

MACROECONOMICS II (ECO00002I)

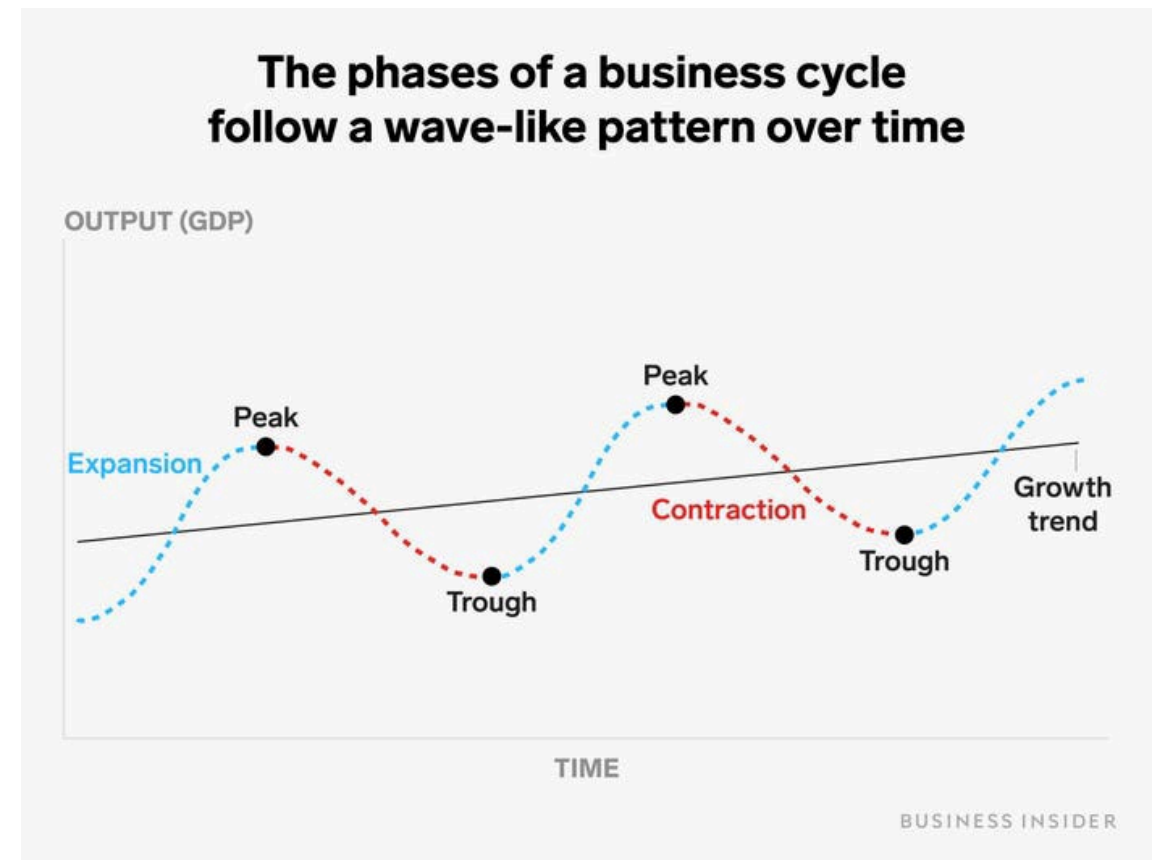
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THE REAL BUSINESS CYCLE SCHOOL

Introduction

- We have already seen in the previous two lectures how the influence of both monetarism and new classical economics questioned the effectiveness of discretionary stabilization policies.
- Such policies were founded on the belief that aggregate demand shocks were the main source of aggregate instability.
- The proponents of both schools of thought emphasized monetary shocks in their explanation of business cycles (fluctuations in GDP around its long-run trend).



Source: [Business Cycle Definition, Its 4 Phases & Effects](#)

Introduction

- The RBC school of thought arose in the 1980s, particularly from the work of:
 - Kydland and Prescott
 - Long and Plosser
- RBC theorists denied that even random shocks to money supply could be a source of business cycles. They proposed only real (i.e. supply side) shocks, not nominal shocks, cause business cycles.
- Their ideas were stimulated by the supply shocks associated with the two OPEC oil price increases during the 1970s.

