Modern Growth Theories
Lecture 3

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Schools of macroeconomic thought

- The orthodox Keynesian and orthodox monetarist schools
- The new classical, real business cycle and new Keynesian schools
- The Austrian and Post Keynesian schools

Keynes (1936), *The General Theory of Employment, Interest and Money*

- The birth of modern macroeconomics.
- The analysis of the interplay between the goods, labour and money markets.
- Provided a robust explanation of a mass unemployment and offered an attractive political action programme for the resolution of the diagnosed problem.
- The authorities can, and therefore should use discretionary fiscal and monetary policy to stabilize output and employment at their full employment levels.
- Failed to deal adequately with the problem of stagflation in the 1970s.

- **Monetarism** was better able to explain the empirical anomaly of stagflation in a more consistent fashion.
- The collapse of a stable demand for money function in the early 1980s undermined monetarism.
- The early 1970s **- new classical school** cast doubt on whether traditional Keynesian aggregate demand management policies can be used to stabilize the economy.
- Policy ineffectiveness proposition, the Lucas critique and time inconsistency.
- Rational expectations, the role of aggregate supply.

- The 1980s - real business cycle models vs new Keynesian models
- **Real business cycle models** - there is no need for stabilization policy, monetary factors are irrelevant in explaining fluctuations, monetary policy can’t be used to influence output and employment even in the short run. Governments shouldn’t attempt to reduce fluctuations in output and employment, which are Pareto-efficient responses to shocks to the production function.
- **New Keynesians** argue that there is a need for stabilization policy as capitalist economies are subjected to shocks from both the demand and supply side of the economy, which cause inefficient fluctuations in output and employment.

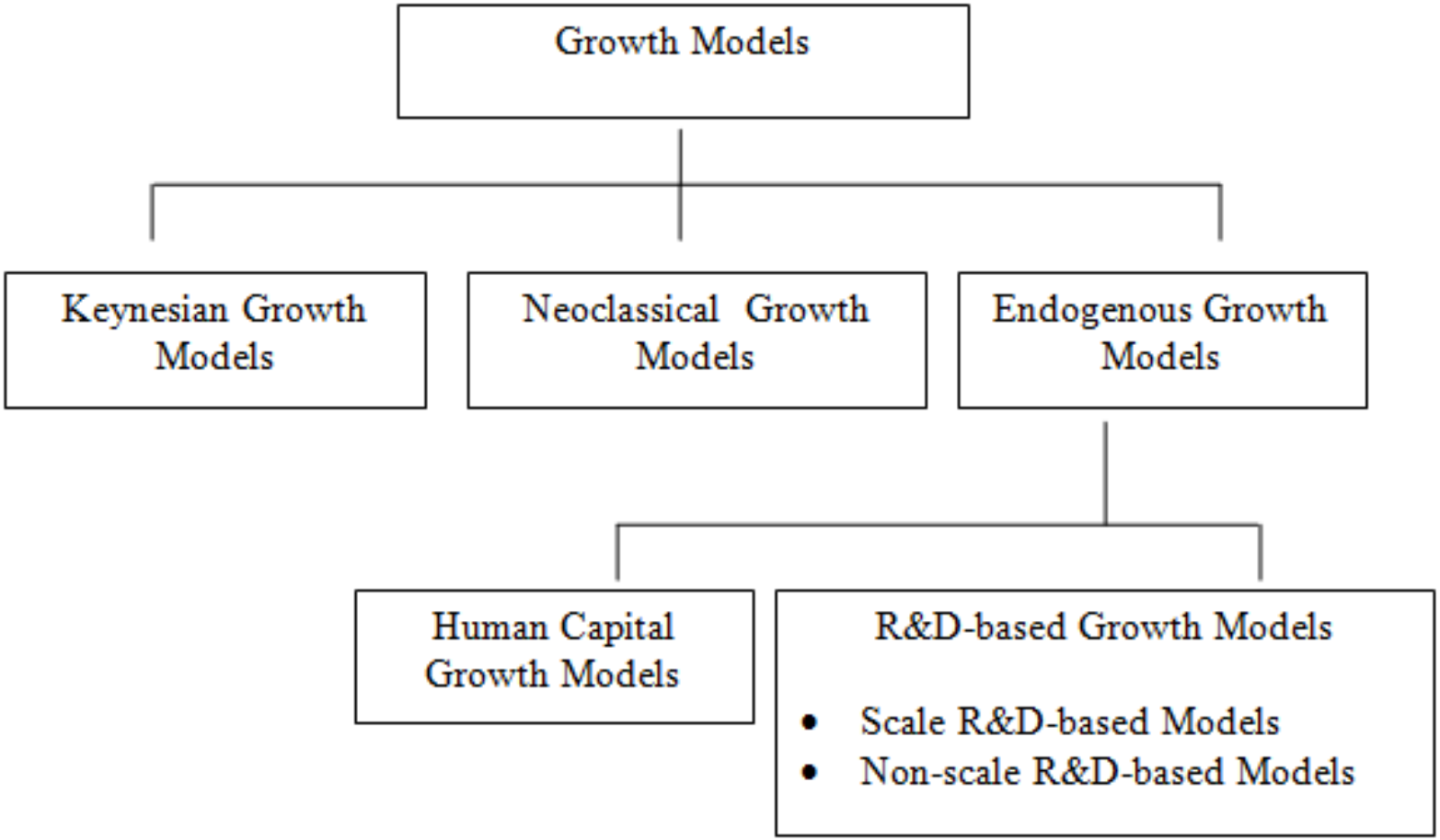
Schools in macroeconomics	*Dominant source of instability*	*Expectations*	*Price/wage adjustment*	*Market adjustment*	*Notion of equilibrium*	*Dominant time frame*	*Rules v. discretion*
Orthodox Keynesian	Fluctuations in autonomous expenditure	Adaptive	Emphasis on nominal wage rigidity	Weak	State of rest probably below full employment	Short	Discretion
Orthodox monetarist	Monetary disturbances	Adaptive	Flexible	Strong	Market clearing at natural rate	Short and long	Rules
New classical	Monetary disturbances	Rational	Perfectly flexible	Very strong	Market clearing at natural rate	Long = short	Rules
Real business cycle	Supply shocks (mainly technological)	Rational	Perfectly flexible	Very strong	Market clearing at moving natural rate	Long = short	Rules
New Keynesian	Demand and supply shocks (eclectic)	Rational	Emphasis on price rigidities	Slow	Consistent with involuntary unemployment	Predominantly short	Constrained discretion
Austrian	Monetary disturbances	Reasonable	Flexible	Strong	Tendency towards	Short and long	Rules
Post Keynesian	Fluctuations in autonomous expenditure	Reasonable	Sticky	Very weak	State of rest probably below full employment	Short	Discretion

