Macroeconomics

Based on the textbook by Karlin and Soskice: *Macroeconomics: Institutions, Instability, and the Financial System*

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What is it all about?

Macroeconomics mainly focuses on two issues:

- *Business cycles*. Where do short-run fluctuations come from? If decision makers want to influence the fluctuations, are their main tools *fiscal policy* and *monetary policy* effective? This is about the short run, with a typical business cycle lasting around 4 years.
- *Economic growth*. What determines the wealth of nations? Is it possible to influence aggregate production functions that determine output from production factors (labor, capital)? This is about the long run, so tools may need time to work, such as improving education and skill levels.

Keynesian models

Models of aggregate demand are sometimes called Keynesian. In a narrower sense, Keynesian models are those models of aggregate demand that use the assumption of short-run constancy (stickiness) of prices. If prices do not move following unexpected exogenous impulses ('shocks'), economic policy will have a strong effect. A small demand impulse from the government will cause a larger effect on the total economy. The proportionality factor between input and output is called the *fiscal multiplier* or in short *multiplier*.

Components of aggregate demand

Technically, aggregate demand is measured by *gross domestic product* (GDP) in *constant prices*, in economic terms 'real output'. In the 'account-zero' identity of aggregate demand, it holds that

$$y^D = C + I + G + (X - M),$$

where y^D denotes *real expenditure*, C stands for *private consumption* by households, I for *gross fixed investment* (in the language of national accounts, *gross fixed capital formation*), G for *government spending on goods and services* (that is, not on transfers or debt service), X for exports, and M for imports.

Three definitions of the GDP

According to many macroeconomics textbooks, there are three definitions of the GDP (all are specified for a given time unit, usually a year or quarter):

- The total of all expenditures by households, the government, and the firms of a country on final market products (= goods and services);
- The total of all values added in the production process by households, firms, and the government of an economy;
- The salaries and profits earned from all production units.

Many textbooks and (historically) British national accounts use all three definitions and call them the expenditure method, the value added method, and the income method. Current national accounts (SNA, OECD) accept the second definition only. The other two are approximately identical (inventories, unfinished goods etc.).

Is GDP and GNP the same?

Gross national product (GNP) was used before a major reform of national accounting by OECD instead of GDP and GNI. GNP, the production by residents of an economy, is difficult to measure. US researchers continued using GNP instead of GDP for some time. GNI (*gross national income*) is the income (wages, profits, etc.) earned by residents of a country. It differs from GDP mainly by profits of foreign-owned firms.

Is purchasing a car investment?

In macroeconomics, *investment* is the production of new production facilities (buildings, machines, farm animals etc.), not the purchase of existing assets. Building a house is investment, buying a house does not add to the aggregate capital stock, is just a transfer of ownership. The word is usually used in its singular form (French investment has increased). An investor is a firm or household that produces capital goods (production facilities), not a person who buys assets (houses or securities).

In national accounts, investment is called *fixed capital formation*.

Purchasing a car can be investment for a firm that uses the car as a means of production (transport). For a household, buying a new car is not investment. It is consumption of durables.

