

# Chapter 11

## The Phillips Curve

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One recurring stylized feature of short-run macroeconomics is a negative relationship between the inflation rate and the unemployment rate. Despite its seeming regularity in the data, there has been and remains considerable debate in the economics profession about how best to model such an effect at a theoretical level – indeed an important branch of the profession simply dismisses the relationship as an unimportant one and thus not even worthy of serious theoretical modeling. But this inflation-unemployment tradeoff seems to still drive much policy discussion, and as such we will adopt the view that it is a potentially important feature of macroeconomics. In this section we will briefly explore how we can modify our existing theoretical model of the macroeconomy to explain the inflation-unemployment tradeoff.

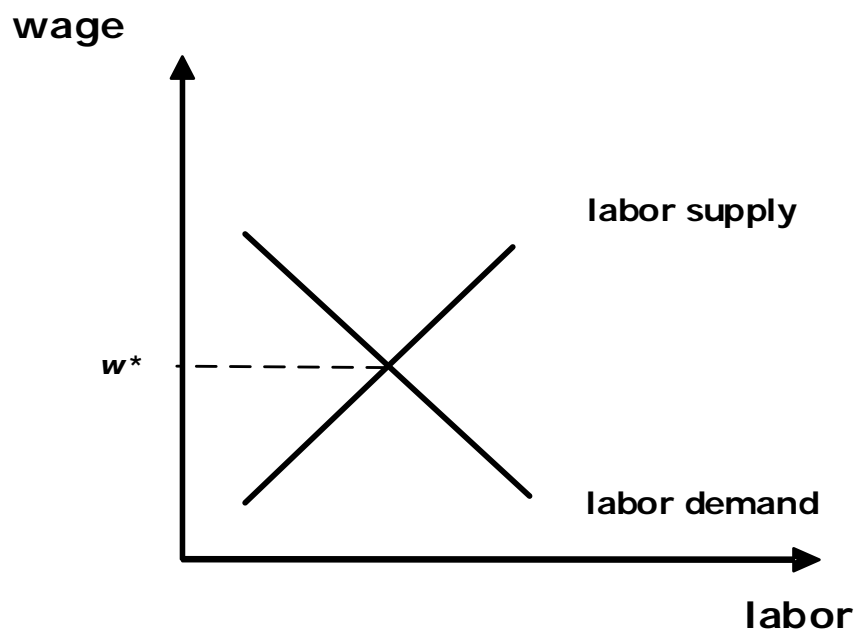
### Nominal Wage Rigidity and the Short-Run Phillips Curve

Consider the view of the basic labor market we have developed thus far using the consumption-labor framework and firm analysis; this is depicted in **Figure 53**, in which a downward-sloping labor demand function interacts with a backward-bending labor supply function to determine the equilibrium wage in the economy. In such a labor market, where labor supply always equals labor demand, unemployment is by definition zero.

Recall that an “unemployed person” is one who is actively looking for employment who has not yet found employment. At the equilibrium wage  $w^*$  in **Figure 53**, no individual wishes to work more hours than he already is. Technically, this is zero unemployment – however, we will appeal to our notion from earlier that there is a “natural” rate of unemployment in the economy, because, for example, of individuals optimally choosing to leave one job to look for another. With the notion of a natural rate of unemployment in the background of our model, then, equilibrium in the labor market implies that the unemployment rate equals the natural rate of unemployment and hence cyclical unemployment is zero. The crucial point to notice is that implicit in our notion of cyclical unemployment is a dependence **on the prevailing wage rate**.

With this view of the labor market, the wage changes due to shifts of labor supply and/or labor demand. But regardless of these shifts, with a perfectly-competitive labor market, cyclical unemployment is zero. Thus it would seem that it is impossible for us to generate in our theoretical model a negative relationship between inflation and unemployment because cyclical unemployment never changes!

Impossible, that is, unless we jettison our assumption of perfect competition in the labor market. The basic premise of perfect competition is that prices adjust quickly and fully to always match demand with supply. However, there is ample reason to believe that the labor market is far from perfectly competitive.<sup>70</sup> The strongest evidence is that wages tend to move very slowly over time, even when other macroeconomic events would tend to suggest sharp movements in wages. Consider a simple example: suppose some event causes the aggregate demand curve to shift inwards. This contractionary event on the macroeconomy shifts the labor demand curve in **Figure 53** to the left, which would imply an immediate fall in the wage rate if the labor market were in perfect competition. That is, a fall in the economy's GDP due to a negative shift of aggregate demand should be accompanied by a simultaneous fall in the wage rate.

