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The new-Keynesian liquidity trap

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ABSTRACT

Many new-Keynesian models produce a deep recession with deflation at the zero bound. These models also make unusual policy predictions: Useless government spending, technical regress, capital destruction, and forward guidance can raise output. Moreover, these predictions are larger as prices become less sticky and as changes are expected further in the future. I show that these predictions are strongly affected by equilibrium selection. For the same interest-rate path, equilibria that bound initial jumps predict mild inflation, small output variation, negative multipliers, small effects of far-off expectations and a smooth frictionless limit. Fiscal policy considerations suggest the latter equilibria.

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1. Introduction

Many models in the new-Keynesian tradition predict a deep recession with deflation when the “natural” rate of interest is negative and the nominal rate is stuck at zero. Those models also produce unusual policy predictions. Forward guidance about central bank actions can strongly stimulate the current level of output. Fully-expected future inflation can raise output. Deliberate capital destruction or productivity reduction can raise output. Government spending, even if financed by current taxation, and even if completely wasted, can have a large output multiplier. A given promise or expectation further in the future has larger effects today. As prices become more flexible, deflation and depression get worse and unusual policy prescriptions become stronger. Tiny price stickiness has unboundedly large effects, though all effects vanish when prices are fully flexible.

For a given path of expected interest rates, new-Keynesian models allow multiple stable equilibrium paths for inflation and output. Thus, to produce a prediction, a researcher must choose an equilibrium as well as a path for expected interest rates.

I show that these liquidity-trap predictions are sensitive to equilibrium choice. Choosing different equilibria, either directly as an additional modeling specification, or by different specifications of central bank equilibrium-selection policy,

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despite exactly the same path of interest-rate expectations, the same model can predict gentle inflation matching the negative natural rate, small output gaps, and normal signs and magnitudes of policies. Inflation, output and policy predictions are smaller for events expected further in the future, and smoothly approach the frictionless limit.

In the most general terms, the standard models choose equilibria by thinking about expectations of output and inflation when the economy exits the zero bound, and then working backwards. The alternative equilibria I study limit how much inflation and output can jump on the day that the economy learns of the natural rate shock. A variety of criteria suggest such a limitation, especially fiscal policy considerations. Since a sharp deflation raises the value of government bonds, a limitation on the government's ability or willingness to raise taxes limits initial deflation, and consequently limits all effects of the zero bound.

1.1. Literature

Werning (2012) shows clearly the predictions for a depression and deflation at the zero bound, and some policy paradoxes. I adopt his simple modeling framework. This paper is not a critique of Werning. Werning studies the properties of one equilibrium. He acknowledges multiple equilibria. I explore their nature.

Kiley (2016) and Wieland (2014) nicely summarize the puzzling predictions of new-Keynesian zero-bound analyses. Christiano et al. (2011), Eggertsson (2011), Woodford (2011), and Carlstrom et al. (2014) all find large fiscal multipliers, and multipliers that increase with the duration of fiscal expansion.

Carlstrom et al. (2015) study forward guidance, and show the backward explosions highlighted here, that inflation and output increase exponentially in the duration of forward guidance. They show the paradox is worse with inflation indexation in the Phillips curve, but lessened with a sticky-information curve following Mankiw and Reis (2002). Since I focus on equilibrium selection issues, I consider only the simple forward-looking Phillips curve.

Eggertsson (2010) and Wieland (2014) analyze the “paradox of toil” that negative productivity can be expansionary. Eggertsson et al. (2013) argue that structural reforms are contractionary. See also the discussion in Fernández-Villaverde (2013).

Werning's (2012) main point, as that of Eggertsson and Woodford (2003) and Woodford (2012), is to study optimal policy. These authors find a path of inflation, output, and interest rates that maximizes a planner's objective. This path typically involves keeping interest rates low for some time after the natural-rate shock ends. They then advocate “forward guidance,” that central bank officials announce and somehow commit to such policies.

This paper makes no optimal policy calculations. I study outcomes for a variety of given policies, as in the above-cited literature. Some of those policies resemble optimal policies. For example, I study postponed rises in interest rates, which Werning (2012) finds are optimal. I focus on the “implementation” problem: To achieve optimal results, it is not enough for the central bank to specify the path of interest rates. The central bank must take some other action to select among multiple equilibria consistent with the optimal interest rate path. Looking at those equilibria, I find that this selection is far more important to the results than is the path of equilibrium interest rates.

2. Model

I use Werning's (2012) simple continuous-time specification of the standard new-Keynesian model:

$$\frac{dx_t}{dt} = \sigma (i_t - r_t - \pi_t) \quad (1)$$

$$\frac{d\pi_t}{dt} = \rho\pi_t - \kappa(x_t + g_t). \quad (2)$$

Here, x_t is the output gap, i_t is the nominal rate of interest, r_t is the “natural” real rate of interest, π_t is inflation, and g_t is a Phillips curve disturbance discussed below. I abstract from constants, so these are all deviations from steady state values.

Eq. (1) expresses the intertemporal substitution of consumption, and consumption equals output. Eq. (2) is the new-Keynesian Phillips curve. Solved forwards, it expresses inflation in terms of expected future output gaps.

Like Werning, I suppose that starting at $t = 0$, the economy suffers from a negative natural rate $r_t = r = -2\%$, which lasts until time $t = T = 5$ before returning to a positive value. Also following Werning, I complete the model by specifying that the path of equilibrium nominal interest rates is zero up to period T , and then rises back to the natural rate $i_t = r_t \geq 0$, for $t \geq T$. I use $\rho = 0.05$, $\sigma = 1$ and $\kappa = 1$.

Then, I find the set of output $\{x_t\}$ and inflation $\{\pi_t\}$ paths that, via (1) and (2), are consistent with this path of interest rates, and do not explode as time increases. It will turn out that there are many such paths.

Perfect foresight of a trap end date is unrealistic. However, it is simple and clear, and it provides a useful guide to the behavior of models with a stochastically ending trap or a slowly mean-reverting natural-rate processes.

Specifying directly the equilibrium path of interest rates does not mean that I assume a peg, that interest rates are exogenous, or that I ignore Taylor rules or other policy rules. Typically, one adds to (1)-(2) a policy rule of the form

$$\dot{i}_t = \dot{i}_t^* + \phi(\pi_t - \pi_t^*) \quad (3)$$

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