

What Happens When the Minimum Wage Rises? It Depends on Monetary Policy

By Andrew Glover and José Mustre-del-Río

In January 2021, members of Congress proposed new legislation to increase the national minimum wage from \$7.25 per hour, where it has been set for over a decade, to \$15 per hour. At the time, the federal funds rate—the target interest rate at which banks borrow and lend to each other overnight—had been near zero since March 2020, when the Federal Open Market Committee (FOMC) sharply cut the rate in response to the COVID-19 shock. Although it is not yet clear whether the proposed minimum wage bill will become law, the effects of any such bill may depend on the stance of monetary policy—both during and after the bill’s implementation.

Changes in interest rates can affect household spending, potentially influencing how a minimum wage increase passes through to the overall economy. For example, if a minimum wage increase leads to a rise in aggregate prices, and the central bank raises nominal interest rates more than one-for-one with increases in inflation, then the real interest rate rises in response to an increase in the minimum wage. Because higher real interest rates make saving more attractive than spending, aggregate demand may fall in turn, leading the minimum wage

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increase to ultimately have a negative effect on employment and prices. However, if the central bank instead keeps nominal rates constant, or raises nominal rates less than one-for-one with increases in inflation, then spending will become more attractive than saving, which can boost aggregate demand. In this case, the minimum wage could have a positive effect on employment and prices.

In this article, we build on Glover's (2019) quantitative framework to examine how monetary policy affects the ways employment and inflation respond to minimum wage increases. Our model-based analysis suggests a minimum wage increase has expansionary (positive) effects on the economy if the central bank is relatively unresponsive to current inflation, and contractionary (negative) effects if the central bank responds more aggressively (more than one-for-one) to current inflation. More generally, our framework suggests that if an increase in the minimum wage engenders contractionary effects, the central bank can mitigate these effects by allowing inflation to rise by more than the nominal rate.

Overall, our quantitative analysis shows that the central bank can potentially influence how an increase in the minimum wage affects the economy. During the COVID-19 pandemic, the FOMC has signaled a willingness "to achieve inflation moderately above 2 percent for some time so that inflation averages 2 percent and longer-term inflation expectations remained well anchored at 2 percent" (Board of Governors of the Federal Reserve System 2020). Our model-based analysis suggests that the Federal Reserve's tolerance of higher temporary inflation could support any expansionary effects of a minimum wage increase and mitigate any contractionary effects.

Section I outlines the model used for our aggregate analysis. Section II provides a quantitative example of how the stance of monetary policy shapes the responses of key aggregate and labor market variables after a minimum wage increase.

I. Labor Markets, Inflation, and Monetary Policy

To understand how minimum wages and the prevailing stance of monetary policy shape economic activity, we use a basic macroeconomic model based on Glover (2019) and extend it to include minimum wages. Our conventional, sticky-price New Keynesian model assumes that prices and wages are slow to adjust to short-term economic changes, an assumption that informs

monetary policy at many central banks. To keep the analysis in this section simple, we assume that once the minimum wage is introduced, all workers are subject to it. (In our more formal quantitative discussion in Section II, we extend the analysis to include workers who are not directly affected by the minimum wage.) Our model allows us to see how the minimum wage increase affects both the labor market and the goods market, how these markets interact, and how interest rates set by the central bank affect the outcomes of a minimum wage increase across the economy.

Figure 1 depicts the labor market in our model and shows how workers' and firms' decisions determine the prevailing or equilibrium wage. Individuals work to earn wages and then spend their wages on goods and services. The curve labeled S represents the labor supply of these workers and slopes up because individuals are willing to work more as wages increase. The curve labeled D represents labor demand determined by firms and slopes down because firms employ fewer workers as wages rise. The prevailing wage is determined by the intersection between the S and D curves, where labor supply equals labor demand.

The figure shows that labor demand, D , depends on the final demand for all goods and services, Y . Note that firms with more final demand for their products will need to hire more workers at any given wage to fulfill their orders. An increase in final demand, which might occur during an economic expansion, shifts the entire labor demand curve to the right: that is, the higher the demand for goods and services, the higher the demand for labor at any given wage. Similarly, a decrease in final demand, which may occur during a recession, shifts the entire labor demand curve left: the lower the demand for goods and services, the lower the demand for labor at any given wage. In this way, the labor market interacts with the goods market.