B. Snowdon, H.R. Vane, 2005, *Modern Macroeconomics. Its Origins, Development, and Current State*

- During the period 1870–1929 economists' research was heavily influenced by the 'marginalist revolution' and was therefore predominantly micro oriented, being directed towards issues relating to the efficient allocation of given resources.
- For a quarter of a century after 1929–33, issues relating to the Great Depression and Keynes's response to that event dominated discussion as the new science of macroeconomics evolved.

- In the period 1939–56 growth theory was dominated by the neo-Keynesian contributions of Roy Harrod (1939, 1948) and Evsey Domar (1946, 1947, 1948).
- In the period 1956–70 growth theory was dominated by Robert Solow (1956, 1957) and Trevor Swan (1956) who pioneered work on the neoclassical growth model.
- The 1970–85 period - business cycle analysis dominated.

- Neo-Keynesian growth models were replaced by neoclassical models as the dominant framework for analysis.
- Neoclassical theories have in turn been challenged by endogenous growth theory since the mid-1980s.
- Renaissance of economic growth research.


Growth Models
Keynesian Growth Models
Neoclassical Growth Models
Endogenous Growth Models
Human Capital Growth Models
R&D-based Growth Models
Scale R&D-based Models
Non-scale R&D-based Models

The renaissance of economic growth research

Source: B. Snowdon, H.R. Vane, 2005, *Modern Macroeconomics. Its Origins, Development, and Current State, pp. 587-588*

- New theoretical insights inspired by the research of Paul Romer (1986) and Robert Lucas (1988); new theoretical tools.
- The availability of a rich array of new data for a large number of countries (Summers and Heston, 1991; Maddison, 2001). Economists have data for most countries which extend back to 1960. Recent empirical research has also focused on patterns of cross country growth.

