Raising an Inflation Target: 
the Japanese Experience with Abenomics

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  - **April 2013**: BOJ unveils “Quantitative and Qualitative Monetary Easing” (QQE).
Preview of Main Results

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- However, such policy might have more limited effects, if it is not fully credible.

- Japan’s recent experience raises this concern as inflation expectations have risen only partially.
Outline

- Data with limited theory: The effects of inflation target shocks using a VAR model
- Theory with limited data: Inflation target shocks in two DSGE models
Quantifying Changes in the Inflation Target: A VAR

- What do Japanese data tell us about the short-run effects of changes in the inflation target?
  Need a way to identify these changes from the data. Use a structural VAR.
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  1. has no long-run effect on GDP and the real exchange rate
  2. is the only shock affecting inflation and interest rates in the long run
  3. affects inflation and the interest rate one-for-one in the long run.
- No restriction on short-run effects.
VAR: Responses to a 2% Inflation Target Shock

1992Q1-2012Q4
VAR Impulse Responses: no ZLB vs. ZLB

1974Q1-1996Q4
VAR Impulse Responses: no ZLB vs. ZLB

1974Q1-1996Q4

1992Q1-2012Q4
Summary of VAR Results

- Reflating the economy leads to (1) a persistent depreciation; (2) a short-run output boost.

- The muted response of interest rates boosts output more for given increase in inflation.

- Responses at the ZLB are much larger.

- Are these shocks plausible/frequent? No.
  An inflation target shock of 2 percentage points is a 6 standard deviation shock in our sample.
A Closed Economy New-Keynesian Model

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- Taylor rule

\[
    r_t = \max \left( 0, \phi_r r_{t-1} + (1-\phi_r) \left( 1\% + \pi_t + \phi_\pi (\pi_t - \pi_t^*) + \frac{\phi_y}{4} \tilde{y}_t \right) \right)
\]
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- What happens when a new \( \pi_t^* = 2\% \) target is announced (starting from 0\%)?
Inflation Target Shock in a NK Model

- GDP
- Inflation Target
- Total Inflation
- 10-year Expected Inflation
- Policy Rate

Graphs showing the impact of an inflation target shock on GDP, inflation, and policy rate with and without ZLB constraints.
Inflation Target Shock: ZLB (our benchmark) vs no ZLB

**GDP**

- **ZLB** (blue, solid line)
- **No ZLB** (red, dashed line)

**Inflation Target**

- **ZLB** (blue, solid line)
- **No ZLB** (red, dashed line)

**Total Inflation**

- **ZLB** (blue, solid line)
- **No ZLB** (red, dashed line)

**10-year Expected Inflation**

- **ZLB** (blue, solid line)
- **No ZLB** (red, dashed line)

**Policy Rate**

- **ZLB** (blue, solid line)
- **No ZLB** (red, dashed line)
Summary of Baseline NK Model

• Inflation target shock moves inflation and inflation expectations close to target by early 2014 (despite large price rigidity.)

• Inflation target shock has powerful effects on GDP (especially in liquidity trap.)

• However, neither inflation nor inflation expectations are at 2 percent today.
Inflation expectations since the start of Abenomics

Long-Term Inflation Expectations
Imperfect Observability

- No realistic amount of price rigidity can explain why long-run inflation expectations are not at 2 percent yet.

- We thus modify the model to allow for imperfect credibility about the inflation target.

- Want to capture two ideas:
  - agents are unsure about the BOJ’s degree of commitment
  - agents are unsure as to what the BOJ will do in the future.
Abenomics: the BOJ’s QQE

QQE calls for a rapid and open-ended expansion of the BOJ balance sheet until the 2 percent target is reached.
Imperfect Credibility

The central bank follows a Taylor rule subject to the ZLB:

\[ r_t = \max \left( 0, \phi_r r_{t-1} + (1-\phi_r) \left( r + \pi_t + \phi_\pi (\pi_t - \pi^*_t) + \frac{\phi_y}{4} \tilde{y}_t \right) + e_t \right) \]

\( \pi^*_t \) : persistent monetary policy shock

\( e_t \) : transitory monetary policy shock

Formally:

\[
\begin{bmatrix}
\pi^*_t \\
\epsilon_t
\end{bmatrix} =
\begin{bmatrix}
0.999 & 0 \\
0 & 0.001
\end{bmatrix}
\begin{bmatrix}
\pi^*_{t-1} \\
\epsilon_{t-1}
\end{bmatrix} +
\begin{bmatrix}
\epsilon_{pt} \\
\epsilon_{qt}
\end{bmatrix}
\]

\( \epsilon_{pt} \sim N(0, \sigma^2_p), \ \epsilon_{qt} \sim N(0, \sigma^2_q) \)

\[ Z_t = \pi^*_t - (1 - \phi_r)^{-1} \phi_\pi^{-1} e_t \]

\( Z_t \): inflation target

\( \pi^*_t \): persistent component

\( \epsilon_t \): transitory component
Imperfect Credibility: Some Intuition

- The BOJ challenge: it would like to change long-run inflation \((E_t \pi_{t+\infty})\) and \(r_t\) in a “stable manner”, affecting \([\pi_t^*, E_t \pi_{t+1}^*, E_t \pi_{t+2}^*, \ldots]\) ....

- ....but agents might not be able to tell whether the target and the long-run interest rate are changing on a permanent or transitory basis.

- In other words, agents cannot tell whether the current deviations from the historical policy rule are going to last “forever” \((\pi_t^*)\) or not \((e_t)\).

