5. Unemployment rate

1. Unemployment rate and participation rate

Definition 1.1. Employment is the number of people having a job. Unemployment is the number of people not having a job but looking for one. The labour force is employment plus unemployment.

Definition 1.2. Unemployment rate = Unemployment / Labour force.

Definition 1.3. Participation rate = Labour force / Economically active population.

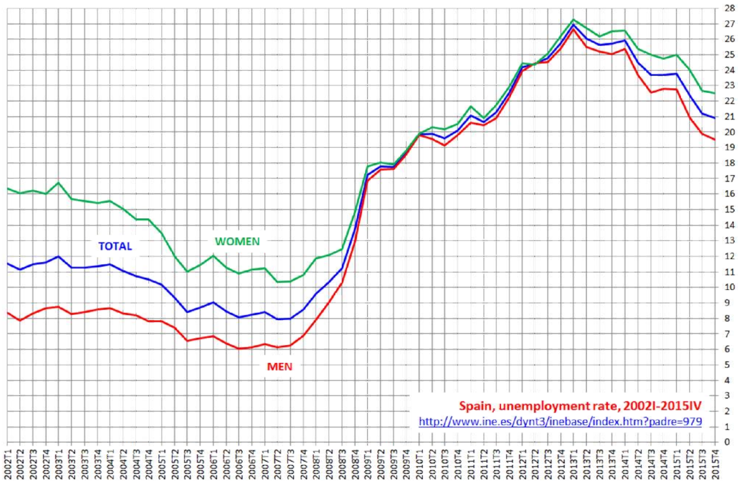

Fig. 1. Unemployment rates, Spain, 2002-2015

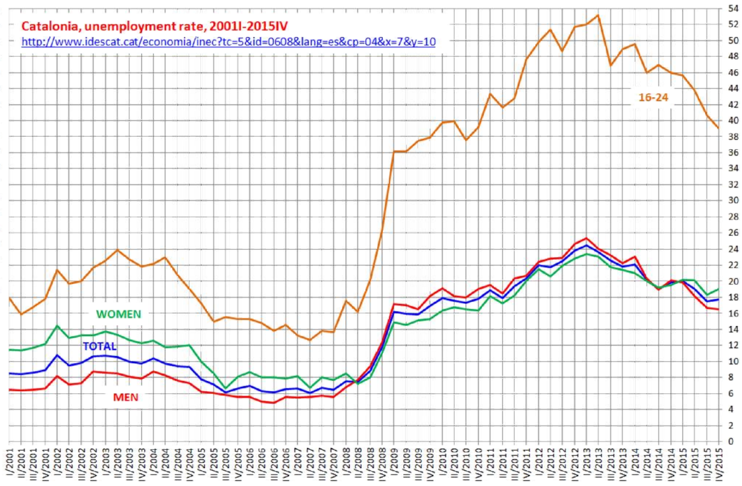

Fig. 2. Unemployment rates, Catalonia, 2001-2015

2. Basic types of unemployment

Actual unemployment can be divided into three categories. The first two define 'natural unemployment'.

• <u>Frictional</u>. Occurs while workers are changing jobs.

• <u>Structural</u>. Due to structural changes in the economy that create and eliminate jobs and to the institutions that match workers and firms (firing and hiring costs, minimum wages, unemployment benefits, mobility restrictions, lack of training…).

• <u>Cyclical</u>. Generated by the short-run fluctuations of GDP (rises with recessions, falls with booms)

3. Okun's law

Okun's law is an empirical relationship suggested in 1962 by the US economist Arthur Okun (1928-80). Definition 1 is just one of the alternative ways of expressing this relationship formally.

Definition 3.1. <u>Okun's law</u> states that there is a negative relationship between the change $\Delta u = u - u_{-1}$ in the unemployment rate and $\hat{Y} = \frac{Y - Y_{-1}}{Y_{-1}}$, the rate of growth $\hat{Y}$ of real GDP Y. A simple formal expression of the law is

$$\Delta u = a - b \cdot \hat{Y}$$

where a and b are positive constants: a represents the increase in u that occurs when the economy does not grow (if $\hat{Y} = 0$, then $\Delta u = a$), whereas b measures the ability of the economy to transform GDP growth into a smaller unemployment rate (increasing y by one point reduces u by b points).

Example 3.2. Expressing the variables as annual percentages, in the US, $a \approx 1.5$ and $b \approx 0.5$. Therefore

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

Example 3.3. If $u_{-1} = 2\%$ and $\hat{Y} = 0$, then $u = u_{-1} + a - \hat{Y}/2 = 2 + 1.5 - 0/2 = 3.5$. Hence, if the unemployment rate at the beginning of the year is 2% and the economy does not grow, at the end of the year the rate is 3.5%.

Example 3.4. If $\hat{Y} = 2\%$, then $u = u_{-1} + 1.5 - \hat{Y}/2 = u_{-1} + 1.5 - 2/2 = u_{-1} + 0.5$. If $\hat{Y} = 3\%$, then $u = u_{-1} + 1.5 - \hat{Y}/2 = u_{-1} + 1.5 - 3/2 = u_{-1}$. Therefore, increasing y from 2% to 3% reduces u from $u_{-1} + 0.5$ to u_{-1}. There is a gain of 0.5 points: an additional 1% in y becomes 0.5 points less of u.

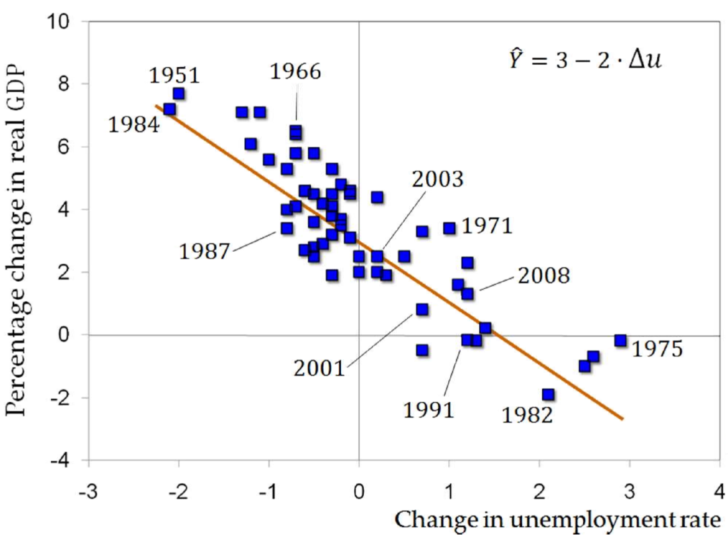

Fig. 3. Okun's law, US, 1951-2008
https://www2.bc.edu/~murphyro/EC204/PPT/CHAP09.ppt