Figure 2 illustrates the goods market in our model and shows how producers and consumers interact in this market to determine output and inflation. Producers combine labor, capital, and other inputs to make final output, Y . They also set the prices at which they sell these goods and services to consumers. Importantly, the more they are asked to produce, the more they must bid up wages and other costs of production to meet their demand. Consequently, higher demand leads producers to raise prices. This relationship between output, Y , and the change in prices or inflation, π , is represented by the upward-sloping Phillips

Figure 1

The Labor Market

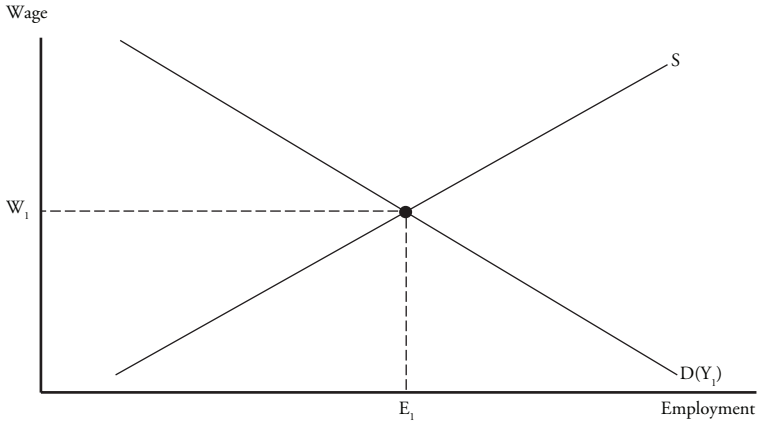
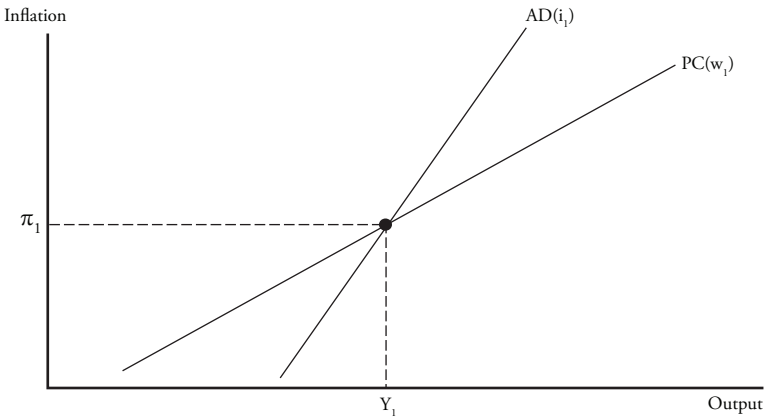


Figure 2

The Goods Market



curve, *PC*. Consumers must decide how many goods and services to purchase today versus tomorrow; to do this, they take into account inflation, π . When inflation rises, consumers understand that prices for goods and services will be higher tomorrow and so purchase more of them today. This second relationship between output, Y , and inflation, π , is represented in Figure 2 by the upward-sloping aggregate demand curve, *AD*. The intersection between the *PC* and *AD* curves determines

final output in the economy, Y , and the corresponding inflation rate, π , at this level of economic activity.

Figure 2 also shows that the aggregate demand curve, AD , depends on the nominal interest rate, i , which is set by the central bank. Holding inflation fixed, a higher nominal interest rate will encourage consumers to save their income because the real rate (the difference between the nominal interest rate and inflation) is higher, and they will earn more interest on their savings (even after accounting for inflation). In contrast, a lower nominal rate will encourage consumers to spend in the present because the real rate is lower, and they will earn less interest on their savings (even after accounting for inflation). When the central bank engages in contractionary monetary policy and increases the nominal interest rate, the entire aggregate demand curve shifts to the left; that is, demand for goods and services today will be lower at any inflation rate. Similarly, when the central bank engages in expansionary monetary policy and decreases the nominal interest rate, the entire aggregate demand curve shifts to the right; aggregate demand today will be higher at any inflation rate.

Although Figures 1 and 2 show how the labor market and goods market behave in general in our model, they do not account for the introduction of a minimum wage. Figure 3 shows how the labor market reacts in response to an increase in wages above the prevailing wage. As the minimum wage is set above the prevailing wage, the minimum wage increase naturally reduces employment. In particular, Figure 3 shows that because the minimum wage, W_{min} , is above the prevailing wage, W , labor supply exceeds labor demand. All else equal, employment falls from E_1 to \tilde{E} .

