# Is Stimulative Fiscal Policy More Effective at the Zero Lower Bound?

*By Renee Haltom and Pierre-Daniel G. Sarte*

**Several recent research efforts have found that stimulative fiscal policy—government spending or tax cuts—can have unusual effects when nominal interest rates are as low as they are today. In particular, some studies have found that the government spending "multiplier" can be much larger at the zero lower bound. Despite these results, some caution is due when interpreting the size of the fiscal multiplier.**

When it comes to treating recessions, academic research in recent years has focused largely on monetary policy, with fiscal policy receiving relatively scant attention. Government spending surges or tax breaks can take a long time to be approved and implemented. Alternatively, monetary policy, through adjustments to short-term interest rates, is perceived to be effective given its important effect on expectations. In particular, the case for monetary policy as the primary recession-fighting tool was bolstered by its apparent success during the Great Moderation extending from the early 1980s to 2007 (though good luck regarding the lack of devastating shocks to the economy likely played a role in that success).

But what if monetary policymakers cannot lower interest rates further to fight an ongoing recession? Since early December 2008, the Fed's policy interest rate, the federal funds rate, has been as low as it can go: the zero lower bound (ZLB). The ZLB is a rare event; aside from the recent episode, the United States had never confronted it in its post-World War II history.[1]

The deep recession of 2007–09 led policymakers to turn to fiscal policy, passing the 2009 American Recovery and Reinvestment Act (ARRA), a major fiscal stimulus effort. Economists differed widely in their assessments of the ARRA's desirability and, since it has been implemented, its efficacy. A revived debate emerged over fiscal policy in the unique setting of the ZLB.

Intuitively, there are reasons to suspect that the economy might exhibit unique dynamics at the ZLB. Very low interest rates are more likely to be associated with deflationary conditions, which the central bank has fewer options to treat at the ZLB. If deflation is expected while at the ZLB, the real interest rate—the nominal interest rate adjusted for inflation—could rise, perversely reducing consumption in an already weak economic environment.

It is very rare for an economy to be at the ZLB, so there is relatively little real-world experience that economists can use to analyze the effects of fiscal policy in that state. This makes theoretical research—in which such an environment can be artificially constructed—an especially useful tool.

To understand why fiscal policy might operate differently at the ZLB, it is useful to first revisit the mechanism of fiscal policy in "normal" times—that is, when nominal interest rates are well above zero.

## Fiscal policy in "normal" times

The efficacy of fiscal policy is often discussed in the context of one question: How big is the multiplier? The multiplier is the change in output resulting from an increase in government spending or tax cuts. A multiplier of one implies that the net effect of each dollar of government spending is to raise GDP by one dollar. When the multiplier is negative, in contrast, government spending is associated with a reduction in output.

In a seminal paper, Baxter and King (1993), hereafter BK, analyze fiscal policy in a neoclassical setting—that is, one where there are no "frictions," which in this context means that government spending is financed by lump-sum taxes and prices are perfectly flexible.[2] The first assumption provides an environment in which the government's choice of funding method does not distort households' behavior and, therefore, the net effects of the stimulus. The flexible-price assumption in the environment provided by BK implies that the model includes no role for monetary policy or a central bank. Since their model includes no role for the central bank, it cannot explore the implications of the ZLB for fiscal policy.

In the BK model, the average person must choose how to allocate his or her time between work and leisure. The economy's total output is composed of consumption, investment, and government spending, and resources are fixed in the short run: When the government consumes the economy's resources, either consumption or investment, or both, must decrease. (Hereafter, we hold investment constant to simplify the analysis.)

BK considers a temporary, unanticipated increase in government purchases. The increase has two competing effects: Government purchases are funded by taxes, so they reduce the average person's income by the same amount. Households feel poorer, so they consume less. But another effect of households feeling poorer is that they choose to work more. (In the parlance of economic theory, both consumption and leisure are "normal" goods in that they fall when income decreases). The increased labor supply boosts production and output. The fact that labor supply increases when households feel poorer is known as a "wealth effect."

The net effect of government purchases in the BK model under plausible calibrations—that is, values of parameters that make the model consistent with key historical behaviors of the economy—is a multiplier of less than one in most cases. To see why, recall that the net change in output must equal the combined changes in its components, which include government spending and consumption. The change in consumption is negative and lower in magnitude than the immediate increase in government spending since economic theory suggests that households will smooth the hit to consumption over many periods. Therefore, the total increase in output must be less than the increase in government spending.

## Accounting for nominal rigidities

The BK result applies to a frictionless environment. However, today's conventional models include "New Keynesian" nominal rigidities, such as sticky prices (prices that fail to adjust instantaneously to changes in the economy). Price rigidity implies a potential role for the central bank in the sense that changes in monetary policy can lead to changes in "real" economic variables, like output and employment, in the short run. It turns out that adding this complication does not dramatically change the multiplier estimates.

