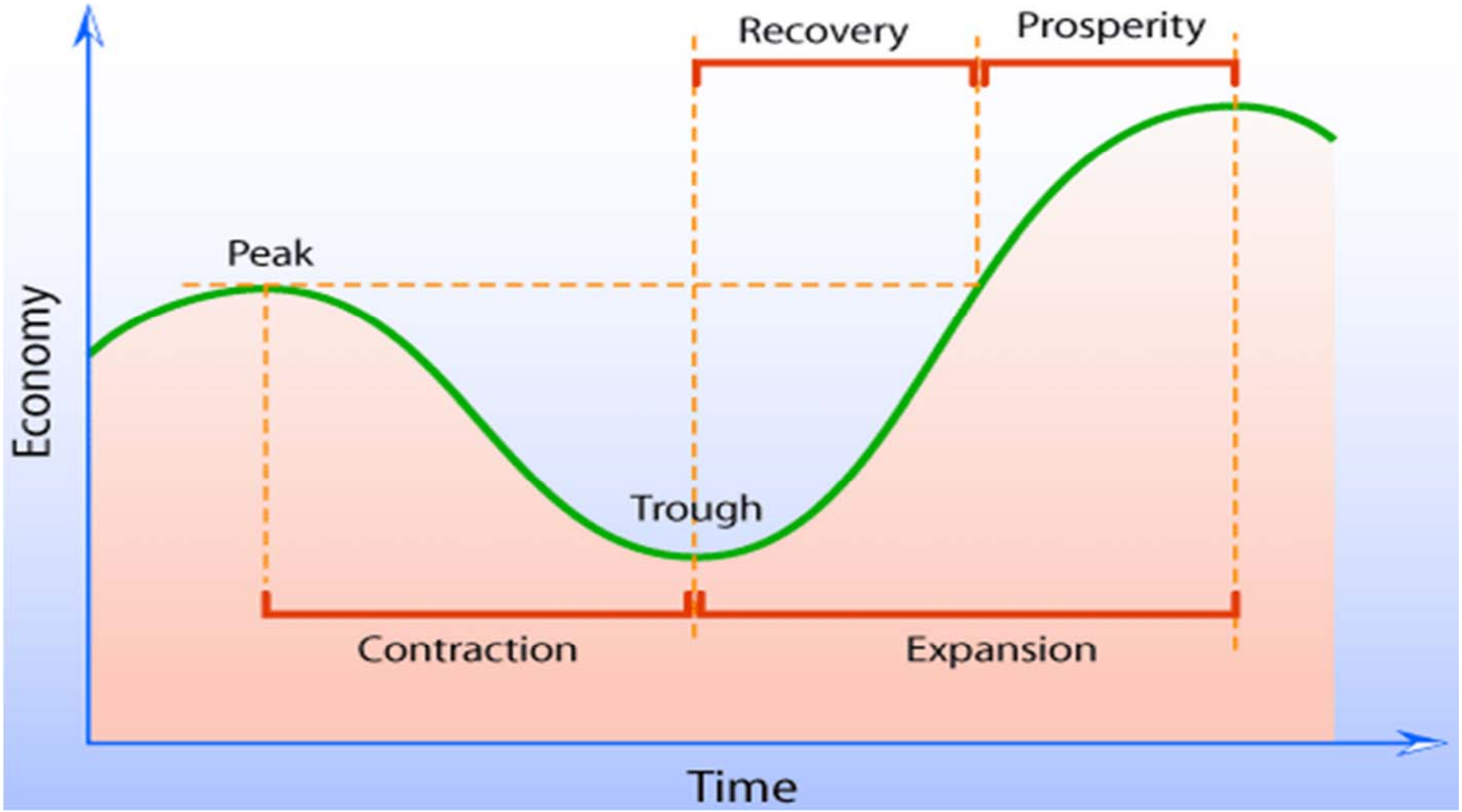
Business (or economic) cycle

- The business cycle consists of the ups and downs in overall economic activity.
- By letting real GDP be the main indicator of overall economic activity, the business cycle can be roughly identified with fluctuations of real GDP.
- An empirical regularity is that modern economies experience business cycles.
- Basic questions in macroeconomics: (i) what causes the business cycle?; (ii) how can it be smoothed?

Stylized view of the business cycle



Typical business cycle

- The period during which economic activity falls is a contraction or a recession. A depression is a severe recession. The trough is the lowest point in the recession.
- The period during which economic activity grows is an expansion or a boom. The highest point in the boom is called the peak.
- A business cycle is given by a decline-recovery sequence from peak to peak or by a recovery-decline sequence from trough to trough.

Eurozone business cycles

http://www.cepr.org/data/eurocoin/recession/

Trough	Peak	Previous Contraction (No of Months from previous peak to trough)	Expansion Phase (No of Months from trough to peak)	Length of the Cycle (No of Months from peak to peak)
-	Feb-89	-	-	-
Nov-92	Oct-94	45	23	68
Nov-95	Nov-97	13	24	37
Oct-98	Nov-99	11	13	24

US business cycles (average)

	DURATION IN MONTHS			
	Contraction	Expansion	Cycle	
	Peak to Trough	*Previous trough to this peak*	*Trough from Previous Trough*	*Peak from Previous Peak*
Average, all cycles:				
1854-2009 (33 cycles)	16	42	56	55*
1854-1919 (16 cycles)	22	27	48	49**
1919-1945 (6 cycles)	18	35	53	53
1945-2009 (11 cycles)	11	59	73	66

* 32 cycles

** 15 cycles

http://www.nber.org/cycles.html

US business cycles (1929-2009)

Peak	Trough	Contraction	Expansion	Cycle	
Quarterly dates are in parentheses		*Peak to Trough*	*Previous trough to this peak*	*Trough from Previous Trough*	*Peak from Previous Peak*
August 1929(III)	March 1933 (I)	43	21	64	34
May 1937(II)	June 1938 (II)	13	50	63	93
February 1945(I)	October 1945 (IV)	8	80	88	93
November 1948(IV)	October 1949 (IV)	11	37	48	45
July 1953(II)	May 1954 (II)	10	45	55	56
August 1957(III)	April 1958 (II)	8	39	47	49
April 1960(II)	February 1961 (I)	10	24	34	32
December 1969(IV)	November 1970 (IV)	11	106	117	116
November 1973(IV)	March 1975 (I)	16	36	52	47
January 1980(I)	July 1980 (III)	6	58	64	74
July 1981(III)	November 1982 (IV)	16	12	28	18
July 1990(III)	March 1991(I)	8	92	100	108
March 2001(I)	November 2001 (IV)	8	120	128	128
December 2007 (IV)	June 2009 (II)	18	73	91	81

http://www.nber.org/cycles.html

Business cycles: stylized facts

- The business cycle is recurrent but not periodic: turning points (peaks and troughs) are certain to occur but at unpredictable moments. The length of the cycle is irregular (5-10 years). The magnitude of the fluctuation is relatively small (± 5% of GDP).

- Each period is self-sustained for a while: growth tends to persist and decline tends also to persist.

- Comovement. All cycles are alike in that there is a tendency of many variables to correlate their behaviour (move together) as the cycle unfolds.

Direction of movement

- Procyclical variable: typically moves in the same direction as overall economic activity (up in an expansion, down in a contraction). Examples: industrial production, consumption, investment, employment, money stock, inflation, stock prices, nominal interest rate.

- Countercyclical variable: typically moves in the opposite direction to overall economic activity. Unemployment is the most obvious example.

- Acyclical variable: shows no typical pattern over the cycle. Example: the real interest rate.

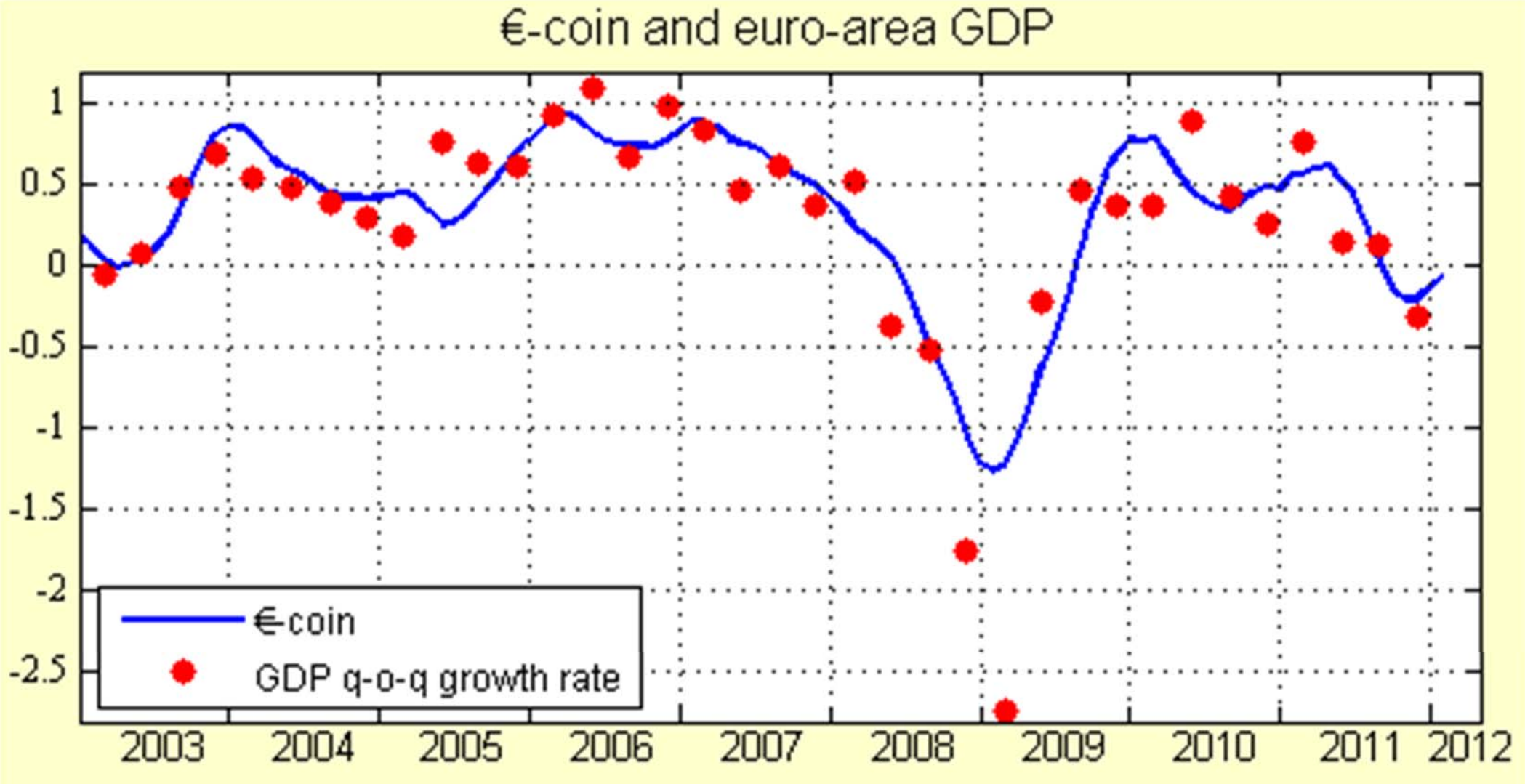
Timing of turning points

- Leading variable: its turning points tend to precede the turning points of the business cycle. Reaches its peak (trough) before the business cycle reaches its peak (trough): money stock, stock prices, inventory investment… Helps to predict the cycle.

- Coincident variable: reaches turning points at about the same time as the business cycle (industrial production, consumption, unemployment).