How much employment falls, if at all, is unclear, as researchers have debated the responsiveness of labor demand to changes in the minimum wage (that is, the slope of the labor demand curve). In general, a steeper labor demand curve leads to a smaller employment decline, while a flatter labor demand curve leads to a larger employment decline. Allegretto and others (2017) suggest the most comprehensive studies available point to only small effects of minimum wages on employment (if any). In contrast, Neumark and Shirley (2021) survey the literature and conclude that minimum wage increases have a modest negative effect on employment. Thus, the decline in employment depicted in

Figure 3

The Labor Market When Minimum Wages Are Imposed

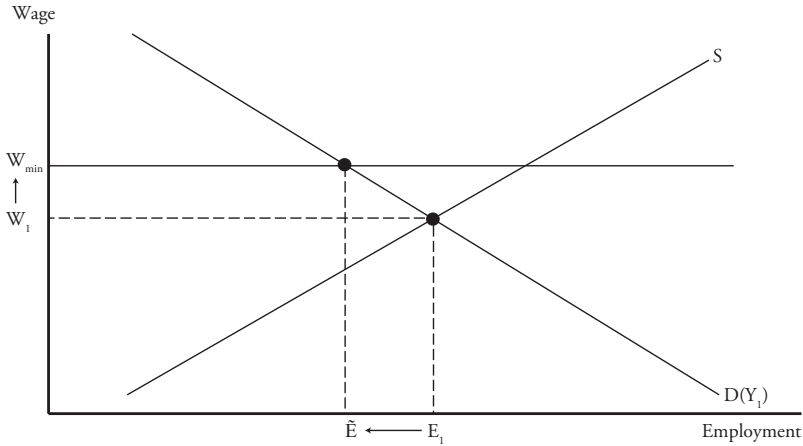


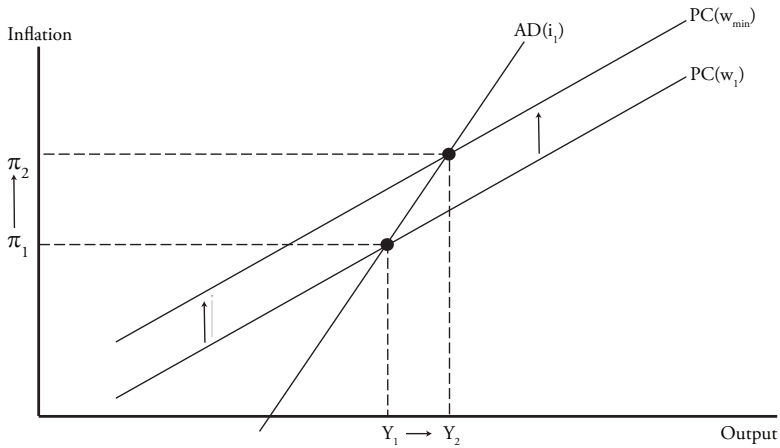
Figure 3 could be considered the result of a somewhat flat (or more responsive) labor demand curve.

Crucially, however, the goods market also adjusts in response to the minimum wage change. In particular, the minimum wage increase makes labor more expensive, and as a result, firms must charge higher prices at any given level of demand for their products. Figure 4 represents this adjustment with an upward shift in the Phillips curve from $PC(W_1)$ to $PC(W_{min})$. Because the Phillips curve, PC , represents the relationship between output and prices charged by producers, it necessarily also depends on producers' costs, including wage costs. Thus, its shift reflects how producers react to the minimum wage increase in the goods market.

Although empirical research is mixed on how a minimum wage increase affects employment, researchers generally agree on how much producers increase their prices in response to increases in the minimum wage (or how much the Phillips curve moves in response to minimum wage increases). For example, Aaronson (2001) finds that restaurant prices rise with increases in the wage bill that result from minimum-wage legislation; this increase is most notable in the quarter when the minimum wage increase comes into effect. Aaronson (2001); Aaronson, French, and MacDonald (2007); and Fougere, Gautier, and Le Bihan (2010) corroborate evidence of pass-through of minimum wages

Figure 4

How the Goods Market Adjusts to Minimum Wages



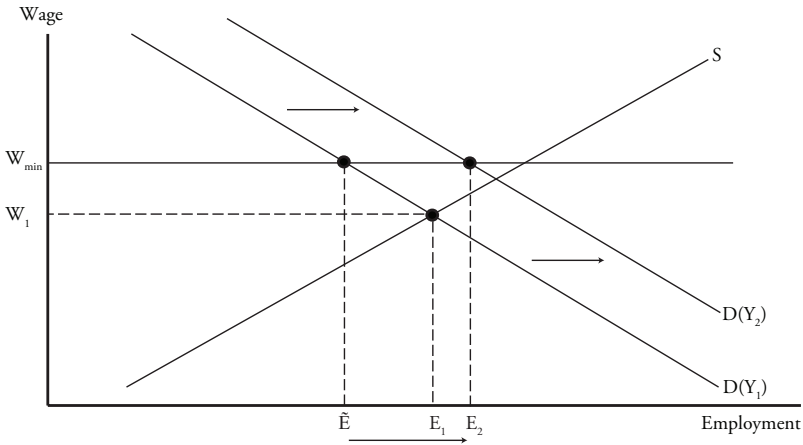
into prices and find more pass-through into prices in industries with a greater share of workers subject to the minimum wage. However, Leung (2020) finds evidence that a city- or state-level increase in the minimum wage is less likely to lead to price increases in firms that set prices at the national level.