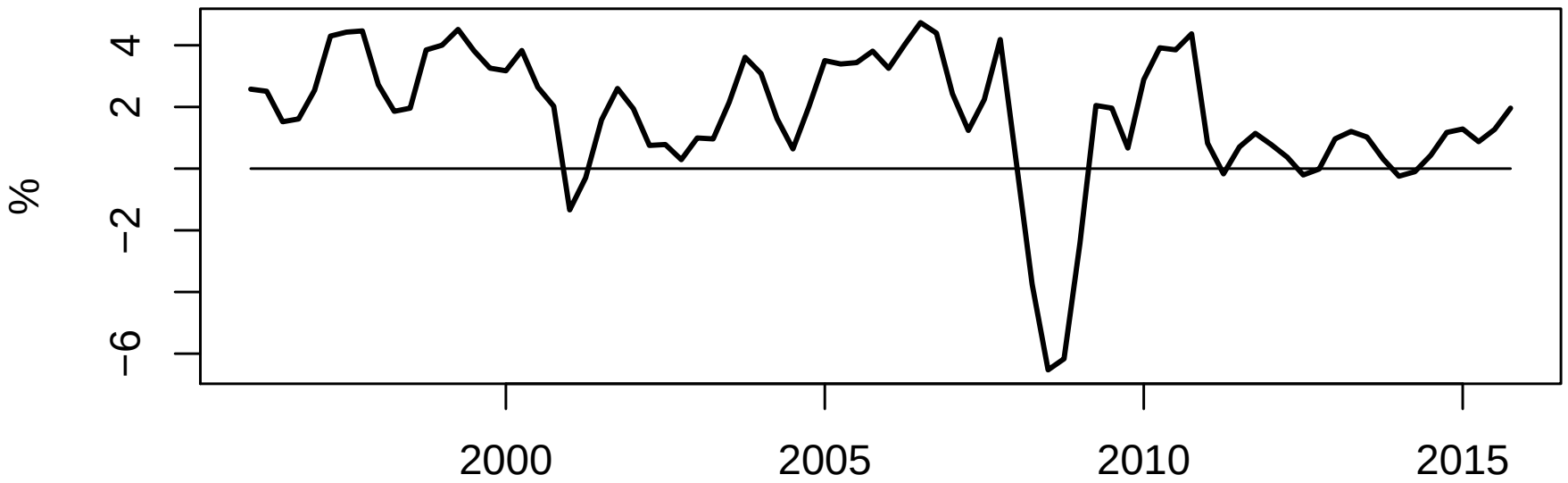
The value added

The main concept for calculating the GDP is the *value added* defined as

> *value added = value of output sold minus costs of input, i.e. raw materials and intermediate goods*

Note that workers are not materials used up in the production process, such that their wages are *not* subtracted. Input may be imported, for example. The *value added tax* is a tax proportional to the value added. It is *paid by the producer* to the government, but the purchaser must pay an increased price to the producer (seller).

Growth and cycles



The graph shows the annual growth rate of Austrian real GDP (seasonally adjusted). Most of the time, this growth rate is positive, but many researchers see cyclical fluctuations of variable length with peaks and troughs: *business cycles*.