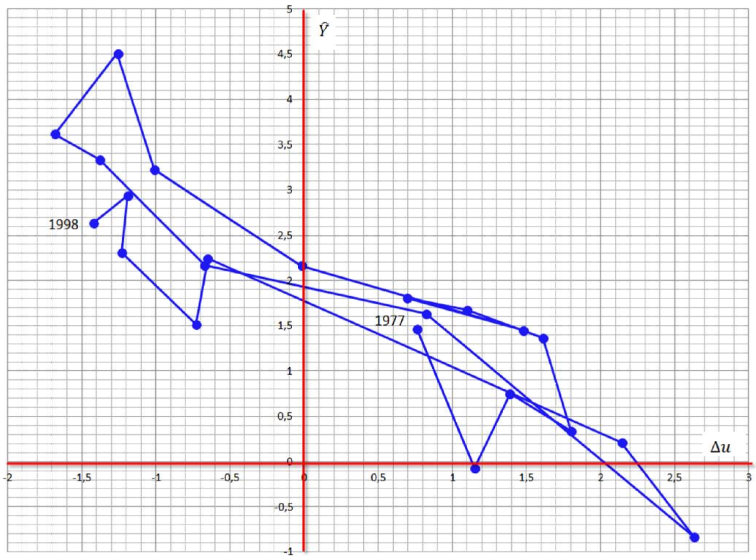

Fig. 4. Okun's law, Spain, 1977-1998
http://www.ine.es

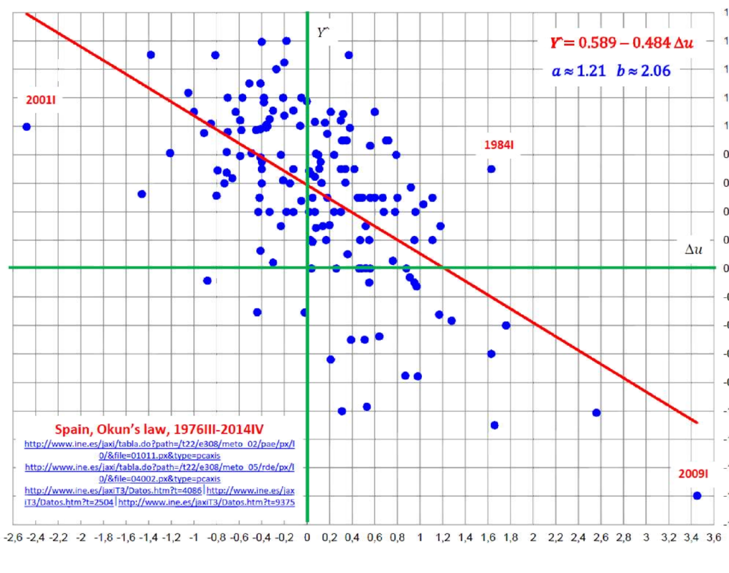

Fig. 5. Okun's law, Spain, 1976III-2014IV

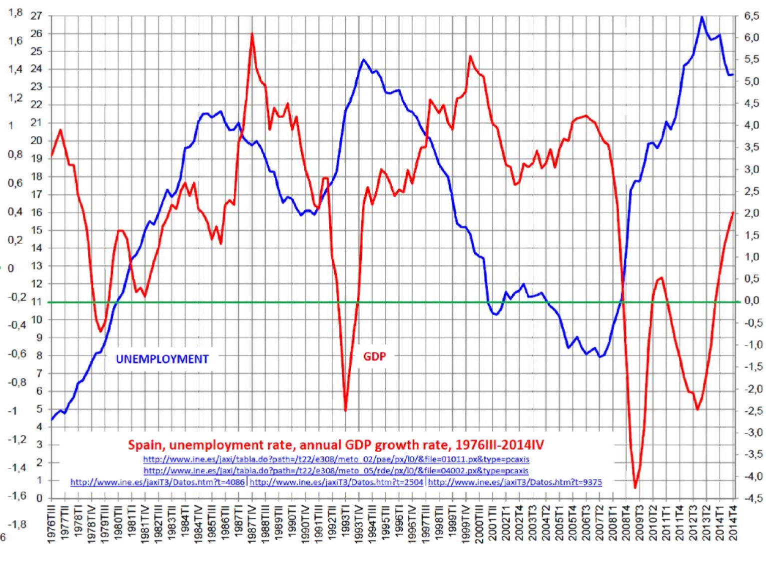

Fig. 6. Unemployment and GDP, Spain, 1976III-2014IV

Figs. 3 and 4 depict the Okun's law relationship between GDP and unemployment (both measured annually) for the US and Spain. Fig. 5 is Okun's law for Spain with quarterly data. The linear approximation to the data suggests that, for Spain, $a \approx 1.21$ and $b \approx 2.06$: with zero GDP growth, the unemployment rate increases by 1.2 percent points every quarter; and an additional percent point in quarterly GDP growth reduces the unemployment rate by 2 percent points during the quarter. Fig. 6 illustrates the apparent inverse relationship between the unemployment rate and GDP growth: when GDP growth falls, the unemployment rate tends to rise; conversely, when GDP growth increases, the unemployment rate tends to decline.

Example 3.5. Let $a = 1$ and $b = 2$, so $\Delta u = 1 - 2 \cdot \hat{Y}$. That is, $u - u_{-1} = 1 - 2 \cdot \hat{Y}$ or $u = u_{-1} + 1 - 2 \cdot \hat{Y}$. This equation provides the current value u of the unemployment rate when the unemployment rate u_{-1} in the immediately preceding period and the current GDP growth rate $\hat{Y}$ are both known. Table 7 shows some values obtained from this equation. Even when GDP grows, the unemployment rate does not decline (this happens from $t = 1$ to $t = 2$). This is due to the fact that $\Delta u < 0$ (the unemployment rate falls) if and only if $a - b \cdot \hat{Y} > 0$; that is, if and only if $\hat{Y} > a/b$. With $a = 1$ and $b = 2$, $a/b = 0.5$. Therefore, for the unemployment rate to be reduced, GDP growth should at least be 0.5%.

time t	0	1	2	3	4	5	6	7
$\hat{Y}$		0	0.25	0.5	1	2	0	−1
u	26	$26 + 1 - 2{\cdot}0 = 27$	$27 + 1 - 2{\cdot}0.25 = 27.5$	$27.5 + 1 - 2{\cdot}0.5 = 27.5$	$27.5 + 1 - 2{\cdot}1 = 26.5$	23.5	24.5	27.5

Table 7. An example illustrating Okun's law, $u = u_{-1} + 1 - 2 \cdot \hat{Y}$

4. The Phillips curve

The Phillips curve is an empirical relationship between the inflation rate and the unemployment rate 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). Fig. 8 plots the inflation rate and the unemployment rate in Spain. The graph suggests that a falling (rising) unemployment rate tends to coincide with a rising (falling) inflation rate.

Definition 4.1. The Phillips curve expresses a negative relationship between the unemployment rate u and the inflation rate π: the lower u, the higher π. With α and β positive constants, a linear Phillips curve is represented by an equation of the sort

$$\pi = \alpha - \beta \cdot u\,.$$

Expressing π and u in percentage terms, that $\pi = \alpha - \beta \cdot u$ means that, to reduce one percentage point the unemployment rate u, it is necessary to accept an increase in the inflation rate π of β points.

Example 4.2. Let $\alpha = 10$ and $\beta = 2$. If $u = 4\%$, then $\pi = 10 - 2{\cdot}4 = 2\%$. Then, for u to be reduced one point (from 4% to 3%), π must be increased in two percentage points (from $\pi = 2\%$ to $\pi = 10 - 2{\cdot}3 = 4\%$).

Parameter α is the inflation rate under zero unemployment. It is a measure of underlying inflation. In contrast to Okun's law, the Phillips curve is in general unstable, since α is a volatile parameter. α depends on inflation expectations and the firms' cost structure: an increase in expected inflation or in the production costs rises α. When α rises, the curve shifts upward, so more inflation must be paid to reduce the unemployment rate. β indicates how sensitive π is to changes in u. It depends on institutional factors, like the bargaining power of trade unions (more power, higher β). Fig. 9 shows the Phillips curve for Spain (in fact, there appear to be at least three such curves, as the curve shifts with time).