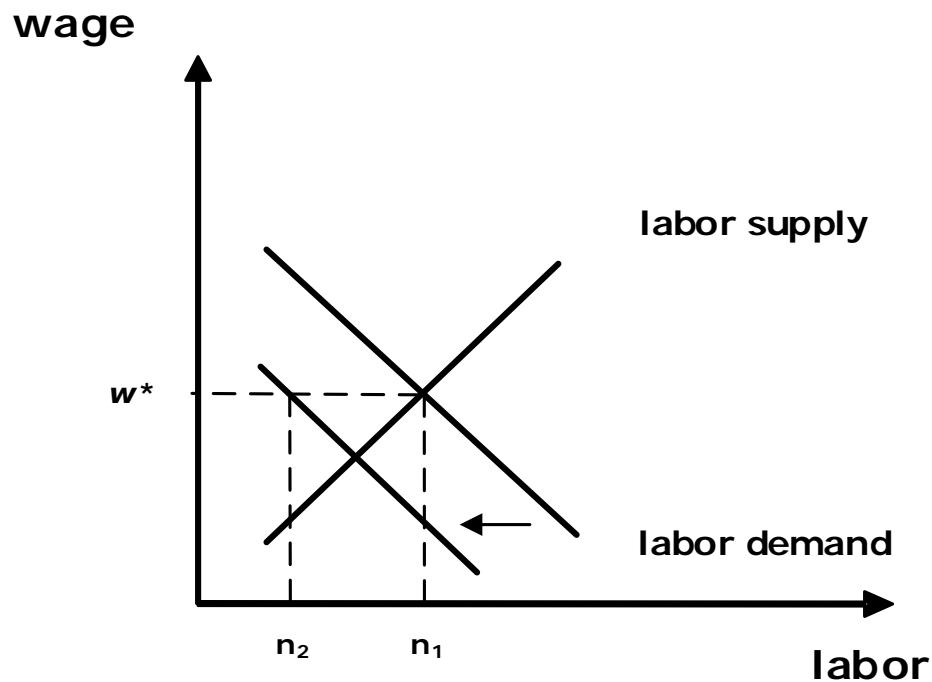


**Figure 53.** In a perfectly-competitive labor market, the intersection of the labor demand function and labor supply function determines the equilibrium wage rate.

But data shows that wages would tend to fall only with a time lag, rather than immediately. However, data also shows that the total number of hours worked in the economy **does** fall simultaneously. It is impossible to reconcile these three observations (fall in GDP, fall in total hours worked, no change in wage rate) with a perfectly-competitive view of the labor market.

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<sup>70</sup> In point of fact, no economist believes that **any** market is **literally** perfectly competitive – rather it comes down a matter of degree, in which we must try to address the question “**How far** from perfect competition?” for a given market. In many ways, the labor market seems quite far from perfect competition, so that we will now abandon the assumption of perfect competition in the labor market while retaining it for other markets.