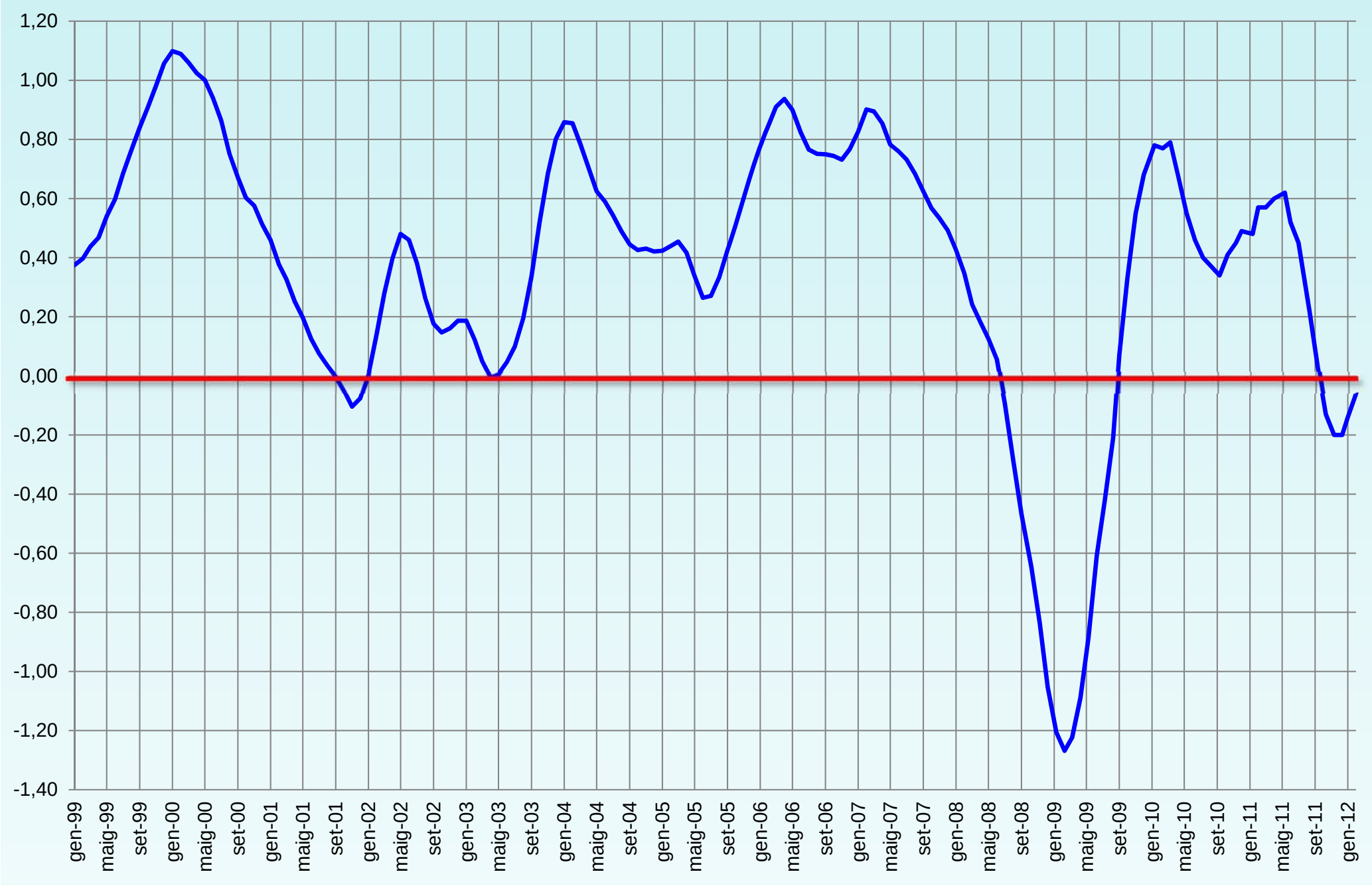
- Lagging variable: peaks and troughs tend to occur later than the business cycle's (inflation, nominal interest rate). Helps to confirm the end of the cycle.

Eurocoin: a coincident indicator



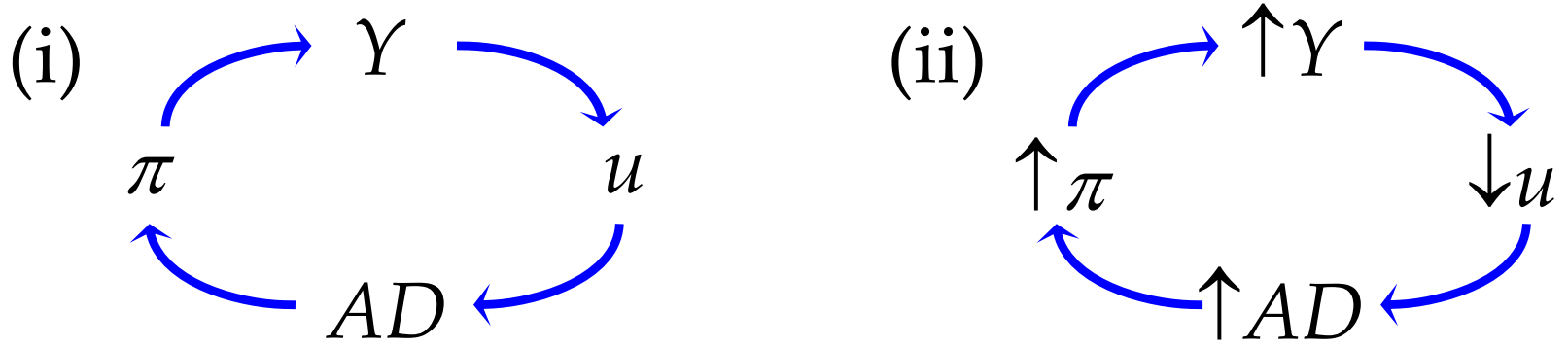
http://eurocoin.cepr.org/

Eurocoin, January 1999-February 2012



Virtuous & vicious circles

- The relationship (i) justifies the <u>self-sustainability</u> of each period in the business cycle.
- In a boom (see (ii)), production (GDP) Y grows. The unemployment rate then tends to fall. This fall stimulates aggregate demand (the overall demand for goods), which in his turn fuels inflation. Finally, a rising inflation rate encourages production. In a recession the opposite occurs.



Okun's law

- It is an empirical relationship described in 1962 by the American economist Arthur Okun (1928-1980).

- Okun's law: there is a negative relationship between the change $\Delta u = u - u_{-1}$ in the unemployment rate and $y = (Y - Y_{-1})/Y_{-1}$, the rate of growth of real GDP Y. The formal expression of the law is

$$\Delta u = a - b \cdot y$$

where a and b are positive constants that depend on the economy considered and the period with respect to which the variables are measured.

Okun's law (US version) I

- Expressing the variables as annual percentages, in the US, $a \approx 1.5$ and $b \approx 0.5$. Therefore:

$$\Delta u = 1.5 - y/2 \qquad \text{or} \qquad u = u_{-1} + 1.5 - y/2.$$

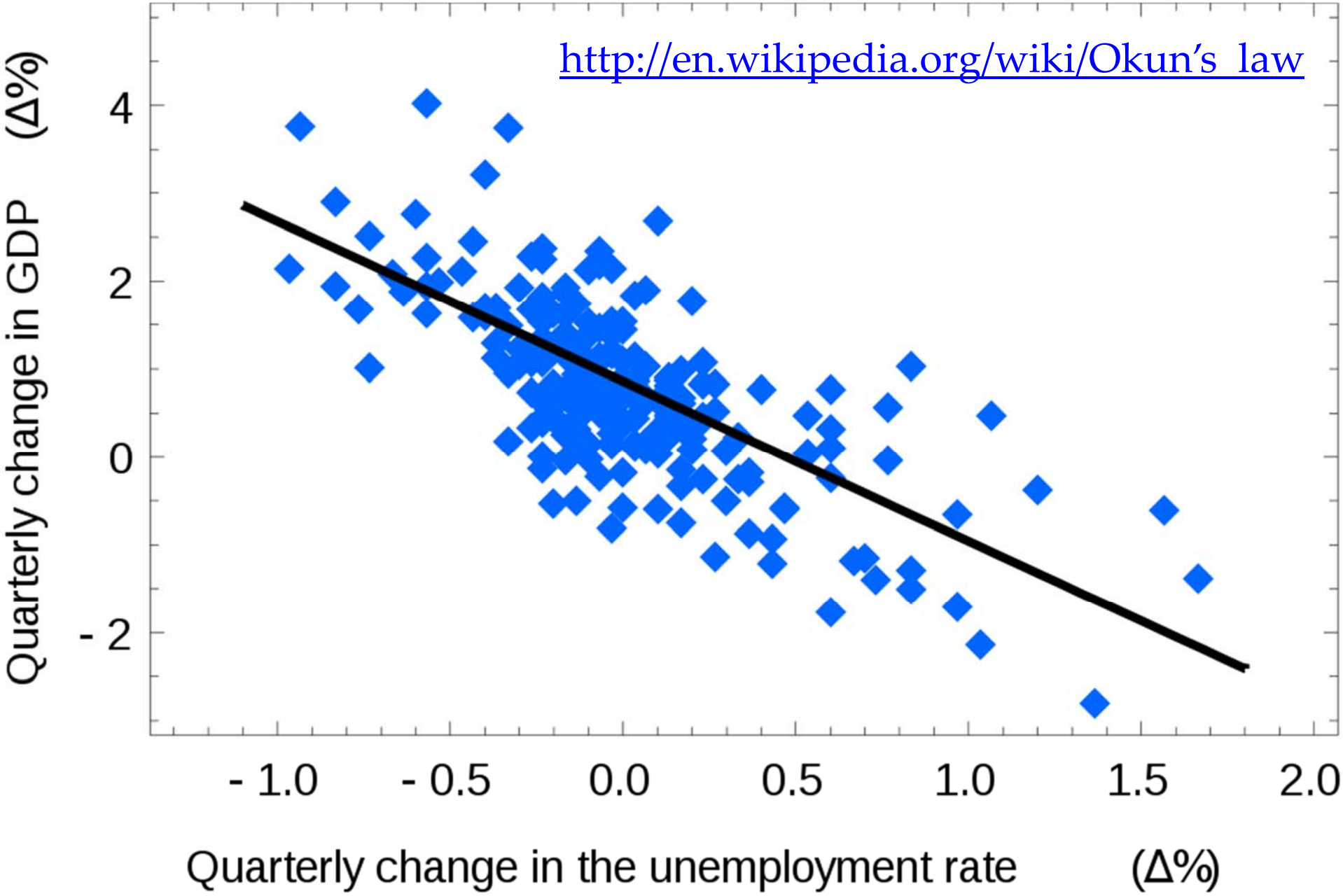
- a represents the increase in u that occurs when the economy does not grow: if $y = 0$, then $\Delta u = a$.

- For instance, if $u_{-1} = 2\%$ and $y = 0$, then $u = u_{-1} + a - y/2 = 2 + 1.5 - 0/2 = 3.5$. Hence, if the unemployment rate at the begining of the year is 2% and the economy does not grow, at the end the rate is 3.5%.