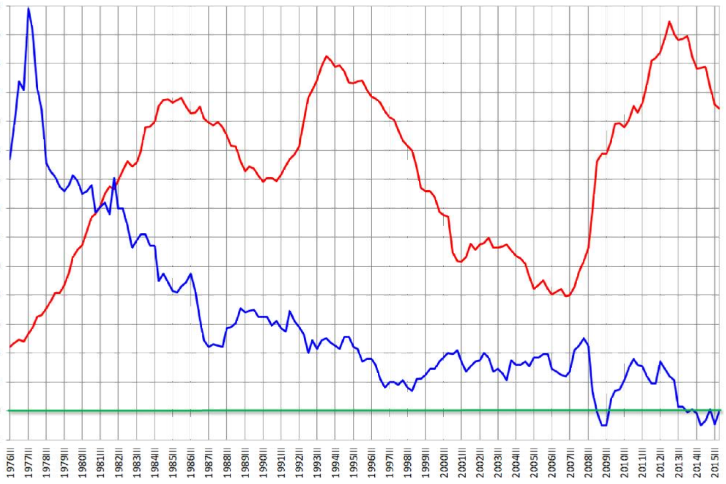

Fig. 8. Inflation and unemployment, Spain, 1976III-2015IV

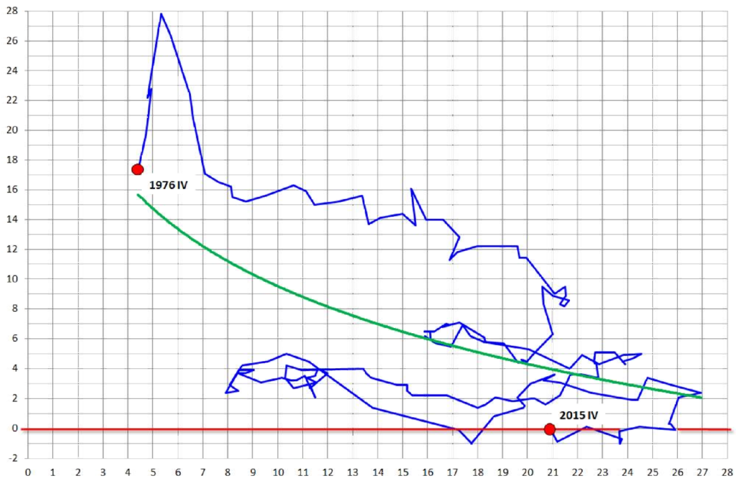

Fig. 9. Phillips curve, Spain, 1976IV-2015IV

5. The Swan diagram

Definition 5.1 (informal). The internal balance of an economy requires full employment of resources (sufficiently low unemployment rate) and price stability (low and stable inflation rate): not too much unemployment, not too much inflation.

Definition 5.2. External balance corresponds to a balanced current account (the supply and demand for the domestic currency are balanced). For simplicity, external balance is defined as zero trade balance.

Internal balance and external balance both are assumed to depend on two variables: domestic expenditures and the real exchange rate. Domestic expenditure is given by sum of the components C (consumption), I (investment), and G (government purchases) of aggregate demand. The remaining component, NX (net exports), depends on competitiveness, which is measured by the real exchange rate.

Definition 5.3. The IB function (drawn in Fig. 10) consists of those combinations of domestic demand and real exchange rate that lead the economy to the internal balance.

The IB function is assumed increasing for the following reason. Suppose the economy is initially at a point, like point a in Fig.10, where the internal balance condition holds (the economy has the "right" amount of unemployment and inflation). If a real appreciation occurs (the real exchange rage increases), then imports rise and exports fall. That is, there is a switch in demand from domestic to foreign goods. As a result, unemployment goes up and the economy moves from point a to b. To restore internal balance by reaching point c, unemployment must be eliminated. This requires an increase in domestic expenditure.

If follows from the previous analysis that points above the IB function (excessive expenditure abroad) imply the existence of unemployment. Below the IB function failure of internal balance is not due to unemployment but to inflation; see Fig. 11.

For instance, at point d in Fig. 10, given the corresponding real exchange rate e'_r, domestic expenditure is excessive with respect to the level D_a required to reach internal balance. This excess of domestic expenditure manifests itself in the form of inflation.

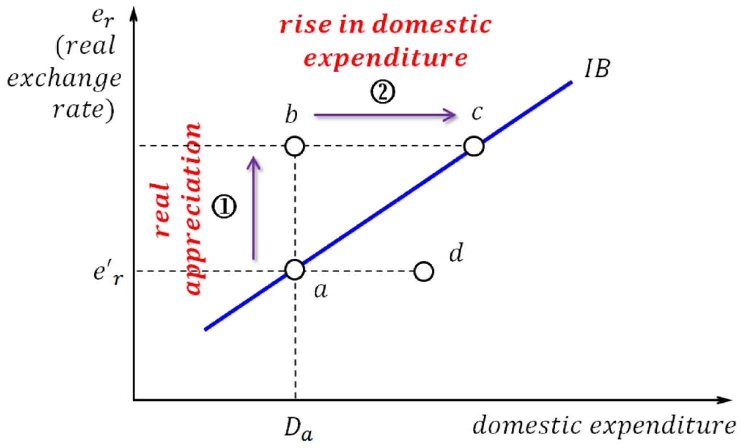

Fig. 10. The internal balance function IB

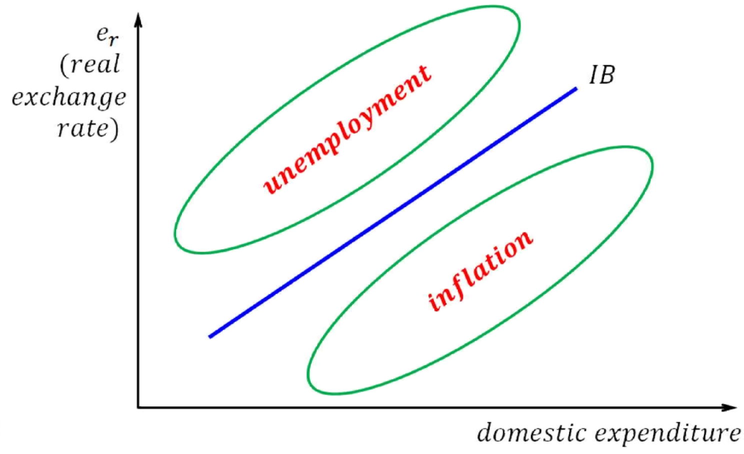

Fig. 11. What occurs outside the IB function

Definition 5.4. The <u>EB function</u> (drawn in Fig. 12) consists of those combinations of domestic demand and real exchange rate that lead the economy to the external balance.

The <u>EB function</u> is assumed <u>decreasing</u> for the following reason. Suppose the economy is initially at a point, like point a in Fig. 12, where the external balance condition (the trade balance is zero) is satisfied. If domestic expenditure increases, GDP and, consequently, income also increase. Part of this additional income is spent buying foreign goods and a trade deficit ensues. To restore external balance by reaching point c, the trade deficit must be neutralized. This requires a reduction of the real exchange rate: a real depreciation (an improvement of competitiveness)

If follows from the previous analysis that <u>points above the EB function</u> (excessive domestic expenditure) <u>generate a trade deficit</u>. Below the EB function failure of external balance is not due to a trade deficit but to <u>trade surplus</u>; see Fig. 13.

For instance, at point d in Fig. 12, given the corresponding level D_a of domestic expenditure, the real exchange rate is smaller than the value e'_r required to reach external balance with D_a. That is, the economy is "too competitive" and therefore runs a trade surplus.