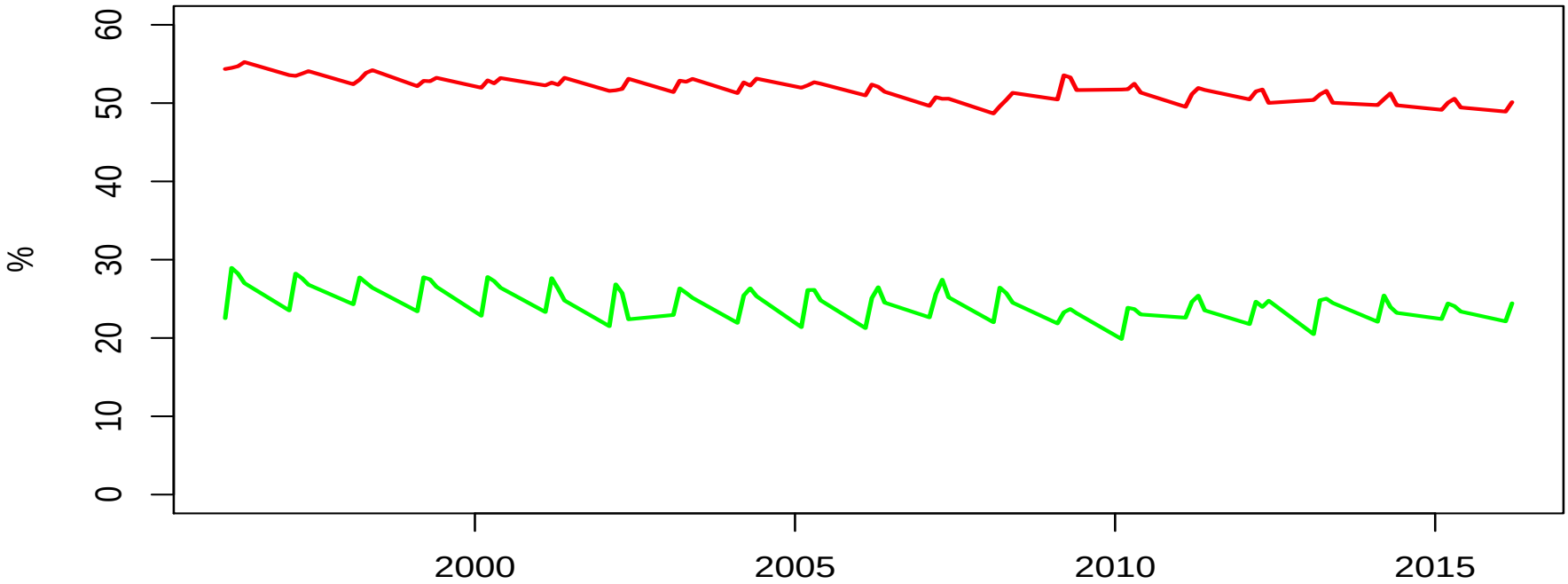
Historical and global events in GDP

- Some researchers call the time from a peak to a trough a *recession*, others see a recession only if several consecutive growth rates are negative. The time from a trough to a peak is often called the *recovery*.
- The particularly pronounced and lengthy global recession before World War II is called the *Great Depression*.
- After the 1960s, longer-run averages of real growth rates have decreased in most OECD countries, even in the US.
- From 1985 to 2006, business cycles were of a lower amplitude than before, *volatility* of GDP growth was smaller, particularly in the US. This episode is called the *Great Moderation*.
- The pronounced recession of 2007–09 that hit upon most OECD and developing countries is called the *global financial crisis*, as it emanated from the US financial sector.

GDP and the main demand components I

Growth rates in Austrian data. Investment (green) is more volatile than consumption (red) or total GDP (black).

GDP and the main demand components II



Shares in GDP for Austrian data. Investment (green) has a much lower share in output than consumption (red). Nonetheless, its movements determine the business cycle.

How does private demand react?

For an adequate evaluation of potential *fiscal policy* by the government, for example to counteract an imminent or observed recession, it is important to know how the private sector will react:

- If households receive an additional income, how much will they spend on purchasing consumer goods and services, how much will they save?
- If households suddenly increase their confidence in their future income, will they immediately spend more?
- If in this process the interest rate rises, will this discourage investment by firms because of their increased costs of raising funds?

A great pioneer of the academic theory of aggregate demand management was the British economist John Maynard Keynes.

What affects aggregate demand?

Three main channels for modeling aggregate demand:

1. *Expectations* are in the focus of theories that emphasize rational agents. If the government increases transfers to households but runs large deficits, households expect higher taxes in the future and will not increase spending. Rising unemployment decreases consumption, as households use *precautionary saving* to insure against unemployment risk;
2. Households do not want to run too much debt, and they may not even be able to do so, as banks will not lend. Also firms face such *credit constraints*;
3. Rising *interest rates* discourage investment and consumption, as they make credits more expensive. They increase the rent and profit income, which should encourage spending, but this effect is typically smaller.

The simplest aggregate demand model

Presume the economy is closed ($X = M = 0$), such that

$$y^D = C + I + G,$$

whereas consumption demand follows

$$C = c_0 + c_1(y - T),$$

i.e. households consume in proportionality to their disposable after-tax income, with ('direct') taxes T. $I = \bar{I}, G = \bar{G}$ are assumed *exogenous* and fixed. Taxes are assumed proportional to income $T = \tau y$ with tax rate τ.

The goods market is said to be *in equilibrium*, if $y = y^D$, i.e. if aggregate production equals aggregate demand.

