

Medium-Term Macroeconomics: Inflation, Unemployment, and Wage-Price Dynamics

In the **medium run** (once wages and prices fully adjust), output and employment return to their natural (potential) levels, and only inflation differs from its pre-shock path. The labor market is modeled by **wage-setting (WS)** and **price-setting (PS)** curves. The WS relation is typically written as

$$W = P^e F(u, z),$$

where W is the nominal wage, P^e expected price level, u the unemployment rate, and z a catch-all for labor-market factors (e.g. benefits, bargaining power). In equilibrium (with $P = P^e$), workers' desired real wage is

$$W/P = F(u, z),$$

a decreasing function of unemployment ¹. Firms' price-setting (with markup μ) implies

$$P = (1 + \mu)W,$$

so they supply a fixed real wage $W/P = 1/(1 + \mu)$ ². Their intersection (where $F(u_n, z) = 1/(1 + \mu)$) pins down the **natural unemployment rate** u_n . Graphically, the PS curve is horizontal (real wage fixed) and the WS curve slopes down (real wage falls as u rises) ² ³. At the intersection (point A), the real wage agreed by workers and firms is $1/(1 + \mu)$. If u deviates from u_n , wage adjustments push it back: when $u < u_n$ (tight labor market), workers demand higher wages than firms offer, raising unemployment; when $u > u_n$, wages fall until firms' wage offer is accepted ² ³. Thus in the medium run output equals its "natural" level (i.e. employment = $N_n = L - u_n$), and living standards (real wage) are determined by structural factors (productivity, markups, institutions), not by cyclical demand ³ ⁴. Changes in structural variables (e.g. a higher markup or more generous unemployment benefits) shift these curves. For example, greater market power (higher μ) lowers $1/(1 + \mu)$ and raises u_n , reducing equilibrium real wage ² ³. Conversely, an increase in bargaining power or unionization (higher z) raises the WS curve and also increases u_n . Importantly, the **natural rate hypothesis** holds that u_n can only change via such real (supply-side) shifts – it "cannot permanently be reduced by demand management" ⁴ ⁵.

Figure: The price-setting (PS) real-wage curve, which is horizontal at $W/P = 1/(1 + \mu)$ for a given markup μ . The intersection of this PS line with the downward-sloping wage-setting (WS) curve determines the natural unemployment u_n and equilibrium real wage ² ³. In this labor-market diagram, an increase in μ (firms' markup) shifts the PS line down (to a lower real wage) and raises u_n . A rise in z (e.g. higher unemployment benefits) shifts the WS curve up and also raises u_n (raising the unemployment rate where wage demands equal wage offers). In all cases the medium-run real wage W/P is pinned by $1/(1 + \mu)$, so structural changes mainly affect u_n and employment, not long-run living standards ² ⁴.

Wage-Price Spirals and Inflation Dynamics

A distinctive feature of medium-run analysis is the **wage-price spiral**: an inflationary feedback loop between wages and prices [6](#) [7](#). In a demand-driven boom, firms raise output and employment. With lower unemployment, workers push for higher nominal wages (to preserve real income). Firms then raise prices to maintain their markups, cutting real balances and demand. As prices rise, workers demand yet higher wages, and so on. In other words, wage hikes “cause price increases, which in turn cause wage increases” in a **positive feedback loop** [7](#) [6](#). Modern New Keynesian models formalize this: if prices and wages adjust with delays (e.g. staggered contracts), a demand shock produces oscillations in real wages and persistent inflation. Blanchard’s classic analysis found that alternating wage- and price-setting leads to a slow adjustment of the price level and damped oscillations in the real wage [8](#). In short, firms and workers disagree on the “correct” real wage; firms set prices for a target markup, while workers bargain for a higher real wage, so nominal wages and prices chase each other upward, amplifying inflation [9](#) [10](#). This spiral stops only when output returns to natural (slack in labor market), so that the actual real wage falls to the target level.