Learning Objectives

Under this topic, we will learn about:

- The assumptions of the Real Business Cycle (RBC) school
- The stylised facts about business cycles, including fluctuations in employment
- The ability of a static, competitive model vs the intertemporal substitution of leisure hypothesis, to explain employment fluctuations
- The policy implications of RBC theory

Assumptions

- Macroeconomics should be explicitly based on microeconomic foundations.
- Markets are perfectly competitive, and prices are perfectly flexible.
- Expectations are rational instead of adaptive.
- Real world fluctuations in output reflect fluctuations in y_n itself, not deviations of y_t from y_n , i.e. y_n is not exogenous.

Our approach to RBC theory in Macroeconomics II

- Actual RBC models are mathematically very complicated, as they represent fully articulated artificial economies, which behave through time in a way that imitates closely the behaviour of actual economies.
- Hence, they can only be studied using computer simulations.
- We will introduce some RBC ideas using a semi-formal approach.
- Our focus will be on the ability of RBC models to explain actual employment fluctuations.

Stylised facts about business cycles

- RBC theory took a more thorough approach to establishing the stylised facts about business cycles.
- Three of these are widely accepted:
 - Employment is procyclical.
 - Consumption and investment are procyclical.
 - The real wage is only slightly procyclical.

Fluctuations in employment in a static, competitive equilibrium model

- First, let's see if we can explain procyclical employment using a static, competitive equilibrium model.
- Features of the model:
 - Economic agents aim to maximize their utility or profits, subject to resource constraints.
 - Agents form expectations rationally.
 - Price flexibility and perfect competition ensure continuous market clearing.

Fluctuations in employment in a static, competitive equilibrium model

- To be able to explain employment fluctuations in such a model of the economy, we need either L^S or L^D to shift. The more likely explanation is the exogenous shifts in the L^d curve.

- The production function in the economy is given by

$$Y = F(K, L, A)$$

where K, L, A denote capital, labour and productivity respectively.

- There are diminishing marginal returns to labour and capital.
- Recall: under perfect competition, profit maximisation by firms implies that the L^d curve is given by the marginal product of labour (MPL) curve:

$$w = F_L(K, L, A) = MPL$$

where w denotes the real wage.

Fluctuations in employment in a static, competitive equilibrium model

- In the short run, capital does not change and hence can be treated as constant.
- This leaves changes in the productivity, A , as the main candidate for causing changes in MPL ($= F_L(K, L, A)$).
- Productivity tends to grow over time due to scientific advances, but this growth is irregular.
- Fluctuations in productivity could also represent one-off shocks such as the weather, natural disasters, etc.