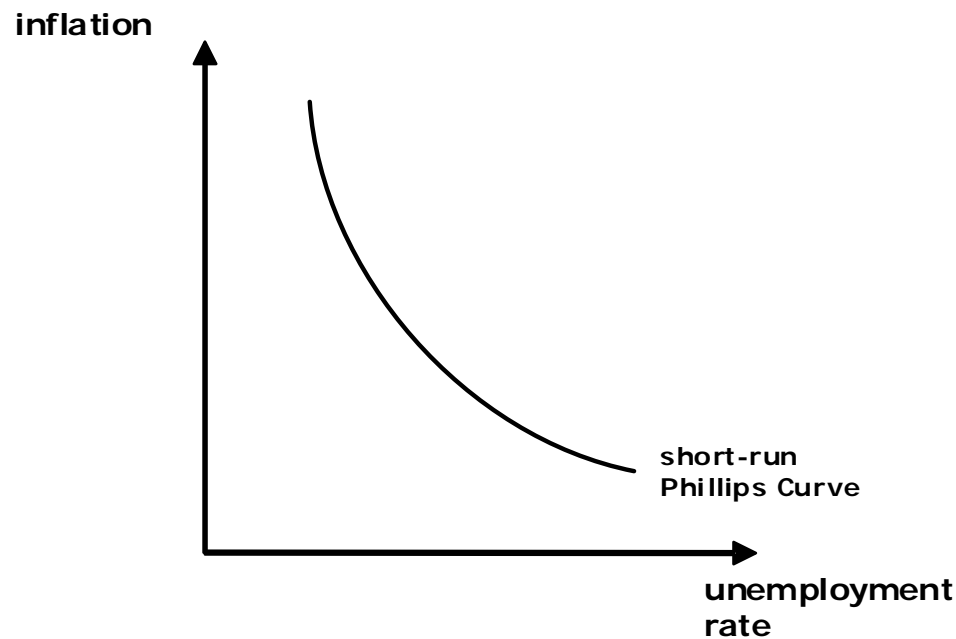
**Figure 54.** With the sticky wage  $w^*$ , a fall in demand for labor is accompanied by a fall in total hours worked from  $n_1$  to  $n_2$ . But at the wage  $w^*$ , the total number of hours individuals would like to work is still  $n_1$  – thus, unemployment has risen from zero to something strictly larger than zero.

Suppose, however, there were some institutional features of the labor market that prevented the wage from adjusting immediately to match demand with supply. For example, suppose a sizable fraction of workers had contracts with their employers that fixed their wages in nominal terms for some period of time, perhaps a year or two. Or suppose there were laws in effect that prevented firms from cutting the wages of their employees.<sup>71</sup>

If such features are important in the labor market, then a decreased demand for labor, represented in **Figure 54** as the inward shift of the labor demand function, does not change the wage rate, and the wage rate remains stuck at  $w^*$ . At the wage rate  $w^*$ , the demand for labor is  $n_2$  following the shift of labor demand, while the (desired) supply of labor is  $n_1$ , so that the actual hours worked in the economy is now  $n_2$ . This excess supply of labor is precisely what is meant by the notion of cyclical unemployment: those workers who are willing to work (or, in our case, those hours of work that “want” to be worked) that cannot find employment. Cyclical unemployment has thus risen from zero to something strictly positive due to the **wage rigidity** (also known as a **sticky wage**).

<sup>71</sup> Such laws in effect do exist in much of Europe and are an often-cited reason for Europe’s persistently higher unemployment rates than in the U.S.

To make our link between unemployment and inflation, we need to consider what happens to inflation in this example. Recall that the initiating event was a fall in aggregate demand, which means that the overall price level of the economy must fall (holding fixed the aggregate supply function). A decline in the price level means, by definition, that inflation has decreased. Thus, the rise in unemployment is accompanied by a fall in inflation – precisely the relationship we set out to model. This negative relationship between the inflation rate and the unemployment rate is captured by the **Phillips Curve**, depicted in