Solving for the equilibrium: the multiplier

Summarizing the formulae yields

$$y = c_0 + c_1(1-\tau)y + I + G$$

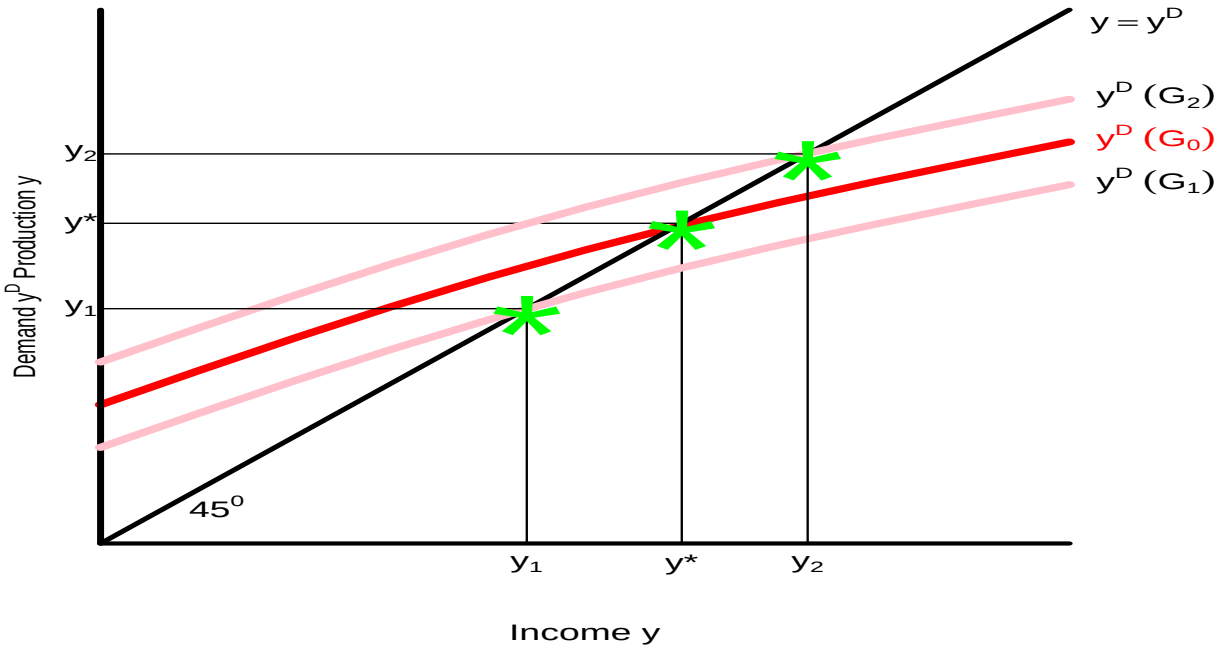
or

$$y = \frac{1}{1 - c_1(1-\tau)}(c_0 + I + G).$$

The expression $\frac{1}{1-c_1(1-\tau)}$ indicates how much y changes if c_0, I, or G are changed by one (infinitesimal) unit. Changing G is done by the government: fiscal policy. Changing c_0 is done by the households: consumer sentiment. Changing I is done by firms. The expression is the **fiscal multiplier** for this model.

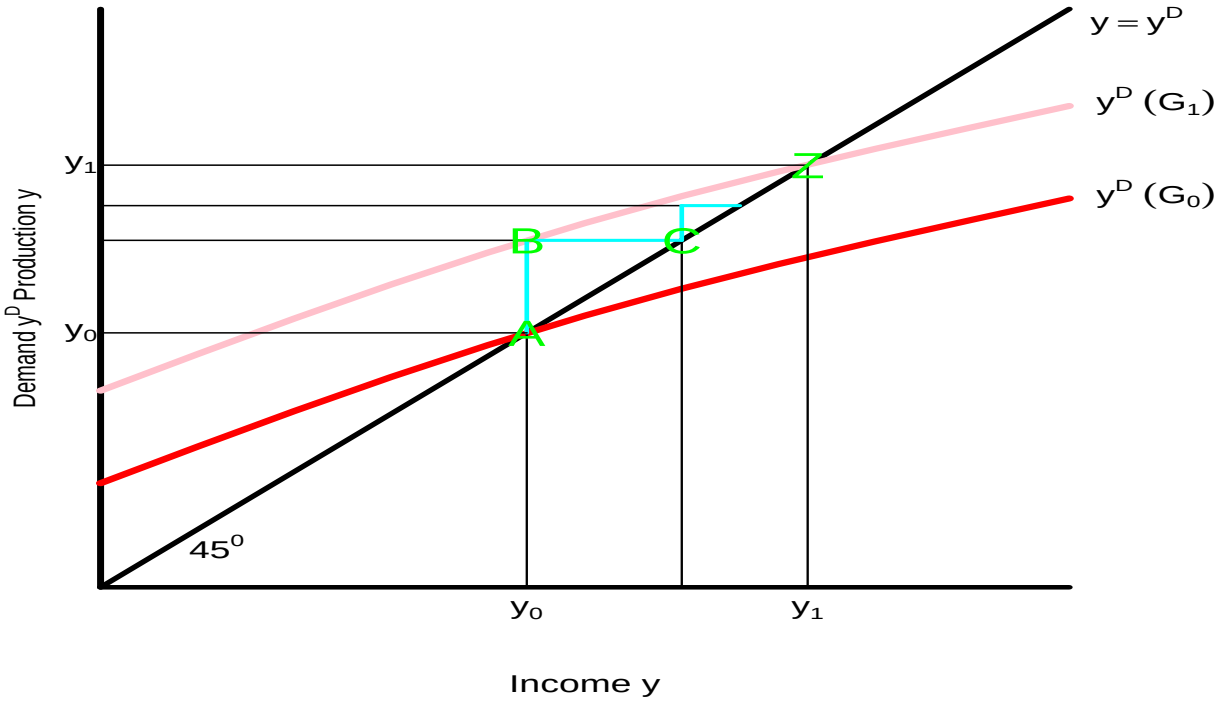
Warning: The formula $\frac{1}{1-c_1(1-\tau)}$ is not generally valid, it is only the multiplier given the assumptions for this very simple model and it changes for other more complex models.