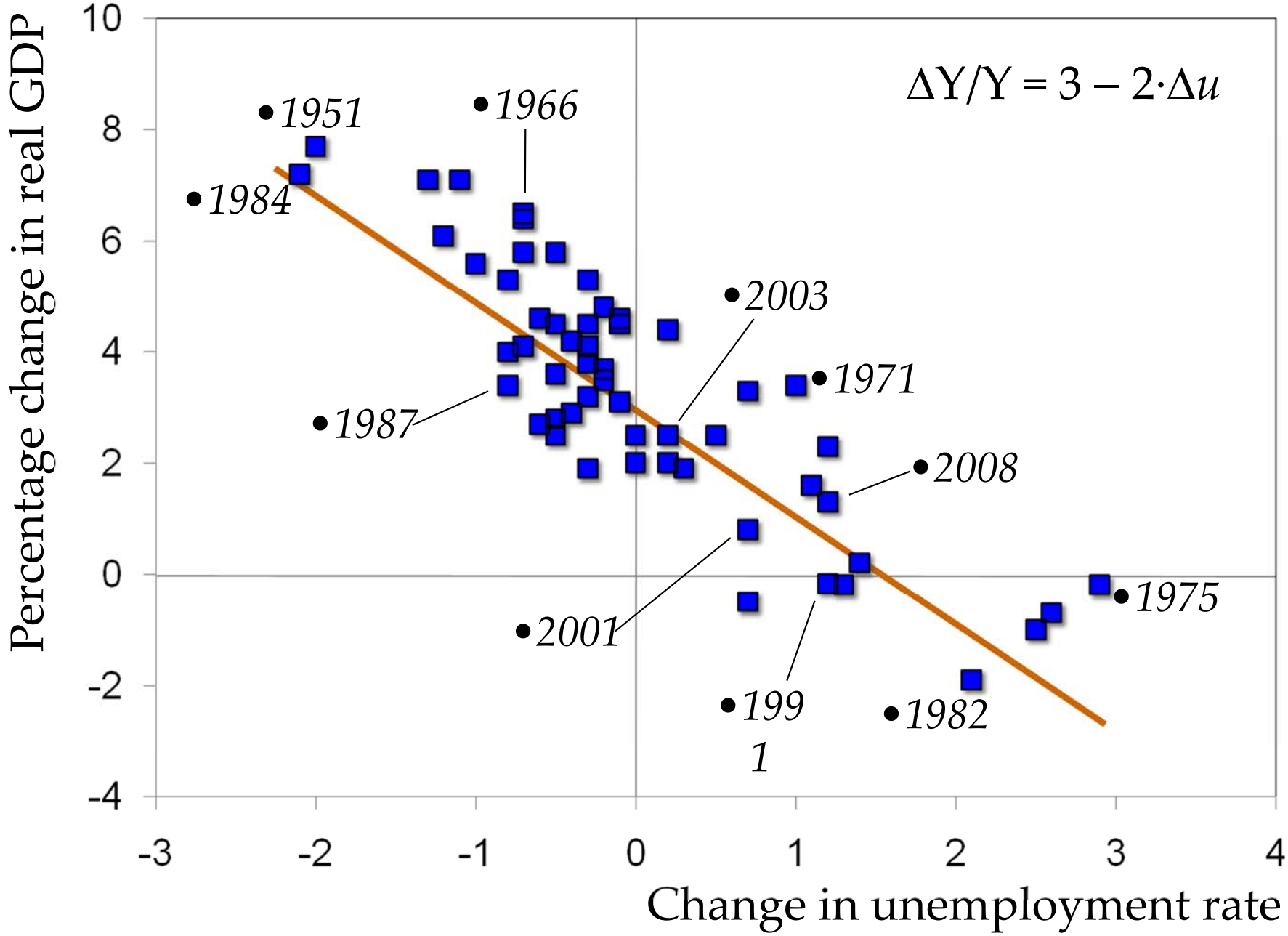
Okun's law (US version) II

- b measures the ability of the economy to transform GDP growth into a smaller unemployment rate: $b \approx 0.5$ means that increasing y by 1 point reduces u by 0.5 points.
- If $y = 2\%$, then $u = u_{-1} + 1.5 - y/2 = u_{-1} + 1.5 - 2/2 = u_{-1} + 0.5$. If $y = 3\%$, then $u = u_{-1} + 1.5 - y/2 = u_{-1} + 1.5 - 3/2 = u_{-1}$.
- Therefore, increasing y from 2% to 3% reduces u from $u_{-1} + 0.5$ to u_{-1}, so there is a gain of 0.5 points: an additional 1% in y becomes 0.5 points less of u.

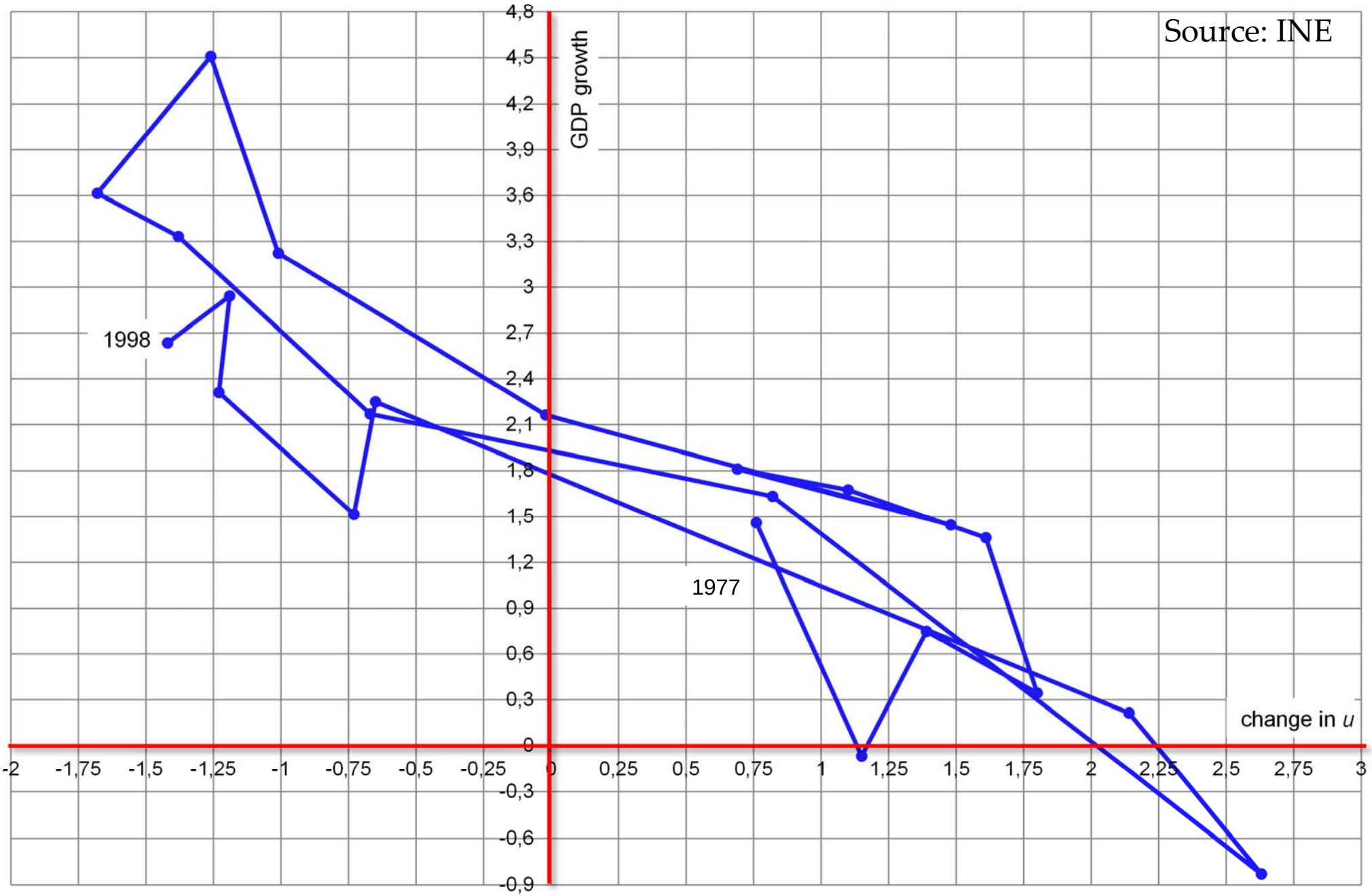
Okun's law, US, 1947-2002



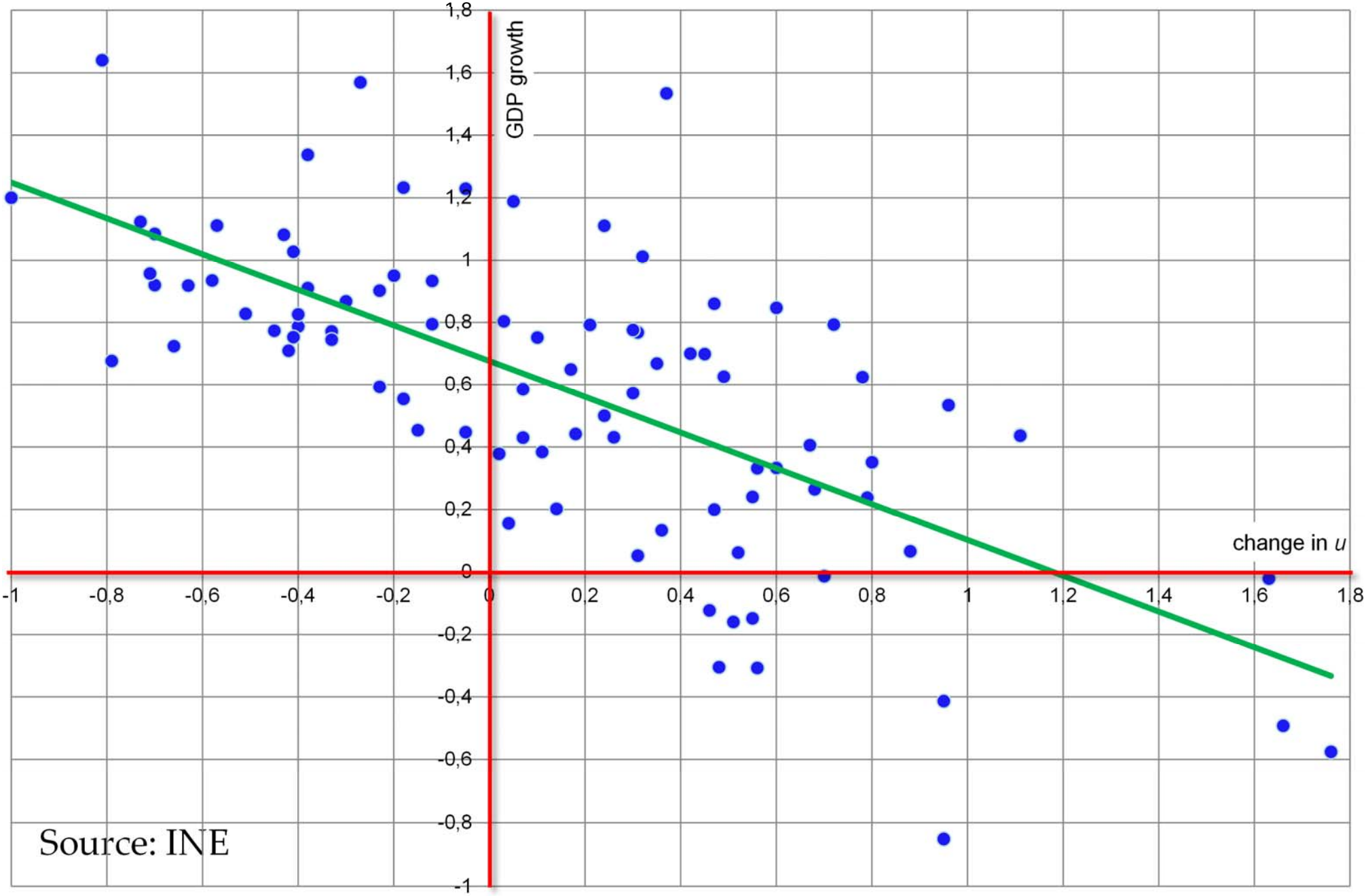
Okun's law, US, 1951-2003



Okun's law, Spain, 1977-1998



Okun's law, Spain, 1976IV-1998IV



Source: INE

The Phillips curve

- It is an empirical relationship described in 1960 by Paul Samuelson and Robert Solow based on a 1958 paper by the New Zealand economist Alban William Housego Phillips (1914-1975).

- The Phillips curve expresses a negative relationship between the unemployment rate u and the inflation rate π: the lower u, the higher π.

- With a and b positive constants, a linear Phillips curve is represented by an equation of the sort

$$\pi = a - b \cdot u \ .$$

Trade-off between u and π

- With π and u expressed as percentages, $\pi = a - b \cdot u$ means that, to reduce 1 percentage point the unemployment rate u, it is necessary to accept an increase in the inflation rate π of b points.