The wage-price spiral mechanism thus **prolongs and intensifies** the effect of shocks. In the simplest view, if wages and prices adjusted instantly there would be no lasting output effects (the short-run shock would instantly equalize real wage aspirations). But with rigidities, the adjustment takes time [11](#). A large negative supply shock (e.g. oil shock) or sustained demand shock can set off a lengthy spiral. Workers’ and firms’ backward-looking expectations mean inflation keeps accelerating until expectations catch up. Importantly, the path of real wages can be complex: in some New Keynesian models, an aggregate demand shock may initially **lower** real wages (prices rise faster than wages) and then wages catch up later [12](#) [6](#). The key is that the wage-price spiral is essentially a conflict over the real wage between labor and firms – it is a **distributional conflict** that plays out via inflation [6](#).

Phillips Curve and Policy in the Medium Run

The WS-PS framework implies the familiar long-run Phillips-curve result: there is *no stable trade-off* between inflation and unemployment in the medium run. In the **short run**, unexpected inflation can temporarily reduce unemployment (moving along a short-run Phillips curve). But once expectations adjust (wages and prices fully adjust), the Phillips curve is **vertical** at the natural rate [5](#) [13](#). Milton Friedman and Edmund Phelps showed that any attempt to exploit a Phillips-curve trade-off only raises inflation without lowering unemployment in the long run [13](#) [5](#). In equilibrium, actual and expected inflation match and unemployment returns to u_n . Thus, once wages and prices have adjusted, *monetary or fiscal expansions do not increase output or lower unemployment* – they only lead to a higher price level or higher inflation rate [5](#) [4](#).

In practical terms, this means **medium-run neutrality** of money. For example, a permanent increase in money supply or fiscal stimulus will boost demand only temporarily. Output first rises (if prices are sticky), but as wages and prices catch up, real balances and real demand fall back, returning output to its natural level [14](#) [5](#). The net effect is higher inflation with no lasting output gain. Likewise, contracting policy (e.g. disinflation) creates a temporary recession, but in the medium run unemployment reverts to u_n , leaving output per capita unchanged [5](#) [4](#). Only real (supply-side) policies can raise u_n ; demand policies merely shift inflation expectations or price levels. Central banks aim to manage expectations to avoid accelerating spirals, but cannot permanently push u below u_n . Overall, living standards (real wages and output per worker) are determined by productivity and labor market structure, and change only slowly via supply shifts (e.g. technology, demographics) rather than medium-run demand moves [4](#) [15](#).

Multiple-Choice Questions

1. **Labor Market Equilibrium:** Suppose the wage-setting function is $W/P = F(u, z)$ and the price-setting fixed real wage is $1/(1 + \mu)$. If the markup μ increases (firms gain market power) **in the medium run**, then:

- A. The natural rate u_n falls (unemployment decreases) and the real wage W/P rises.
- B. The natural rate u_n rises (unemployment increases) and the real wage W/P falls.
- C. u_n is unchanged (only price level changes) and W/P falls.
- D. u_n falls (unemployment decreases) but W/P remains unchanged.

Answer: B. A higher markup μ means firms set a higher price over wage, so $W/P = 1/(1 + \mu)$ is lower 2. The PS curve shifts down to a lower real wage. The WS curve must intersect this new lower line, which occurs at a higher unemployment rate u_n (since higher u lowers workers' wage demands to match the firms' offer). Thus u_n rises and medium-run W/P falls 2 3.

1. **Unemployment Benefits:** In the same WS-PS model, if the government raises unemployment benefits (parameter z in $F(u, z)$), then in the new medium-run equilibrium:

- A. u_n decreases (unemployment falls) because workers accept lower wages.
- B. u_n increases (unemployment rises) because workers demand higher wages.
- C. u_n is unchanged, but the equilibrium real wage W/P changes.
- D. Both u_n and W/P remain unchanged (only prices adjust).

Answer: B. Higher unemployment benefits make joblessness less painful, raising workers' wage demands at each unemployment rate (WS shifts up). To re-equilibrate, unemployment must rise so that workers' agreed real wage falls to the firms' level. Thus the natural rate u_n increases 3 4, and the medium-run real wage (determined by PS) is unchanged in value, since PS still fixes $W/P = 1/(1 + \mu)$.

1. **Demand Shock Dynamics:** An economy is initially at the natural output and unemployment. The central bank unexpectedly increases the money supply permanently. In the **short run** output and employment rise. In the **medium run** (after all wages and prices adjust), we expect:

- A. Output is above potential (permanently), unemployment below u_n , and inflation accelerating.
- B. Output returns to potential, unemployment returns to u_n , but the price level is permanently higher.
- C. Output and unemployment remain above potential and below u_n respectively, but inflation stabilizes.
- D. Output falls below potential, unemployment exceeds u_n , and deflation occurs.