The renaissance of economic growth research

Source: B. Snowdon, H.R. Vane, 2005, *Modern Macroeconomics. Its Origins, Development, and Current State, pp. 587-588*

- A growing realization that a large number of developing countries, particularly in sub-Saharan Africa, were not ‘catching up’ and converging with the levels of income per capita of the rich OECD economies.
- The sudden and unexpected collapse of the Soviet Union and other ‘Eastern Bloc’ economies at the end of the 1980s focused attention on the relationship between social, political and economic structures and an economy’s capacity to sustain economic growth.

The renaissance of economic growth research

Source: B. Snowdon, H.R. Vane, 2005, *Modern Macroeconomics. Its Origins, Development, and Current State, pp. 587-588*

- Increasing concern during the 1980s that the economic position of the USA relative to other major OECD economies, especially Japan and Germany, was being eroded.
- Concern relating to the causes of the productivity growth slowdown, beginning in the late 1960s/early 1970s, but not clearly recognized until the early 1980s.

The renaissance of economic growth research

Source: B. Snowdon, H.R. Vane, 2005, *Modern Macroeconomics. Its Origins, Development, and Current State, pp. 587-588*

- The rise of information technology and with it the ‘knowledge’ (or ‘weightless’) economy. New national income accounting techniques were needed.
- Increasing awareness of problems relating to the measurement of economic growth and that the true rate of progress is likely to be ‘substantially underestimated’ using conventional estimation techniques.

The renaissance of economic growth research

Source: B. Snowdon, H.R. Vane, 2005, *Modern Macroeconomics. Its Origins, Development, and Current State, pp. 587-588*

- Increasing recognition of the spectacular growth performance displayed by the 'East Asian Tiger' economies as well as the 'growth disasters' and disappointments experienced in many developing economies (sub-Saharan Africa, Latin America and Southern Asia).
- The increasing influence, during the 1980s, of the real business cycle approach to the study of economic fluctuations where the Solow neoclassical growth model is used as the benchmark for studying both fluctuations and growth (Kydland and Prescott, 1982).

Harrod model

- Dynamic extension of the Keynesian analysis of static equilibrium (short-run macroeconomics).
- Harrod and Domar independently developed theories that relate an economy's rate of growth to its capital stock.
- Keynes emphasized the impact of investment on aggregate demand.
- Harrod and Domar emphasized how investment spending also increased an economy's productive capacity.

Harrod model

- Roy F. Harrod (1900-1978)
- *An Essay in Dynamic Theory*, „Economic Journal”, 1939, 49(193), 14-33.

AN ESSAY IN DYNAMIC THEORY

1. THE following pages constitute a tentative and preliminary attempt to give the outline of a "dynamic" theory. Static theory consists of a classification of terms with a view to systematic thinking, together with the extraction of such knowledge about the adjustments due to a change of circumstances as is yielded by the "laws of supply and demand." It has for some time appeared to me that it ought to be possible to develop a similar classification and system of axioms to meet the situation in which certain forces are operating steadily to increase or decrease certain magnitudes in the system. The consequent "theory" would not profess to determine the course of events in detail, but should provide a framework of concepts relevant to the study of change analogous to that provided by static theory for the study of rest.

Harrod model – assumptions

- Closed a two-sector economy (households and firms).
- There is the absence of government interference.
- There is a fixed proportion of capital and labour in the productive process (constant capital-labour ratio).
- The capital coefficient – the ratio of capital stock to income is assumed to be fixed (constant capital-output ratio).
- The marginal propensity to save remains constant.
- The average propensity to save is equal to marginal propensity to save.
- There are no lags in adjustments between investments and creation of productive capacity.

Harrod model – assumptions

- An economy with single commodity Y
- A Leontief technology

$$Y = F(K, L) = \min\left\{\frac{K}{v}, \frac{L}{a}\right\}$$

- To produce one unit of goods we need v units of capital K and a units of labour L, where v and a are numbers.
- Constant returns to scale
- K/Y and L/Y are constant

Harrod model – assumptions

- If the available capital stock and labour force happen to be such that

$$\frac{K}{v} = \frac{L}{a}$$

than all workers and machines are fully employed.

Harrod model – assumptions

- If K and L are such that $\frac{K}{v} > \frac{L}{a}$

then only quantity of capital $\frac{v}{a}L$
is used, and the remainder remains idle.

