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The zero lower bound, the dual mandate, and unconventional dynamics ☆

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ABSTRACT

This paper examines monetary policy when it is constrained by the zero lower bound (ZLB) on the nominal interest rate. Our analysis uses a nonlinear New Keynesian model with technology and discount factor shocks. Specifically, we investigate why technology shocks may have unconventional effects at the ZLB, what factors affect the likelihood of hitting the ZLB, and the implications of alternative monetary policy rules. We initially focus on a New Keynesian model without capital (Model 1) and then study that model with capital (Model 2). The advantage of including capital is that it introduces another mechanism for intertemporal substitution that strengthens the expectational effects of the ZLB. Four main findings emerge: (1) In Model 1, the choice of output target in the Taylor rule may reverse the effects of technology shocks when the ZLB binds; (2) When the central bank targets steady-state output in Model 2, a positive technology shock at the ZLB leads to more pronounced unconventional dynamics than in Model 1; (3) The presence of capital changes the qualitative effects of demand shocks and alters the impact of a monetary policy rule that emphasizes output stability; and (4) In Model 1, the constrained linear solution is a decent approximation of the nonlinear solution, but meaningful differences exist between the solutions in Model 2.

1. Introduction

In the aftermath of the 2008 financial crisis, aggregate demand fell sharply. The Fed responded by lowering its policy rate to its zero lower bound (ZLB) by the end of the year. Six years after the crisis began, the Fed's target interest rate remains near zero and the economy is below potential.

Fig. 1 shows the U.S. and Japanese interbank lending rates and employment-to-population percentages from 1990 to 2014. The U.S. policy rate (solid line) has varied between 8.3% and 0% since 1990 and has been held below 25 basis points

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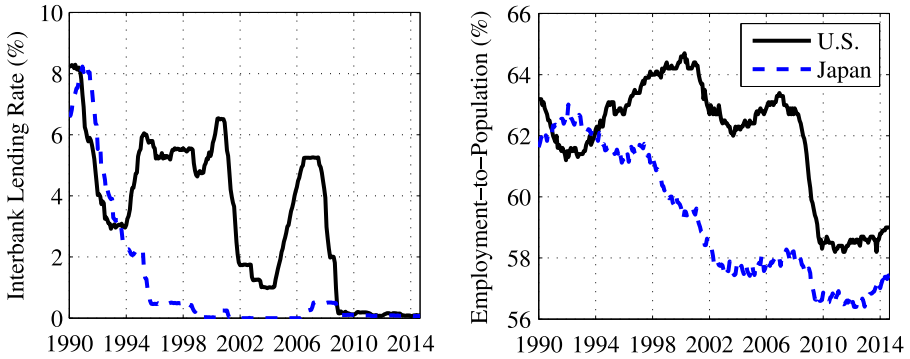

Fig. 1. U.S. and Japanese interbank lending rates (left panel) and employment-to-population percentages (right panel). Sources: Federal Reserve, Bank of Japan, U.S. Bureau of Labor Statistics, and Statistics Bureau of Japan.

since the end of 2008. During that time period, policymakers shifted their focus from inflation to the real economy, since the inflation rate has been at or below the Fed's inflation target. The Bank of Japan sharply lowered its policy rate in 1991 (dashed line), reaching 50 basis points in 1995. Since then it has remained between 0 and 50 basis points, while the employment-to-population percentage has fallen steadily from 62% to about 57.5%. The Japanese economy slightly rebounded in the mid-2000s, but after the financial crisis, the policy rate was cut and the employment-to-population percentage fell even further.

Over the last two decades, the Japanese economy has endured anemic growth in real GDP and slight deflation. Their experience has generated a significant amount of research on the effects of the Bank of Japan's zero interest rate policy (e.g., Braun and Waki, 2006; Eggertsson and Woodford, 2003; Hoshi and Kashyap, 2000; Ito and Mishkin, 2006; Krugman, 1998; Posen, 1998). Many arguments for avoiding the ZLB are motivated in part by the recent Japanese experience.

This paper examines the consequences of the ZLB constraint on the nominal interest rate. Our analysis uses a nonlinear New Keynesian model with technology and discount factor shocks that allows for the ZLB to occasionally bind. Discount factor shocks are a proxy for changes in demand that occurred during the Great Recession, while technology shocks account for changes in supply. When either shock pushes the nominal rate toward zero, households increasingly anticipate a ZLB event, which affects current economic outcomes through expectations. We refer to that anticipation as the "expectational effects" of hitting the ZLB. There are similar expectational effects of leaving the ZLB. Our solution method captures both of those effects. Within this framework, we investigate why technology shocks may have unconventional effects at the ZLB, what factors affect the likelihood of hitting the ZLB, and the tradeoffs a central bank faces under a dual mandate.

We initially focus on a New Keynesian model without capital and then study that model with capital to draw comparisons. In the model without capital, positive technology shocks may have unconventional effects at the ZLB, depending on which measure of output is targeted in the monetary policy rule. When the central bank targets steady-state output, positive technology shocks can cause output to decline when the ZLB binds. Those unconventional dynamics, however, nearly disappear when the central bank targets potential output, which is the level of output in our model with flexible prices. In that case, only large technology shocks reduce output when the ZLB binds.[1] We show the differences between the two output targets since both are used in the literature.

We focus on the specification in which the central bank targets steady-state output, but it is optimal in our model to target potential output. The Fed's January 2012 long-term policy statement emphasizes its dual mandate—stable prices and an economy operating at potential. Given that potential output is unobservable, policymakers tend to target an empirical measure of potential output that has the smooth characteristics of steady-state output (Basu and Fernald, 2009). Moreover, Orphanides (2003a,b) and Orphanides and van Norden (2002) show that a variety of estimates of potential output require substantial revisions as more data become available, which indicates that potential output is not measured accurately in real time. For those reasons, we analyze the theoretical implications of targeting steady-state output and compare them to a potential output target.

Most of the ZLB literature uses models without capital.[2] Capital, however, provides households with another margin to smooth consumption, which strengthens the expectational effects of the ZLB. Arbitrage implies that the real interest rate equals the expected future real rental rate of capital. The decline in demand when the ZLB binds leads to a sharp reduction

[1] Wieland (2014) uses structural VAR evidence to argue that these unconventional dynamics did not occur following the 2011 earthquake/tsunami in Japan or the recent oil supply shocks. Braun and Waki (2006) show that technology shocks generate unconventional dynamics at the ZLB in a log-linearized model with capital where the central bank targets steady-state output. Using a nonlinear model with capital and a monetary policy rule that does not respond to output, Braun and Körber (2011) show that these unconventional dynamics may disappear if the expected duration at the ZLB is short enough. We find that the monetary response to output also changes the qualitative effects of technology shocks.

[2] There are a few notable exceptions. Christiano (2004) shows that capital dampens the effect of discount factor shocks at the ZLB. Braun and Waki (2006) examine the effects of various monetary responses to inflation and output. Braun and Körber (2011), Christiano et al. (2011), and Eggertsson (2011) compute fiscal multipliers at the ZLB.