Christiano, Eichenbaum, and Rebelo (2011), hereafter CER, analyze fiscal policy in a New Keynesian setting.[3] The central bank is assumed to set monetary policy by following a standard Taylor rule, in which it sets nominal interest rates by weighing the relative performances of inflation and employment. Like the BK model, the wealth effect in response to a sudden increase in government purchases is a key component of the economy's response: The taxes that finance an increase in government purchases make households feel poorer, causing them to work more, thus increasing output.

But an additional effect serves to raise employment even further in the CER model. Not all firms are able to adjust their prices, and those that cannot adjust must produce a disproportionate share of output because their low relative price means they face relatively high demand. In order to meet this demand, they have to employ more inputs. They compete for inputs and ultimately have to pay higher prices for them, paying higher wages to workers, for example. Firms' markup, the spread of prices over marginal cost, falls. Not all goods prices have risen, but input prices have risen, tantamount to an increase in the real wage. The increase in the real wage induces households to supply more labor, amplifying the rise in employment and output induced by the wealth effect of increased government purchases alone.

CER also assume the utility people get out of an additional unit of consumption is not independent from their labor supply, and in particular, increases with their hours worked. This assumption captures the notion that consumption enjoyed in rare moments of free time is appreciated to a greater degree. This feature of the model induces people to consume more when they work more, and potentially reverses the initial fall in consumption induced by the taxes that fund the stimulus. Overall, in CER's model, consumption actually rises in response to government spending.

As before, the change in output must equal the net change in government spending and consumption (holding investment constant). Now that consumption responds positively, it must be the case that the change in output is greater than the change in government spending. In this case, therefore, the multiplier exceeds one. (When this assumption is relaxed, and the marginal utility of consumption no longer rises with income, the multiplier once again falls below one, but remains positive.)

In the CER model, the resulting sticky-price multiplier under conventional assumptions is 1.05. CER also show that the size of the multiplier depends on various characteristics of the economy. For example, CER show that the multiplier grows when:

1. prices get stickier, since the markup falls more

rapidly when aggregate demand rises. (In fact, mirroring the BK result, the multiplier falls below one when prices are perfectly flexible.);
2. the central bank is less responsive to inflationary pressures or, viewed differently, the central bank cooperates with fiscal policy by keeping interest rates low in the face of fiscal expansion; and
3. the government's spending program is shorter lived. A relatively permanent program increases the present value of taxes, increasing the negative effect on consumption.

Even so, CER argue that it is difficult for a sticky-price model with plausible calibrations to produce a multiplier greater than 1.2.

## Things change at the ZLB

Many models explore the ZLB by introducing a shock to the economy that is large enough to bring nominal interest rates to zero, such that the ZLB becomes "binding." As the shock causes a severe output contraction, the Taylor rule implies that the central bank should set a negative nominal interest rate, which most economists regard as impossible in practice. The ZLB therefore becomes binding when the economy hits this point, and the central bank simply sets interest rates to zero.

The specific situation considered by CER is a shock to households' "discount factor," a measure of how patient people are with respect to consumption. In their experiment, people start to value tomorrow's consumption more, increasing savings today. One could imagine a number of real-world scenarios that might cause this to be the case.[4] People may have formed worsening expectations of future economic performance or simply become more uncertain about the future. The practical effect of the shock is that consumption falls, therefore reducing aggregate demand.

CER show that when the ZLB is binding, the shock causes an economic tailspin: The fall in demand induced by lower consumption reduces competition for inputs, causing marginal cost to decline and putting downward pressure on prices. Not all firms can change their prices instantaneously, so households

expect future lower prices (rather than a complete, one-time adjustment downward). However, the nominal interest rate is stuck at zero.

Here the real interest rate becomes critical. With nominal interest rates at zero and prices expected to fall, the real interest rate becomes positive: The rewards to saving have increased. This further reinforces households' initial desire to save, thus lowering demand even further, and so on.

The same feedback effect that produces a severe economic contraction at the ZLB (in response to a discount rate shock) produces a very large government spending multiplier (in response to a government spending shock). In the CER standard sticky-price model, an increase in aggregate demand induced by government spending forces firms to compete for inputs. Their markup falls, and prices are expected to rise. With zero nominal interest rates, the real interest rate becomes negative—households effectively are taxed by saving—thus further inducing households to spend. The rise in spending further increases the initial rise in aggregate demand from government purchases.

To summarize, the key mechanism underlying the larger government spending multiplier in the CER framework at the ZLB is the feedback effect that produces ever lower real interest rates. When nominal interest rates are stuck at zero, that effect will be ignited once prices are expected to rise. CER calculate a government spending multiplier at the ZLB equal to 3.7.