Absent any other changes in the economy, inflation, output, and employment can actually rise in response to the minimum wage increase. Because the aggregate demand curve, $AD(i_t)$, in Figure 4 does not move in response to the minimum wage increase, the shift in the Phillips curve to $PC(w_{min})$ actually causes both inflation and output to rise (from π_1 to π_2 and Y_1 to Y_2 , respectively). With greater demand for their products, firms can increase their labor demand at all wage rates, so the labor demand curve in Figure 5 shifts to the right from $D(Y_1)$ to $D(Y_2)$. As a result, employment rises to E_2 , which is above \tilde{E} , the level that would have prevailed absent changes in the goods market. In our stark example, the increase in demand spurred by rising inflation causes employment to rise above the non-minimum-wage level, E_1 , as well.

An important caveat to the previous analysis is that it ignores the potential actions (or reactions) of the central bank. The figures assume a fixed nominal interest rate, and hence a fixed aggregate demand curve as well. With a fixed nominal interest rate and higher inflation, the real

Figure 5

The Labor Market Once the Goods Market Adjusts

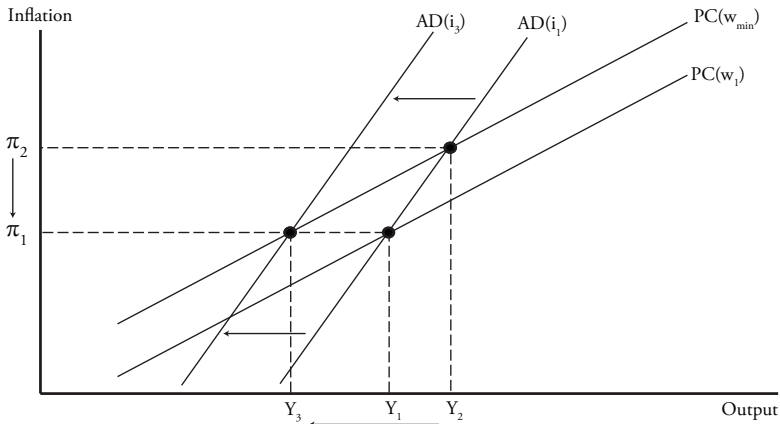


interest rate falls and causes demand (and output) to rise. Thus, the analysis so far has assumed the central bank is willing to tolerate higher inflation; in this case, the minimum wage increase is more likely to be expansionary. To complete the analysis, we now consider what happens when the central bank reacts to rising inflation by tightening policy.

The central bank, following a policy rule by responding to inflation that deviates from a specific target, could raise the nominal interest rate by more than the rise in inflation. As noted, for a given inflation rate, a higher nominal interest rate encourages saving and discourages spending. Thus, demand for goods and services falls at any inflation rate. Figure 6 represents this as a shift in the aggregate demand curve from $AD(i_1)$ to $AD(i_3)$. In our example, the central bank brings inflation down from π_2 back to the same rate absent the minimum wage, π_1 . Overall, because the nominal interest rate is higher and inflation is unchanged, the real interest rate rises. This higher real rate discourages spending today and, as a result, brings demand down to Y_3 . Demand falls both below the level that would have prevailed absent the response of the central bank, Y_2 , and below its non-minimum-wage level, Y_1 . Hence, the minimum wage increase effectively becomes contractionary because the central bank responds aggressively to inflation.

Figure 6

The Goods Market When the Central Bank Responds to Rising Inflation



How contractionary an effect the minimum wage has depends both on how strongly the central bank responds to rising inflation and how responsive aggregate demand is to a change in interest rates (that is, how steep the aggregate demand curve is). Central banks often follow the Taylor principle, which suggests the nominal interest rate should respond more than one-for-one to rising inflation to cool an overheating economy. Under these conditions, a minimum wage increase is likely to be contractionary. At the same time, work by Van Zandweghe and Braxton (2013) and Willis and Cao (2015) suggests aggregate demand has become less sensitive to the nominal interest rate since the Great Recession, which implies that a rising nominal interest rate may generate smaller contractionary effects on the aggregate economy than before. Combining these two observations suggests that qualitatively, aggregate demand should fall following the minimum wage increase, as depicted in Figure 6. This decline, however, may be smaller now than in the past, as aggregate demand may have become less sensitive to interest rates.