The Keynesian cross



The equilibrium is at the intersection of the aggregate demand function and the identity $y = y^D$. Increasing or decreasing G (fiscal policy) shifts the demand function upward or downward and yields new equilibria.

Fiscal expansion: a stairway to heaven?



The reaction to an increase in government spending can be viewed as a sequence of steps; production increases to satisfy demand, the additional income creates additional demand, until Z is attained.

Shifted curves

The classical presentation of basic macro-economic models is by *comparative statics*: states of the economy at different time points are compared; movement between the states is sketched only. Some states can be described as intersections of curves: solutions to both conditions (equations).

Curves correspond to equations, such as $y = f(x, z)$ for z given in the (x, y)–space. For given z, the relation of x and y is *on the curve*. For different z, there will be a different, parallel curve: the curve has shifted. Carefully distinguish movements on a curve and shifts of curves.

The investment-saving identity

From

$$y = C + I + G$$

it follows that

$$(y - T - C) + (T - G) = I,$$

which can be read as investment I equaling the sum of *household saving* and *government saving*. Investment must be financed by saving, either from households or from the government. In reality, there is a third component, *firm saving* from undistributed profits.

The paradox of thrift

In a recession, with low output and increasing government deficit, does it make sense to tell households to save, such that investment will pick up again? Households could increase their saving by reducing c_0 and thus C. Because of the multiplier

$$\Delta y = \frac{1}{1 - c_1(1 - \tau)} \Delta c_0,$$

output will fall, which is unwanted in a recession. Moreover, because in

$$(y - T - C) + (T - G) = I$$

the right-hand side I remains constant and the first term increases, the second term falls, thus government deficit increases. Total saving from households plus government will not change at all.

