forrester 1980). One simplified version of such a model, used to analyse inflation rise after US peak oil and relative transitions towards non-conventional energy resources, was proposed in Sterman (1981). Our generic macro-economic model consists of an update of Sterman (1981). In particular, the banking system and its relationship with households' savings have been restructured. In this model the role of a central bank, commercial and investments banks has been aggregated in a single agent which is in charge of money supply, setting interest rates, and responsible to defaulted assets from the private sector. The government sector has also been included to collect taxes from every economic agent, and provide those with public expenditures and subsidies. In addition, considerations on the model production function were made to allow for testing scenarios with both neoclassical and heterodox economic approaches. A balance sheet for the representation of every financial transactions has also been adopted, and stock and flow consistency has been assured. The model has been applied to the transition of a generic economy towards a green economy, accounting for feedback loops between energy and agricultural sectors. Figure 1 represents the division in macro-sectors of our generic resource-economic model.

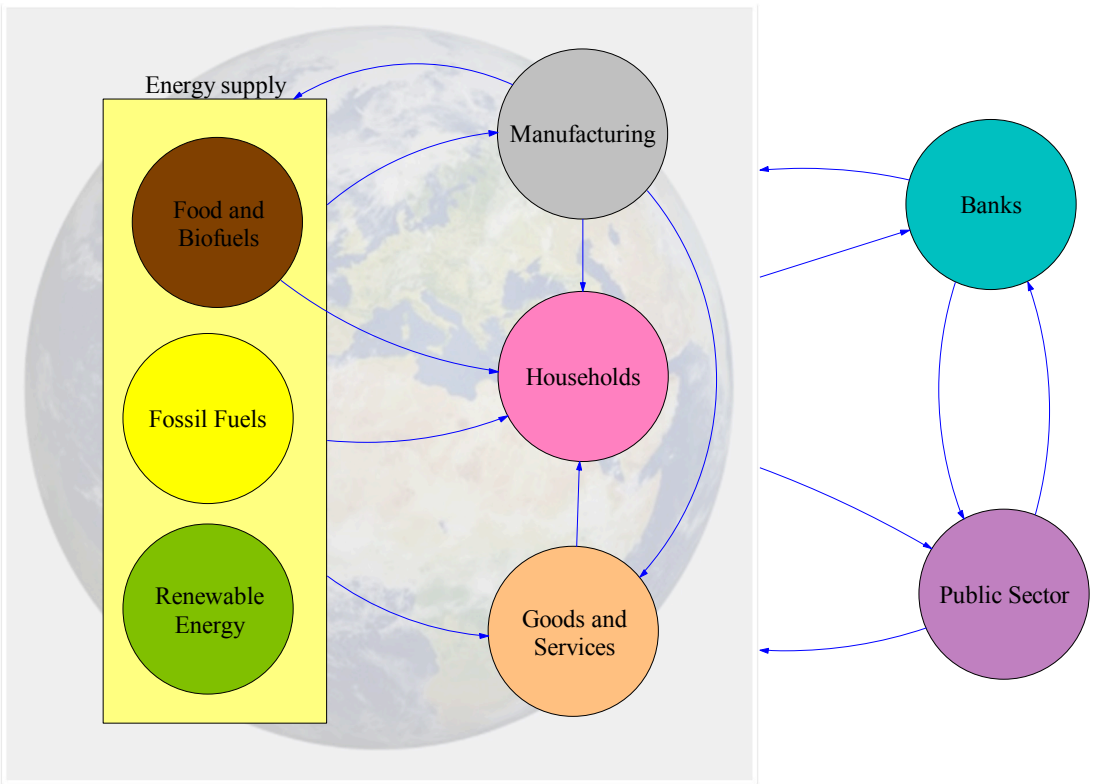

Figure 1 – Sectors representing a generic macro-region within the model

The final model can be considered as a general disequilibrium model of the economy, which relies on the use of non-linear relationships for defining structural relationships among variables. Exogenous variables include population growth, technological change, as well as the limits to growth as the natural extremes of the global economy. The dynamics of business as usual growth have been placed as the foundation of the economy, relying on both public stimuli from government (Keynesianism), financial leverage from central banks as money supplier (Chicago School of Economics), and relying on population growth and income rise as increase in demand. The endogenous variables represented in the model include GDP, consumption, investments, savings, commodity prices (both real and nominal), wages (both real and nominal), inflation rate, labour, employment and unemployment, interest rates, default rate, money supply, debt and borrowing rate, energy production, agricultural land, food production and biofuel production among others. The final structure can be easily calibrated based on available public historical data (World Bank, International Monetary Fund, International Energy Agency, Food and Agriculture Organization), to represent the overarching dynamics of a generic macro-region. Econometric analysis has also been performed for the estimation of critical parameters in order to support meaningfulness in the calibration.

In order to model the interconnection among macro-regions, data are taken from UNFCCC database relying on the methodology proposed by Buchner et al. (2017), to describe overall dynamics in climate finance initiatives and possible results on Inequality of capabilities in the green economic transition in current business as usual scenario. The model will allow for climate stress test, including climate shocks, analysis of stranded assets, and sustainable policy making, and possible implication for economic adaptation and global inequality. As initial prototype, this works also aims at being an effort towards a global network climate finance model to support global sustainability transition.

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