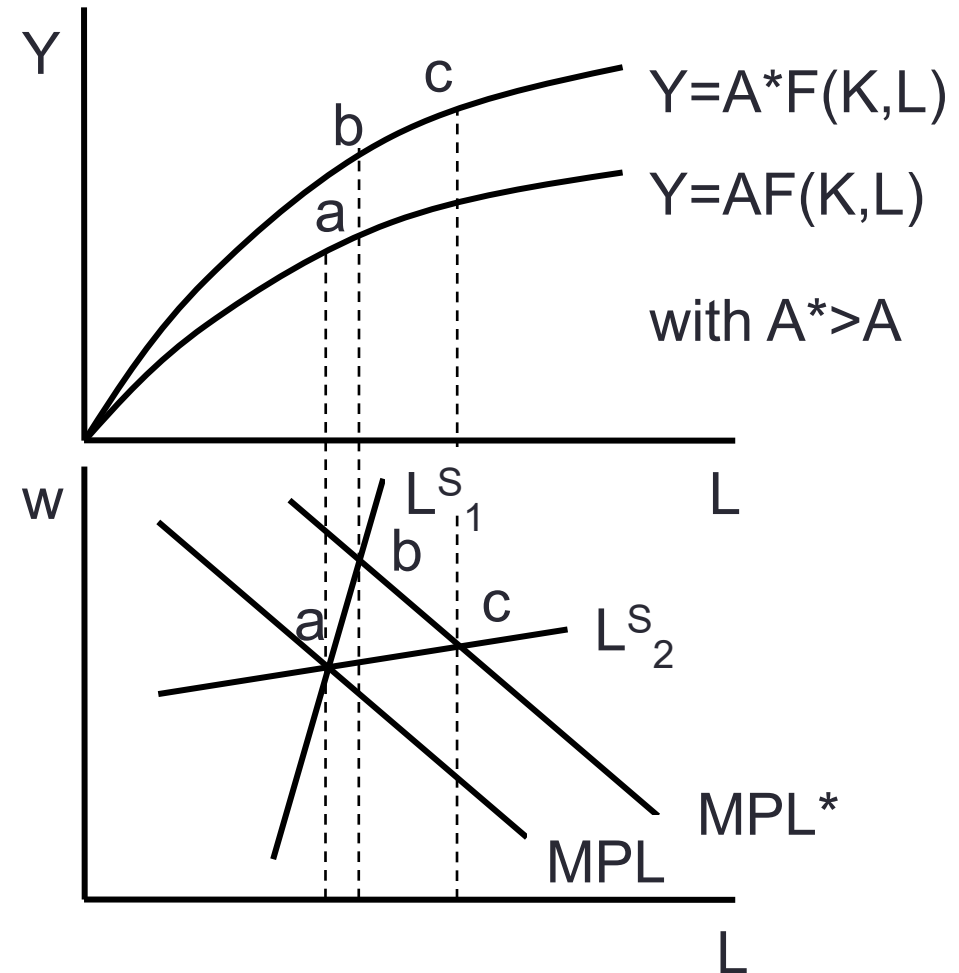
Multiplicative productivity shocks in a static, competitive equilibrium model

- If $Y = AF(K,L)$, then $\frac{\partial Y}{\partial L} = MPL = AF_L(K,L)$.
- At given (K,L) , the increase in A raises Y and MPL .
- The effects of the increase on Y and L can be demonstrated by using the diagrams for the labour market and the production function jointly.

Multiplicative productivity shocks in a static, competitive equilibrium model

Output and employment fluctuations due to a positive productivity shock with:

- A steep labour supply function, L^{S_1}
- A flat labour supply function, L^{S_2}



Labour supply in a static, competitive equilibrium model

- Since the aggregate supply of labour depends on the labour supply decisions of individuals, we need to consider how a change in the real wage influences the amount of labour individuals choose to supply.
- The utility function for the representative worker is such that consumption (C) and leisure ($\bar{L} - L$) both yield utility:

$$U(C, (\bar{L} - L))$$

- The worker maximizes this utility subject to their budget constraint ($C = wL$).

Labour supply in a static, competitive equilibrium model

- The benefits of employment relate mainly to the income earned, which allows the individual to consume goods and services.
- However, in order to earn income, workers will need to allocate less of their time to leisure.
- Hence, a rise in the real wage has both a substitution effect and an income effect:
 - A rise in the real wage corresponds to a rise in the price of leisure, causing the household to substitute out of leisure into consumption, increasing labour supply (*substitution effect*).
 - However, a higher real wage makes workers feel wealthier, resulting in a decrease in labour supply (income effect).

Limitations of the static, competitive equilibrium model

- This implies labour supply is likely to be inelastic in w because the income effect of an increase in the real wage counteracts the substitution effect.
- In addition, econometric studies find the real wage elasticity of labour supply to be between 0 – 0.5.
- **First limitation:** In this model, to explain big fluctuations in employment, we need labour supply to be very elastic in the real wage (L^S_2 in the previous figure).
- **Second limitation:** the equilibrium model of employment fluctuations implies any unemployment is voluntary.

The intertemporal substitution of leisure hypothesis

- To overcome the problems created by an inelastic L^S curve, RBC theorists developed the labour supply theory, which views it as part of an intertemporal choice problem.
- Imagine a household who lives for two periods who consumes goods and supplies labour in both periods.
- The intertemporal budget of the household is then given by

$$w_1 L_1 + \frac{w_2}{(1+r)} L_2 = C_1 + \frac{C_2}{(1+r)}$$

where w_t, L_t and r correspond to the real wage, labour supply and the real interest rate in period t , respectively.