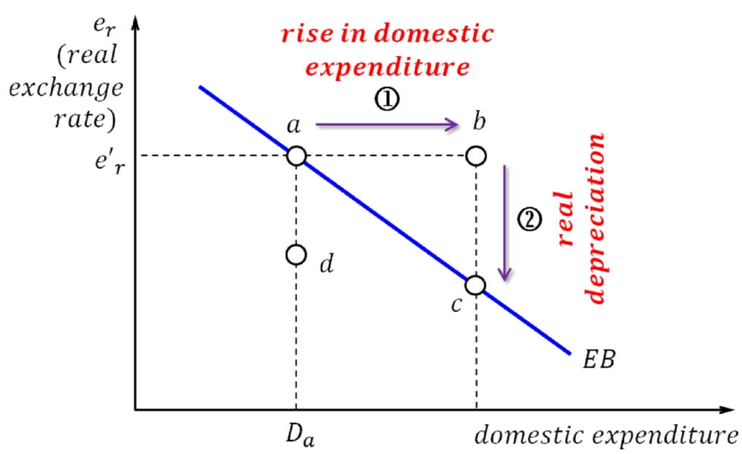

Fig. 12. The external balance function EB

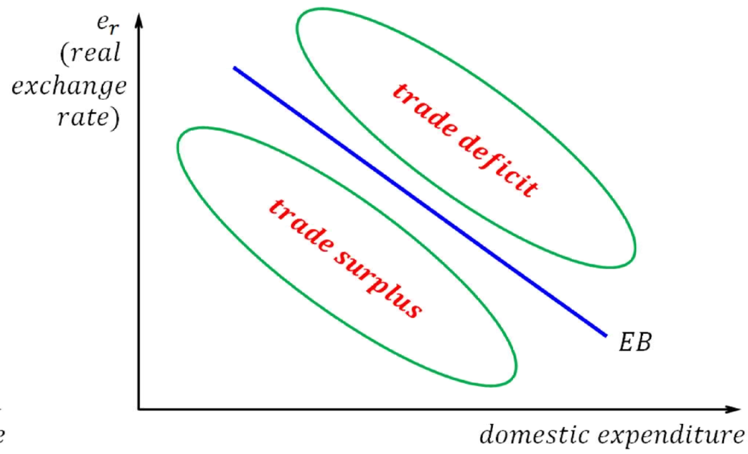

Fig. 13. What occurs outside the EB function

Definition 5.5. The Swan diagram (due to Trevor W. Swan) combines the IB and EB functions (see Fig. 14) to identify the real exchange rate level and the amount of domestic expenditure that allows the economy to simultaneously reach its internal and external balances.

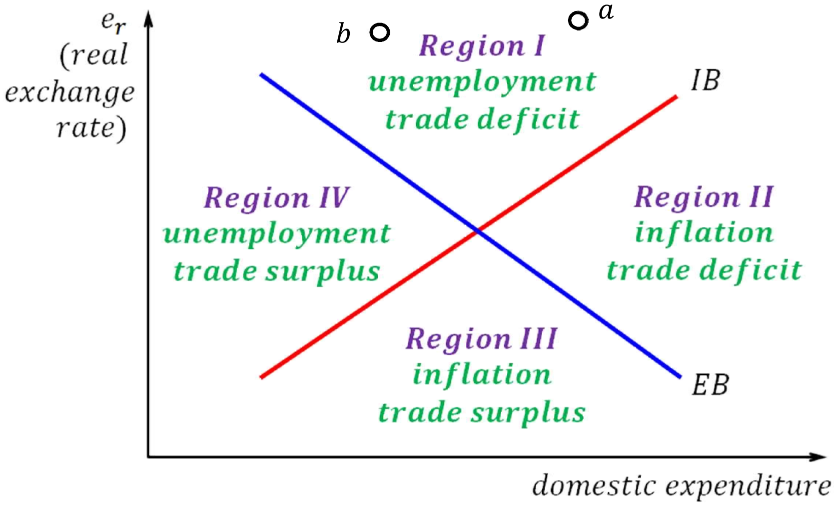

Fig. 14. The Swan diagram

The Swan diagram separates the plane into four regions. In region I, there is unemployment and trade deficit (Spain, Egypt, Poland). In region II, inflation coexists with a trade deficit (Brazil, Turkey, Colombia, Morocco). In region III, there is inflation and a trade surplus (China, Russia, Korea). In region IV, the economy has unemployment and runs a trade surplus (Hungary, Slovakia).

Though the Swan diagram may lack precision (how is internal balance unambiguously defined?), it is useful to illustrate some points. Firstly, it shows that a way to solve a problem may worsen another problem, so policies must take into account their full effects not just the desired or intended ones.

Example 5.6. Suppose the economy is in point *a* of Region I in Fig. 14. At *a*, the economy suffers from excessive unemployment. It may appear that more expenditure is needed to reduce unemployment. Yet, the diagram suggests that the unemployment problem is not solved by changing expenditure (increasing it) but by shifting expenditure. To reach the intersection of lines IB and EB, domestic expenditure must fall and net exports rise (through depreciation). If only the unemployment problem is attacked by boosting domestic expenditure, internal balance could be reached at a price: the trade deficit worsens.

Indeed, in an economy that lies in Region I in Fig. 14 moves horizontally towards the IB function (by increasing domestic expenditure) to solve the unemployment problem, the consequence is that the economy moves away from the EB function (the trade deficit worsens, as more expenditure lead to more income and more income boosts imports).

And secondly, the Swan diagram alerts against the orthodox principle "one size fits all", according to which solutions to macroeconomic problems need not take into account particular features of the economy suffering from those problems. To put it in a nutshell, the principle maintains that if it works once, it works always.

Example 5.7. Suppose two economies are in Region I in Fig. 14, one situated on point *a* and the other on point *b*. If both economies want to meet the conditions of internal and external balance, it is plain that both should reduce the real exchange rate (become more competitive to reduce the trade deficit). But, to reach internal balance, the economy on *b* should expand domestic expenditure, whereas the economy on *a* should contract domestic expenditure. Consequently, there is not a single recommendation for both economies to attain internal and external balance.

6. Involuntary unemployment

Definition 6.1. Involuntary unemployment is the unemployment that occurs when, at the prevailing wage rate in the economy, there are people willing to work but are not given a job.

The models developed next illustrate basic reasons for the existence and persistence of involuntary unemployment:

- "too high" wage rates (classical or orthodox explanation);
- insufficient labour demand, due to insufficient aggregate demand (Keynesian explanation);
- existence of market power on the supply side (because of trade unions);
- existence of labour discrimination; and
- structural reasons (an economy does not exist to employ every one willing to be employed).

7. The orthodox (classical) labour market model

Definition 7.1. The orthodox labour market is a standard competitive market model in which "price" is represented by the real wage ω (the nominal or monetary wage W divided by some price level P, like the CPI) and "quantity" is labour (labour supplied and demanded, where labour can be measured as number of persons or as number of hours of work). Fig. 15 represents graphically the orthodox labour market.

Definition 7.2. The labour supply function in the orthodox labour market associates with each real wage ω the total amount N^s of labour that workers in the economy are willing to supply (up to the maximum labour that can be supplied, which corresponds to the economically active population $\bar{N}$).