Tax cuts are another commonly cited recession-fighting tool. Eggertsson (2010) considers a model similar to CER to investigate the effects of a tax cut.[5] In normal times, tax cuts to stimulate aggregate supply are expansionary. Workers get to keep a greater proportion of each dollar they earn, so for any given wage, people want to work more. Firms can then produce more cheaply, exerting downward pressure on prices. In Eggertsson's model, the Taylor rule leads the central bank to respond by lowering interest rates. After this adjustment, the model produces a

multiplier of 0.16 (each dollar of labor tax cuts increases output by 16 cents).

However, Eggertsson finds that the multiplier for a cut in labor taxes flips signs at the ZLB. Because nominal interest rates are stuck at zero, downward price pressures create deflationary expectations that the central bank is unable to address with accommodative policy. This pushes the real interest rate higher, setting off the same feedback effect that exists in the CER model, having a negative effect on spending. Therefore, in Eggertsson's model, the multiplier from a 1 percent cut in the labor tax at the ZLB switches from being positive to negative, at -1.02.

A temporary sales tax reduction, on the other hand, is expansionary. It makes consumption today cheaper relative to the future, stimulating spending. Overall, Eggertsson's results suggest that expansionary fiscal policy at the ZLB should avoid tax cuts that stimulate aggregate supply—like a cut in the labor tax—and instead favor those that stimulate aggregate demand—like a cut in the sales tax. As in the CER model, the key mechanism is forces that create inflationary expectations at the ZLB, therefore pushing the real interest rate below zero.

### Do implementation lags matter?

Government spending programs are hard to implement instantaneously. Since fiscal policy appears to operate differently at the ZLB, it is worth exploring whether the ZLB must be in place when stimulus spending comes online in order for the multiplier to remain large.

CER show that a spending program with implementation lags can produce a large multiplier today relative to the non-ZLB case. However, critical to this outcome is that the ZLB still be in effect when the spending hits the economy. The effect operates through inflation expectations: An expected increase in government spending in future periods increases future output and inflation, and therefore produces higher expected inflation and a lower real interest rate today. This reduces savings and increases consumption.

That said, in the CER model, implementation lags reduce the government spending multiplier at the ZLB. Compared with an immediate ZLB multiplier of 3.7, the one-period lag multiplier falls to 1.5. However, the multiplier does not decrease quickly with additional lags; a two-period lag still produces a multiplier of 1.44. But, again, it is critical that the ZLB still be in place when the spending hits the economy. If the ZLB is no longer binding when the spending comes online, the multiplier drops to 0.46.

The implication for policy is that if spending increases are expected to be implemented with a lag, the stimulus may be more successful when the ZLB is expected to be in place for some time (perhaps, for example, when the economic contraction is very severe). However, this will only work, in the CER model, if the government has promised in advance that it will increase spending any time the ZLB is reached, such that to expect a binding ZLB in the future is to expect a stimulus program in the future.

Braun and Körber (2011) provide further evidence of the importance of expectations to the size of the multiplier in New Keynesian models.[6] In particular, they cast doubt on the large multipliers that New Keynesian models produce at the ZLB. They construct an alternative model and fit it to data from Japan's experience with the ZLB in the late 1990s and 2000s.[7] They show that the large multipliers hold only when households expect the ZLB to be binding for several years. However, when households in their model hold such expectations, the model predicts much more volatility in the Japanese economy than it actually experienced during that period. Braun and Körber point to research suggesting households expected the ZLB in Japan to bind for a shorter period of roughly two years. When households in their model hold such expectations, the government spending multiplier is only 0.9. With similar expectations, they also find, contrary to Eggertsson's result, that a cut in labor taxes is expansionary.

### What does the multiplier really tell us?
Perhaps the only thing fiscal policy literature has determined with certainty is that there is no one multiplier. Rather than framing the question as the hunt for "the" multiplier, policymakers considering fiscal stimulus ought to weigh factors that are likely to make a proposed program effective.

To that end, there are a number of important questions to consider. Each of the studies cited here shows that the effectiveness of fiscal policy depends critically on the environment. A specific example may clarify this point: As emphasized by Christiano (2010), some of the effects described above hinge on two assumptions: first, that downward price pressures produce deflation over time, and second, that aggregate spending is very sensitive to the real interest rate.[8] It is not clear the extent to which either of these conditions is true in practice.

Additionally, an increase in output following fiscal stimulus does not necessarily mean that welfare has increased. For example, in the BK neoclassical model without frictions, higher output is the result of households working harder, and consumption is permanently lower, thus households actually are worse off than before.