- Suppose the household derives utility from leisure $(\bar{L} - L_t)$ and consumption (C_t) in both periods, i.e., $U_1(C_1, (\bar{L} - L_1)), U_2(C_2, (\bar{L} - L_2))$.

Temporary vs. permanent rise in the real wage

- In the two-period model, with a temporary increase in the real wage (i.e. a rise in w_1 with a constant w_2), the household again substitutes out of current leisure, but can substitute into
 - Consumption (C_1 or C_2)
 - Future leisure (as w_2 stays the same)
- A permanent rise, however, implies future leisure does not become cheaper relative to current leisure.
- Conclusion: a temporary rise in the real wage strengthens the substitution effect in the two-period model, resulting in a higher labour supply response, and hence, a flat labour supply function.

Effect of an increase in the real interest rate

- Recall that the intertemporal budget of the household is given by

$$w_1 L_1 + \frac{w_2}{(1+r)} L_2 = C_1 + \frac{C_2}{(1+r)}$$

- To see the effect of a rise in the real interest rate, notice that the increase reduces the price of future leisure $\frac{w_2}{(1+r)}$
- Households will substitute out of current leisure into future leisure, resulting in an increase in L_1 .
- Implication: $L^S(w, r)$
(+,+)

The intertemporal substitution of leisure hypothesis

To summarise:

- The intertemporal substitution of leisure hypothesis gives us a richer view of the labour supply decision.
- Real wage elasticity depends on whether the change in wages is temporary or permanent, with temporary changes resulting in a more elastic labour supply.
- Real interest rate is an additional determinant of labour supply.

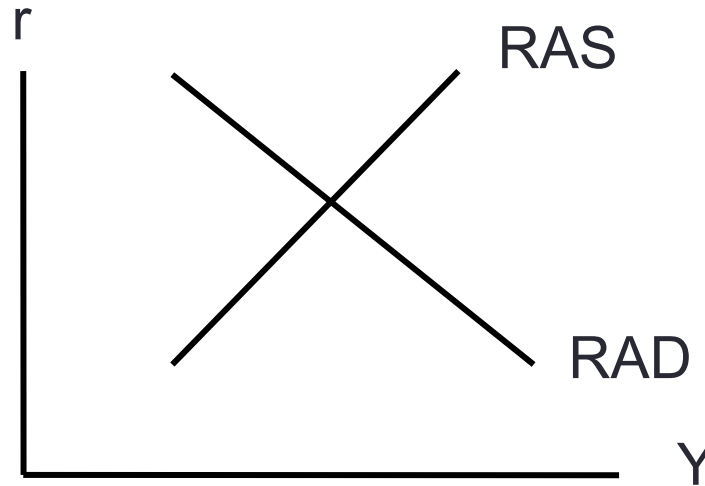
The intertemporal substitution of leisure hypothesis and large employment fluctuations

- Let's consider again the case of a temporary change in the real wage, without taking the change in the real interest rate into account.
- The labour supply changes more when there is temporary change in the real wage, which implies a more elastic labour supply curve.
- Hence, temporary productivity shocks result in a larger change in employment, giving rise to L^S_2 rather than L^S_1 .

The intertemporal substitution of leisure hypothesis and large employment fluctuations

- Let's now incorporate the change in the real interest rate into our analysis.
- If we want changes in the real interest to shift the labour supply curve, we need to have a more sophisticated approach.
- For this purpose, we can use the real aggregate demand - real aggregate supply (RAD-RAS) diagram.

The RAD-RAS Diagram



The RAD-RAS diagram differs from the traditional AD-AS diagram, as it has the real interest rate, r , rather than the (nominal) price level, P on the vertical axis.

- In a world of rational expectations, perfect price flexibility and full information, the neutrality of money is guaranteed.
- Since nominal variables do not influence real variables, output and employment are entirely determined by real forces.

