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The Real Business Cycle paradigm

The RBC model emphasizes supply (technology) disturbances as the main source of macroeconomic fluctuations in a world with rational individuals and perfectly flexible prices.

I. How did it come into existence?

A. Two empirical findings concerning monetary policy and economic shocks suggested a dominant role for the supply side of the economy and led to the RBC model

a) Most macroeconomic series seem to follow a random walk (Nelson and Plosser, 1981) $\Rightarrow$ Changes in macroeconomic activity are mostly permanent (business cycles have a large permanent component) $\Rightarrow$ AD cannot (?) induce permanent changes in quantities $\Rightarrow$ AS shocks must be behind macroeconomic fluctuations

$x(t) = x(t-1) + u(t) + ... = u(t) + u(t-1) + u(t-2) + ...$

Random walk: Stochastic trend, shocks have permanent effects

b) Money did not seem to matter for economic activity in VARs (Sims):

But what is the instrument of monetary policy?

B. Disatisfaction with the flexible price RE model (Lucas). The informational lags it requires are not plausible

II. An important **methodological** development: Set up, calibration, solution and simulation of stochastic, dynamic, general equilibrium models.

Steps

1. Construct an artificial economy (a model)
2. Derive the optimality conditions (FOC)
3. Compute the steady state
4. Postulate values for the parameters of the model and the distribution of the shocks (calibration)
5. Solve the model numerically as a function of the state variables and the shocks
6. Simulate: Feed in random values for the shocks (according to their distribution) in the derived solutions and generate time series for the variables of interest (output, investment, consumption, inflation...)
7. Calculate various moments of the joint probability distribution of these artificially generated time series (variances, covariances, autocorrelation..)
8. Calculate the same moments using actual data (stylized facts)
9. Model evaluation: Compare the two sets of moments

III. Main difficulties:

a) Selection of parameter values (calibration)

b) Technology shocks are unobservable. How large are they in reality?

The model needs large and persistent shocks in order to deliver satisfactory results

Computation of technology shocks

The Solow-Prescott residual: Supply shocks = Multifactor productivity

$Y_t = Z_t K_t^{\ a} H_t^{\ 1-a}$

$z_t = y_t - ak_t - (1-a)h_t$

Problems with the Solow residual

1. It can be forecasted using irrelevant things (military spending, monetary variables..)

2. It generates an unreasonably high probability of technological regression (40%)

3. It is contaminated by labor hoarding, capacity utilization, imperfect competition

c) Is the supply of labor sufficient elastic (intertemporal vs intratemporal)?

d) Dynamics (Lack of internal propagation mechanism)

e) Lack of formal statistical validation of theories

Empirical performance: How well does the standard RBC model match the behavior of actual economies?

A great deal of success. The biggest problems are found in accounting for labor market behavior (e.g. for the lack of correlation between the real wage and employment)

Some other properties

Irrelevance of money for real economic activity (neutrality)

Optimality of business cycles (voluntary unemployment, creative destruction

<u>Unemployment</u>

Worker-job mismatch. Job creation and destruction.

Business Cycle Stylized Facts

Lucas: Business cycles are all alike

Volatility

- Consumption of non-durables and services fluctuates much less than output
- Consumption-production of durable goods exhibits greater volatility than output
- Government expenditure is less volatile than output
- Investment fluctuates much more than output
- Capital is much less volatile than output, but capital utilization in manufacturing is more volatile than output
- Total hours worked are about as volatile as output
- Employment is as volatile as output but hours per worker are much less volatile than output. That is, fluctuations in hours are due more to fluctuations in employment than to fluctuations in average hours
- Labor productivity is less volatile than output
- The real wage is much less volatile than output

Comovements

- Most macroeconomic series are procyclical (positive contemporaneous correlation with output)
- Output across sectors moves together
- Total hours worked and aggregate output are very highly correlated
- Wages, Government Expenditure and the Capital Stock are un-correlated with output (acyclical)
- The trade balance is countercyclical
- Short term nominal interest rates, monetary aggregates and inflation are procyclical
- The general price level is countercyclical
- The real interest rate is countercyclical

Persistence

All macroeconomic aggregates display substantial persistence (about 0.9). This implies business cycle predictability

A successful theory of the business cycle ought to conform to the stylized facts

Some growth stylized facts

- Stability of the great ratios

Investment/Output, Labor Income/Output, Consumption/Income

Implication: Similar rate of growth in many variables (common trend)

- Constancy of hours per person

- The model
- The driving process (quarterly data)

$$z_t = r \bullet z_{t-1} + e_t \qquad z = \log Z$$
$$r = 0.979 \quad s_e = 0.0072$$

- Solution
- Results

Some key points

The importance of inter-temporal elasticity of substitution in labor supply

The labor market implications (strong pro-cyclicality of the real wage)

The counter-cyclicality of the aggregate price level

The requirement of large and volatile technology shocks

Extensions:

a) To deal with labor market shortcomings of RBC predictions

1. Lack of correlation between employment and the real wage

2. Variation in total hours is due to variation in employment rather than in hours worked per person

The RBC model fails to match these two fact because it uses a very high labor supply elasticity (around 4). The micro evidence suggests a much smaller number

Intensive vs extensive margin in employment variation.

- Labor supply shifts

Indivisible labor

Household production

- Additional shocks

Fiscal policy u(c,g) g ↑ T ↑ c↓ leisure ↓ work ↑

Monetary policy

- Other

Wage contracts

b) To deal with the Solow residual

Variable capital utilization

$$Y_t = Z_t (m_t K_t)^a (X_t H_t)^{1-a}$$
$$K_{t+1} = (1 - d(m_t))K_t + I_t$$

Result: Variable utilization scales down the volatility of the Solow residual. But it still generates sufficient output volatility

$z_t = y_t - a(k_t + m_t) - (1-a)h_t$ proxy for m: electricity utilization