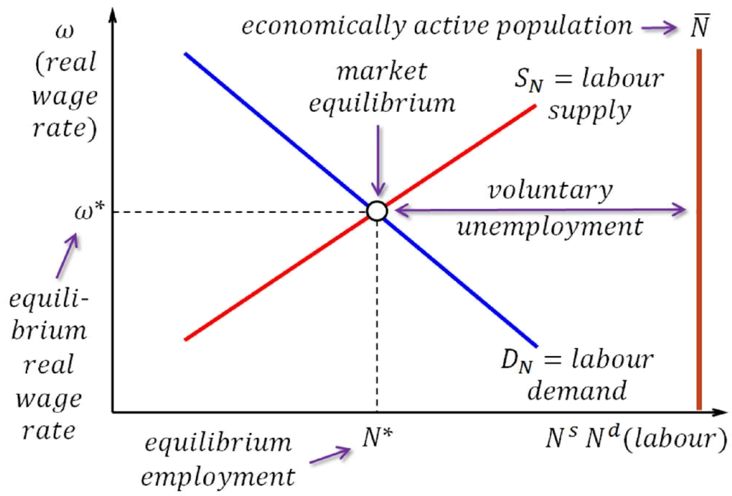

Fig. 15. The orthodox labour market model

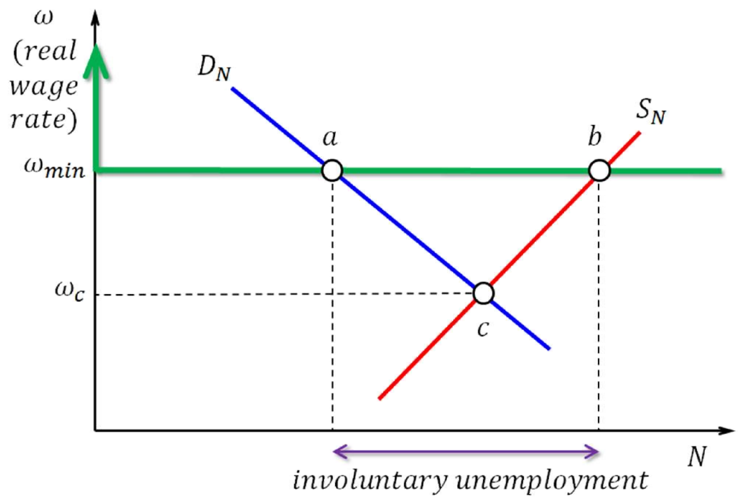

Fig. 16. Minimum wages and involuntary unemployment

The labour supply function is assumed to be increasing, at least for an initial interval of wage rates: the higher ω, the higher the amount of labour supplied. It is theoretically possible that, for wages above a certain wage threshold, the labour supply function bends backwards and becomes decreasing: paying too much to workers encourages them to replace hours of work by hours of leisure. Since such wage threshold is likely to too high compare with average wages in an economy, the prospect that the economy could reach that decreasing section of the labour supply function does not seem to be realistic. For this reason, the labour supply function will be assumed increasing.

Definition 7.3. The labour demand function in the orthodox labour market associates with each real wage ω the total amount N^d of labour that firms in the economy are willing to hire.

The labour demand function can be constructed as follows. Take any firm using labour to produce a certain commodity. Imagine that it does so by means of a production function $q(n)$ that establishes the total amount of the commodity that can be produced using n units of labour.

Define the firm's profit function as $\pi(n) = p \cdot q(n) - W \cdot n$, where n is the amount of labour the firm hires, p is the price at which the firm sells (assuming the market for the commodity is competitive), and W is the nominal wage (the moneary cost of hiring each unit of labour).

Suppose that the aim of the firm is to choose n to maximize the profit function. Assuming the function differentiable, the first order condition for a maximun is $\frac{d\pi}{dn} = 0$. Since the firm is a price taker in the commodity market

$$\frac{d\pi}{dn} = p \cdot \frac{dq(n)}{dn} - W = 0\,.$$

The derivative $\frac{dq(n)}{dn}$ is the marginal product (or productivity) of labour, or MPL, function of the firm. The MPL function measures, for each amount of labour N hired by the firm, the amount of production that can be attributed to the last unit of labour in N. Loosely speaking, the MPL function indicates how much an additional worker can produce.

It seems plausible that the first workers will be highly productive and that this productivity is increasing: more workers can make better use of the firm's means of production. When the production function $q(n)$ is initially convex, increasing n in a certain percentage makes q increase in a larger percentage, which means that the derivative $\frac{dq(n)}{dn}$ is increasing.

But it appears plausible that, eventually, simply adding more workers will not be enough to increase MPL. Otherwise, a small plot of land could feed the whole world or a single factory produce all the commodities the world consumes. Consequently, it is reasonable to expect that the firm's MPL function will become decreasing: each additional worker contributes to increase production but each time less. Equivalently, to rise production in a given amount, the firm needs each time more workers owing to the fact that each additional worker is less productive.

Example 7.4. If $q(n) = 2 \cdot\ n^{1/2}$, then $\text{MPL}(n) = \frac{dq(n)}{dn} = 2 \cdot \frac{1}{2} \cdot n^{1/2\,-\,1} = n^{-1/2} = \frac{1}{n^{1/2}}$. This function is always downward sloping: a rise in n leads to a fall in MPL.

The profit maximizing condition for the firm is then $p \cdot \text{MPL}(n) = W$. Equivalently, $\text{MPL}(n) = W/p$. This expression implicitly defines the firm's labour demand function: the firm hires labour until the marginal product of the last worker (what the firm obtains in real terms from hiring the worker) equals the cost (in real terms) of the last worker (the real wage W/p).

Remark 7.5. The condition $\text{MPL} = W/p$ lies behind the orthodox prescription that real wages should "get in line" with productivity: workers cannot expect be granted a higher real wage without becoming more productive. In fact, the condition $\text{MPL} = W/p$ captures the idea that labour is paid according to the value of its marginal productivity: $W = p \cdot \text{MPL}$ (since MPL is amount of commodity produced and p is the price of the commodity, $p \cdot \text{MPL}$ is the monetary value of what the last worker hired produces).

Example 7.4 (continued). With $\text{MPL}(n) = \frac{1}{n^{1/2}}$, the condition $\text{MPL}(n) = W/p$ amounts to $\frac{1}{n^{1/2}} = \frac{W}{p}$. Solving for n,

$$n = \frac{1}{(W/p)^2} \text{ or } n = \frac{p^2}{W^2}$$

This says that the demand for labour is stimulated by a rise in the price of the commodity the firm produces or by a fall in the nominal wage rate. The expression $n = \frac{1}{(W/p)^2}$ represents the firm's demand for labour. Insofar as a rise in $\frac{W}{p}$ causes a fall in the demand for labour n, the firm's demand for labour is a decreasing function of the real wage $\frac{W}{p}$.

Since the labour demand of each firm is inversely correlated with a certain wage rate, by disregarding the fallacy of composition, one may jump to the conclusion that the aggregate demand for labour in an economy is inversely correlated with the economy's real wage. This is what Fig. 15 represents: the labour demand function corresponding to the whole economy is assumed downward sloping: the higher the real wage ω, the lower the aggregate demand for labour N^d.

Definition 7.6. The equilibrium real wage rate ω^* is the real wage rate such that labour supplied at ω^* equals labour demanded at ω^*.
Given ω^*, there is no involuntary unemployment: everyone willing to get hired at ω^* is hired. The difference $\bar{N} - N^*$ can be viewed as voluntary unemployment, as the people represented by $\bar{N} - N^*$ regard the equilibrium wage rate as insufficient to encourage them to supply labour. On the other hand, $\frac{N*}{\bar{N}}$ would be the participation rate.

8. Involuntary unemployment in the orthodox labour market model

Establishing a mininum real wage ω_{min} above the equilibrium wage rate ω^* generates involuntary unemployment in a competitive labour market. This possibility is shown in Fig. 16, where market equilibrium occurs at point c. If the minimum wage rate ω_{min} is set, the market state is no longer represented by c but by a: although workers are willing to reach b, firms cannot be forced to hire more workers than the amount given by a. At the prevailing wage rate ω_{min} there is an excess supply, interpreted as involuntary unemployment.

