The Modern Environmental Macroeconomics

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DSGE Models of the Economy-1

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- It uses artificial model economies that, although simple, can mimic important aspects of the behaviour of actual economies through time.
- The main determinant of economic outcomes is agents' dynamic decision problems.

DSGE Models of the Economy-2

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2. second, we use this model to generate simulated time series,
3. third, we confront these generated time series with analogous statistics from the actual economy under study and,
4. finally, we use the simulated model to do various (policy) experiments.

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- These models (known as RBC models), in contrast to old-style, Keynesian macroeconometric models, are based on microfounded, optimizing behavior and a general equilibrium framework.
- They focused mainly on the impact of technology shocks (see Plosser, 1989) and showed that business cycle research is possible without being subject to the Lucas critique.

The baseline RBC model-1

- A single consumer-producer chooses a utility maximizing consumption profile:

$$E_t \sum_{t=0}^{\infty} \beta^t u(c_t) \equiv E_t \sum_{t=0}^{\infty} \beta^t \log(c_t) \tag{1}$$

subject to the following budget constraint:

$$c_t + k_{t+1} - (1-\delta) k_t = A_t k_t^{\alpha} \tag{2}$$

The baseline RBC model-2

- The above maximization problem gives the following pair of dynamic equations:

$$E_t c_{t+1} = \beta E_t c_t \left(1 - \delta + \alpha A_t k_t^{\alpha - 1}\right) \tag{3}$$

$$c_t + k_{t+1} - (1 - \delta) k_t = A_t k_t^{\alpha} \tag{4}$$

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- Regarding cycllical component, z_t, it is usually assumed that $z_t = \rho z_{t-1} + \varepsilon_t$.
- Hence, the stochastic productivity is the only source of uncertainty in the economy and is the engine of the Real Business Cycle doctrine.

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- Nowadays, these methods are widely used in work on fiscal and public finance policy, monetary economics, international economics, labour economics, asset pricing, political economy, etc.
- Recent macroeconomic models also include market imperfections, policy failures, several shocks, etc.
- These models, known as dynamic stochastic general equilibrium (DSGE) (for reviews, see e.g. Cooley and Prescott 1995, King and Rebelo 1999, Rebelo 2005, McGrattan 2006, Kydland 2006).

DSGE models-2

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- A DSGE model is able theoretically to account for inter-connections between different sectors of the economy and can identify sources of fluctuations, answer questions about structural changes, assess the impact of policy changes, perform counterfactual scenarios etc.

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- The equations describing these blocks have been derived by microfoundations which in turn are based on specific assumptions regarding the behavior of the main economic players in the economy, such as households, producers, banks, monetary and fiscal authorities.
- These agents interact through markets that may clear or not every period, and this is the process that leads to the "general equilibrium" nature of these models.

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- Third step, as this system usually does not have a closed-form analytical solution, we need to approximate the solution in the neighborhood of a given point, in most cases the non-stochastic steady state. So in this step, we determine the non-stochastic long-run equilibrium of the model economy.

Solution methodology-2

- Fourth step, we either (log-)linear approximate the system of non-linear stochastic difference equations around the steady-state leading to a system of linear difference equations in state-space form and we solve this system with the help of the usual procedures, or we take a second (or higher) order approximation of the same set of equations around the steady-state.

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- Sixth step, we calculate the variances and conduct a variance decomposition of the underlying shocks and impulse response functions of the variables of interest.
- Finally, we evaluate the model by looking at measures of fit to the data.