Derivation of the RAD Curve

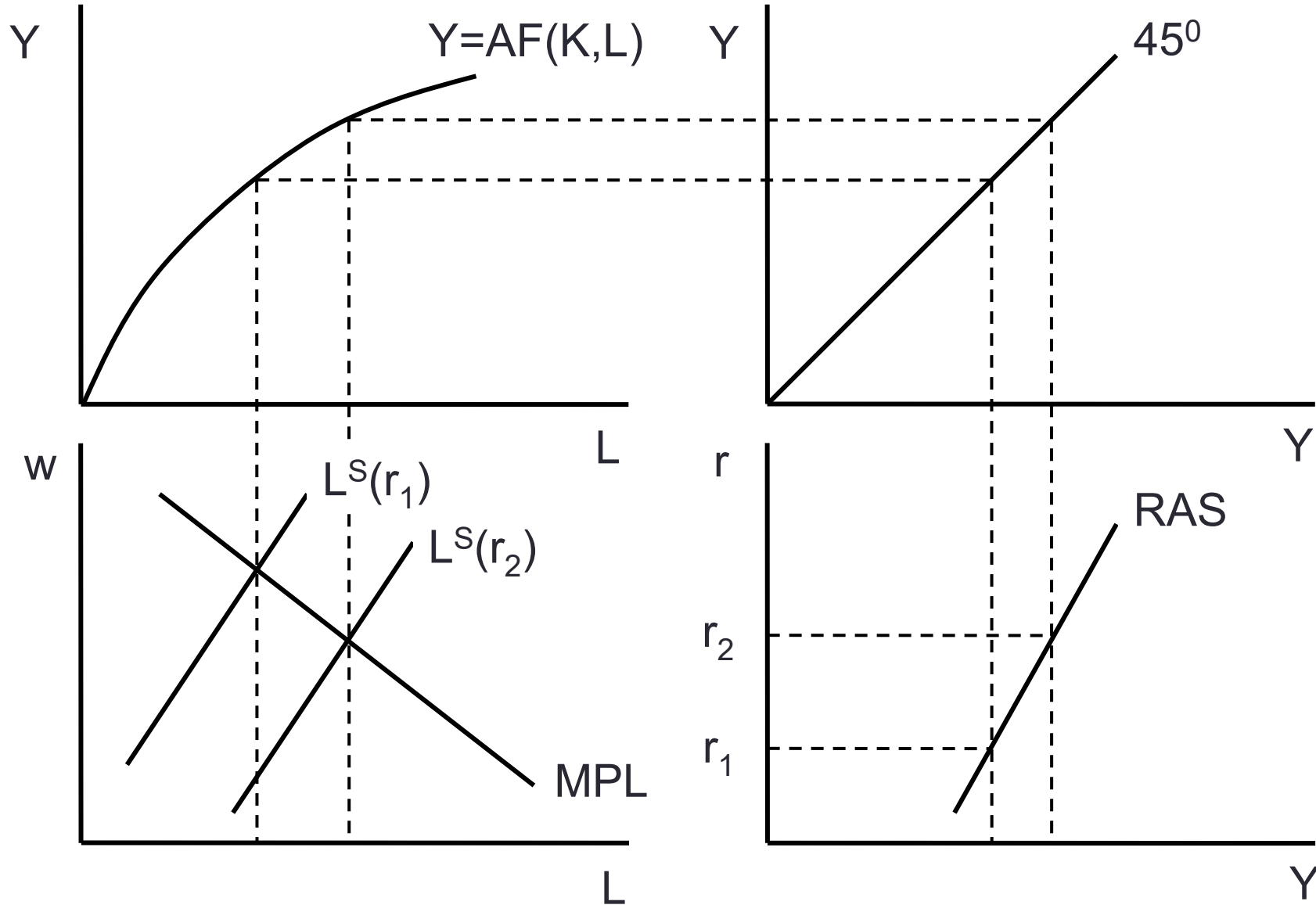
- This is already familiar as the “IS Curve”, where investment depends negatively on the real interest rate.
- The RAD Curve is given by

$$Y = C(Y-T) + I(r) + G$$

+ -

Remark: for consistency with our approach to deriving the labour supply, we should assume consumption does not depend just only on current disposable income (Y-T), but also on the present value of future disposable income. However, at the moment, it is sufficient for us just to consider current Y-T.