If the minimum wage increase leads aggregate demand to fall, firms will decrease their labor demand at all wage rates. Figure 7 shows how the demand curve consequently shifts to the left, from $D(Y_2)$ to

it is not. We then assess how monetary policy helps determine whether minimum wage increases are expansionary or contractionary.

To provide quantitative results, we must pick values for the model's inputs and make a few key choices. First, we focus on the economy's response to a minimum wage increase of 100 percent, which resembles the proposals to increase the federal minimum wage from \$7.25 to \$15 per hour. Second, following Glover (2019), we assume 3 percent of all workers are low-wage workers subject to the minimum wage, while the remaining 97 percent are high-wage workers not subject to the minimum wage.¹ Third, we assume low- and high-wage workers are perfect complements in production. In other words, when changing the level of production, increases (or decreases) in the demand for low-wage workers requires similar increases (or decreases) in the demand for high-wage workers. Although this assumption may appear extreme, it actually yields fairly conservative estimates of how prices respond to a minimum wage increase.² If we instead assume some substitutability between low- and high-wage workers, the model predicts minimum wage increases that are even more inflationary—hence, the central bank's response becomes even more relevant.

Aggregate responses to minimum wage increases

Chart 1 shows how output, inflation, and employment respond after a 100 percent minimum wage increase at quarter 0 under two monetary policy scenarios. In the first scenario, the central bank keeps the nominal rate fixed after an increase in the minimum wage; the blue lines show the associated responses. In the second scenario, the central bank follows the Taylor principle and increases the nominal interest rate more than one-for-one with inflation to ward off inflationary pressures, leaving the observed path of inflation fairly flat; the green lines show the associated responses under this assumption. All changes are measured relative to what would have happened absent any minimum wage change. Thus, a 0 percent change does not necessarily mean no change in the variable, but rather no change in the variable relative to a scenario with no minimum wage change.

Panel A of Chart 1 reiterates the key insight from Section I: an increase in the minimum wage can be expansionary if the central bank is willing to tolerate higher inflation and keep the nominal interest rate

Chart 1

The Economy's Reaction to a Higher Minimum Wage Depends on the Central Bank's Response

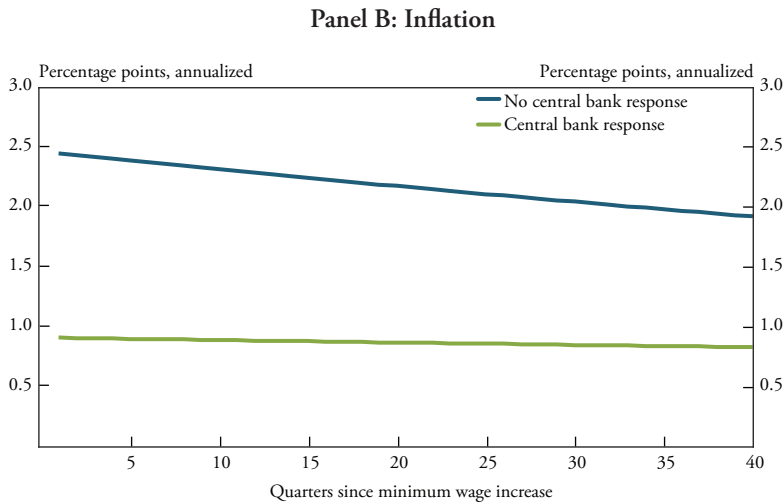
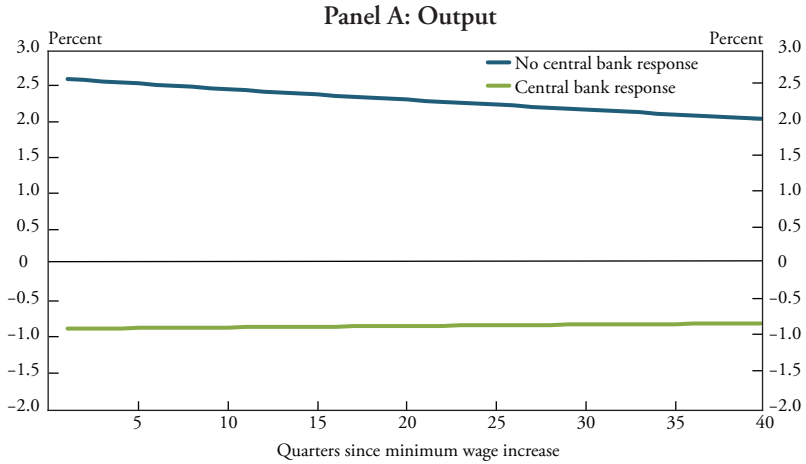
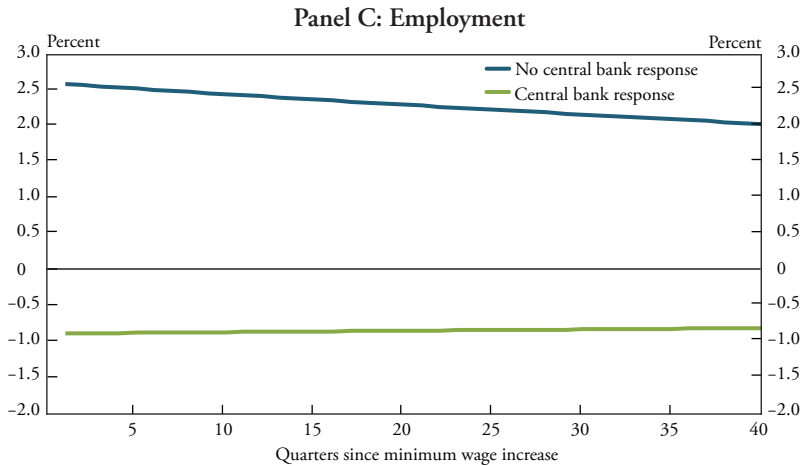


