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May 26-28, 2018
Clarion Hotel Sign, Stockholm



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Monetary Stabilization Policy in a Low-Interest-Rate World

Michael Woodford

Columbia University

Nobel Symposium on Money and Banking
Stockholm
May 26-27, 2018

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 - the target for which was further decided on a **meeting-by-meeting basis**, with no commitment in advance

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— but not interest rates or other financial conditions

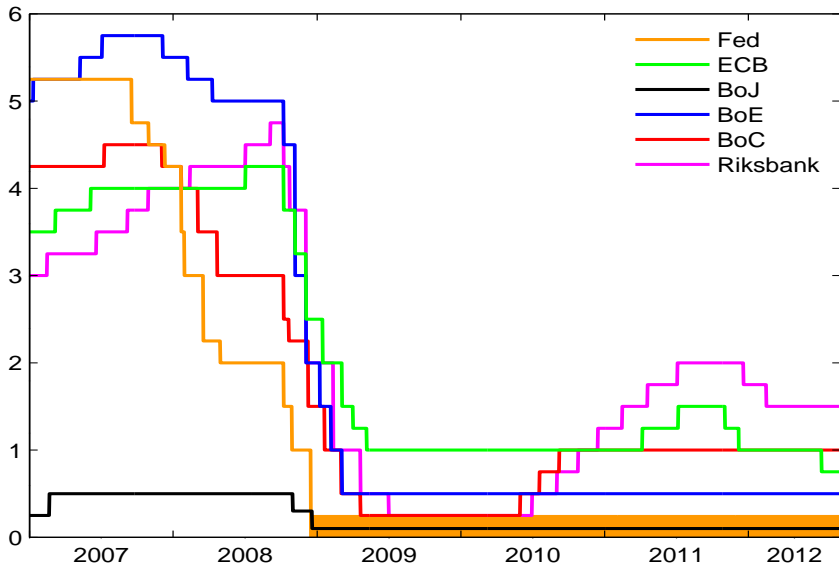
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- Discussions of **strategy** to be followed in the future were instead couched in terms of targets for **inflation**, and perhaps stabilization goals for certain real variables as well [“**flexible inflation targeting**”]
— but not interest rates or other financial conditions
- Consequences for CB **balance sheet** treated as details of implementation that need not even be discussed at policy meetings, let alone specified in advance

A New World for Monetary Policy?

- Instead, following the crisis, interest-rate policy of many CBs was constrained by a [to some extent self-imposed] **effective lower bound** on policy rates

Central-Bank Policy Rates



A New World for Monetary Policy?

- This has meant, not that policy committees had nothing to do, but that focus shifted largely to **other measures**, notably
 - balance-sheet expansion, even when not in order to implement a different interest-rate target [“quantitative easing”]
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 - balance-sheet expansion, even when not in order to implement a different interest-rate target [“**quantitative easing**”]
 - statements about future interest rates, even when current operating target unchanged [“**forward guidance**”]
- To what extent does this mean that the entire **conceptual framework** of monetary stabilization policy needs to be reconsidered, for a world in which ELB might well continue periodically to bind?

A Theory of Optimal Policy

- The general framework for the conduct of policy by many central banks before the crisis — **“flexible inflation targeting”** (Svensson and Woodford, 2005; Woodford, 2012a) — can be given a normative justification (Woodford, 2003, 2011) as optimal policy for an economy in which only important sources of inefficiency are
 - market power and tax distortions
 - distortions resulting from fact that wages and/or prices are not adjusted instantaneously in response to changing conditions

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 - market power and tax distortions
 - distortions resulting from fact that wages and/or prices are not adjusted instantaneously in response to changing conditions
- Role of monetary policy is conceived to be the **mitigation of the distortions resulting from nominal rigidities**, by maintaining an environment in which carefully tracking constantly changing nominal aggregate demand is not necessary

A Theory of Optimal Policy

- Policy prescription at the **policy targets level**:
 - solve Ramsey policy problem, optimizing over **allocations and price paths** consistent with Calvo-style staggered price setting, and tax distortions