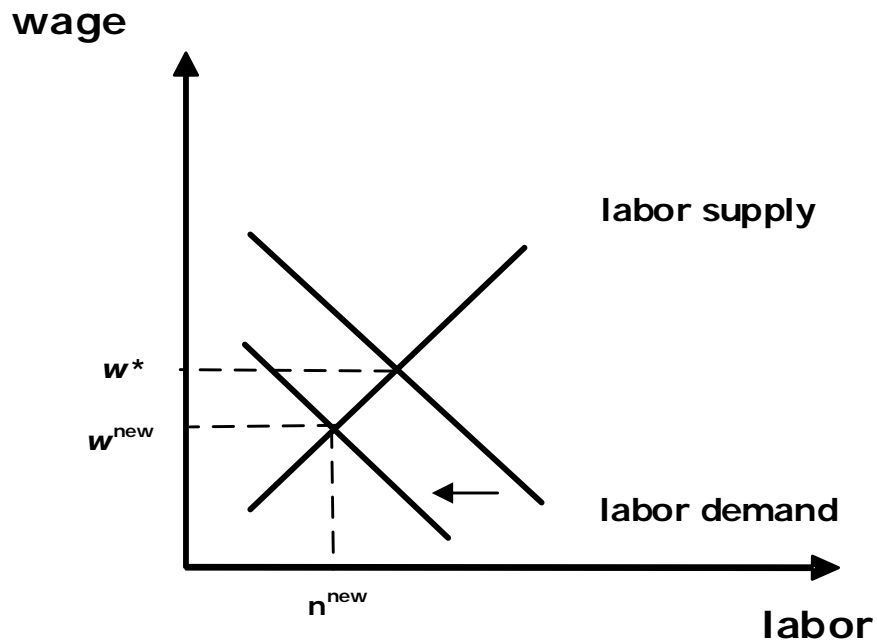


**Figure 55.** The Phillips Curve depicts the short-run negative relationship between the inflation rate and the unemployment rate.

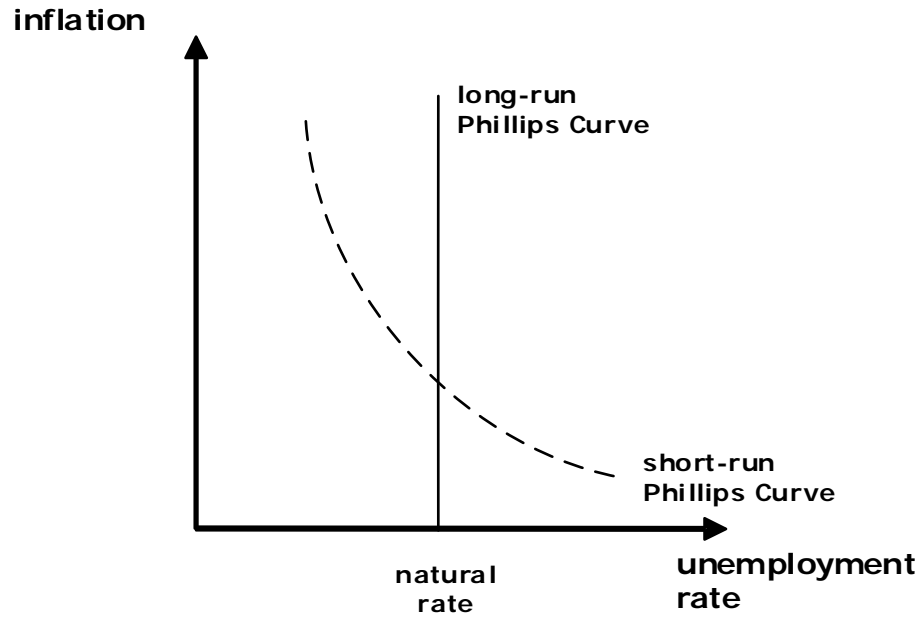
## The Long-Run Phillips Curve

Supposing that contracts that specify wages in advance are the primary source of wage rigidity, then if aggregate demand continues to slump for a protracted period, we would expect the new round of labor contracts negotiated when the original labor contracts expire to feature lower wages. Continuing with our example from **Figure 54**, suppose that after some period of time with the wage stuck at  $w^*$  and unemployment above its natural rate, new rounds of wage negotiation yield the lower nominal wage  $w^*$  in **Figure 56**. At this lower wage, cyclical unemployment is back down to zero, implying that the unemployment rate is back to its natural rate. This occurs **even though aggregate demand remains at its depressed level** – that is, even though inflation stays low, unemployment will eventually gravitate back to its natural rate. Thus, in the long-run

(i.e., that period of time when all wages can be renegotiated – equivalently, that length of time necessary for nominal wage rigidities to disappear), the unemployment rate equals the natural rate no matter what the inflation rate. This long-run relationship is embodied in the vertical **long-run Phillips Curve** shown in



**Figure 56.** After a protracted length of time during which the wage remains stuck above the market-clearing wage, it is likely that firms will win wage reductions in the next round of wage negotiations. A decrease in the wage from  $w^*$  to  $w^{\text{new}}$  thus lowers cyclical employment back to zero and hence the unemployment rate down to the natural rate.



**Figure 57.** In the long-run, there is likely to be no trade-off between inflation and unemployment because in the long-run wages will adjust. This idea is embodied in the vertical long-run Phillips Curve.