Chart 1 (continued)



Notes: The blue lines represent the responses of each variable when the central bank keeps the nominal interest rate fixed. The green lines represent the responses of each variable when the central bank increases the nominal interest rate. Source: Authors' calculations.

fixed. The blue line shows that, in our model, output grows for many periods after a minimum wage increase when the central bank keeps the nominal interest rate fixed. For example, the level of output immediately increases by 2.5 percentage points after a minimum wage increase relative to what it would have been absent a change in the minimum wage. In contrast, the green line shows that output actually falls after a minimum wage increase when the central bank chooses to increase the nominal rate to ward off additional inflation.

Panel B of Chart 1 quantifies the inflationary trade-off the central bank faces in light of the minimum wage increase. The blue line shows that if the central bank is willing to tolerate higher inflation in response to the minimum wage increase, then inflation rises by roughly 2.5 percentage points (annualized) relative to the inflation rate absent the minimum wage increase. These additional inflationary pressures, fueled by the aforementioned expansion in economic activity, decay over time but fairly gradually. Indeed, even after 40 quarters—10 years—inflation remains 2 percentage points (annualized) higher than the inflation rate absent the minimum wage increase. In contrast, the green line shows that if the central bank chooses to raise the nominal interest rate to temper inflationary pressures, then inflation increases by a more modest 1 percent (annualized per quarter).

Lastly, Panel C of Chart 1 quantifies the change in overall employment after a minimum wage increase under both monetary policy scenarios. Because low- and high-wage workers are perfect complements, the employment response of both types of workers will be the same and equal to the overall response. The blue line shows that employment of all workers rises when the minimum wage increases and the central bank keeps the nominal rate fixed. To accommodate the subsequent increase in demand, employment rises immediately by about 2.5 percent relative to the level that would have prevailed absent the minimum wage increase; however, as demand gradually ebbs, so does the increase in employment. In contrast, the green line shows that overall employment actually falls after the minimum wage increases if the central bank raises the nominal rate to offset some of the increase in inflation. Specifically, employment falls by about half a percentage point relative to the level that would have prevailed absent the minimum wage increase. Notably, this reduction in employment remains fairly steady over the plotted time horizon.

Although the positive employment response to a minimum wage increase appears large when compared with previous empirical research (which usually finds a slightly negative response), our finding is not directly comparable to empirical estimates for a few reasons. First, empirical estimates tend to only focus on specific industries or regions and hence cannot be compared with our aggregate response. Our aggregate response not only encompasses all industries, but also accounts for the response of final demand, which in turn feeds back into labor demand. Second, while most empirical studies focus on small changes in the minimum wage, our model explores much larger changes in the minimum wage. Third, our finding, unlike empirical estimates, is based on a scenario that holds the central bank's response fixed. This assumption is crucial because the central bank's actions affect how aggregate demand responds (through the real interest rate) as well as the subsequent response of aggregate employment (to the change in aggregate demand).