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 - log-linearize FOCs around optimal steady state \Rightarrow optimal **target criterion** (Benigno and Woodford, 2005):

$$\pi_t + \phi(x_t - x_{t-1}) = \bar{\pi}$$

where π_t is the inflation rate [**Dixit-Stiglitz index**], $x_t \equiv \log(Y_t/Y_t^*)$ is the “output gap,” Y_t is aggregate output [**Dixit-Stiglitz index**], Y_t^* is a welfare-theoretic concept of potential output [**function of exogenous real disturbances**], and $\bar{\pi}$ is the optimal steady-state inflation rate

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- a form of “flexible inflation target”

A Theory of Optimal Policy

- Policy prescription at the **operating target level**:
 - model-implied stochastic pricing kernel for financial assets

$$m_{t+1} = \beta \frac{\lambda(Y_{t+1}; \zeta_{t+1})}{\lambda(Y_t; \zeta_t)} \frac{P_t}{P_{t+1}}$$

determined by above solution to Ramsey problem

- determines financial conditions consistent with the Ramsey allocation; in particular, state-contingent evolution of **short-term nominal interest rate** i_t [identified with policy rate]

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- relation can be used to determine adjustments of M_t and/or i_t^{CB} needed to implement desired state-contingent evolution of i_t

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- Yet as long as the solution to the Ramsey problem above implies a nominal interest-rate process satisfying $i_t \geq \underline{i}$ at all times [as will necessarily be true with **small enough shocks**], then
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 - the question of how interest-rate target will be implemented can be ignored in choice of operating target at each policy meeting

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 - the question of how interest-rate target will be implemented can be ignored in choice of operating target at each policy meeting
- However, experience since 2008 shows that we cannot assume this!

Optimal Policy When the ELB Binds

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 - FOCs characterizing optimal feasible allocation now a system of Kuhn-Tucker conditions, that include inequalities and complementary slackness conditions (Eggertsson and Woodford, 2003; Woodford, 2011, sec. 1.6)

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- Can again log-linearize these FOCs; and once again, can show that satisfaction of a **target criterion** — that involves only the price level and the output gap — is necessary and sufficient for a non-explosive solution to represent the optimal allocation

Optimal Policy When the ELB Binds

- Optimal target criterion (Eggertsson and Woodford, 2003):
 - ① the “**output-gap-adjusted price level**”

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- ③ the target level should be adjusted according to the rule

$$p_{t+1}^* - p_t^* = \bar{\pi} + \psi_1 \Delta_{t-1} - \psi_2 \Delta_{t-2}$$

where $\Delta_t \equiv p_t^* - \tilde{p}_t \geq 0$ is the **target shortfall**, and the coefficients $\psi_1 > \psi_2 > 0$ depend on model parameters.

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Optimal Policy When the ELB Binds

- However, an important difference from prescription when ELB assumed never to bind: optimal target criterion no longer can be verified simply by looking at current projections for **inflation** and **output growth**, in a history-independent way
- When the ELB temporarily binds, this fact should change the **outlook for subsequent policy** [even conditional on future fundamentals]:
 - the fact that gap-adjusted price-level target is **not allowed to decline** in response to persistent target undershoots requires that subsequent policy will target a **higher rate of nominal growth** than would otherwise be the case
 - in order to create **expectations** of looser conditions later, stimulating aggregate demand despite ELB constraint

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- When the crisis of 2008 arrived, however, and ELB was reached, there was **no reason** for the private sector to expect that, based on previous explanations of CB policy commitments
 - and simply behaving that way **later** would accomplish nothing, if it could not be **anticipated** while policy is still constrained by ELB

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- Was there anything CBs could do?

“Quantitative Easing”?

- One popular answer: a CB that finds that cutting its policy rate all the way to the ELB is still insufficient monetary stimulus should **continue to expand the monetary base** through open-market purchases, to extent necessary to achieve desired volume of aggregate nominal spending [**“quantitative easing” as a substitute for interest-rate reduction**]

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 - a policy urged upon Japan by many Western economists, when ELB reached in late 1990s
 - in its classic formulation [**e.g., Milton Friedman**], the point is increase in **monetary liabilities** of CB, not the particular type of assets acquired

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- Idea may appeal as one that allows stimulative measures to be taken **immediately** (when evident that they are needed), with no need to make commitments to do anything in **future** that may not seem desirable then