Answer: B. In the medium run, monetary expansions are neutral: output returns to natural (potential) and unemployment returns to u_n . The only lasting effect is a higher inflation or price level 5 4. Expansionary policy cannot permanently boost real output or employment beyond the natural rate, it only "dilutes" the currency and raises prices.

1. **Real Wage Dynamics:** Consider a negative supply shock (e.g. oil price spike) that drives up production costs. According to wage-price spiral theory with sticky wages and prices, the **initial** effect on real wages W/P is most likely:

- A. Real wages immediately rise and stay above pre-shock levels.
- B. Real wages remain constant (nominal wages and prices rise equally).
- C. Real wages fall (prices jump faster than wages) and then gradually recover.
- D. Real wages fall permanently below pre-shock levels.

Answer: C. An adverse supply shock pushes up prices quickly. Sticky wages adjust more slowly, so initially P rises more than W , causing W/P to fall. Over time, wages catch up (through the wage-price spiral dynamics), so the real wage tends to return to its equilibrium level [6](#) [8](#). Thus a temporary dip followed by recovery (oscillation) is expected.

1. **Phillips Curve:** Which statement best describes the Phillips curve in the medium run?
 - A. It is downward-sloping: higher inflation always means lower unemployment.
 - B. It is upward-sloping: higher inflation always means higher unemployment.
 - C. It is vertical: unemployment stays at the natural rate regardless of inflation.
 - D. It is horizontal: any level of unemployment can coexist with stable inflation.

Answer: C. The long-run (medium-run) Phillips curve is vertical at the natural rate u_n . Friedman and Phelps showed that in equilibrium unemployment is independent of inflation [5](#) [13](#). Attempts to keep unemployment below u_n only lead to accelerating inflation with no long-run gain in employment.

1. **Monetary-Fiscal Mix:** A government enacts both a large tax cut and a loose monetary policy simultaneously. In the medium run, after expectations adjust, the most likely outcome is:
 - A. Higher real output and lower unemployment, with moderate inflation.
 - B. Unchanged real output/unemployment at natural rate, but higher inflation.
 - C. Lower inflation and permanently lower unemployment.
 - D. An immediate jump in output and employment that persists indefinitely.

Answer: B. Joint expansionary monetary and fiscal policy boosts demand only transiently. In the medium run, output is back at its natural level (determined by WS-PS) and unemployment at u_n [5](#) [4](#). The large demand push instead raises inflation more strongly. There is no long-term expansion of real output, only a higher price path.

1. **Labor Supply Shock:** Suppose a wave of immigration greatly increases the labor force (shifting L up). Other things equal, this tends to:
 - A. Raise the natural unemployment rate u_n and lower the natural output Y_n .
 - B. Lower u_n (since more workers compete for jobs) and raise Y_n .
 - C. Not change u_n , but increase Y_n .
 - D. Have no effect on Y_n or u_n in medium run.

Answer: B. A larger labor force (more workers) makes unemployment more abundant. This strengthens firms' wage-setting position (shifting WS down), so equilibrium unemployment u_n falls [1](#) [3](#). Meanwhile, with more labor, the natural employment $N_n = L - u_n$ increases, raising natural output $Y_n = f(N_n)$ [16](#).

1. **Sticky-Price Neutrality:** Under sticky prices and wages, a temporary increase in aggregate demand causes a price-wage spiral. If both prices and wages became completely flexible (no stickiness), the medium-run effect of the demand increase would be:
 - A. A permanent increase in output above natural with no change in prices.
 - B. No change in output (stays at natural) but an immediate permanent increase in price level.
 - C. Oscillating output around natural before settling at a higher output level.
 - D. A delayed rise in output and unemployment followed by disinflation.

Answer: B. With fully flexible wages and prices, a demand increase raises both proportionally, so real output stays at its natural level. Only the price level rises to accommodate higher spending. In other words, there is *immediate* price level adjustment and no lasting real effects 11 5.