- Conversely, if $\frac{K}{v} < \frac{L}{a}$

then only the amount of labour $\frac{a}{v}K$
is used and the remainder is unemployed

Harrod model – assumptions

- A fixed-proportions production function, fixed coefficient production function.
- *K/L* is constant if production is efficient.
- In most cases, we will have either excess capital or excess labour. There is plenty of labour, capital is the limiting factor (capital is binding constraint).

$$Y = \frac{K}{v}$$

$$\frac{K}{Y} = v$$

$$\frac{Y}{K} = \frac{1}{v}$$

$$\frac{\Delta Y}{\Delta K} = \frac{1}{v}$$

v – capital-output ratio is constant

Harrod model – assumptions

- A closed economy (no trade or capital flows)
- Savings *S* must be used for investment *I*

$$S_t = I_t$$

Plans to invest equal plans to save – the condition for income and output to be in equilibrium

- A constant fraction of income is saved – *s* the savings rate

$$S_t = s \cdot Y_t$$

Harrod model

- What must be the rate of growth of income for plans to invest to equal plans to save in order to ensure moving equilibrium in a growing economy through time?

- The model describes the mobilization of savings for generating sufficient investment to accelerate economic growth.

Harrod model

- Changes in capital stock comes from investment and the depreciation of the capital stock. Net investment is defined as the change in the capital stock.

$$K_{t+1} = K_t + I_t - \delta \cdot K_t$$

$$\Delta K = K_{t+1} - K_t \qquad \Delta K = I_t - \delta \cdot K_t$$

$$g_K = \frac{K_{t+1} - K_t}{K_t}$$

Harrod model

$$g_K = \frac{K_{t+1} - K_t}{K_t} = \frac{I_t - \delta \cdot K_t}{K_t} = \frac{I_t}{K_t} - \delta$$

$$g_K = \frac{S_t}{K_t} - \delta = \frac{s \cdot Y_t}{K_t} - \delta = \frac{s}{v} - \delta$$

$$\boxed{g_K = \frac{s}{v} - \delta}$$

Harrod model

$$\frac{K_t}{Y_t} = \nu \qquad \frac{\Delta Y}{\Delta K} = \frac{1}{\nu}$$

$$\frac{1}{\nu} = \frac{Y_{t+1} - Y_t}{K_{t+1} - K_t} = \frac{Y_{t+1} - Y_t}{K_t + I_t - \delta \cdot K_t - K_t}$$

$$\frac{1}{\nu} = \frac{Y_{t+1} - Y_t}{s \cdot Y_t - \delta \cdot K_t} = \frac{\Delta Y}{s \cdot Y_t - \delta \cdot \nu \cdot Y_t}$$

$$\frac{1}{\nu} = \frac{Y_{t+1} - Y_t}{s \cdot Y_t - \delta \cdot K_t} = \frac{\Delta Y}{(s - \delta \cdot \nu) Y_t}$$

$$g_Y = \frac{Y_{t+1} - Y_t}{Y_t} = \frac{s - \delta \cdot \nu}{\nu} = \boxed{\frac{s}{\nu} - \delta}$$

Harrod model

$$g_Y = \frac{s}{v} - \delta$$

$\frac{dg_Y}{ds} > 0$ Savings increase growth

$\frac{dg_Y}{dv} < 0$ Efficiency increases growth

$\frac{dg_Y}{d\delta} < 0$ Depreciation decreases growth

Harrod model

$$g_Y = \frac{s}{v}$$

$s = 6\%$

$v = 3$

$$g_Y = \frac{6\%}{3} = 2\%$$

$s = 15\%$

$v = 3$

$$g_Y = \frac{15\%}{3} = 5\%$$

$$\frac{\Delta K}{\Delta Y} = \nu$$

Harrod model

- Capital-output ratio – efficiency with which capital is used, a measure of capital efficiency, a high *v* implies a high increase in capital stock relative to the increase in GDP.
- ICOR – incremental capital-output ratio (the ratio of investments to growth which is equal to 1 divided by the marginal product of capital).
- The higher ICOR, the lower the productivity of capital

$$ICOR = \frac{I}{\Delta Y}$$

Harrod model – assumptions

- Changes in income induce investment
- *ICOR* is a metric that assesses the marginal amount of investment capital necessary for an entity to generate the next unit of production.
- It relates new investment to the change aggregate demand.