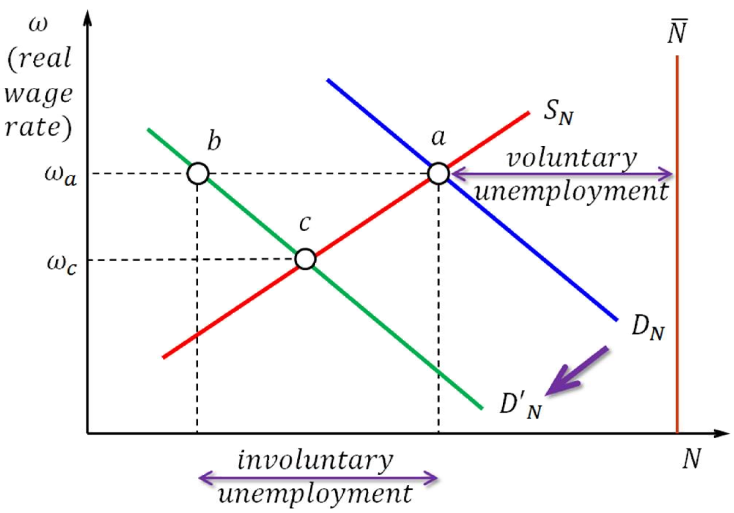

Fig. 17. Unemployment due to sticky wages

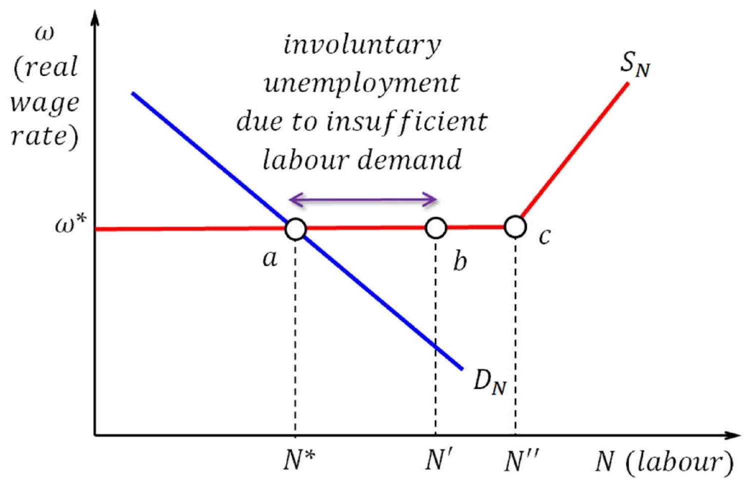

Fig. 18. Unemployment due to insufficient demand

Involuntary unemployment in a competitive labour market may also temporarily arise if the real wage rate adjusts sluggishly. Fig. 17 illustrates this situation. Market equilibrium occurs initially at a, with wage rate ω_a. The demand for labour function shifts to the left. The new equilibrium is represented by c. But if the real wage rate takes time to adjust (decrease), the wage rate in the market may temporarily remain at the initial level ω_a. The market is then at b, where involuntary unemployment exists.

It is the existence of involuntary unemployment in b that makes workers be willing to accept a lower wage rate. The existence of unemployment gives firms more power to set terms with workers: it is easier for a firm to fire a worker not acceptting a lower wage because there is a "reserve army" of workers waiting to be hired and ready to accept the lower wage.

Fig. 18 shows how involuntary unemployment can arise in the orthodox labour market model as a result of a shortage in the demand for labour. Suppose the S^N function combines a flat with an upward sloping section. The flact section at real wage ω^* would mean that, when the real wage is ω^*, (i) workers are, in principle, indifferent between supplying labour or not, and (ii) some random variable determines the amount actually supplied. Market equilibrium occurs at a, where employment is N^*. If workers finally choose to supply N' (effective labour supply given by b), there is involuntary unemployment represented by the difference $N' - N^*$.

What the orthodox model seems to miss is that firms do not hire workers because they aim at accumulating workers. The labour force is a means to produce commodities and obtain a profit by selling the commodities produced. For that reason, the demand for labour by firms is a derived demand: it arises as an intermediate step in the process of reaching the firms' final goal, which is making profits.

Accordingly, the demand for labour crucially depends on sales expectations: no matter how "cheap" labour is, workers will not be hired if firms do not expect to sell what these workers would produce. This is the fundamental insight behind heredox explanation of involuntary unemployment: making cheaper to firms the production of commodities by reducing the wage rate is not in general enough to encourage firms to hire more workers. The crucial factor to induce firms to hire more workers is that firms expect to sell what the additional workers will produce.

9. Involuntary unemployment and trade unions

http://en.wikipedia.org/wiki/Trade_unions_in_the_United_Kingdom

Supply-side market power in the labour market is typically associated with the existence of trade unions. For any given amount of labour N, the wage rate unions demand to supply N will be higher than the wage rate dictated by the supply of labour function. This follows from the fact that unions (since they can organize strikes) have more bargaining power over wages than individual workers.

Thus, the function S_{UNIONS} associating with each amount of labour N the wage rate that unions will ask to be willing to supply N must lie above the supply of labour function. Fig. 19 combines the function S_{UNIONS} with a competitive labour demand function D_N. Without trade unions, market equilibrium is at c. With unions market equilibrium is at u. The distance between u and v represents involuntary unemployment: given wage ω_u, workers would individually like to supply N_v but the presence of the union only allows N_u to be hired.

When the wage is "too high", the obvious solution to get rid of unemployment is to lower the wage (or let the wage adjust by itself). When unemployment is due to lack of labour demand, the natural solution is an aggregate demand expansion that induces firms to hire more workers to satisfy the additional demand. When the cause of unemployment is market power (unions), the solution seems harder to implement: how to reduce the unions' bargaining power without raising protests by part of the workers?

10. Price setting and wage setting model

In modern economies, the nominal wage rate of a substantial number of workers is determined through collective bargaining involving unions. If workers are represented by unions, at any level of employment, the real wage will be above the wage rate dictated by the labour supply function. It is assumed that unions establish the real wage using a wage setting function WS sloping upward and lying above the labour supply function S_N; see Fig. 20. The higher the unions' bargaining power, the larger the vertical distance between between WS and S_N.