An aggregate demand model with endogenous investment

Presume the economy is closed ($X = M = 0$), such that

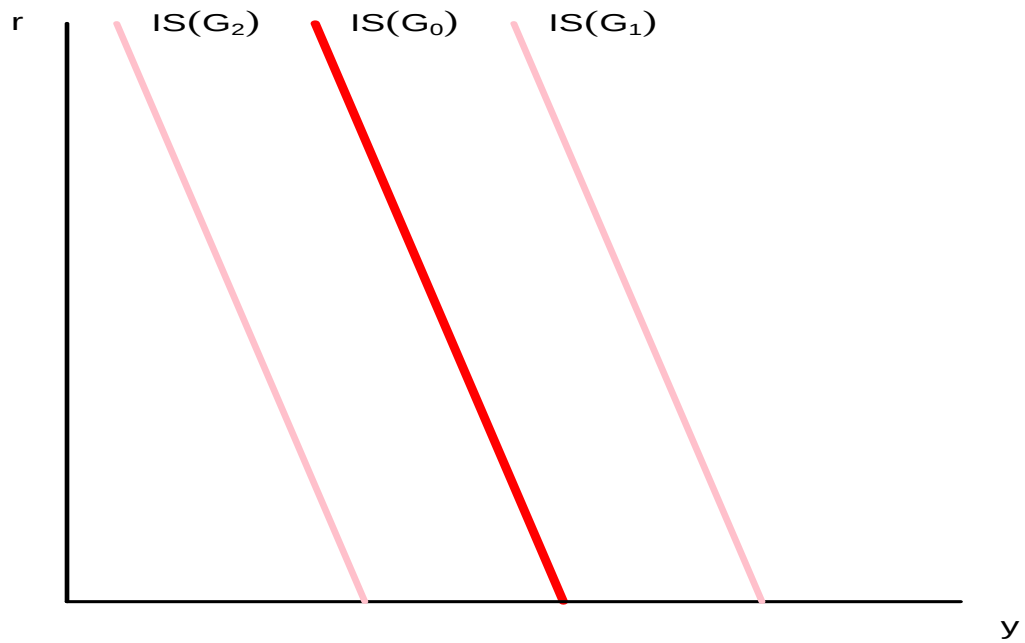
$$y^D = C + I + G,$$

with both consumption and investment demand following functions

$$C = c_0 + c_1(y - T), \quad I = a_0 - a_1 r,$$

such that investment reacts negatively to the real interest rate r. Different values of r shift the demand curves in the Keynes cross and imply different short-run equilibria y in an (y, r) diagram. The resulting falling curve is the **IS curve** (*investment equals saving*).

IS curves



Varying G or c_0 shifts IS curves. Here, $G_2 < G_0 < G_1$.

The multiplier with endogenous investment

Summarizing the formulae yields

$$y = c_0 + c_1(1-\tau)y + a_0 - a_1 r + G$$

or

$$y = \frac{1}{1 - c_1(1-\tau)}(c_0 + a_0 - a_1 r + G).$$

The fiscal multiplier remains the same as in the simple model, $\frac{1}{1-c_1(1-\tau)}$. If investment is assumed to depend on income, as is done by some authors, for example

$$I = a_0 - a_1 r + a_2 y,$$

the multiplier will be higher than in the model with exogenous investment.

The IS curve in a formula

Assuming the aggregate demand model with endogenous investment, we already showed that

$$y = \frac{1}{1 - c_1(1 - \tau)}(c_0 + a_0 - a_1 r + G).$$

or, in short,

$$y = A - ar,$$

with $A = (c_0 + a_0 + G)/\{1 - c_1(1 - \tau)\}$ and $a = a_1/\{1 - c_1(1 - \tau)\}$. Thus, in this model the IS curve has a slope of $-1/a$, as it is drawn with r on the ordinate axis.

What changes the IS curve?

The IS curve *shifts* if c_0, a_0, G change, i.e. as a consequence of shifts in consumer or firm sentiment or of changes in government spending (fiscal policy focusing on spending).

The IS curve *changes its slope and rotates* if

1. the tax rate τ changes due to fiscal policy focusing on taxes: a lower tax rate implies a flatter IS curve; or
2. the income sensitivity of consumers c_1 changes: more sensitivity implies a flatter IS curve;
3. the interest sensitivity of investment a_1 changes: more sensitivity implies a flatter IS curve.

What has become of the LM curve?

The classical comparative-statics presentation of the Keynesian model uses a rising curve in an (y, i) diagram, the so-called LM curve (*liquidity equals money*). It represents the money market and says that additional demand drives up money demand and thus increases the nominal interest rate i if no more money is supplied. The model presented here—to be completed in later sections—does not use this curve and rather relies on supply-side characteristics. The central bank is supposed to follow a Taylor rule in the interest of inflation targeting and more or less sets the interest rate directly.

The role of expectations

Economic theory does not assume that agents simply spend out of their current income but that they are rational planners. Households form expectations of future household income; firms form expectations on future returns to their investment.

Expectations can be

- *adaptive*: a weighted average of previous expectations and updates formed on new observations;
- *rational*: the expectation of the variable seen as a random variable embedded in a full macro-economic model with all feedback reactions taken into account.

The present value

For any economic variable X_t (returns on a security, flow of incomes), consider a fixed or average real interest rate r and expectations of future X_{t+h} denoted by X^E_{t+h}, if rational, then $\mathrm{E}_t X_{t+h} = X^E_{t+h}$.

Then, the *present value* of X_t is defined as

$$X_t + \frac{X^E_{t+1}}{1+r} + \frac{X^E_{t+2}}{(1+r)^2} + \ldots = \sum_{h=0}^{T} \frac{X^E_{t+h}}{(1+r)^h}.$$

Instead of the real interest rate r, agents may use other discount factors.