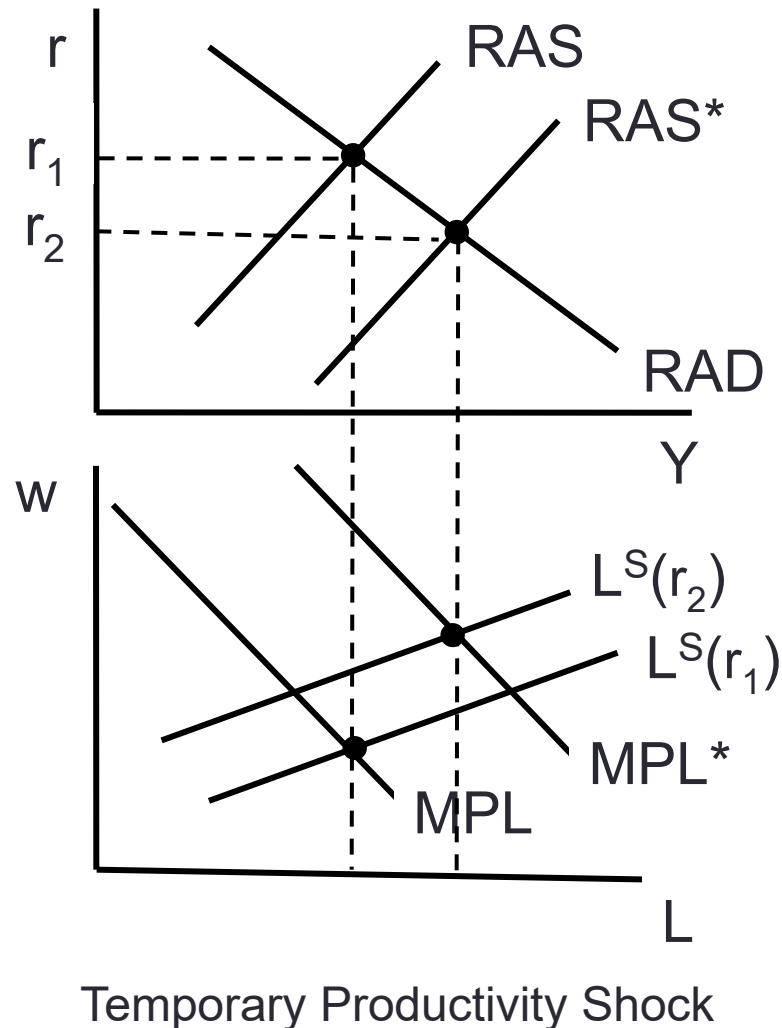
Derivation of the RAS Curve



The intertemporal substitution of leisure hypothesis and large employment fluctuations

