



Economic Letter

Fed's Effective Lower Bound Constraint on Monetary Policy Created Uncertainty

by Michael Plante, Alexander W. Richter and Nathaniel A. Throckmorton

ABSTRACT: Uncertainty about the economy increased when the Fed reduced the federal funds rate to its effective lower bound because the constraint restricted the Fed's ability to stabilize the economy. As a result, a much stronger negative relationship between uncertainty and economic activity emerged during and shortly after the Great Recession.

The financial crisis and subsequent recession compelled the Fed to take unprecedented action in December 2008.

Policymakers reduced the benchmark federal funds rate to a range of 0 to 25 basis points (0.25 percentage points)—the effective lower bound (ELB).

Reaching the ELB was important because the federal funds rate is the primary tool the Fed uses to implement monetary policy, and pushing the rate so low constrained the central bank's ability to stabilize the economy and meet its goal of full employment and price stability.

Economists widely believe the ELB can have significant negative implications for economic activity. However, the ELB can also create uncertainty about the future economy. Since the ELB prevents the Fed from responding to unexpected negative economic events with its traditional policy tool, those events more severely affect the economy than in normal times. Uncertainty about the economy rises because people have a more difficult time predicting future outcomes.

In many cases, uncertainty is viewed as an outside factor that negatively affects the economy. Uncertainty about tax and spending policies—such as the debt ceiling or the sunset provision that could

have ended the George W. Bush-era tax cuts—can delay investment decisions and prompt consumers and firms to protect themselves from potentially negative impacts. Such uncertainty, emanating from external factors, is often referred to as exogenous uncertainty.

By comparison, changes in uncertainty due to the ELB were caused by a severe contraction in demand from consumers and firms. In other words, uncertainty arose in response to an event that was endogenous to the economy, rather than the impetus for the contraction.

Data indicate a strong negative contemporaneous correlation between uncertainty and real (inflation-adjusted) gross domestic product (GDP) growth emerged in late 2008 during the Great Recession. Lagged real GDP growth also became more tightly linked with current uncertainty, indicating that poor economic conditions drove uncertainty. Those findings are in line with what economic theory predicts when the ELB constrains the Fed. While the ELB was not the only source of uncertainty during this period, evidence suggests it was a major contributing factor.

Empirical Measures of Uncertainty

Uncertainty is not directly observed in the data, so economists and policy-

makers use a variety of proxies to gauge its level in the economy. One well-known proxy is the VIX, which captures the risk-neutral expected volatility in the S&P 500 stock market index over the coming 30 days. Another common measure is the dispersion of individual economic forecasts. The Survey of Professional Forecasters (SPF) is a frequently cited source that calculates the dispersion in forecasts of various macroeconomic variables.

These proxies suffer from a critical drawback: They may not reflect uncertainty. For example, stock market volatility can represent changes in leverage or risk aversion, and forecasters can disagree even when they are confident in their own projection.

Economists recently developed an uncertainty index (abbreviated as JLN) based on 132 macroeconomic time series.¹ The major advantage of this index over other uncertainty proxies is that it specifically attempts to measure uncertainty. More precisely, it distinguishes between uncertainty—whether indicators are more or less predictable—and unconditional volatility.

Chart 1 plots the three measures of uncertainty normalized to have zero mean and unit variance—so they are directly comparable—using data from

first quarter 1990 to fourth quarter 2016. Although there is a connection between the three series, it is not perfect, reflecting the fact that the two proxies can vary for reasons besides changes in uncertainty. However, all three measures sharply increased during the Great Recession.

ELB and Uncertainty in Theory

A theoretical model provides a useful framework for learning how the ELB impacts economic activity and uncertainty.

The model, which is commonly used in the monetary policy literature, includes equations that describe how households choose to spend and save, how much labor they provide to the private sector, how firms decide to set prices and how a central bank such as the Fed sets its policy rate. The equation that describes the behavior of the central bank determines how strongly the Fed adjusts its policy rate in response to inflation and economic activity.²

The measure of uncertainty in the model is based on the same statistic used to calculate the macro uncertainty index. Specifically, it equals the *ex ante*—or forecasted—average volatility of real GDP growth.