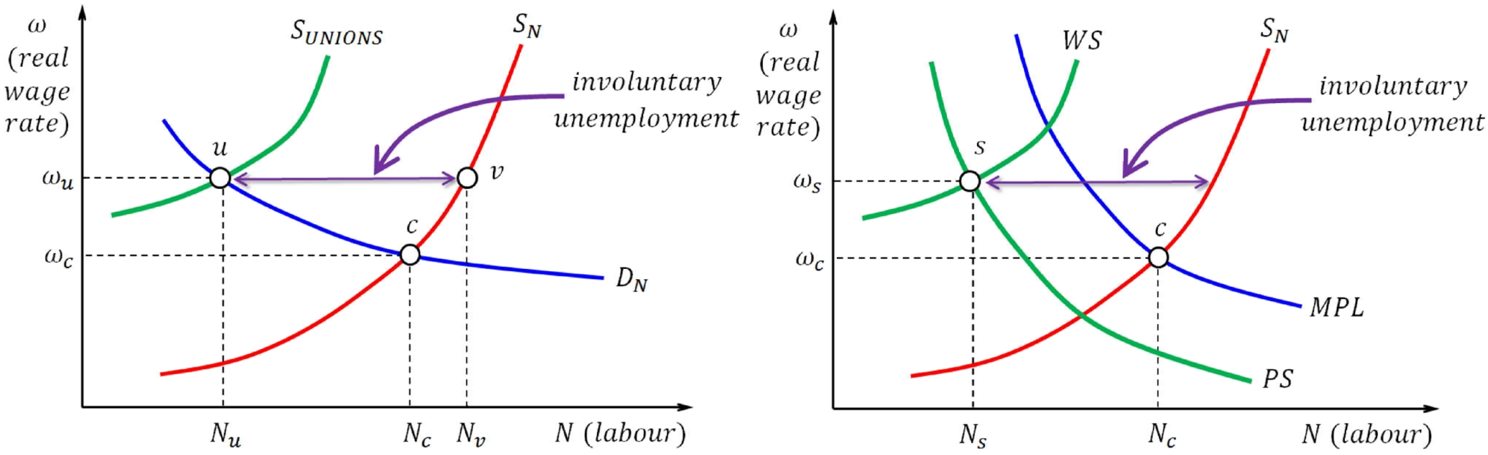

Fig. 19. Unemployment due to trade unions

Fig. 20. The PS-WS employment model

The assumption that WS is increasing follows from the interpretation of unemployment as a device to discipline the unions' demands for higher wages. When employment N is small, unemployment is high, for which reason the bargaining power of unions is small: firms could fire workers with high unemployment because there are workers willing to accept the conditions that fired workers would like to improve. With small bargaining power of unions come lower real wages. Conversely, when employment N is high, unemployment is low, the bargaining power of unions is high and, as a result, firms are more willing to accept higher wages: if they fire a worker, it is harder to replaced him or her due to the low unemployment.

Whereas workers (through unions) are assumed to set the nominal wage, firms are supposed to fix the prices of the commodities they produce. A simple price setting rule consists of adding a mark-up $\tilde{\mu} > 0$ to labour costs:

$$P = (1 + \tilde{\mu}) \cdot \frac{W}{MPL}.$$

W is measured in money (EUR) and MPL in units of product per worker. Thus, $\frac{W}{MPL}$ is the money paid to workers divided by what they produce. In other words, $\frac{W}{MPL}$ is the (labour) cost of producing a unit of the commodity (unit labour costs). Rearranging,

$$\frac{1}{1+\tilde{\mu}} \cdot MPL = \frac{W}{P}.$$

Given that $\tilde{\mu} > 0$, it must that $\frac{1}{1+\tilde{\mu}} < 1$. Therefore, for some $\mu > 0$, $\frac{1}{1+\tilde{\mu}} = 1 - \mu$. Consequently,

$$(1-\mu) \cdot MPL = \frac{W}{P}.$$

In sum,

$$MPL \quad = \quad \frac{W}{P} \quad + \quad \mu \cdot MPL.$$

production per worker = real wage per worker + real profit per worker

Under perfect competition in the labour and product markets, $\frac{W}{p} = MPL$. If the prices of goods are set by firms as a marking up of labour costs per worker, then $\frac{W}{p} = (1-\mu) \cdot MPL$. This equation represents the price setting function PS. Since $0 < \mu < 1$, $\frac{W}{p} = (1-\mu) \cdot MPL$ means that $\frac{W}{p} < MPL$. The parameter μ measures the amount of the workers' productivity appropiated by the firms

As the MPL function is downward sloping, the PS function is downward sloping as well. PS lies below MPL because PS is a fraction of MPL (the constant $1-\mu$ is smaller than 1); see Fig. 6. In this figure the wage and price setting decisions are consistent only at point s, where, at the prevailing wage ω_s, there is involuntary unemployment represented by the difference $N_c - N_s$.

11. Segmented labour market model

Suppose workers may have some (perhaps economically irrelevant) feature that firms (the owners of firms to be more accurate) may like or dislike (for instance, being a man).

Firms classify workers in two types (I and II) depending on whether they possess the feature or not. Some firms (type I firms) prefer type I workers; the rest (type II firms) prefer type II workers.

Each type of firms defines a different (competitive) labour market. Workers are unaware of the fact that there are two types of firms. From their perspective, the labour market is not segmented.

Example 11.1. The analysis proceeds in terms of a numerical example, with the following characteristics.

- Supply of labour function of type I workers: $S_N^I = 4 \cdot \omega$ (ω is the real wage rate).
- Demand for labour function of type I firms: $D_N^I = 60 - 2 \cdot \omega$ ($N_I^d = 0$ if $\omega > 30$).
- Market equilibrium (type I): $(N_I, \omega_I) = (40,\ 10)$.
- Supply of labour function of type II workers: $S_N^{II} = 12 \cdot \omega$.
- Demand for labour function of type II firms: $D_N^{II} = 80 - 4 \cdot \omega$ ($N_{II}^d = 0$ if $\omega > 20$).
- Market equilibrium (type II): $(N_{II}, \omega_{II}) = (60,\ 5)$.

In this case, $\frac{40}{40+60} = \frac{2}{5} = 40\%$ of employment corresponds to type I workers and $\frac{60}{40+60} = \frac{3}{5} = 60\%$ to type II. Using these weights, the average real wage rate would be $\tilde{\omega} = \frac{2}{5} \cdot \omega_I + \frac{3}{5} \cdot \omega_{II} = \frac{2}{5} \cdot 10 + \frac{3}{5} \cdot 5 = 7$.

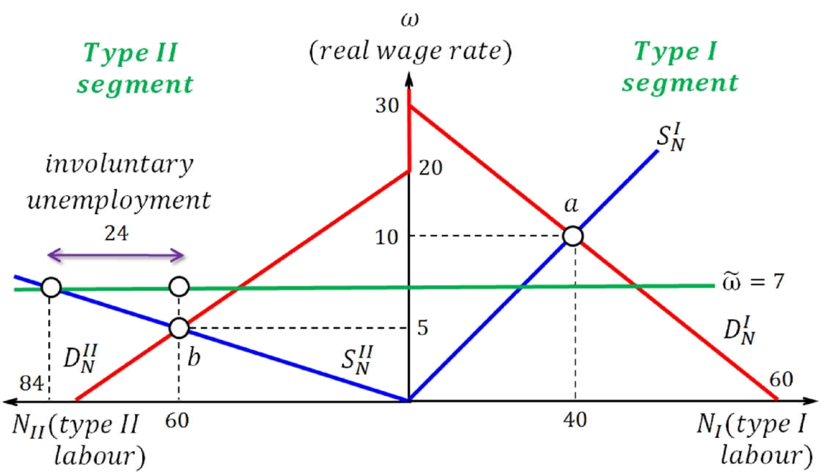

Fig. 21. Segmented labour market example

At $\tilde{\omega} = 7$, no more type I workers than are actually employed would like to be hired. But, at $\tilde{\omega} = 7$, type II workers would like to supply $S_N^{II} = 12 \cdot \tilde{\omega} = 84$. Since employment of type II workers equals $N_{II} = 60$, involuntary unemployment appears to be $S_N^{II}(\tilde{\omega} = 7) - N_{II} = 84 - 60 = 24$ (unemployment rate $= 24/(24 + N_I + N_{II}) = 19.3\%$). Fig. 21 represents Example 11.1 graphically. Though each segment is in equilibrium, there is a sense in which involuntary unemployment exists.

12. The employment–production–income–spending (E-PIS) model

It postulates three linear relations linking employment with production, income, and spending.

- EP relation (production → employment): establishes the amount of employment required to reach a certain GDP level; see Fig. 22.
- EI relation (income → employment): identifies the amount of labour supplied for every value of aggregate income; see Fig. 24.
- ES relation (employment → expenditure): indicates the aggregate level of spending associated with any given amount of employment; see Fig. 23.