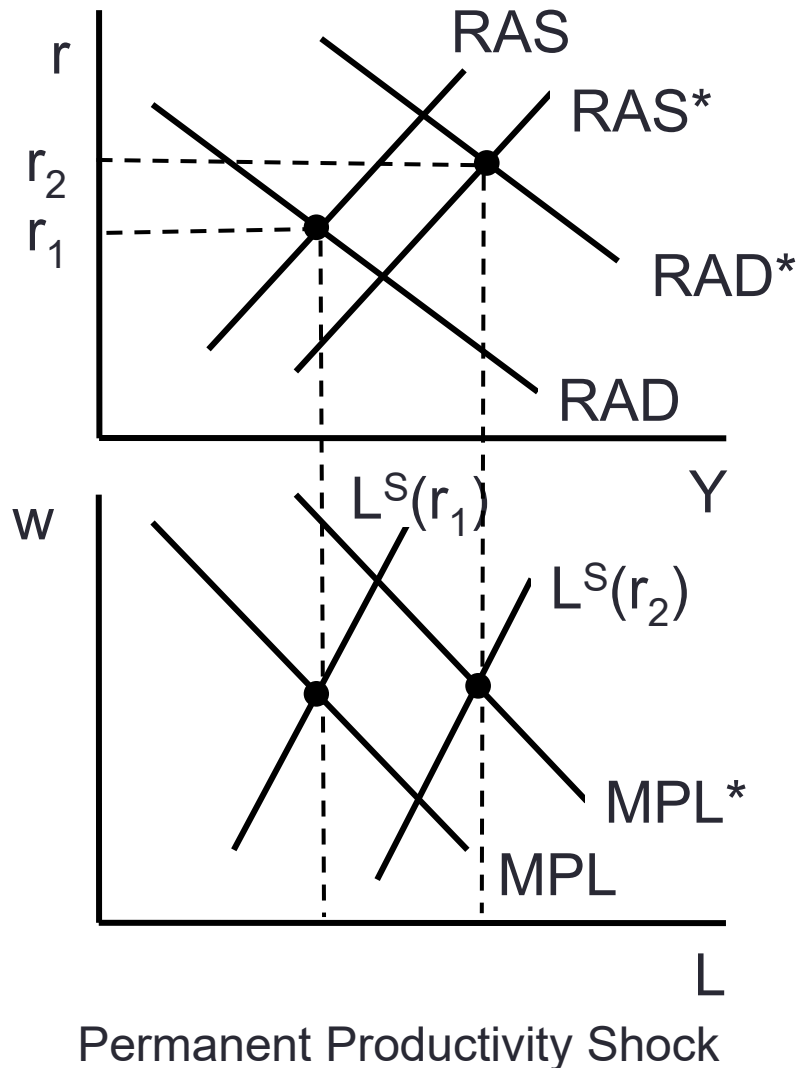
- Remember: RBC theorists developed the intertemporal substitution of leisure hypothesis to overcome the problems created by an inelastic L^S curve.
- Now that we have an intertemporal model that incorporates both the goods and the labour markets, we can consider whether the intertemporal substitution of leisure hypothesis can explain large employment fluctuations.
- To do this, we can use the diagrams for the labour market and RAD-RAS and start with the case of a temporary positive productivity shock.

Temporary Productivity Shocks in the RAD-RAS model



- Remark: Since we have a temporary change in productivity and hence the real wage, we can depict labour supply as more elastic.
- Conclusion: When productivity shocks are temporary, it is not clear whether the intertemporal substitution of leisure hypothesis is able to explain large employment fluctuations.

Permanent Productivity Shocks in the RAD-RAS model



- Remark: Since we have a permanent change in productivity and hence the real wage, we can depict labour supply as more inelastic.
- Even though the labour supply curve is not more elastic than in the static model, the fact that it shifts right produces a larger fluctuation in employment.
- Conclusion: with a permanent productivity shock, if r rises, the intertemporal substitution of leisure hypothesis can help to explain large employment fluctuations.

The intertemporal substitution of leisure hypothesis: remarks

- The intertemporal substitution of leisure hypothesis introduces conflicting effects, preventing us from having straightforward conclusions.