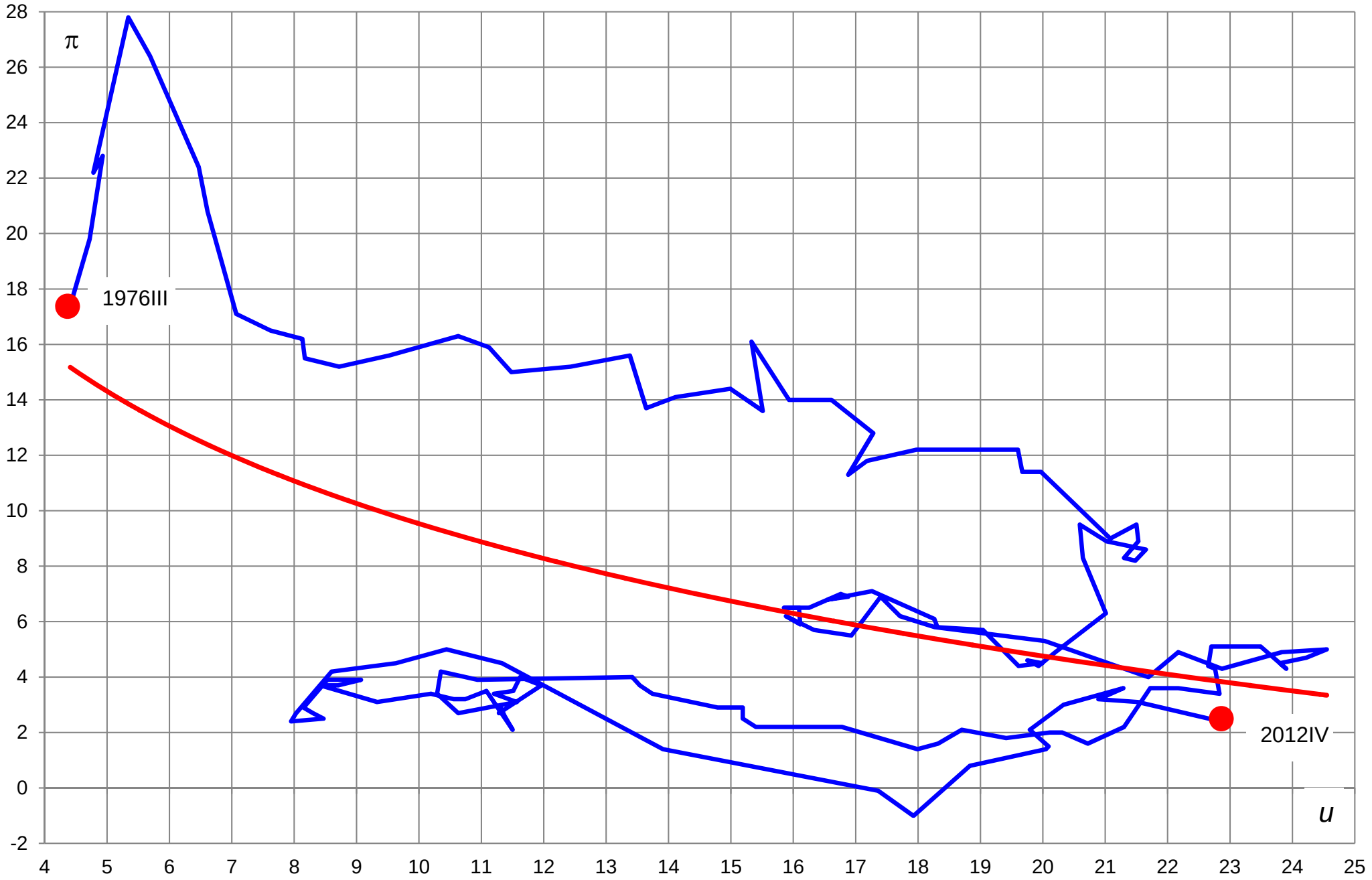
- Let $a = 10$ and $b = 2$. If $u = 4\%$, then $\pi = 10 - 2 \cdot 4 = 2\%$. Then, for u to be reduced one point (and go from 4% to 3%), π must be increased in two percentage points (from $\pi = 2\%$ to $\pi = 10 - 2 \cdot 3 = 4\%$).

- a is the inflation rate that obtains with zero unemployment. It is a measure of underlying inflation.

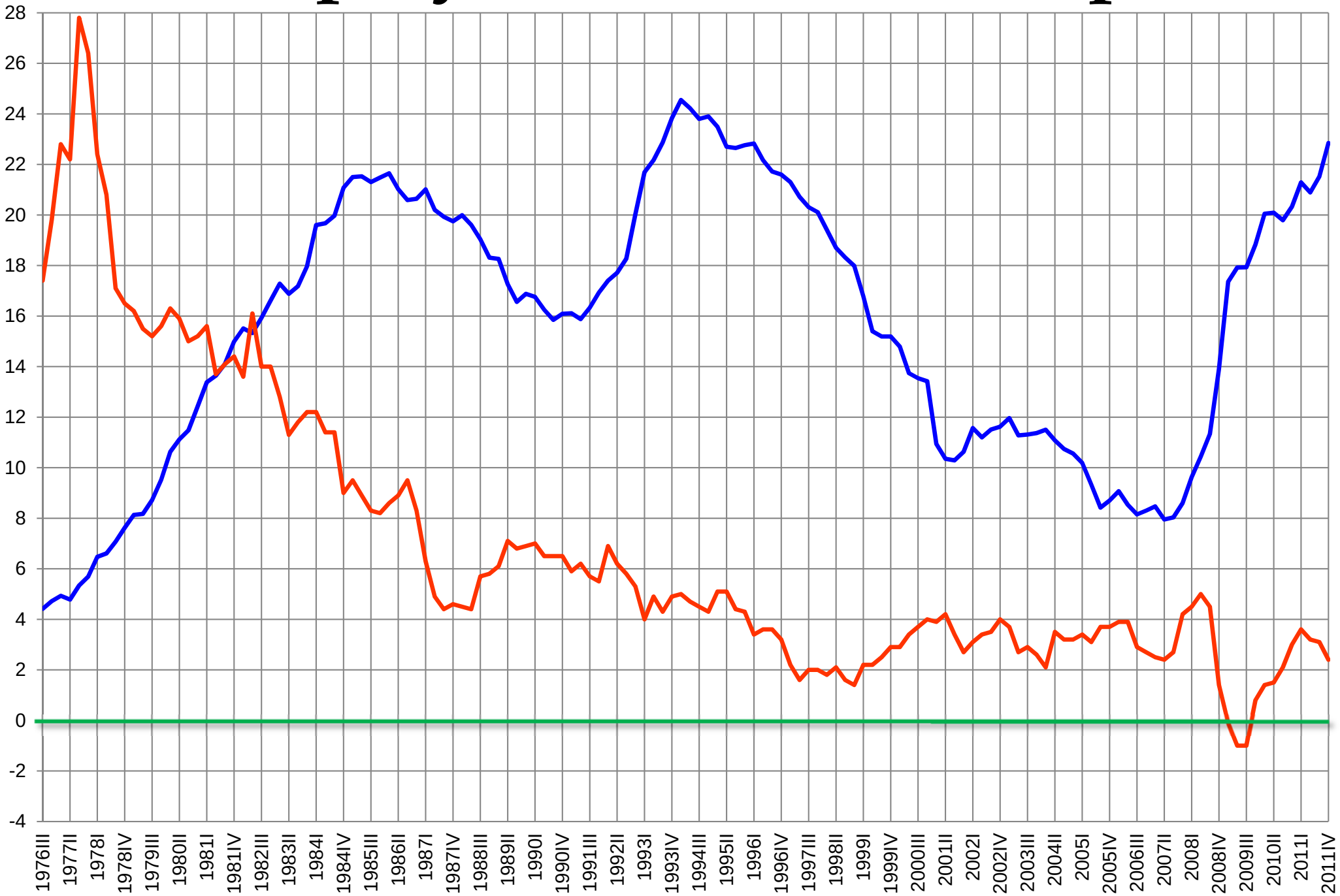
Unstability of the Phillips curve

- In contrast to Okun's law, the Phillips curve is in general unstable, since a is a volatile parameter.
- a depends on inflation expectations and the firms' cost structure: an increase in expected inflation or in the production costs rises a. When a rises, the curve shifts upward, so more inflation must be paid to reduce the unemployment rate.
- b indicates how sensitive π is to changes in u. It depends on institutional factors, like the bargaining power of trade unions (more power, higher b).

Phillips curve, Spain, 1976III-2010IV



Unemployment, Inflation, Spain

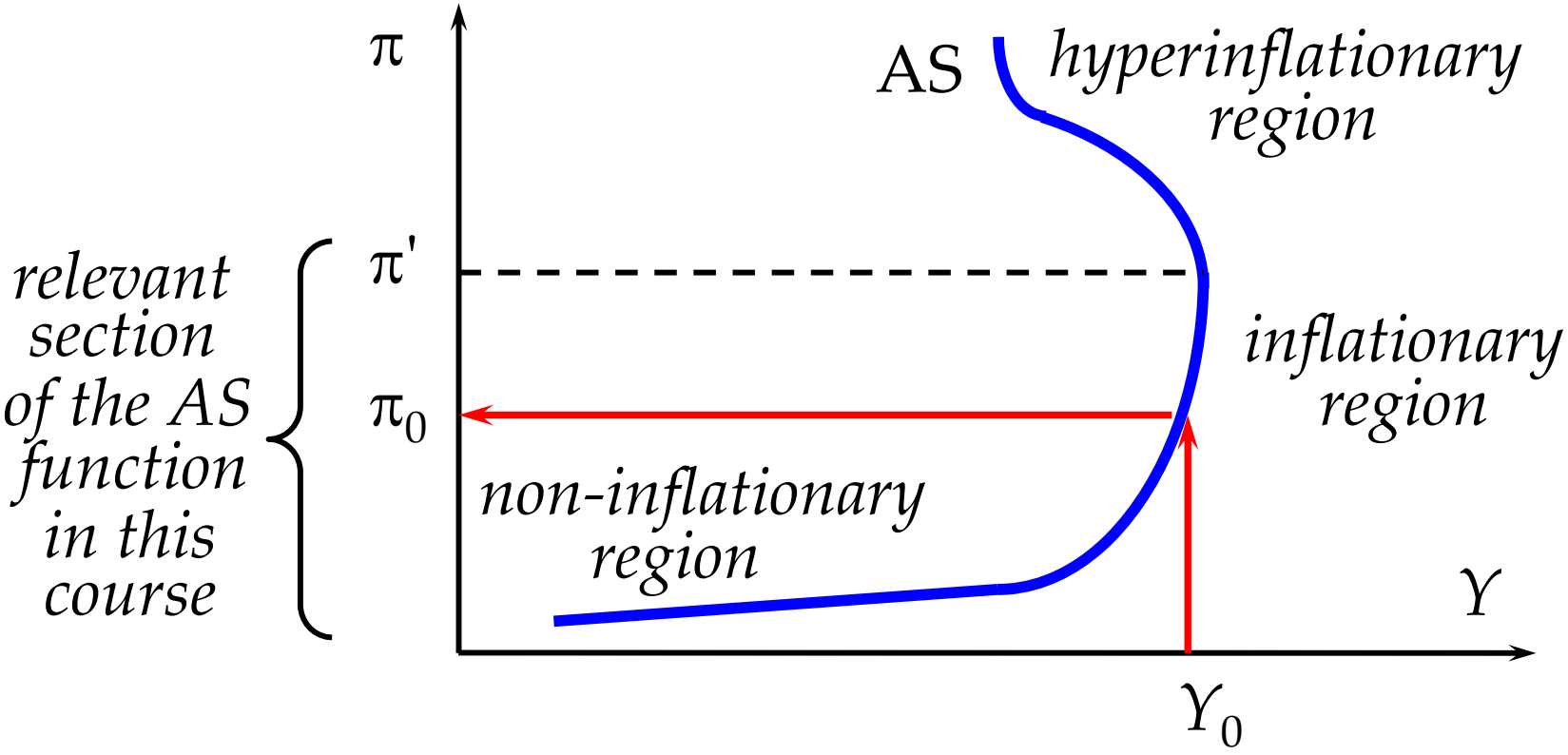


AS-AD model & business cycle

- The aggregate supply-aggregate demand (AS-AD) model is a model built to analyze the fluctuations of both the real GDP Y and the inflation rate π.
- The AS-AD model can be used to provide explanations of the business cycle and to determine the effect of exogenous shocks on the business cycle.
- Loosely speaking, the AS-AD model can be viewed as a macroeconomic version of the competitive market model in which the whole economy is taken to be the market. The model is used to ascertain the impact on Y and π of economic shocks.

Aggregate supply (AS) function

- The AS function establishes, for every amount Y of aggregate production (real GDP), the inflation rate π that results in the economy during the period of time in which Y is produced (when Y_0 is produced, the economy generates inflation rate π_0).



Upward-sloping section

- The AS function is assumed to be upward-sloping up to a certain inflation rate π'. It is for that section that the AS function is read in the direction $Y \rightarrow \pi$: production determines inflation.
- The upward-sloping section has two regions. In the non-inflationary region (that may start for negative π), the economy can grow without rising π significantly: there are idle resources usable to increase production without creating a pressure on costs.
- Along the inflationary region, the price to be paid for producing more is more inflation.

Explaining the inflationary region I

- Inflation in this region is cost-push inflation.
- Competition for resources. The amount of resources is finite. Hence, as the economy approaches the maximum value of Y that is feasible, firms encounter resource bottlenecks. Eventually, firms can only obtain more inputs by detracting them from other firms. This requires paying more for those inputs to attract them.
- Training costs. More production eventually demands hiring more workers, who in general should be trained to be able to operate efficiently.

Explaining the inflationary region II

- Reorganization costs. Changing the scale of production may require a production process redesign, which is costly.

- Diminishing marginal productivity. All production process eventually face the law of diminishing marginal productivity: each additional unit of input will in the long run add less to total production. So, to produce the same again, more inputs are needed and costs therefore increase.