- We calibrate the imperfect credibility by the signal-to-noise ratio, \(\sigma_p^2 / \sigma_q^2\):
  - \(\sigma_p^2 / \sigma_q^2\) high: inflation target shock fully credible (as before)
  - \(\sigma_p^2 / \sigma_q^2\) low: inflation target shock less than fully credible.
Impulse Responses: Perfect vs Imperfect Credibility
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Calibrate signal-to-noise to get rise in expected inflation as in data: effect on GDP is now smaller
Model Results so Far

1. Inflation target shocks can be powerful at the ZLB.

2. Inflation target shocks are more powerful the more agents expect them to be permanent (the larger the signal-to-noise ratio $\sigma_p^2 / \sigma_q^2$.)
Quantifying the Effect of Abenomics

- How much progress has Japan made so far?
  Closed-economy NK model suggests limited progress.
Quantifying the Effect of Abenomics

- How much progress has Japan made so far? Closed-economy NK model suggests limited progress.

- However, international variables may suggest otherwise. Exchange rate and trade price movements have been large since Abenomics. Want to understand their role.
External prices since the start of Abenomics
Inflation Target Shocks using SIGMA

- Add imperfect credibility to the Fed Staff’s open-economy, multi-country model, SIGMA (Erceg, Guerrieri and Gust, 2006.)
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- Model features LCP. We assume that:
  1. Japanese exporters change their prices (in dollars) very infrequently → Exports respond little to exchange rate.
  2. U.S. and ROW exporters adjust their prices (in yen) more frequently → Imports respond strongly to exchange rate.
Inflation Target Shock in SIGMA

- GDP
- Policy Rate
- 10-year Yield
- Total Inflation
- Domestic Inflation
- Export Price Inflation
- Import Price Inflation
- Real Yen Index
- Trade Balance (share of GDP)
- Real Exports (growth contrib.)
- Real Imports (growth contrib.)

**Graphs:**
- Time series plots for GDP, Policy Rate, 10-year Yield, Total Inflation, Domestic Inflation, Export Price Inflation, Import Price Inflation, Real Yen Index, Trade Balance (share of GDP), Real Exports (growth contrib.), and Real Imports (growth contrib.).

**Key Points:**
- The graphs illustrate the impact of an inflation target shock in SIGMA.
- The target shock is represented by a blue line, while the target and depreciation shocks are shown in red.
- The graphs cover the years 2012 to 2020.

**Legend:**
- Blue line: Target Shock
- Red line: Target and Depreciation Shocks
Inflation Target Shock in SIGMA

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- Inflation rises towards its target very slowly.

- However, model unable to capture large yen depreciation seen in the data and through the VAR. Layer depreciation shock on top of inflation target shock.
Inflation Target and Depreciation Shocks in SIGMA

- GDP
- Policy Rate
- 10-year Yield
- Total Inflation
- Domestic Inflation
- 10-year Inflation Expectations
- Real Yen Index
- Export Price Inflation
- Import Price Inflation
- Trade Balance (share of GDP)
- Real Exports (growth contrib.)
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Target Shock
Target and Depreciation Shocks
The Evidence from SIGMA

- The additional depreciation shock leads to a short-lived surge in domestic total inflation through import prices.
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- The surge in total inflation is reversed quickly as the inflationary impulse of depreciation dies out.
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- The additional depreciation shock leads to a short-lived surge in domestic total inflation through import prices.

- The surge in total inflation is reversed quickly as the inflationary impulse of depreciation dies out.

- Inflation eventually rises towards its target very slowly.
Total and Core Inflation since Abenomics

Four-quarter percent change

Start of Abenomics

Total CPI

Core CPI
Conclusions and Future Research

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- To-do list for the future:
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  1. examine which steps a central bank can take to improve its credibility (one idea: be more explicit about the path of future monetary policy)
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- To-do list for the future:
  1. examine which steps a central bank can take to improve its credibility (one idea: be more explicit about the path of future monetary policy)
  2. jointly study the effects of structural reforms and changes in the inflation target.
Imperfect Observability – Background Calculations

When the ZLB does not bind we can rewrite the Taylor rules as:

\[ r_t = \phi_r r_{t-1} + (1-\phi_r) \left( rr + \pi_t + \phi_\pi (\pi_t - \pi_t^*) + \frac{\phi_y}{4} \tilde{y}_t \right) + e_t \]

\[ = \phi_r r_{t-1} + (1-\phi_r) \left( rr + \pi_t + \phi_\pi \pi_t - \phi_\pi \pi_t^* + \frac{\phi_y}{4} \tilde{y}_t + \frac{e_t}{1-\phi_r} \right) \]

\[ = \phi_r r_{t-1} + (1-\phi_r) \left( rr + \pi_t + \phi_\pi \pi_t - \phi_\pi \pi_t^* - \frac{-\phi_\pi e_t}{(1-\phi_r) \phi_\pi} + \frac{\phi_y}{4} \tilde{y}_t \right) \]

\[ = 0, \phi_r r_{t-1} + (1-\phi_r) \left( rr + \pi_t + \phi_\pi \pi_t - \phi_\pi \left( \pi_t^* - \frac{e_t}{(1-\phi_r) \phi_\pi} \right) + \frac{\phi_y}{4} \tilde{y}_t \right) \]

\[ = \phi_r r_{t-1} + (1-\phi_r) \left( rr + \pi_t + \phi_\pi \pi_t - \phi_\pi (Z_t) + \frac{\phi_y}{4} \tilde{y}_t \right) \]

\[ = \phi_r r_{t-1} + (1-\phi_r) \left( rr + \pi_t + \phi_\pi (\pi_t - Z_t) + \frac{\phi_y}{4} \tilde{y}_t \right) \]