To understand this statistic better,

suppose people are asked to predict how much the economy will grow next quarter. They would make use of the information available to them and come up with their best estimate. However, in all likelihood, each person would factor in uncertainty.

For example, if the most likely growth rate is 2 percent, someone who is fairly confident might predict real GDP growth between 1.5 percent and 2.5 percent, while someone who is more uncertain might say 1 percent to 3 percent. A wider average range implies higher expected volatility of real GDP growth and, hence, greater uncertainty.

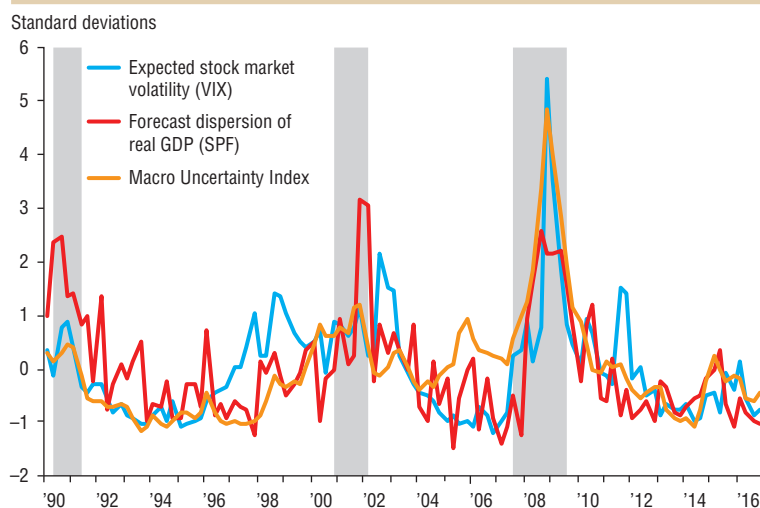
Changes in aggregate demand play a key role in bringing the economy to the ELB and affecting uncertainty. One proxy for changes in aggregate demand in our model is the risk premium, which affects the return on bonds, typically in excess of the “safe” return Treasuries provide. Chart 2A shows the relationship between the risk premium and real GDP predicted by the model. Both values are shown as percent deviations from their long-run values.

When the risk premium is elevated, aggregate demand is lower because households have a greater incentive to save and postpone consumption. Firms respond to the lower consumption demand by decreasing their prices and cutting production, so the lines in Chart 2A slope downward.

The Fed, as long as it is not constrained by the ELB, pursues its mandate to stabilize prices and maintain full employment by reducing its policy rate in response to lower output and inflation. Usually, this mitigates the effects of the lower demand. In situations when the risk premium is extremely high and demand is sufficiently low—as during the Great Recession—the Fed is compelled to reduce its policy rate to the ELB. At that point, rate reductions are no longer possible. The economy becomes more sensitive to further declines in demand, which leads to lower real GDP than if the Fed was unconstrained. Thus, the slopes in Chart 2A become steeper.

Chart 2B shows how the risk premium affects real GDP uncertainty. When the policy rate is above its ELB, the risk premium has little effect on the

Chart 1 | Uncertainty Increases Sharply During the Great Recession



NOTES: Values are standard normalized using the entire time series. Shaded areas denote U.S. recessions.
SOURCES: Survey of Professional Forecasters; Chicago Board Options Exchange; “Measuring Uncertainty,” *American Economic Review*; National Bureau of Economic Research.

level of uncertainty. When it is near or equal to its ELB, further increases in the risk premium sharply increase real GDP uncertainty.

To understand why, imagine several people are trying to forecast real GDP next quarter. Away from the ELB, the Fed is able to help stabilize the economy, so the range of plausible forecasts is relatively narrow. When the Fed loses that ability due to the ELB, output is more sensitive to shocks that hit the economy, so the range of forecasts is much wider.

For example, when the risk premium equals its long-run value, a 1 standard deviation (+/-0.2 percent) change moves real GDP by +/-0.4 percent. In contrast, when the risk premium is 1.0 percent above its long-run value, a +/-0.2 percent change moves real GDP approximately +/-1.1 percent. The broader range of future output values translates into greater forecast error volatility and, hence, higher uncertainty.