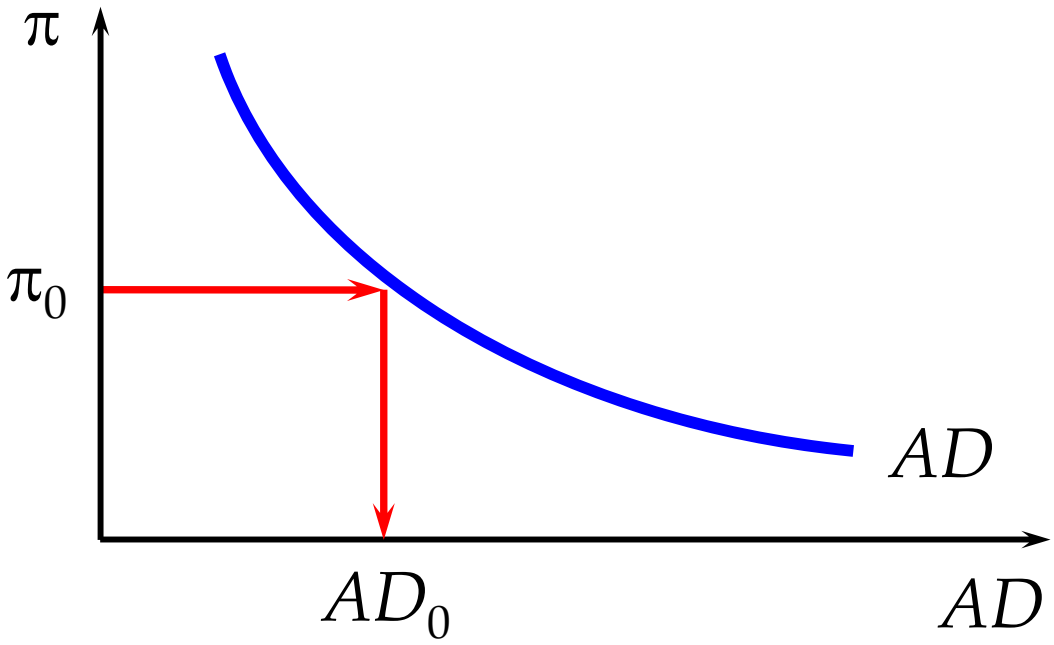
- Example: hours of study is the input to produce knowledge. With all likelihood, the tenth hour does not add as much knowledge as the first one.

Downward-sloping section

- The AS function is assumed downward-sloping above a certain inflation rate π'.
- For a high enough inflation rate (hyperinflation), the production activities no longer run smooth, because, as prices are changing so fast, agents in the economy are more concerned with preserving purchasing power.
- The normal operation of the productive system is disturbed (it is hard to make correct decisions when prices may vary every minute). So it is reasonable to expect a drop in Y when π goes up in an economy suffering from hyperinflation.

Aggregate demand (AD) function

- The AD function establishes, for each inflation rate π, the amount AD of planned aggregate expenditure. AD is the sum of four components: C (aggregate planned consumption) + I (aggregate planned investment) + G (planned government purchases) + NX (aggregate planned net exports).



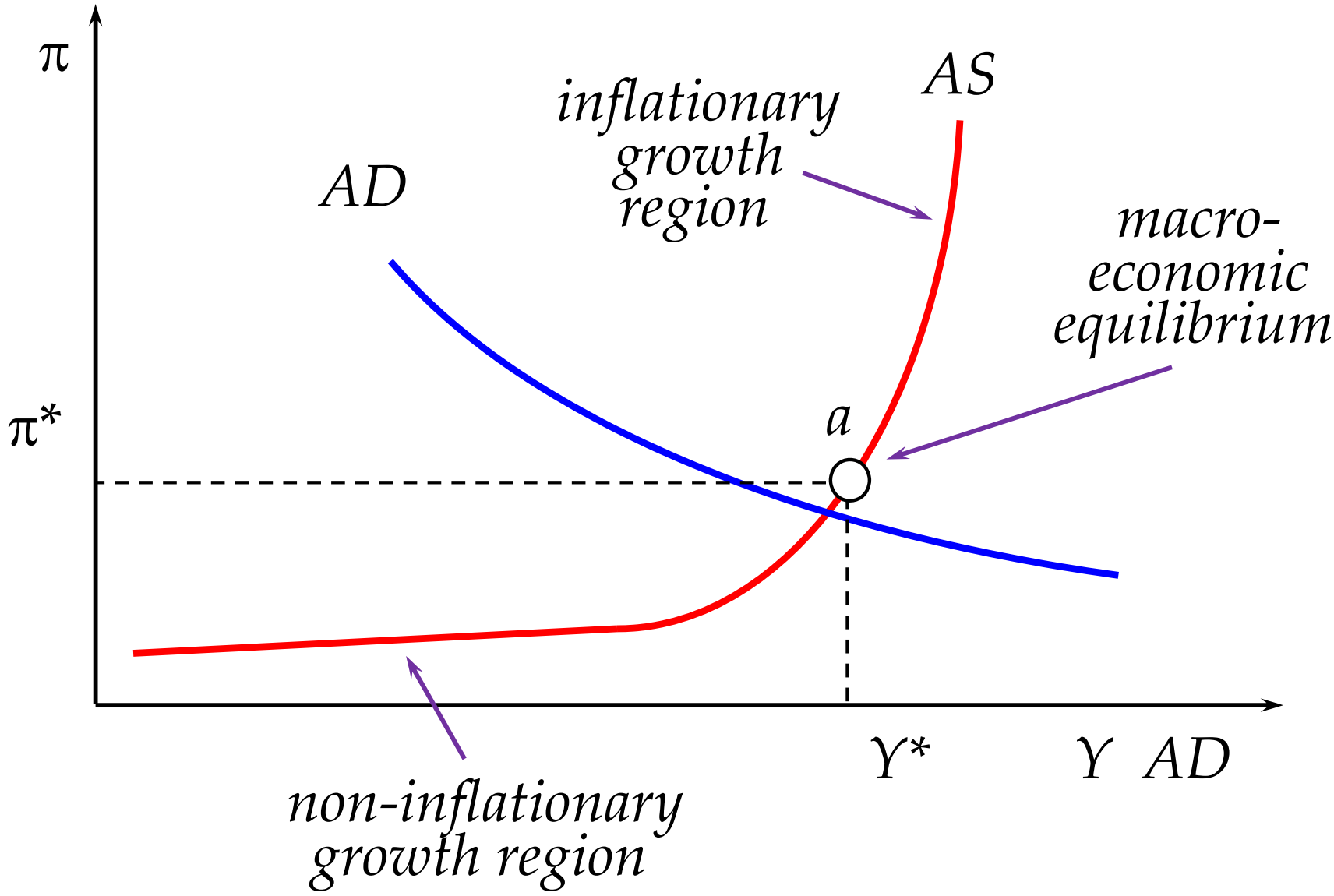
The AD is downward-sloping

- Reason 1: as the inflation rate grows, purchasing power diminishes (so consumption tends to be reduced) and competitiveness is eroded (so net exports NX diminish).
- Reason 2: as the inflation rate grows, the CB reacts by rising the interest rate i, which tends to reduce C and I. The increase in i tends to rise the exchange rate e. This rise erodes competitiveness, making net exports NX fall.
- Reason 3: a rise in the inflation rate directly erodes competitiveness, which tends to reduce NX.

Macroeconomic equilibrium

- The macroeconomic equilibrium condition states that $Y = AD$: aggregate production equals planned aggregate expenditure.
- Any pair (Y^*, π^*) satisfying the macroeconomic equilibrium condition is a macroeconomic equilibrium. Y^* is the equilibrium production (equilibrium income or equilibrium expenditure) and π^* is the equilibrium inflation rate.
- Geometrically, a macroeconomic equilibrium is represented by the intersection of the AS function and the AD function.

Macroeconomic equilibrium displayed



Changes in macro equilibrium

- Not everything is constant along the AS function: wages, for instance, may change. That change is endogenous in the sense that it is generated by the production sector itself.
- Not everything is constant along the AD function: the *i* and *e,* for instance, may change (the change of *i* is the result of a built-in feature of the model: the automatic response of the CB to rising inflation).
- Since it may not be obvious what can change or not along these functions, it is convenient to list factors that naturally shift them.

Negative shocks to the AS function

- The AS function is expected to shift left when
  - production costs exogenously rise (for instance, an oil shock for an oil importing economy or the government declares a wage increase);
  - the amount of resources (factors of production) falls;
  - less credit is available;
  - the number of firms is reduced;
  - the government rises taxes;
  - the inflation rate is expected to rise the next period (likely effect);
  - more pessimistic expectations of businessmen on the evolution of the economy.

Positive shocks to the AS function

- The AS function is expected to shift right when
  - production costs exogenously fall;
  - the amount of resources increases;
  - more credit is available;
  - the number of firms rises;
  - the government lowers taxes;
  - previous investments become operative;
  - technological progress applied to production;
  - improvements in the organization of production;
  - productivity increases;
  - businessmen adopt optimistic (profit) expectations.

Positive shocks to consumption

- Aggregate planned consumption *C* (and, therefore, *AD*) is positively affected by
  - increases in income and wealth (for instance, a rise in the price of shares);
  - an increase in the number of consumers (more population);
  - the expectation that income, wealth, the inflation rate, or the interest rate will grow in the future (better to consume now than later);
  - a reduction of taxation/a rise in transfers;
  - the reduction in the (real) interest rate;
  - credit made more easily available.

Positive shocks to investment

- Aggregate planned investment I (and, therefore, AD) is positively affected by
  - favourable expectations by businessmen (on profits, the evolution of the economy);
  - an increase in the number of firms;
  - subsidies stimulating investment;
  - a reduction of taxes on profits;
  - the reduction in the (real) interest rate;
  - credit made more easily available;
  - technological progress.

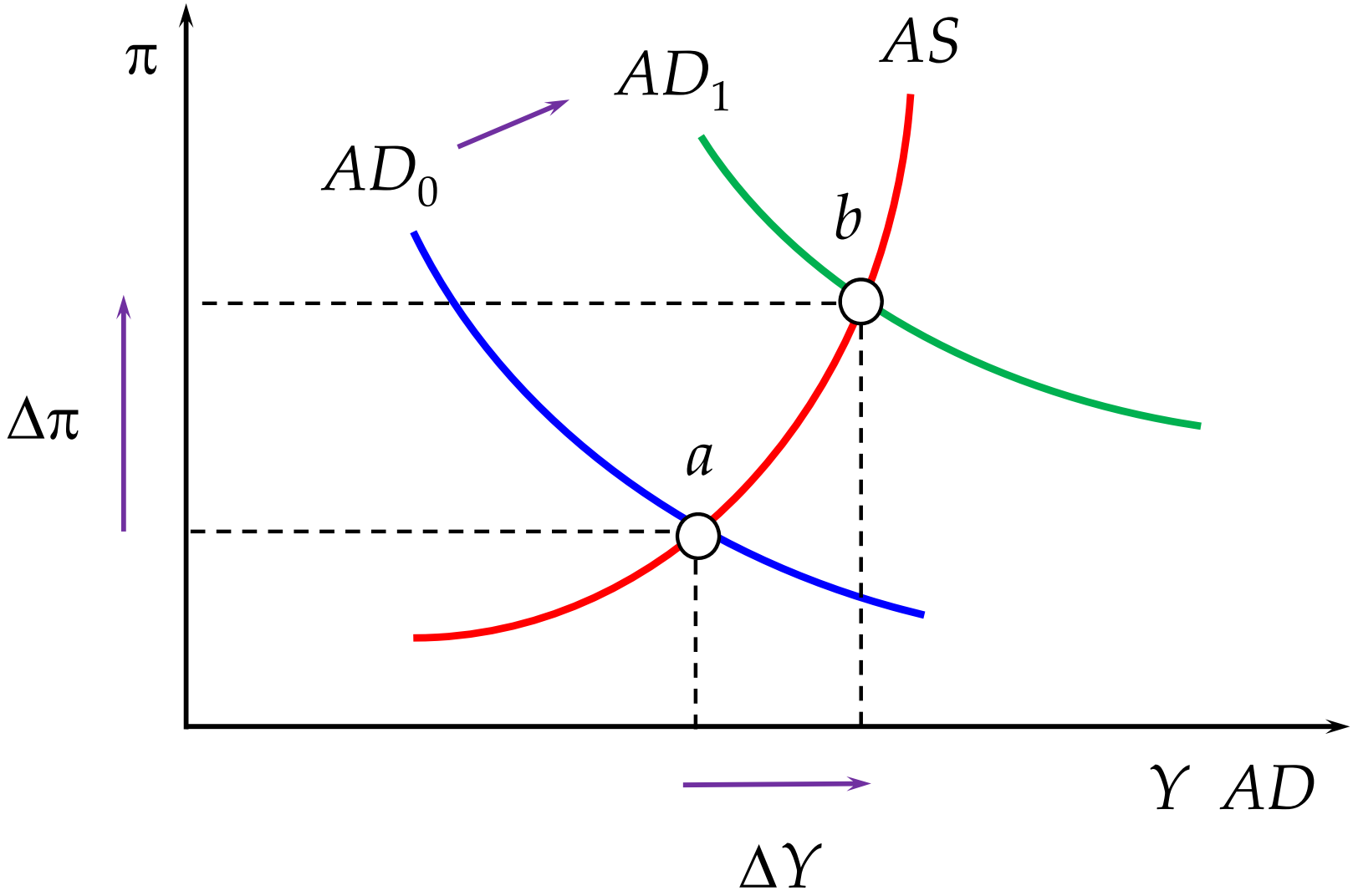
Positive shocks to net exports

- Aggregate planned net exports *NX* (and, therefore, *AD*) is positively affected by
  - a reduction in domestic income (less imports);
  - an increase in foreign income (more exports);
  - a depreciation of the nominal exchange rate (domestic goods become cheaper);
  - a reduction in domestic inflation in comparison to the rest of the world (competiteveness is gained);
  - an increase in foreign inflation in comparison to domestic inflation;
  - government subsidies to exports;
  - a rise in tariffs.