Earnings responses to minimum wage increases

Having examined the aggregate effects of increasing the minimum wage under two monetary policy scenarios, we now assess how the same increase affects low-wage and high-wage workers differently. In

general, low-wage workers will benefit from a higher hourly wage rate, but demand for their labor will fall when the central bank raises rates. In contrast, high-wage workers will only benefit from higher labor demand (if the central bank keeps rates fixed), as their hourly rate does not change. To quantitatively account for both changes in the hourly wage rate and labor demand, we focus on how real earnings (the hourly rate times hours worked, adjusted for inflation) respond to minimum wage increases under our two monetary policy scenarios. Chart 2 breaks these earnings responses down by low- and high-wage workers. Panel A plots the real earnings responses of low-wage workers when the central bank keeps the nominal interest rate fixed (blue line) or increases it (green line). Panel B plots the corresponding response for high-wage workers.

The blue line in Panel A of Chart 2 shows the earnings of low-wage workers increase slightly more than one-for-one as a result of a minimum wage increase when the central bank keeps the nominal rate fixed. As noted previously, low-wage workers' earnings increase both because the minimum wage raises their hourly rate and because demand for their labor services increases. This second effect accounts for the extra increase in the earnings of low-wage workers above and beyond the minimum wage increase. However, this boost to real earnings of low-wage workers wanes gradually over time as higher inflation erodes it.

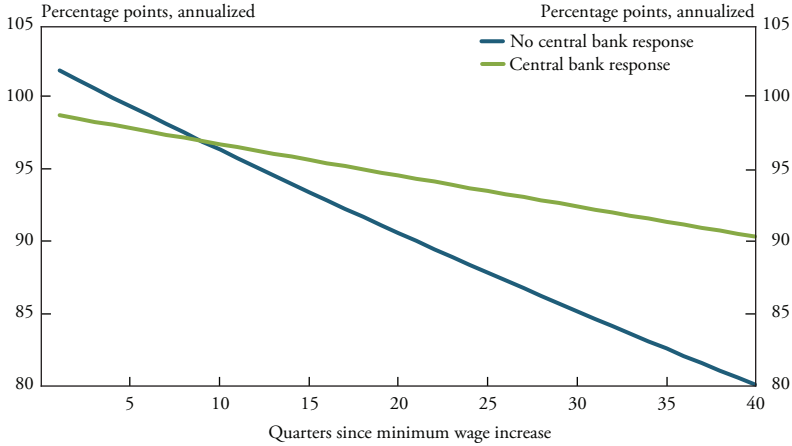
The green line shows that when the central bank increases the nominal rate to ward off inflationary pressures, the real earnings of low-wage workers initially increase by less because demand for labor is lower when the central bank increases rates (as shown in Chart 1, Panel C). However, because inflation is systematically lower (as shown in Chart 1, Panel B), the boost to real earnings of low-wage workers erodes less quickly; eventually, real earnings of low-wage workers are higher than if the central bank had kept rates fixed. Thus, while output and employment in aggregate tend to be higher in response to the minimum wage increase when the central bank keeps rates fixed, low-wage workers benefit more over time from higher nominal rates when the central bank responds to the higher minimum wage.

The earnings responses of high-wage workers are much less nuanced. The blue line in Panel B of Chart 2 shows that when the nominal interest rate is fixed, the earnings of high-wage workers increase; this increase is entirely due to increased labor demand, as their hourly rate is not subject to the minimum wage. In contrast, the green line shows that

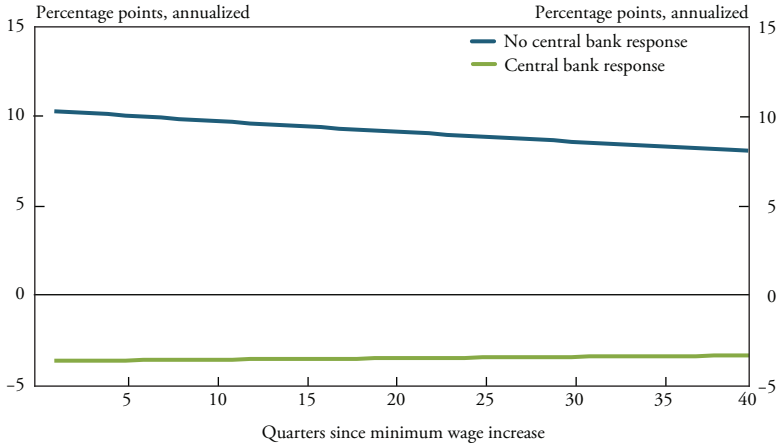
Chart 2

Real Earnings of Low-Wage Workers Rise with a Higher Minimum Wage Regardless of the Central Bank's Response

Panel A: Low-wage workers



Panel B: High-wage workers



Notes: The blue lines represent the responses of real earnings for either low- or high-wage workers when the central bank keeps the nominal interest rate fixed. The green lines represent the responses of real earnings for either low- or high-wage workers when the central bank increases the nominal interest rate.