1. **Minimum Wage Policy:** In the WS-PS model, imposing a binding minimum wage (above the equilibrium wage) will:
 - A. Shift the PS curve up, reducing unemployment.
 - B. Shift the WS curve down, reducing unemployment.
 - C. Increase structural unemployment by making z effectively higher.
 - D. Have no effect on the medium-run equilibrium.

Answer: C. A higher minimum wage effectively behaves like an increase in z (bargaining power or reservation wage) – workers demand higher wages. The WS curve shifts up. To restore equilibrium, unemployment must rise (higher u_n). Thus the natural rate increases (more unemployment) 4 1.

1. **Policy Effectiveness:** Which policy is likely to lower the natural rate of unemployment u_n in the medium run?
 - A. A permanent cut in the income tax rate (demand-stimulating).
 - B. Reducing union bargaining power (lower z).
 - C. A one-time reduction in interest rates (monetary easing).
 - D. Increasing money growth to raise inflation expectations.

Answer: B. Only a supply-side change can lower u_n . Reducing union power (lower z) shifts the WS curve down, so workers accept lower real wages at a given unemployment – this reduces the natural unemployment 1 3. Demand-side policies like tax cuts or money growth only affect inflation or the timing of output, not u_n .

Long-Answer Questions

1. **Wage-Price Spiral Mechanisms:** Explain the wage–price spiral and its implications for inflation persistence. How do demand and supply shocks differ in their spiral effects? Discuss how sticky wages/prices and expectations influence the dynamics.

Sample Answer: A wage–price spiral is a self-reinforcing cycle where rising wages lead to higher prices and vice versa 6 7. It occurs when workers bargain for higher nominal wages (to defend real wages) and firms raise prices to protect markups; each side's action fuels the other. In the medium run this mechanism can prolong inflation: with sticky prices/wages, a shock (e.g. increased AD) initially pushes output and employment up, but as workers demand higher wages, firms raise prices, reducing real balances and output, and the process repeats. In formal models (e.g. Blanchard, 1986) this yields slow adjustment of the price level and damped oscillations of real wages 8 6.

The effects of demand vs. supply shocks differ. An aggregate demand shock typically raises both wages and prices; real wages may initially fall if prices jump faster than wages (since output is above natural) and later recover 6 8. A negative supply shock (higher costs) raises prices first, and sticky wages lag, so the real wage temporarily declines; the spiral then raises wages over time until output returns to the lower natural level. Sticky-price models show that expectations matter: if inflation is expected, workers demand higher wages up front, magnifying the spiral. Rational expectations or credible policy (inflation-targeting) can mitigate the spiral by anchoring expectations and making the adjustment quicker.

Overall, wage-price spirals imply inflation persistence: shocks have longer effects on output when nominal rigidities prevent instant equilibrium 11 6.

1. Natural Rate and Structural Change: Define the natural rate of unemployment. What real (structural) factors determine it? Analyze how changes in labor market institutions or technology (such as unemployment benefits, minimum wage, or capital mobility) shift the natural rate and the WS/PS equilibrium.

Sample Answer: The **natural rate of unemployment** is the equilibrium unemployment rate when the economy is at its potential (full-employment) output 3 13. It arises where wage-setting and price-setting real wages coincide. Real factors determining it include labor market frictions (search, mobility costs), bargaining power, and competition. For example, the model shows u_n solves $F(u_n, z) = 1/(1 + \mu)$, so it depends on z (unemployment insurance, unions) and μ (markup, product market power) 2 3.

Structural changes shift these curves. More generous unemployment benefits (higher z) raise wage demands at every u (WS shifts up), so equilibrium occurs at higher u_n – unemployment permanently rises 3 1. Stricter labor regulations or a higher minimum wage also act like higher z , increasing u_n . Conversely, reforms that increase competition (lower μ) shift PS up (higher W/P for firms), lowering u_n and raising the real wage 2 3. Technological improvements raising productivity increase the marginal product of labor, effectively shifting the WS curve (workers can be paid more for a given u), which can reduce the equilibrium unemployment. In all cases, these are **supply-side** policies: they change the intersection of WS and PS and thus the natural rate. Demand-side tools (fiscal/monetary) cannot permanently alter u_n 4 15.