Effects of an AD expansion

- The next slide shows the effect of an AD expansion: the equilibrium inflation rate and production both rise (an AD contraction causes the opposite result).
- This general conclusion should be qualified: if the economy lies in the non-inflationary region, the increase in the inflation rate may be negligible (and the AD expansion only creates GDP growth).
- If the economy lies ahead in the inflationary region (and near the largest feasible amount of production), it is the increase in production that may be negligible (so the AD expansion only creates inflation).

Positive demand shock: primary effects



Multiplier effect (I)

- The impact on Y^* of a change in the AD function is the result of an expenditure multiplier effect.
- Since expenditure AD depends on income Y and, in equilibrium $Y = AD$, the sequence

$$\Delta AD \rightarrow \Delta Y \rightarrow \Delta AD \rightarrow \Delta Y \rightarrow \ldots$$

  is generated, so a change in AD multiplies itself.
- Example. Let the AD function only depend on C and I, so $AD = C + I$. Let I be constant. Specifically, $C = 4 + 0.8Y - \pi$ and $I = 10$ (the 0.8 is the marginal propensity c to consume: which fraction of an additional unit of income is consumed).

Multiplier effect (II)

- The AS function is $Y = 30\pi$. The macroeconomic equilibrium is obtained from the condition $Y = DA$. That is, $Y = 4 + 0.8Y - \pi + 10$. Thus, $0.2Y = 14 - \pi$. As $Y = 30\pi$, $\pi = 2$ (it is assumed that π is a percentage).
- Imagine now that there is an increase in investment, from 10 to 17 (for instance, businessmen become more optimistic).
- To better illustrate the multiplier effect, assume that the inflation rate does not change and remains at 2% (it is as if the AS function were horizontal at $\pi = 2$: the economy absorbs any increase in planned expenditure without fuelling inflation).

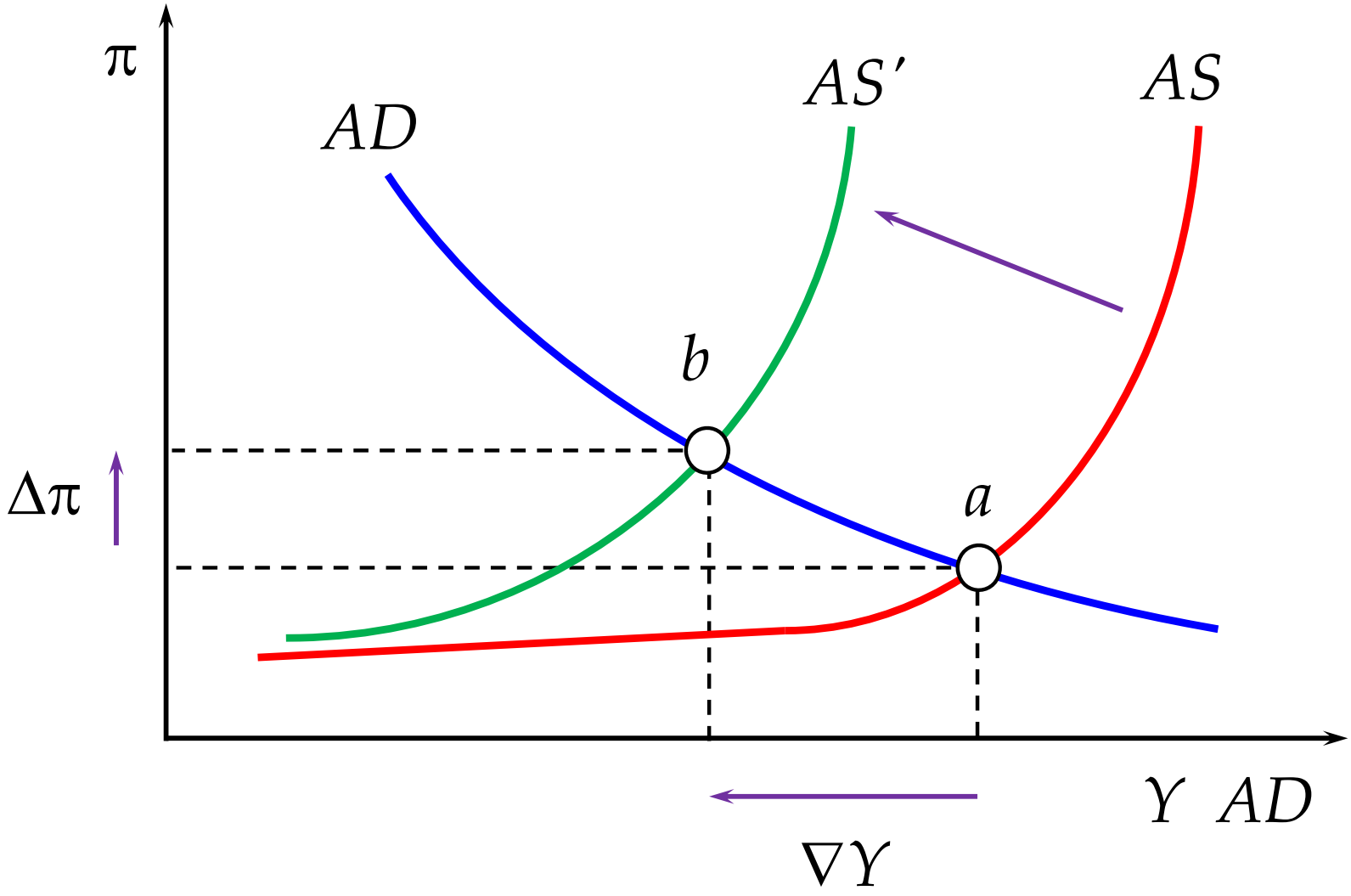
Multiplier effect (III)

- The state of the economy is described by conditions $Y = AD$ and $\pi = 2$. Hence, $Y = 4 + 0.8Y - \pi + 17 = 19 + 0.8Y$. It then follows that $0.2Y = 19$, so $Y = 95$.
- To sum up, expenditure has only been increased 7 units (from $I = 10$ to $I = 17$), but production (and income) have risen 35 units (from $Y = 60$ to $Y = 95$). This is caused by the multiplier effect. In this case, the multiplier is 5, obtained from $1/(1 - c)$.
- When the AS function enters the picture, part of the expenditure is transformed into inflation. With $Y = 30\pi$ and $AD = 4 + 0.8Y - \pi + 17$, $\pi^* = 3$ and $Y^* = 90$ (5 units of income are lost due to inflation).

Effects of an AS contraction

- The next slide shows the effect of an AS contraction: the equilibrium inflation rate rises but production falls.
- This phenomenon is called stagflation: stagnant economy with rising inflation. Western economies all experienced staglation in the 1970s.
- An AS expansion causes the opposite result: non-inflationary growth. The US economy experienced this result in the 1990s (it was then speculated that a *New Economy* was born capable of sustaining non-inflationary growth thanks to continuous productivity gains created by the digital revolution).

Negative supply shock: primary effects



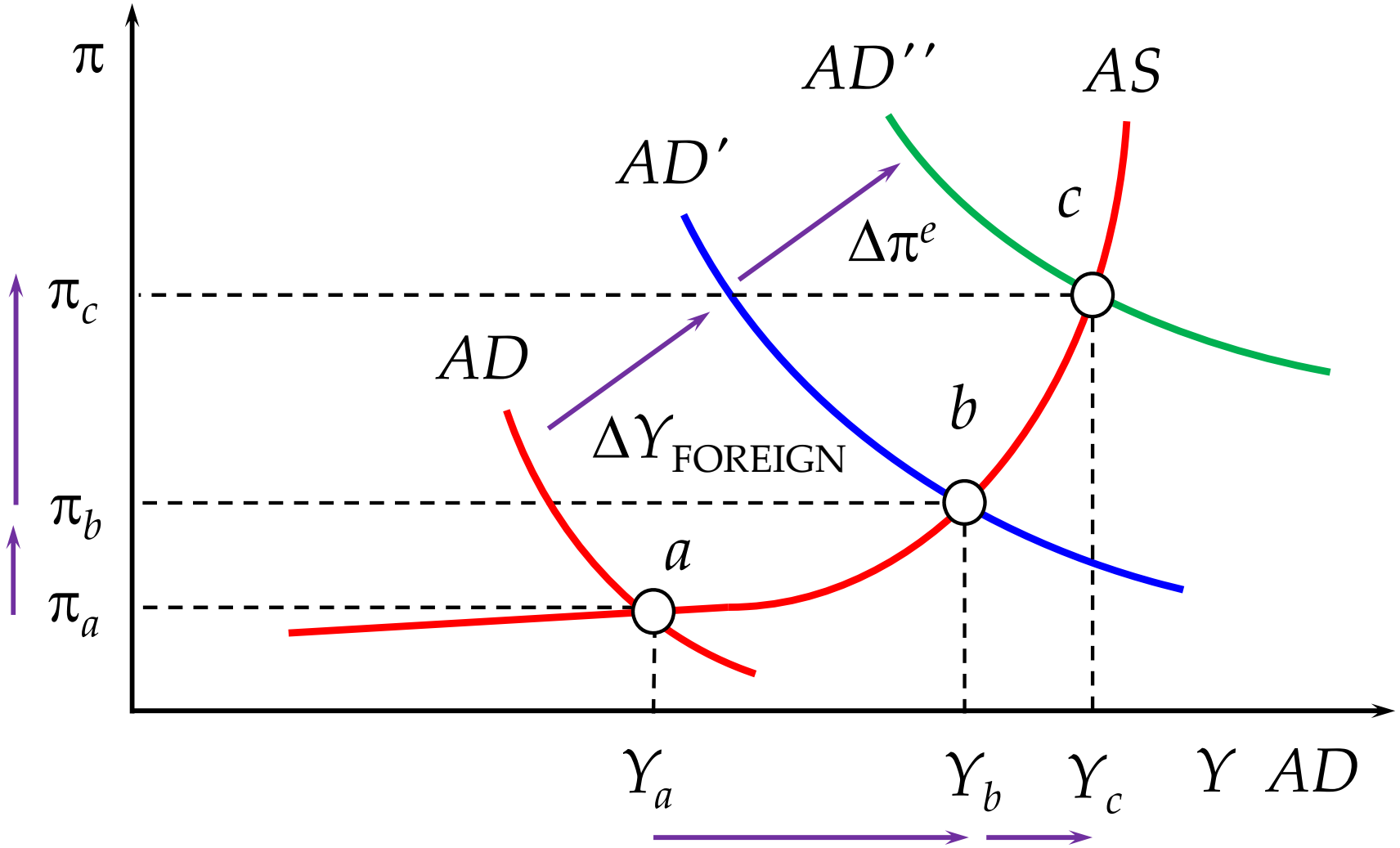
Secondary effects of shocks

- The effects of a shock need not be limited to the primary effects, because the new macroeconomic equilibrium need not be stable. Consequently, the initial shock may generate more shocks.

- The additional changes in the macro equilibrium are typically generated by changes in the expected inflation rate (π^e) caused by the initial shock.

- Suppose, for instance, that foreign outcome rises. This causes a positive demand shock (ΔNX) that shifts right the AD function; see the next slide.

