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Constructing a multi-sectoral SFC model including the energy sector

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Abstract: This paper describes the design and implementation of a stock-flow-consistent (SFC) model constructed to investigate the impact of the energy sectors (initially, gas and electricity) on the economy as a whole. The transition to renewable sources of energy will require higher levels of both publicly and privately funded capital investment, quicken the process of capital depreciation for current capital, and affect sectoral rates of growth in labour productivity. Specifically, the model will simulate impact of these shocks on the inflation rate, consumption, and shifts in income distribution. The model includes households, firms, and the government and foreign sectors. Analysing the impact of carbon offset policies is outside the scope of this study, although the model could later be extended to perform this task.

Data from 2019-2020 Input-Output tables (5209.0.55.001 Australian National Accounts: Input-Output Tables, 2019-20) has been aggregated into the following industry groups: (i) Agriculture and mining (groups 01-09); (ii) Manufacturing (groups 10-25); (iii) Electricity (group 26); (iv) Construction (groups 30-32) - “C”; (v) Water, gas, waste, trade and all services (groups 27-29 and 33-95) - “S”.

The aggregated input-output table has then been transformed to type I Leontief inverse matrix in order to calculate how much of each industry’s output is needed (directly and indirectly) to produce one unit of a given industry’s output. The calculations are done using the nominal (monetary) values of products. In order to calculate quantities of “representative” commodities demanded and produced in a time period, price indices can be used. It is assumed that price indices are equal to 100 in year 2019-2020. Furthermore, it is assumed that industry groups produce homogeneous representative goods.

The five-sector production sector model is embedded within a demand-driven SFC model, originally based on GROWTH from Chapter 11 of Godley and Lavoie (2007). The model has been extended to allow for the simulation of shifts in income distribution, by distinguishing between low-income and high-income households. A fixed fraction of demand is satisfied by high-income households, supplying “complex labour” This fraction together (with a chosen rate for distributed profits) is one of the key income distribution parameters, slowly changing in time. The Modigliani-like aggregate consumption function defined in Godley and Lavoie (2007) has been modified to better accommodate the effects of productivity changes. Each year, high-income households are assumed to consume a fixed fraction of their expected stock of wealth, expressed in labour time. In contrast, it is assumed that low-income households are obliged to consume all their income. In accordance with the models described in Godley and Lavoie (2007), prices are assumed to be “cost-determined” within each of the production sectors (normal cost pricing). In addition, simplified interactions with the global economy are imposed – with a significant fraction of manufactured goods being imported, while the products of the mining and agricultural sectors are partially exported.

REFERENCES

Godley, W., & Lavoie, M. 2007. Monetary economics: An integrated approach to credit, money, income, production and wealth. Palgrave Macmillan.

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