1. Policy Effectiveness: Critically assess the ability of monetary and fiscal policy to influence output and employment in the medium run. Under what conditions can policy affect real variables, and when is it neutral? Use the labor market and wage-price framework in your explanation.

Sample Answer: In the medium run, with flexible wages and prices, monetary and fiscal policy are largely neutral for real output and employment 5 4. Any demand stimulus only causes higher prices rather than higher real production. For example, an expansionary policy temporarily shifts aggregate demand up, raising output above potential. But as wages and prices adjust (workers' price expectations rise), output returns to the natural level and unemployment to u_n 5 11. Thus in equilibrium, the only effect is a higher inflation rate or price level.

Policy can influence real variables only if it affects expectations or structural variables. A credible monetary policy can lower inflation expectations, easing the adjustment costs of disinflation (affecting short-run trade-offs). Fiscal policy can matter if it changes real incentives (e.g. tax cuts that permanently raise labor supply). In the WS-PS model, only shifts in WS (through z) or PS (through μ) change u_n . Policymakers can shorten the **transition** back to u_n by stabilizing demand (limiting the wage-price spiral), but cannot alter the medium-run equilibrium real output. This reflects the classical dichotomy: money changes nominal variables, real variables are set by real supply-side conditions 5 4.

1. Inflation-Unemployment Trade-off: Analyze why the Phillips curve may appear downward-sloping in the short run but vertical in the long run. Discuss the roles of expectations and wage stickiness in this evolution.

Sample Answer: In the short run, with wages and prices partially sticky, higher demand (or surprise inflation) can temporarily reduce unemployment – moving along a short-run Phillips curve 13. Workers do not immediately anticipate the higher inflation, so their real wages fall, allowing firms to hire more.

Conversely, unexpected disinflation causes unemployment to rise temporarily. This downward-sloping short-run Phillips curve reflects nominal rigidities and adaptive expectations.

Over time, inflation expectations adjust: if unemployment stays below u_n , workers see rising inflation and demand higher wages, pushing back unemployment to u_n . As Milton Friedman argued, in the long run unemployment returns to the unique natural rate once expectations catch up [15](#) [5](#). Wage stickiness delays but does not prevent this: a persistent gap between actual and expected inflation cannot be sustained. Eventually the Phillips curve **shifts** as people update their expectations, so only anticipated inflation is observed. In equilibrium, the Phillips curve is vertical: there is no long-run trade-off between inflation and unemployment [5](#) [13](#). This implies only unexpected inflation can move unemployment away from u_n , and policymakers cannot permanently lower unemployment by accelerating inflation.

1. **Real Wage Dynamics and Policy:** Using the concept of the wage–price spiral, discuss how a credible inflation-targeting policy regime influences real-wage dynamics and medium-run inflation. What happens to the spiral if agents trust that inflation will remain low?

Sample Answer: A credible low-inflation regime anchors wage and price expectations, weakening the spiral. If workers and firms believe inflation will stay at target, workers will demand wages consistent with that expectation, and firms will set prices accordingly. Under such credible targeting, even if demand rises, workers won't expect a higher future price level and thus won't push nominal wages up aggressively. The distributional conflict over the real wage is muted. Technically, the WS curve has an inflation-anchoring channel: if P^e is unchanged, an output boom raises W and P only moderately, so the feedback spiral is limited [11](#) [6](#).

In contrast, if inflation expectations were unanchored (or adaptive), a demand shock would raise P^e over time, shifting the WS curve upward and creating a larger spiral. With credible targeting, any unexpected inflation is quickly countered by policy (e.g. higher interest rates), so actual inflation returns to target and unemployment reverts to u_n without a strong spiral. Real wages thus adjust smoothly: a temporary rise in nominal wages leads to moderate inflation rather than runaway price hikes. In summary, trust in a low-inflation policy regime shortens and dampens the wage–price spiral, preserving medium-run stability and keeping real wages and output near natural values [5](#) [11](#).

Sources: Blanchard's analysis of WS-PS and wage–price spirals [1](#) [14](#) [5](#), Phillips–Friedman–Phelps theory [15](#) [13](#), and modern New Keynesian work [9](#) [8](#) inform these answers.

[1](#) [2](#) Wage-Setting, Price-Setting Relations | CourseNotes

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