Role of inflationary expectations



Self-replicating shocks

- Suppose *AD* is drawn assuming a correct expected inflation rate: $\pi^e = \pi_a$. After the shock, the inflation rate rises to π_b, so people realize that their expectation is incorrect: inflation is higher than expected.

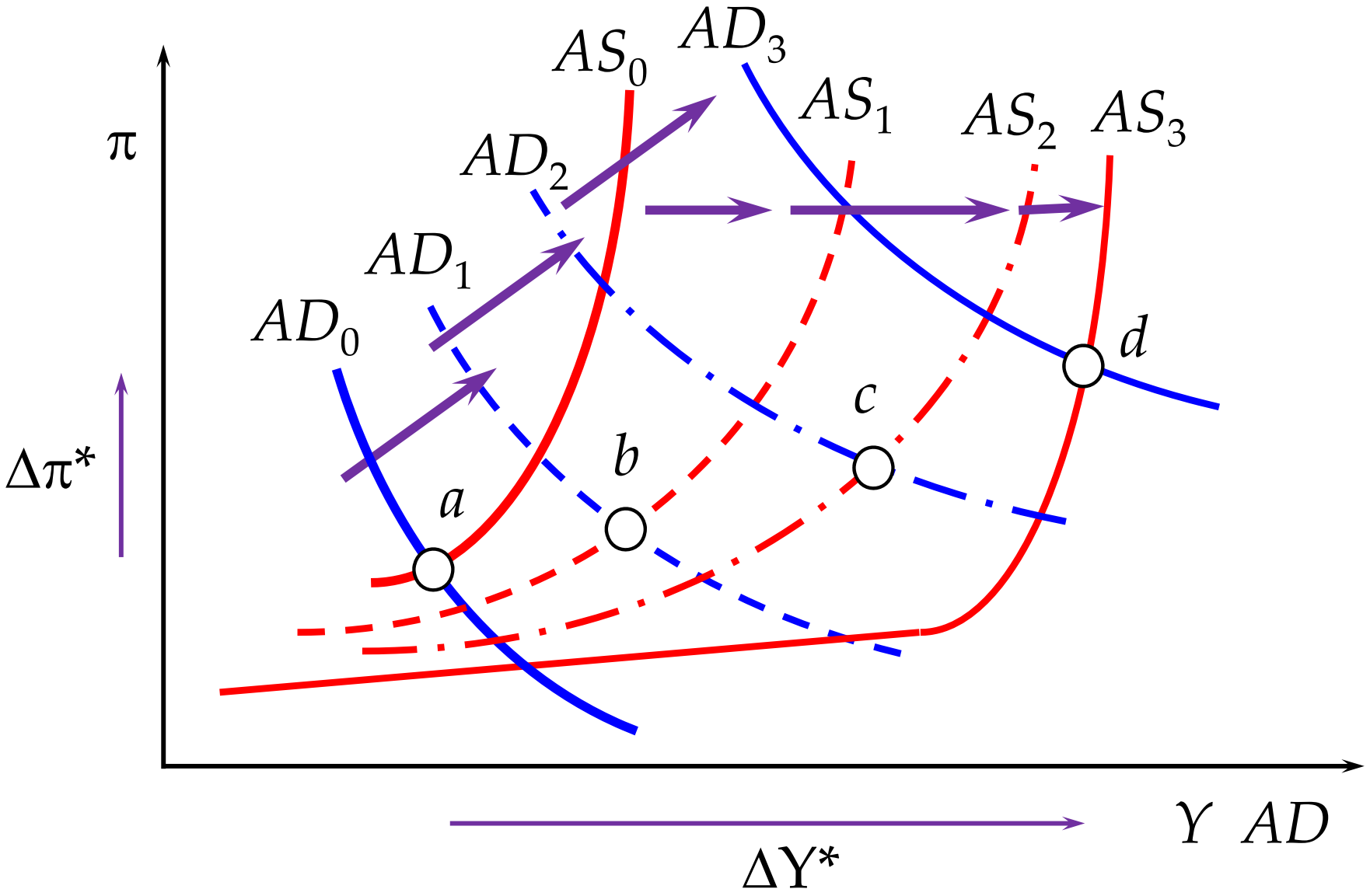
- It is reasonable to presume that people will rise π^e. This shifts the AD function from *AD′* to *AD′′*, which stimulates the economy further.

- If π^e in *AD′′* is smaller than the new equilibrium inflation rate π_c, inflationary expectations will continue to grow. Curiously, it is the expectation of a higher inflation that generates a higher inflation.

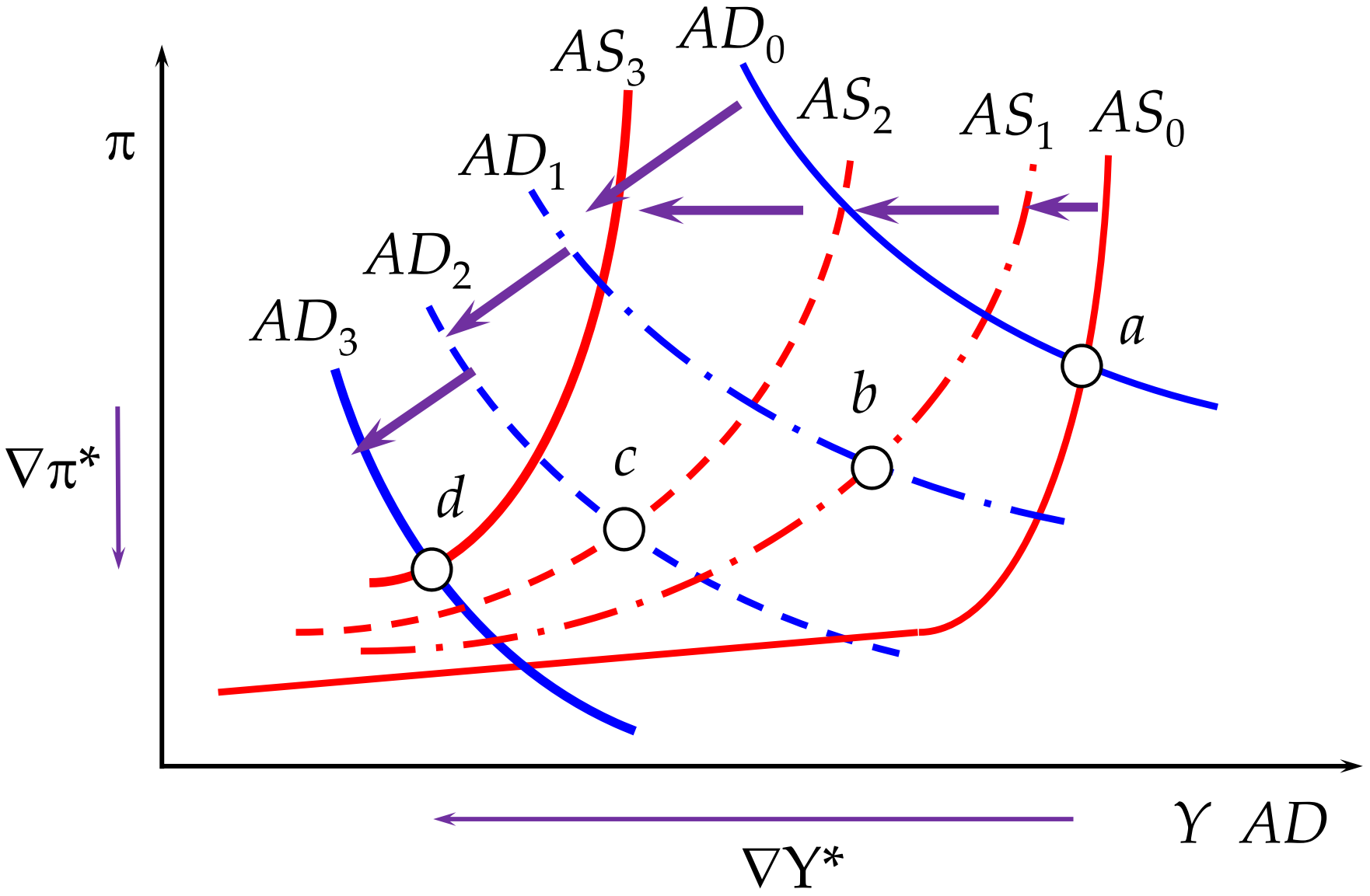
Business cycle in the AS-AD model

- That same logic explains the sustainability of the expansion period of the business cycle (and also the sustainability of the recession period).
- The next two slides illustrate how the expansion and recession period arise: a continuous shift in, typically, both functions.
- The third slide (130) depicts the typical evolution of production and the inflation rate during the business cycle. The fourth slide (131) shows how this pattern can be generated by a simple example.