Chart 2C provides another way to see how the ELB affects real GDP uncertainty by plotting the probability density functions (PDF)—which illustrate the likelihood of an event—for real GDP next quarter, given three different values for the risk premium. The values on the horizontal axis are shown in deviations from the mean forecast of real GDP.

The risk premium has little effect so long as the ELB does not bind—in good or normal times. In other words, the dispersion in the forecasts is roughly the same, regardless of the level of demand. However, as the policy rate gets close to and eventually hits the ELB (bad times), the PDFs become flatter and skewed to the left, reflecting a much higher level of uncertainty.

Stronger Inflation Response

The monetary policy response to economic changes also affects uncertainty regardless of whether the ELB binds. For example, theory predicts that in normal times when the Fed is able to use its traditional policy tool, a more aggressive response to inflation leads to less uncertainty—not only about inflation but also about the broader economy. Likewise, when the ELB binds, a promise by the Fed to more aggressively respond to inflation after it raises its policy rate can

mitigate some of the increased uncertainty that can accompany the ELB.

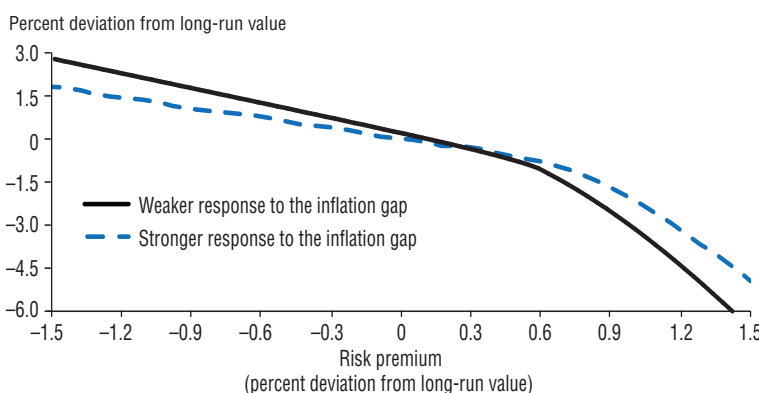
The theoretical model helps illustrate how monetary policy affects uncertainty. Suppose the policy rate is far from its ELB. Chart 2A shows real GDP becomes less sensitive to changes in the risk premium (the slopes of the lines are flatter) when the Fed more strongly responds to the infla-

tion gap. The distribution of real GDP next quarter becomes tighter around its expected value because there is less uncertainty surrounding real GDP (Chart 2B).

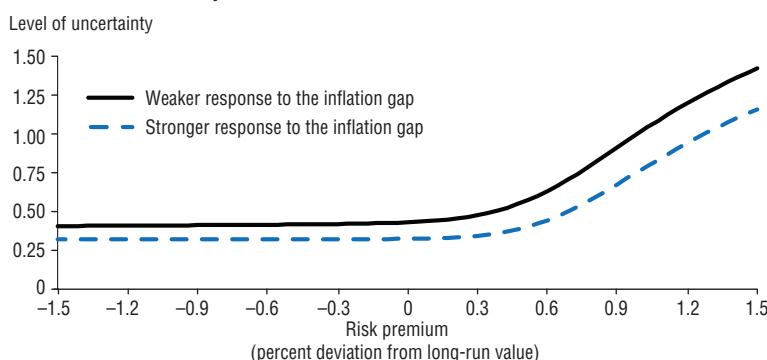
When the ELB binds, the Fed is able to reduce uncertainty by promising greater stability in the future, even though it has no ability to directly influence outcomes in the current quarter.

Chart 2 Effective Lower Bound Increases Uncertainty

A. Real GDP

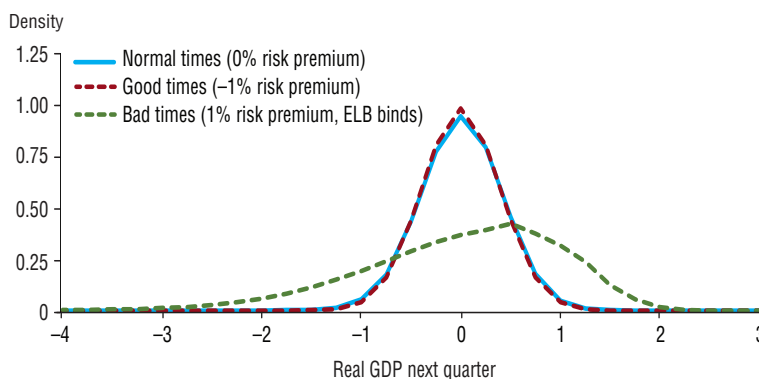


B. Real GDP Uncertainty



NOTE: Level of uncertainty measures the expected volatility of real GDP growth.