Source: Authors' calculations.

when the central bank raises the nominal interest rate to bring down inflation, the real earnings of high-wage workers fall because demand for their labor decreases and their hourly rate of pay is not boosted by the minimum wage. Overall, the earnings of high-wage workers rise with minimum wage increases when the central bank keeps rates fixed, but otherwise fall.

Insight and caveats

The model-based quantitative analysis in this section confirms that if the central bank is willing to tolerate inflation and hold the nominal rate fixed, then output, employment, and inflation all increase relative to what would have occurred absent the minimum wage increase. In contrast, if the central bank is unwilling to tolerate inflation and increases the nominal interest rate, then the same minimum wage increase produces a decrease in output and employment. Overall, the quantitative mechanism we highlight in this section aligns with Eggertson (2012) and Eggertson and Krugman (2012), who argue that when nominal interest rates are temporarily pegged, many inflationary shocks (such as an increase in the minimum wage) increase spending and output by lowering real interest rates.³

The results from this section also provide additional insight into the earnings responses of low- and high-wage workers, which cannot easily be ascertained from the intuitive analysis in Section I. The real earnings of high-wage workers behave much like all other aggregates, increasing when the central bank keeps rates steady but decreasing otherwise. The dynamics of the real earnings of low-wage workers, however, are more subtle. Initially, the earnings of low-wage workers rise more when the central bank holds rates steady. However, over time, the earnings of low-wage workers are actually higher when the central bank increases rates and keeps inflation from rising. Lower inflation in this case erodes nominal earnings less, leaving real earnings higher than if inflation had been left unchecked.

As with any quantitative analysis, our results are subject to a few caveats. First, the specific numbers presented in this section depend on the assumptions we made at the outset (such as the share of low-wage workers and the substitutability of low- and high-wage workers). Although adjusting these assumptions changes some of the specific

numbers, it does not change our broader conclusions. Second, our model is fairly complex but nevertheless lacks many important features of the real world; thus, the conclusions drawn from it should be interpreted in a relative sense. For example, in the real world, we may observe a decline in output after a minimum wage increase even while monetary policy holds interest rates steady and allows inflation to rise. This would not necessarily represent a failure of the model's predictions. Rather, the model shows that output may have fallen by even more had monetary policy not remained steady in the face of higher minimum wages and rising inflation.

Conclusions

How does a minimum wage increase affect the economy? Our model-based analysis suggests the answer depends crucially on the central bank's response to any subsequent increase in inflation. In our model, if the central bank is willing to tolerate additional inflation, then increasing the minimum wage is expansionary. The combination of higher inflation (brought on by the minimum wage increase) and a steady nominal rate (because the central bank does not react to the rise in inflation) decreases the real interest rate, which spurs economic activity. In contrast, if the central bank is unwilling to let inflation rise, then increasing the minimum wage is contractionary. The combination of a higher nominal rate (because the central bank acts to curtail the inflationary pressures of the minimum wage increase) and steady inflation causes the real interest rate to rise, which dampens economic activity.

Beyond providing a quantitative foundation for the importance of monetary policy in shaping the effects of a minimum wage increase, our analysis offers some insight for the current debate over raising the minimum wage. Because the FOMC has expressed a willingness to tolerate higher inflation for some time in order to reach its inflation objectives on average, raising the minimum wage now may be more expansionary than in the past. Indeed, even though only a modest fraction of workers actually earns the minimum wage, our quantitative analysis reveals a mechanism by which a minimum wage increase could actually lead to increased output, provided inflation is allowed to rise.

Endnotes

¹Our assumption of a 3 percent share of low-wage workers subject to the minimum wage is consistent with empirical evidence from Neumark, Schweitzer, and Wascher (2004), who find that roughly 3 percent of workers earn up to 110 percent of the minimum wage.

²If low- and high-wage workers can be substituted for each other, then an increase in the minimum wage shifts relative labor demand away from low-wage workers and toward high-wage workers. The increase in demand for high-wage workers increases their wages and, as a consequence, the production costs for firms. The increase in production costs for firms stemming from greater demand of high-wage workers will tend to shift the Phillips curve even more than in the case of perfect complementarity, as high-wage workers are a larger share of employment. Hence, the inflationary effect of the minimum wage increase is even larger.

³See Wieland (2019) and Garin, Lester, and Sims (2019) for recent empirical work on this mechanism.

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