$$I_t = ICOR \cdot \left(Y_t - Y_{t-1} \right)$$

Harrod model

$$S_t = I_t$$

The economy is in equilibrium when desired investment equals actual savings

$$S_t = s \cdot Y_{t-1}$$

$$I_t = ICOR \cdot \left(Y_t - Y_{t-1}\right)$$

$$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \frac{s}{ICOR}$$

Harrod model

$$Y_t = \left(1 + \frac{s}{ICOR}\right) \cdot Y_{t-1}$$

$$Y_t = \left(1 + \frac{s}{ICOR}\right)^t \cdot Y_0$$

$$g_Y = \frac{s}{ICOR} \qquad g_Y = \frac{s}{ICOR} - \delta$$

- **The growth rate of GDP is directly (positively) related to the savings ratio**, i.e., the more an economy is able to save – and therefore invest – out of a given GDP, the greater will be the growth of that GDP.

- **The growth rate of GDP is indirectly (negatively) related to the economy's capital-output ratio**, i.e., the higher is ICOR, the lower will be the rate of GDP growth.

Harrod model

- Capital accumulation and savings were the two main ingredients necessary for an economy to grow.

- Economic growth can be accelerated by
  - changing the saving rate
  - improving technology.

Harrod model

- **Actual growth rate** – an economy has some growth rate at which it is actually growing. It may not be steady growth.

- **Warranted (desired) growth rate** is the growth rate at which all savings are absorbed into investments. *Ex ante S* should be exactly equal to the *ex post I*.

- **Natural growth rate** is the rate of economic growth required to maintain full employment.

Harrod model

$$g_Y = \frac{s}{ICOR}$$

- Knife-edge dynamics (boom, inflationary situation)

$$g_a > g_w \quad \Rightarrow \quad \frac{s}{ICOR_{actual}} > \frac{s}{ICOR_{desired}}$$

$$g_a > g_w \quad \Rightarrow \quad ICOR_{desired} > ICOR_{actual}$$

- Investors have to increase *ICOR*, they increase investment, but it leads to g_a increase, gap between actual and warranted growth rates increases.

Harrod model

$$g_Y = \frac{s}{ICOR}$$

- Knife-edge dynamics (recession, unemployment)

$$g_a < g_w \quad \Rightarrow \quad \frac{s}{ICOR_{actual}} < \frac{s}{ICOR_{desired}}$$

$$g_a < g_w \quad \Rightarrow \quad ICOR_{desired} < ICOR_{actual}$$

- Investors think that they have overinvested, and reduce their investment, actual growth rate falls

Harrod model

- When investors/producers think they are producing more they are actually producing less.

$$g_a < g_w$$

- When investors/producers think they are producing less they are actually producing more.

$$g_a > g_w$$

Harrod model

- Harrod concludes that because of wrong reasoning of producers, it is not possible to achieve steady growth.
- Growth in capitalist economy is basically unstable.

Harrod model

- Natural rate of growth – the maximum rate of growth of the economy (long term growth rate of population + neutral technical progress)

$$g_n = g_L + g_T$$

- Full employment $g_a = g_w = g_n$
- Never achieved

Harrod model

- Knife-edge dynamics
- If growth rate of labour force > warranted growth rate – then chronic unemployment
- If growth rate of labour force < warranted growth rate – then chronic labour shortage

Harrod model – weaknesses

- Savings as sufficient (investment is uncertain)
- Rigid assumption of fixed proportions
- No diminishing returns, no factor substitution
- No technological change
- Unrealistic lack of response of ICOR to policy (development raises ICOR)

Harrod model – weaknesses

- Difficult to increase the savings ratio in lower-income countries. Since many developing countries have low marginal propensities to save, countries suffer from a persistent **domestic savings gap.**
- Many developing countries also **lack a sound financial system**. Increased saving by households does not necessarily mean there will be invested.
- Efficiency gains that reduce the capital/output ratio are difficult to achieve in developing countries due to **weaknesses in human capital**, causing capital to be used inefficiently.

Harrod model – weaknesses

- Research and development (R&D) are low in developing countries to improve the capital/output ratio.

- Borrowing from overseas to fill the savings gap causes external debt repayment problems later.

Harrod model

- The simple model was convenient for economic planners seeking a specific target growth rate; the formula could be used to justify the foreign aid and government taxation if private domestic saving was not sufficient.

Harrod model

- Used to calculate financing gaps – how much foreign assistance to achieve a particular rate of output growth?

$$g_Y = \frac{s}{v} - \delta$$

$$g_Y = \frac{s_{private} + s_{public} + s_{foreign}}{v} - \delta$$