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 - once this point is reached, private-sector willingness to hold increased reserves should become **infinitely elastic**
 - increased volume of private transactions is no longer necessary in order for larger quantity of base money to be held

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- Leads to a **demand function for base money** of the form

$$\frac{M_t}{P_t} \geq L \left(Y_t, \frac{1 + i_t}{1 + i_t^{CB}} \right), \quad i_t \geq i_t^{CB}$$

where i_t^{CB} is the interest rate on central-bank balances, and at least one relation must hold with equality at any point in time

— but the first inequality **need not** be an equality, once $i_t = i_t^{CB}$

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- Remaining equations that determine equilibrium paths for $\{P_t, Y_t, i_t\}$ **also** unchanged by a change in the path of $\{M_t\}$, assuming **no change** in the reaction function that determines **interest-rate target** i_t as function of evolution of $\{P_t, Y_t\}$

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 - their result depends on assumption that monetary base is **permanently increased**
 - which implies a different interest-rate policy after ELB ceases to bind

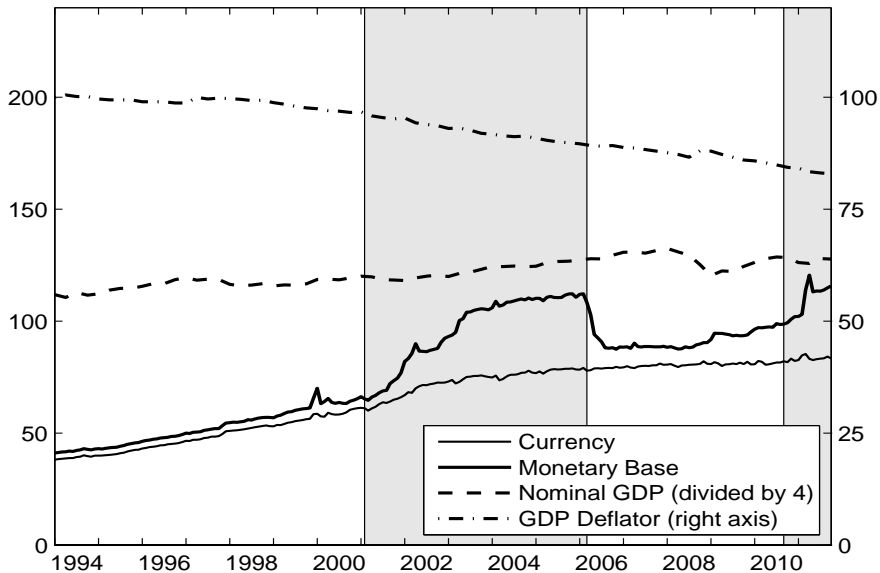
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 - their result depends on assumption that monetary base is **permanently increased**
 - which implies a different interest-rate policy after ELB ceases to bind
- In fact, the “OMO” is mathematically equivalent (in their model) to commitment to a (higher) **nominal GDP level target**

A Signalling Justification for QE?

- In practice, no reason to think that a central bank that greatly increases the supply of reserves (and hence of base money) because constrained by the ELB is intending to **permanently increase** the supply of reserves

Japan: The Original QE Experiment



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- Moreover, in the Auerbach-Obstfeld model, a permanent increase in the monetary base only amounts to a commitment to raise the implicit long-run target for nominal GDP **because zero interest is paid on CB balances**
 - if instead, the interest rate paid on reserves is increased once the ELB ceases to bind, a permanently larger supply of reserves **need not** imply any long-run stimulus to nominal demand
 - this seems to be the current intention of the Fed (Logan, 2018)

“Forward Guidance”?

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 - an approach used by the Fed, among others, in the aftermath of global financial crisis
 - statements advising that interest rates were **unlikely to be increased** above lower bound, as quickly as might otherwise have been expected

“Forward Guidance”?