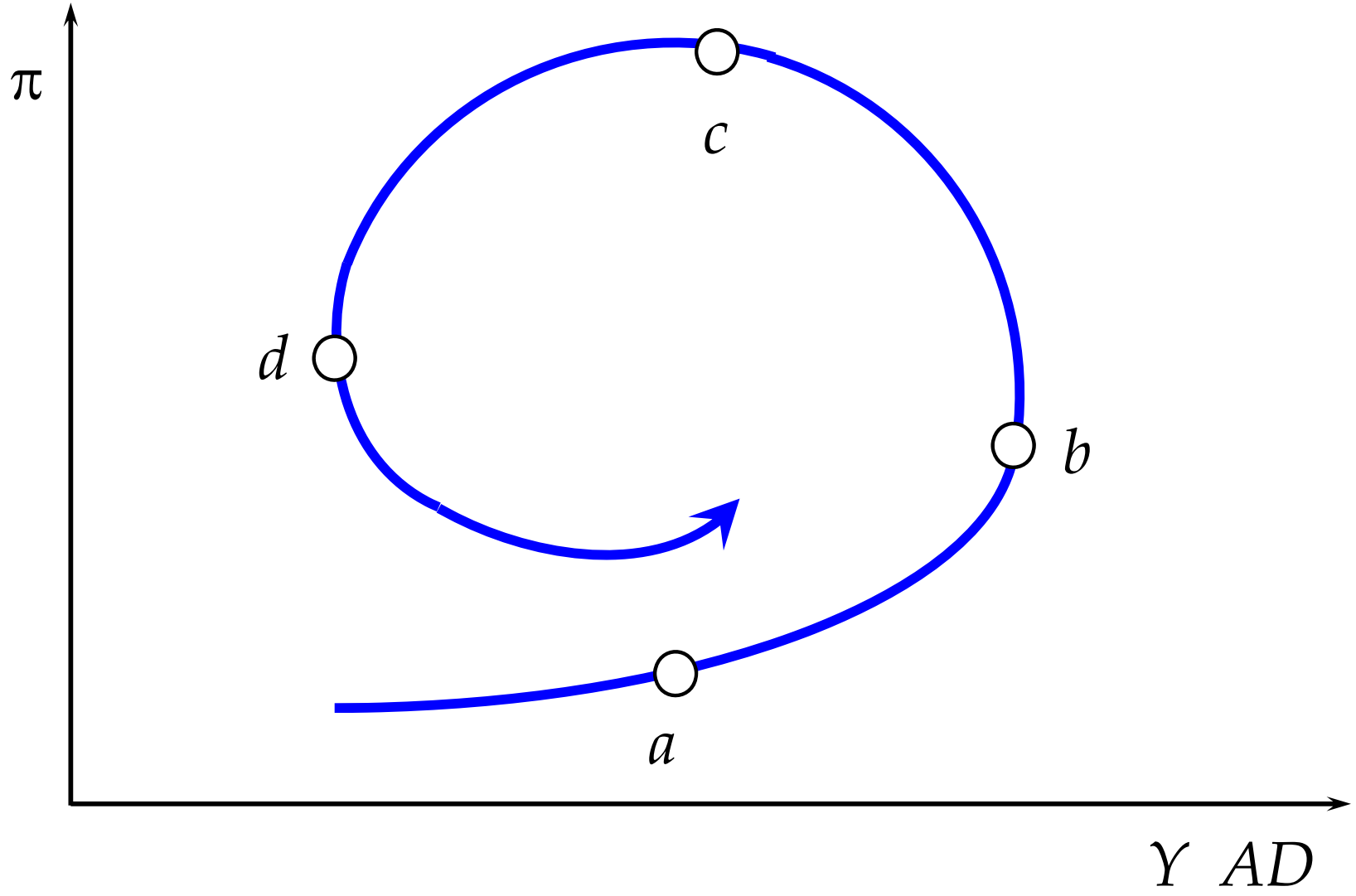
A booming economy



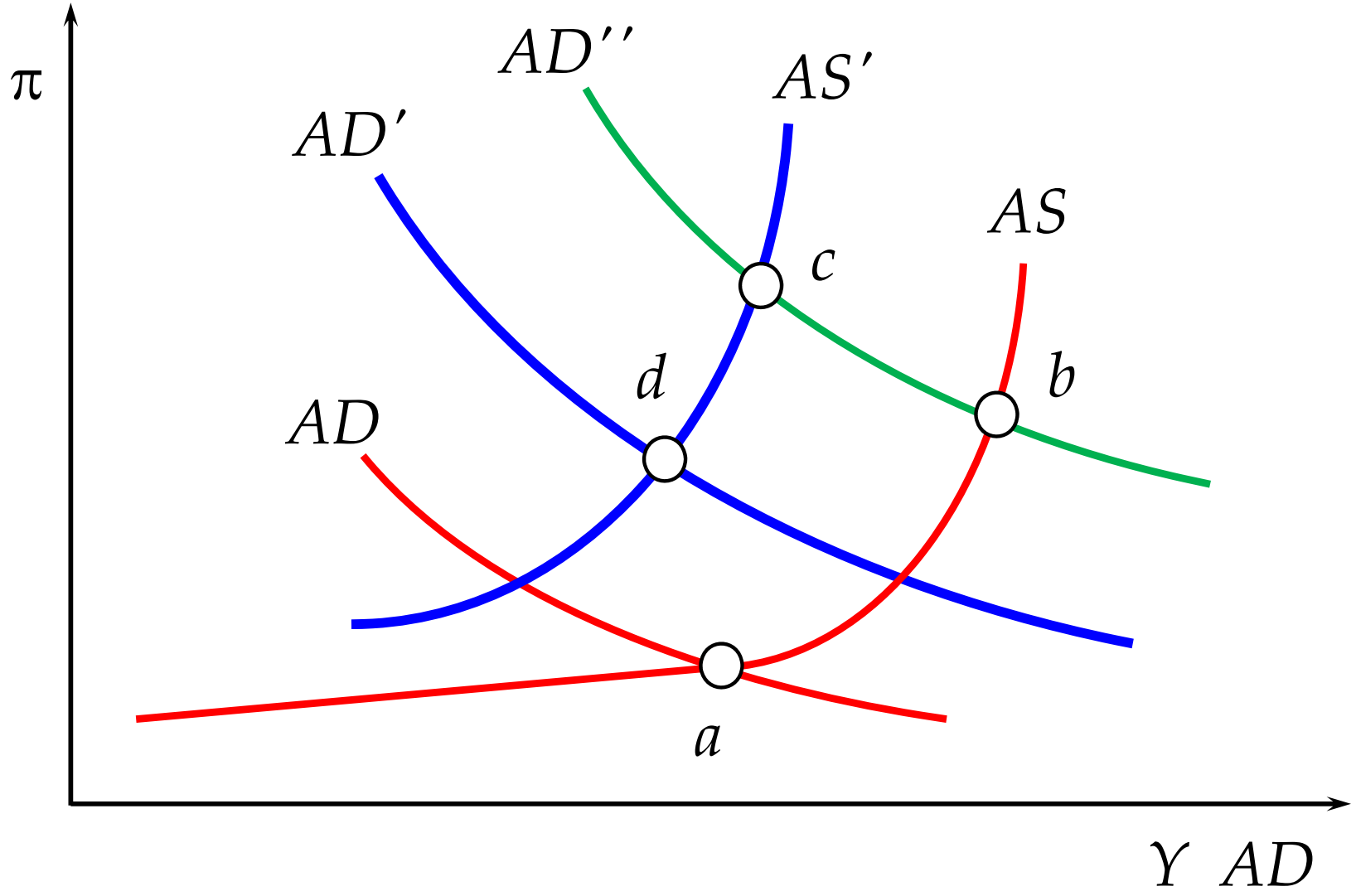
A slumping economy



Typical business cycle loop



Business cycle example



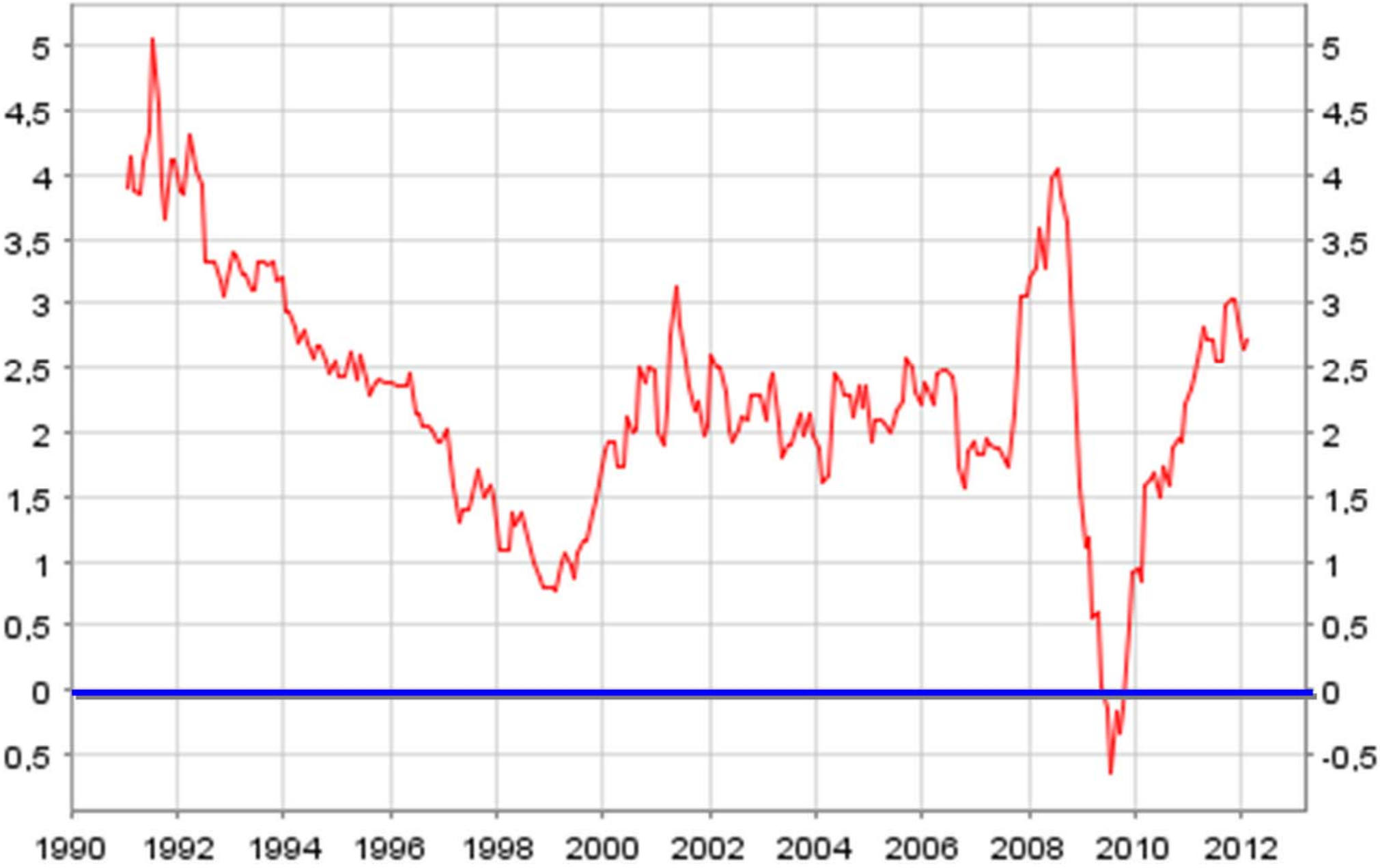
Creating business cycles: an example

- The initial point is *a*. The collective agreement of wages is being negotiated and workers expect a certain increase in wages. At the expense of the future wage increase, workers raise consumption now. AD shifts to the right and *b* is reached.
- By then the agreement terms are known: there is a surge in wages but less than expected. That increase shifts AS to the left. The equilibrium goes from *b* to *c*. But since the wage rise was smaller than expected, workers cut consumption (*AD*' moves to *AD*'') and *d* is reached.

Long-run & short-run macroeconomics

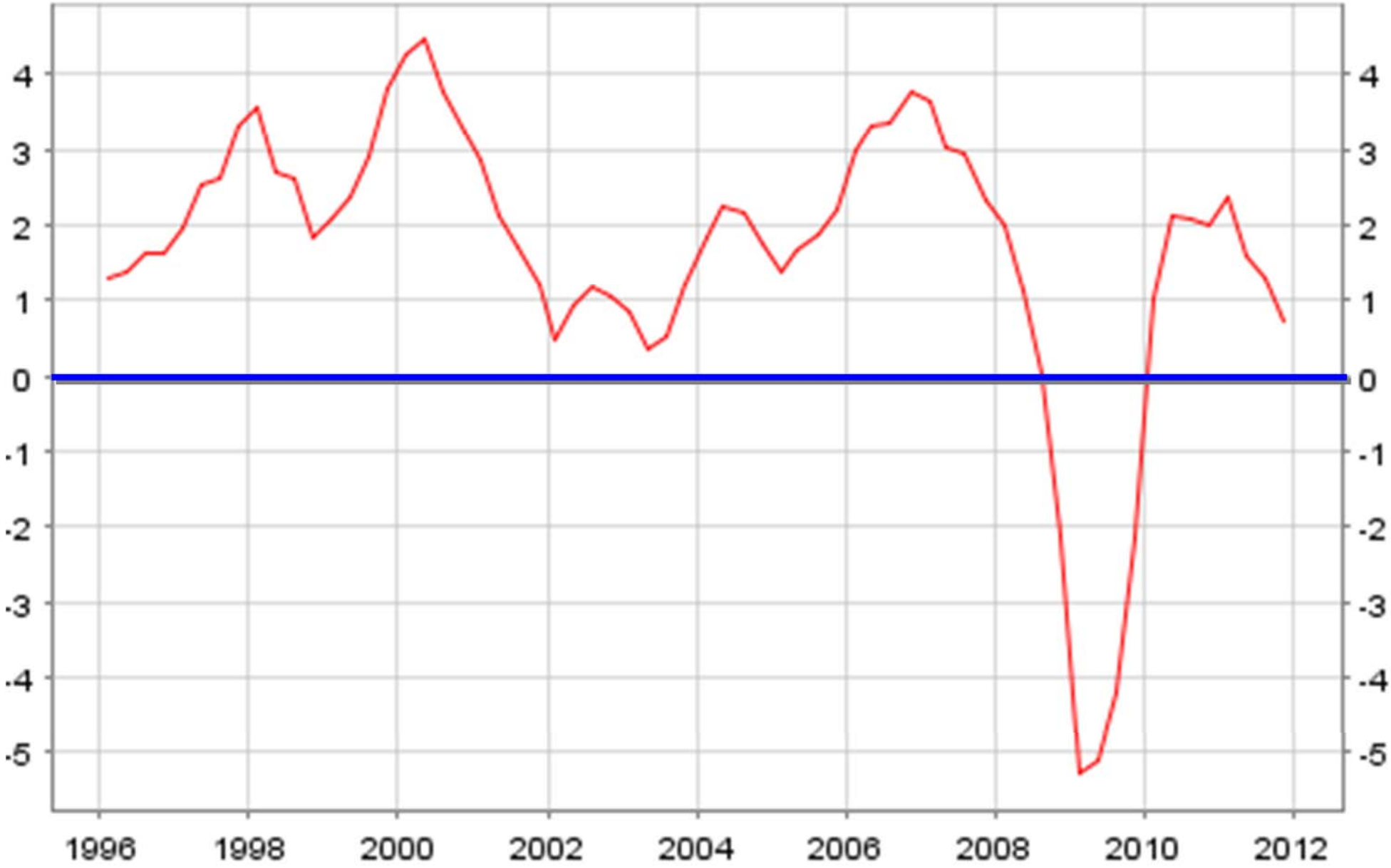
- Textbooks make production converge to a long run fixed production level representing potential GDP, which is presumed to be given and unaffected by short run decisions. This is a quite debatable assumption (in fact, there is no long run but a sequence of short runs).
- "The long run is a misleading guide to current affairs. In the long run we are all dead. Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is past the ocean is flat again." J. M. Keynes, *A Tract on Monetary Reform*, 1923, Ch. 3.

HCPI inflation, Eurozone, Jan91-Feb12



http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=122.ICP.M.U2.N.000000.4.ANR

GDP growth, Eurozone, 1996Q1-2011Q4



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Annual GDP growth, Spain 1971I-2011II