C. Probability Density Function



NOTE: For each curve, higher density values reflect greater chances of particular outcomes. Risk premiums are expressed as a deviation from the long-run value.

SOURCE: Authors' calculations.

Table 1
1 Stronger Correlations in the ELB Sample

A. Pre-ELB sample (first quarter 1986–third quarter 2008)

	-3	-2	-1	0	1	2	3
VIX	-0.02	0.02	-0.12	-0.16	-0.13	-0.06	0.04
SPF	-0.22	-0.41	-0.39	-0.36	-0.18	-0.29	-0.10
JLN	-0.15	-0.35	-0.38	-0.47	-0.44	-0.46	-0.49

B. ELB sample (fourth quarter 2008–fourth quarter 2011)

	-3	-2	-1	0	1	2	5
VIX	-0.24	-0.58	-0.73	-0.81	-0.66	-0.44	-0.09
SPF	-0.51	-0.66	-0.72	-0.53	-0.44	-0.25	-0.01
JLN	-0.86	-0.89	-0.85	-0.74	-0.62	-0.24	0.09

NOTE: Correlations between current uncertainty and real GDP growth in the same period (0), previous or lagged periods (-1, -2 and -3) and future or leading periods (1, 2 and 3).

SOURCES: Bureau of Economic Analysis; Survey of Professional Forecasters; Chicago Board Options Exchange; "Measuring Uncertainty," *American Economic Review*, authors' calculations.

However, the Fed is not able to completely eliminate the increase in uncertainty.

Testing the Theory

The theoretical model tells us there should be a tighter link between uncertainty and economic activity when the ELB binds. Away from the ELB, real GDP can vary a lot even though there is little movement in uncertainty. At the ELB, however, there is a strong negative relationship; a decrease in real GDP generally accompanies a sharp increase in uncertainty.

Table 1 shows the contemporaneous correlations—where 1 is perfectly correlated, -1 is perfectly negatively correlated and 0 shows no correlation—between the three measures of uncertainty and real GDP growth, as well as the same cor-

relations at leads and lags of real GDP growth. Table 1A is based on the pre-ELB sample, while Table 1B uses data from when the Fed was most constrained—before the effects of unconventional policy.

A much stronger negative correlation emerged when the federal funds rate was stuck at its ELB. Most interestingly, the correlations with lags of real GDP growth became stronger, while the correlations with leads of real GDP growth were either weaker or unchanged in the ELB sample.

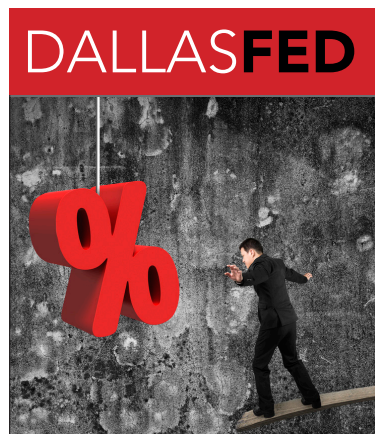
The results show that periods of high uncertainty do not necessarily mean uncertainty is having a large effect on economic activity. At the ELB, changes in uncertainty are mostly a byproduct of what is going on in the economy.

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Notes

¹"Measuring Uncertainty," by Kyle Jurado, Sydney C. Ludvigson and Serena Ng, *American Economic Review*, vol. 105, no. 3, March 2015, pp. 1177–1216.

²For a complete description of the model as well as additional results, see "The Zero Lower Bound and Endogenous Uncertainty," by Michael Plante, Alexander W. Richter and Nathaniel A. Throckmorton, *Economic Journal*, 2017, forthcoming.



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