- What if instead, when CB finds itself constrained by the ELB, it makes an **ad hoc announcement** about the outlook for future policy — perhaps extending years into the future — in light of the unusual circumstances? [**“forward guidance”**]
- Each such statement offered as a one-off response to a **particular situation**, rather than a commitment to any **general rule** to be followed from then on
 - nonetheless, if announcement were taken to be a **credible commitment**, and its consequences were **correctly understood**, RE analysis would imply same equilibrium response as in the RE equilibrium with a systematic history-dependent policy of kind advocated by Eggertsson-Woodford

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- Actual experiments with forward guidance have been rather different from a commitment to a price-level targeting regime (Woodford, 2012b, 2013):
 - in practice, CBs reluctant to **commit** to future policy different than would seem desirable at that time
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 - in practice, CBs reluctant to **commit** to future policy different than would seem desirable at that time
 - only offer view about what they currently anticipate that future conditions will warrant
 - date-based, rather than outcome-dependent, statements about future policy
 - this has limited CBs’ willingness to continue to be specific once change in target is near

How Much Can We Rely on People's Foresight?

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 - which one may doubt, especially in the case of a **novel** policy experiment
- We know from experimental game theory (Crawford *et al.*, 2013) that when people have to play a game for **the first time**, their ability to reason their way to Nash equilibrium play is limited, despite being told precisely what the possible actions and payoffs of all players are
 - though convergence to equilibrium play **through experience** is more reliable

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- And RE predictions depend critically on assuming that people not only believe the policy commitment, but **correctly anticipate** its future equilibrium effects
 - which one may doubt, especially in the case of a **novel** policy experiment
- We also know from experiments that people's ability to solve dynamic optimization problems through **explicit forward planning** is limited (Keramati *et al.*, 2016)
 - though again, learning from experience is possible in case of sufficiently repetitive situations

Forward Guidance in More Realistic Models

- Woodford (2018) shows how it is possible to analyze the effects of an ad hoc policy commitment while assuming that people (and firms) engage in **forward planning** only a **finite distance into the future**
 - boundedly rational strategizing of the kind used by programs to play chess or go

Forward Guidance in More Realistic Models

- Woodford (2018) shows how it is possible to analyze the effects of an ad hoc policy commitment while assuming that people (and firms) engage in **forward planning** only a **finite distance into the future**
 - boundedly rational strategizing of the kind used by programs to play chess or go
- García-Schmidt and Woodford (2015) instead assume people form complete optimal plans for **themselves**, but do not model **others** as taking into account implications of the new policy, or model others as modeling others, and so on forever
 - as in models of “level- k reasoning” in experimental game theory

Implications of Bounded Forward Planning

- In these models, a commitment to maintain looser policy in the future [understood as commitment to different policy for unchanged fundamentals, not a forecast of worse fundamentals] should still increase both output and inflation when announced — but by **less** than under the RE analysis, especially in the case of a **long-lasting** commitment [relative to the length of planning horizons]

Implications of Bounded Forward Planning

- This reason for doubting the strength of effects expected from **ad hoc forward guidance** doesn't mean that consistently conforming to a **price level targeting** regime couldn't have benefits in an ELB episode, that depend on **anticipation** of subsequent return to price-level target path

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 - effectiveness of ad hoc FG depends on people's being able to **deduce** the future effects of a newly announced (but unfamiliar) policy — an ability that may be limited
 - effectiveness of the PLT regime instead could be based on **learning from experience** that departures from PL target path are eventually corrected — likely more reliable, as long as pattern to be learned is not complex

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 - effectiveness of the PLT regime instead could be based on **learning from experience** that departures from PL target path are eventually corrected — likely more reliable, as long as pattern to be learned is not complex
 - RE analysis treats the two policies as **equivalent** — but in practice they are unlikely to be

Preparing for Future ELB Episodes

- Lesson of these analyses: should expect **ad hoc** measures adopted only after the ELB binds [**whether balance-sheet expansion or forward guidance regarding interest-rate policy**] to be of limited effectiveness

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- Lesson of these analyses: should expect **ad hoc** measures adopted only after the ELB binds [**whether balance-sheet expansion or forward guidance regarding interest-rate policy**] to be of limited effectiveness
- Adoption of a **nominal level target** during the period **before** the next ELB episode would instead make it possible for people to come to understand — through **experience** rather than **deduction** — the implications of the CB's commitment to such a regime

— and hence have expectations of a stabilizing character when the ELB again becomes a binding constraint on interest-rate policy

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