Keynes and the Robots.

An agent-based macroeconomic model

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Keynes, the Classics, Walras... and Pasinetti

- Pasinetti’s distinction:
  - Exchange economy (Marshall, Walras, neoclassicals)
  - Production economy (Smith, Marx, Schumpeter)

- Keynes made the transition in the early 1930s when he moved from “the pure theory of money” to “the monetary theory of production” in his Cambridge lectures (Pasinetti)
Exchange or production?

• In an exchange-based model, endowments (of production factors) determine the outcome.
• In a production-based model, the organization of production and endogenous accumulation of production factors determine the outcome.
Keynes’ transition

- Exchange $\rightarrow$ production
- Prices as signals of scarcity $\rightarrow$ institutions for markets
- Static equilibrium $\rightarrow$ dynamic analysis

- The multiplier as a guiding economic principle
An interpretation of all this

• Core issues are Say’s Law and the multiplier
• Say’s Law: supply creates its own demand
• With nominal wages and investment fixed in the “short run”, if workers spend the entire wage they earn, then
  – There is one price level that clears the market
  – I = S = Profits is an *ex post* identity
• If we want to get out of this “exchange” paradigm, we need to introduce an element of consumption that is independent of current wage income
A break with neo-Schumpeterians and an alliance with Keynesians

• Break Say’s Law by introducing (1) hoarding of current income, (2) “autonomous” consumer spending
• The old idea of the multiplier enables us to do away with Walrasian dynamics of market clearing (or non-clearing)
Foundations of our model – I

• We do not have a price mechanism for the goods market
• Consumption demand of workers depends on current income (MPC < 1) and accumulated wealth assets (past savings that were invested)
• We explicitly model the multiplier
  – A consumer buys a good, which is produced “on the spot”, for which wages need to be paid, these wages are spent (partly) as consumption, ... (until all “intended” demand is “very small” and the period ends)
Labour compensation

- Each period, the wage rate is multiplied with a factor that depends on the debt of the firm
- When debt as fraction of the capital stock is comparatively large (low), the factor is smaller (larger) than 1
- Note that this is a fundamentally different perspective than wages being the price on the labour market
A fundamental question

• Where does “initial” demand for the multiplier come from?

• Our answer (in line with Keynesian thinking) is that initial or autonomous demand comes from investment and from the “monetary sphere”

• This is fundamentally different from current Schumpeterian models (and Keynes-Schumpeter models), which assume that all wages are spent and (thus) contain a form of Say’s Law
Monetary theory

• We rely on Godley and Lavoie’s theory
• Consumers save a part of their income and accumulate it into monetary assets (that earn interest), the stock of these assets influences consumption
• Government debt (bills, in our case) are a key monetary asset, and the quantity in which it is supplied is a key driver of consumption and the macro economy
Foundations of our model – II

• Government debt is financed by issuing bills, for which the central bank sets an interest rate.
• Given this interest rate, and given supply of private bills issued by firms, households demand a certain amount of government and private bills; the central bank buys/sells enough bills to make supply equal to this demand (i.e., maintain the intended interest rate on the bills).
• Supply of private bills (firms) increases by the difference between investment and (gross) profits (i.e., the firms’ current deficit), the latter is determined by demand and the going wage rate.
• Government finances interest payments by a sales tax.
Financial markets in our model

- When the level of debt issued by the firm becomes large (approaches the value of the capital stock of the firm), the probability that the firm goes bankrupt increases.
- With bankruptcy, bills issued by the firm become worthless because the debt of the firm is canceled, this has an effect on the asset stock of workers/consumers and hence on consumption.
- Because of the risk of bankruptcy, households are only willing to hold firm bills if they pay higher interest; the more private bills are supplied, and given the interest on government bills, the higher the interest rate on them will be.
Model sequence

1. The multiplier process runs (employment, consumption and production levels are determined)
2. Interest is paid, and the market for bills is cleared
3. The firm sets desired investment (accelerator) and wages it is willing to pay
4. Wealth-based consumption and investment plans are inputs into a new multiplier process (back to 1, a new period starts)
The business cycle
Investment and interest
Varying parameters – public interest rate
Keynes and the robots

• What will happen to the business cycle if the capital-labour ratio increases drastically?
• The model has fixed labour and capital coefficients, we can increase the capital-labour ratio by increasing the capital-output ratio (3 in base run, we start at 1 for new experiments)
Base run parameter set - volatility

Standard deviation of GDP
Base run parameter set – interest rate
Base run parameter set - bankruptcies
Base run parameter set – employment rate
Does increasing the capital-output ratio always increase employment?

• To test this, we run a different parameter set, in which:
  – A higher marginal propensity to save out of current income
  – A zero marginal propensity to save out of wealth
  – A lower depreciation rate

• We run this with base run financial markets, and with very low interest rate spread (=high lambda1)
New parameter set - volatility
New parameter set – interest rate
New parameter set - bankruptcies
New parameter set – employment rate