There also are additional real-world costs of stimulus that may not be encompassed in the sterile environment of a theoretical model. They include factors such as the longer-term budgetary impact of government programs and the degree to which the government spends its dollars on productive endeavors. In addition, fiscal policy can produce well-known distortionary effects. If not properly targeted, government spending can cause welfare loss by displacing private economic activity.[9] Additionally, the above models assume for simplicity that fiscal policy is financed with nondistorting lump-sum taxes. This is rarely the case in reality. Drautzburg and Uhlig (2011) show that distortionary taxes can significantly reduce the multiplier in the long run, possibly causing it to be negative.[10]

Finally, fiscal policy may not be the only stimulative option at the ZLB. Many economists have argued that the central bank is not powerless in this scenario. The central bank can influence longer-term interest rates by purchasing large amounts of long-term assets, as the Fed has done.[11] It can commit to

a higher inflation target to prevent deflationary expectations.[12] There are also ways in which the central bank could attempt to mimic the conditions of negative nominal interest rates.[13] The feasibility and desirability of these various policy options is an ongoing subject of debate.

For these reasons, the likely size of the multiplier is only one component of the question of whether a specific stimulative fiscal program is "worth it." That is, one should be cautious of drawing simple inferences between the size of the multiplier and whether fiscal policy is the right tool for treating a weak economy. ∎

Renee Haltom is a writer and Pierre-Daniel G. Sarte is a senior economist in the Research Department at the Federal Reserve Bank of Richmond.

## Endnotes

[1] Some economists have argued that the rarity of the ZLB in part caused the profession to misjudge the likelihood that we would end up there in the recent episode. See Hess Chung, Jean-Philippe Laforte, David Reifschneider, and John C. Williams, "Have We Underestimated the Likelihood and Severity of Zero Lower Bound Events?" Federal Reserve Bank of San Francisco Working Paper No. 2011-01, January 2011.

[2] See Marianne Baxter and Robert G. King, "Fiscal Policy in General Equilibrium," *The American Economic Review*, June 1993, vol. 83, no. 3, pp. 315-334.

[3] See Lawrence J. Christiano, Martin Eichenbaum, and Sergio Rebelo, "When Is the Government Spending Multiplier Large?" *Journal of Political Economy*, February 2011, vol. 119, no. 1, pp. 78-121.

[4] Indeed, during the recent episode, the personal savings rate jumped from roughly 2 percent before the recession to a more than 25-year high of 8.2 percent during the recession.

[5] See Gauti B. Eggertsson, "What Fiscal Policy Is Effective at Zero Interest Rates?" in *NBER Macroeconomics Annual 2010*, edited by Daron Acemoglu and Michael Woodford, University of Chicago Press, 2011.

[6] See R. Anton Braun and Lena Mareen Körber, "New Keynesian Dynamics in a Low Interest Rate Environment," Federal Reserve Bank of Atlanta Working Paper No. 2011-10, May 2011.

[7] Japan experienced a stagnant economy for most of the 1990s and confronted the ZLB from much of 1999 through 2006, and again, like many countries, during the recent global financial crisis.

[8] See Lawrence J. Christiano, "Comment on Eggertsson, 'What Fiscal Policy is Effective at Zero Interest Rates?'" Center for Quantitative Economic Research Working Paper No. 10-06, November 2010.

[9] For a discussion from the perspective of economic efficiency, see Kartik B. Athreya and Renee Courtois, "Recent Fiscal Policy and the Manipulation of Aggregate Economic Activity," Federal Reserve Bank of Richmond *Economic Brief*, August 2009, no. 09-08.

[10] See Thorsten Drautzburg and Harald Uhlig, "Fiscal Stimulus and Distortionary Taxation," NBER Working Paper No. 17111, June 2011.

[11] For an overview of this mechanism, see, Renee Courtois Haltom and Juan Carlos Hatchondo, "How Might the Fed's Large-Scale Asset Purchases Lower Long-Term Interest Rates?" Federal Reserve Bank of Richmond *Economic Brief*, January 2011, no. 11-01.

[12] See Bennett T. McCallum, "Should Central Banks Raise their Inflation Targets? Some Relevant Issues," NBER Working Paper No. 17005, May 2011, also forthcoming in Federal Reserve Bank of Richmond *Economic Quarterly*, Second Quarter 2011.

[13] See, among others, Willem H. Buiter, "Negative Nominal Interest Rates: Three Ways to Overcome the Zero Lower Bound," *North American Journal of Economics and Finance*, December 2009, vol. 20, no. 3, pp. 212-238; and Marvin Goodfriend, "Overcoming the Zero Bound on Interest Rate Policy," *Journal of Money, Credit, and Banking*, November 2000, Part 2, vol. 32, no. 4, pp. 1007-1035.

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