Permanent income hypothesis

MODIGLIANI and FRIEDMAN assumed that households use their discounted lifetime income over a technically infinite lifetime

$$y_t + \frac{y^E_{t+1}}{1+r} + \frac{y^E_{t+2}}{(1+r)^2} + \ldots = \sum_{h=0}^{\infty} \frac{y^E_{t+h}}{(1+r)^h}$$

plus some wealth endowment, i.e. *permanent income* y^P_t, in order to plan their current consumption C_t. The *permanent income hypothesis* is often abbreviated as *PIH*. Note that y is meant to represent after-tax income, in the aggregate previously denoted as $y - T$.

Empirical evidence on the PIH

Persons that plan according to the PIH are expected to smooth their consumption over their lifetimes. They should run debt in their young working ages and pay back their debts later on, as their salaries and wages increse.

In fact, young persons run far less debt than PIH would predict. It may be, however, that they are *liquidity constrained*, i.e. they do not get the loans they want.

If PIH holds, households are expected to react very little to temporary increases in their incomes. In fact, households react perceptibly even to temporary cuts or increases.

Some economists maintain that many households face liquidity constraints and that PIH explains their behavior partially. Others opine that humans are *impatient*.

Other potential influence factors on consumption

Apart from disposable income and lifetime income, other factors may affect consumer behavior:

- *Uncertainty* may discourage consumption. Unemployment may be an indicator of a higher risk of losing one's job.
- Changes in the relative price structure may confuse consumers.
- A higher *real interest rate* makes consumer credits more expensive and saving (foregone consumption) more attractive.
- Increased *wealth* relative to income due to a higher valuation of assets (e.g. houses) encourages consumption.
- The government's budget deficit or debt may affect long-run income expectations and hence consumption.
- Wage income is more relevant for consumption than other income (psychological effect).

Investment and Tobin's q

The investment demand function suggested above

$$I = a_0 - a_1 r$$

is overly simple. One may consider output y as an additional argument: $I = a_0 - a_1 r + a_2 y$. Another suggestion is *Tobin's marginal q*, the ratio of the *marginal benefit* and *marginal cost* of an investment

$$q = \frac{P \cdot \Pi_K}{\delta + r},$$

with the market price P, the marginal productivity of capital Π_K, and depreciation rate δ.

Tobin's average q

With Tobin's marginal q, it is easy to see that: for $q > 1$, firms should invest. For $q < 1$, firms should rather buy securities. Tobin's marginal q is difficult to determine, as the production function and its derivative Π_K are unknown.

A popular alternative is *Tobin's average* Q, the ratio of the *market value of the firm*—often interpreted as the price on the stock market—and the *replacement cost of capital*. Again, at $Q > 1$, firms should invest, whereas they should purchase securities with fixed interest rate r if $Q < 1$.

Empirical evidence on investment functions

- Investment behavior is much more difficult to model than consumer behavior. Technically, R^2 is lower.
- Often, investment does not show a strong reaction to real interest rates. Sometimes, the challenge is to find a definition of the real interest rate that implies investment response.
- The *cash flow* (after tax profit) is more significant in explaining investment demand than the q theory would suggest. Theory argues that this response may be due to liquidity constraints.
- *Uncertainty* may discourage investment.

Summary: effects impacting on the IS curve

We know that c_0, a_0, G shift the IS curve, whereas τ, c_1, a_1 change the slope of the IS curve. We note the additional potential effects:

- The presence of credit-constrained and impatient households increases the multiplier and flattens the IS curve (c_1).
- Uncertainty about whether income shocks are permanent or transitory supports traditional consumption functions rather than PIH and flattens the IS curve.
- Rising unemployment discourages consumption and shifts the IS curve leftward.
- Rising house prices support loans, encourage consumption, and shift the IS curve to the right.
- Removing liquidity constraints shifts the IS curve to the right.

Summary: effects impacting on the IS curve based on q

- Increased output prices, capital productivity Π_K, lower depreciation δ benefit investment and shift the IS curve to the right.
- Optimism, as for example signaled by a strong stock market, shifts the IS curve right.

What is the short run?

The IS curve connects short-run equilibria in the (Y, r) space. A short-run equilibrium is a goods market equilibrium that corresponds to the assumption that all additional demand is satisfied by additional supply *at constant prices*. In any longer run, demand is either not satisfied any more or prices rise.

Whether the IS curve is of interest, this depends on whether this 'Keynesian' assumption is satisfied at least for a short time. If prices are fully flexible, there will be no IS curve.

Time has come to take a look at supply...