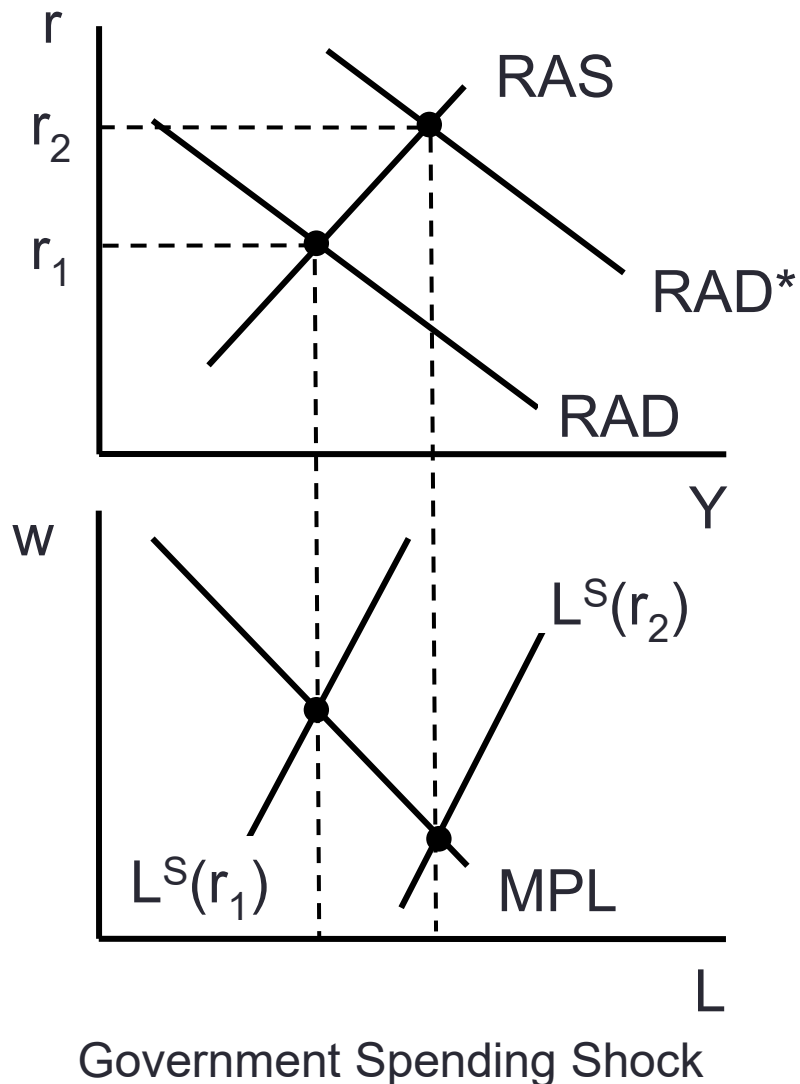
- The clearest statement we can make is:

Compared to a static model, the intertemporal substitution of leisure hypothesis can result in larger employment fluctuations, conditional on permanent productivity shocks increasing the interest rate.

The intertemporal substitution of leisure hypothesis: remarks

- To the extent that productivity shocks reflect randomness in scientific advances, it seems more likely that they would be permanent than temporary.
- With all productivity shocks the real wage is procyclical, but with permanent ones it is less strongly procyclical.
- This is in line with the stylised fact that we discussed earlier: the real wage is slightly procyclical.

Government Spending Shocks in the RAD-RAS model



- Another real shock that can easily be considered using the RAD-RAS model is a government spending shock.
- Conclusion: Large changes in government spending can explain large employment fluctuations. However, they result in the real wage to be countercyclical.

Policy implications of RBC Theory

- Before the 1980s, there was an underlying consensus among macroeconomists relating to three important issues:
 1. Fluctuations in aggregate output are temporary deviations from some underlying trend rate of growth, i.e. they represent $y_t - y_n$.
 2. Aggregate instability in the form of business cycles is socially undesirable since it reduces economic welfare.
 3. Monetary changes are an important factor when it comes to explaining the business cycle.

Policy implications of RBC Theory

- RBC theorists turned conventional thinking about economic fluctuations completely on its head by arguing that:
 - Fluctuations in output reflect fluctuations in y_n itself, not deviations of y_t from y_n .
 - Recessions represent the aggregate outcome of responses to random changes in the constraints that agents face.
 - Given these changes, rational agents react optimally, and market outcomes are efficient.

Policy implications of RBC Theory

- This implied that fluctuations in the business cycle should not be viewed as welfare-reducing deviations from an ideal path of output.
- Hence, costly efforts at stabilisation are likely to be counter-productive.
- In real business cycle theory, there is no meaning to a stated government objective such as 'full employment' because the economy is already there.
- If technological change is the key factor in determining both growth and fluctuations, we need to develop a better understanding of the factors which determine the rate of technological progress.

References

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- Froyen, R., *Macroeconomics: Theories and Policies* (2013, 10th edition, Pearson), Ch. 12, “Real Business Cycles and New Keynesian Economics” [Reading advice: **Recommended**].
- Plosser, C., “Understanding Real Business Cycles”, *Journal of Economic Perspectives* 1989, vol. 3, pp. 51-77 [Reading advice: **Recommended**].