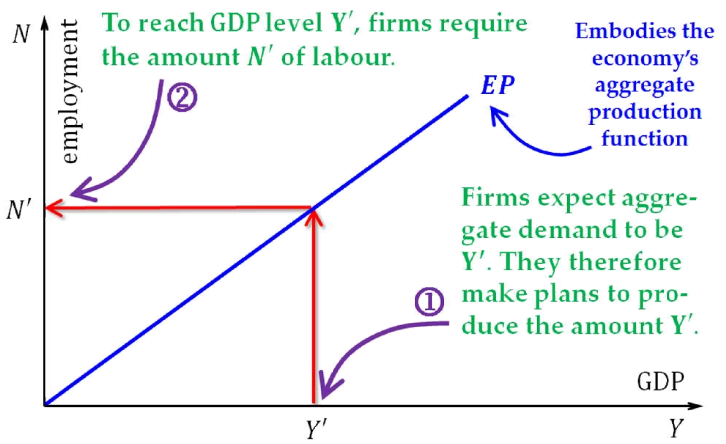

Fig. 22. The production-employment relation

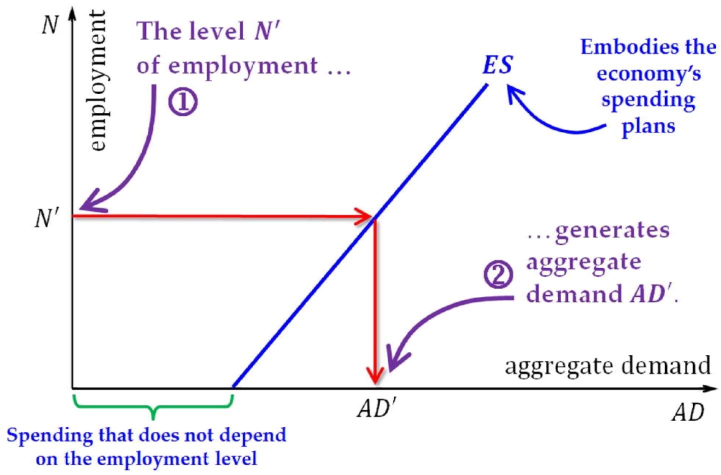

Fig. 23. The employment-expenditure relation

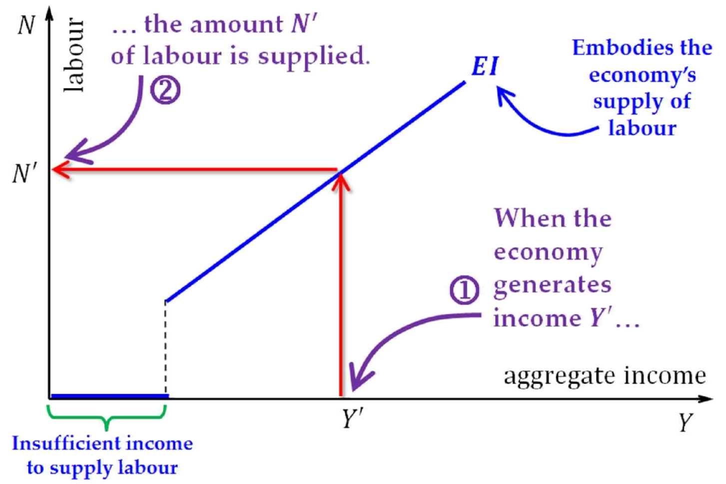

Fig. 24. The income-employment relation

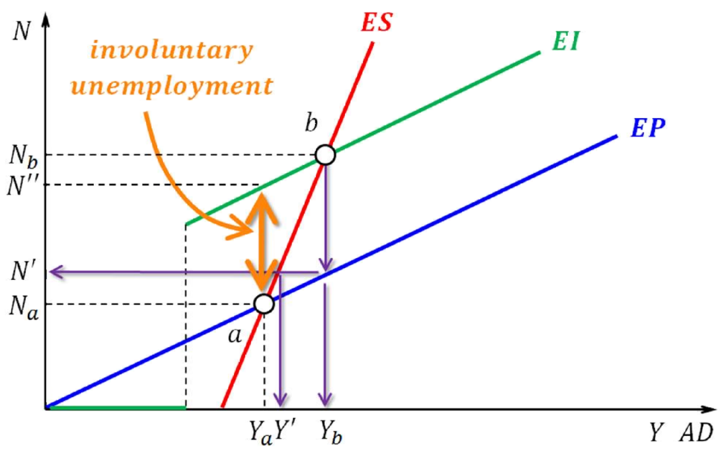

Fig. 25. The E-PIS model

When the three relations are drawn simultaneously, as in Fig. 25, there is no point at which the three lines intersect. Without delving into details, assume that the solution is found at a point when two lines intersect. Leaving the origin aside, there are two candidates: point a and point b.

Point b is not stable in the sense that it is not self-sustained). At b, employment is N_b and aggregate demand is Y_b. But, according to EP, to produce Y_b, the economy only needs the amount $N' < N_b$ of labour. Hence, b does not represent a consistent state of the economy.

At a, employment is N_a and aggregate demand is Y_a. To generate a GDP equal to Y_a firms demand exactly the amount N_a of labour. In addition, the level N_a of employment generates precisely the level Y_a of aggregate demand. This state of the economy appears self-consistent and stable.

The problem is that there is involuntary unemployment at point a. Given income Y_a, workers would like to supply the amount N'' of labour. Since employment at a is only N_a, $N'' - N_a$ defines the level of involuntary unemployment. Further investigations of the model are left as an exercise (for instance, what shifts in the lines would reduce involuntary unemployment?).

The arguably simplest description of an economy is given by the loop

$$\ldots \to \textbf{production} \to \textbf{income} \to \textbf{expenditure} \to \textbf{production} \to \ldots$$

The E-PIS model inserts labour in this loop; see Fig. 26. First, production creates a derived demand: the demand for labour. Second, the income the economy generates is a key variable helping workers to decide the amount of labour supplied. Lastly, the level of employment, once determined, significantly contributes to establish aggregate demand, which in turn affects production.

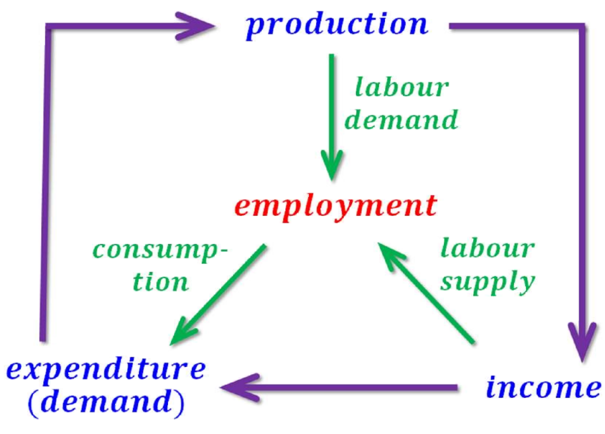

Fig. 26. Conceptual basis of the E-PIS model

The classical (orthodox) view of this process attributes to the labour market the leading role. Employment is first established, this next determines production, and production is finally used.

The Keynesian (hetereodox) view inverts the order. First, expenditure decisions are made. These decisions indicate the necessary production level. Finally, the labour required to carry out the production plan is hired.

The E-PIS model aligns itself with the latter view. The state of the economy is foremost determined by the firms' expected level of aggregate demand. To meet the expected demand level Y, firms hire the amount of labour N necessary to produce Y. As long as the income level corresponding to production level Y induces workers to supply at least N, the employment-income relation is irrelevant.

Since there is no obvious reason why the EI relation cannot be established independently of the other relations, it is highly unlikely that workers will exactly supply N. Thus, the excess of labour supplied constitutes involuntary unemployment. As it emerges from the working of the economy itself, it seems that it will be hard to eliminate completely.