Discussion “Expectations-Driven Liquidity Traps: Implications for Monetary and Fiscal Policy” Nakata Schmidt
SUERF Bank of Italy Conference

Discussant: Juan Passadore (EIEF)

November 19, 2020
Interesting Paper. Important question. In a nutshell:

- Equilibrium multiplicity. Construct an equilibrium that switches between two states. Sunspot: No change in fundamentals, coordination failure.
- Many results in the paper. Two of them subject to recent policy discussions:
  - Raise the inflation target?
  - Expansionary fiscal policy.

Discussion:

- Commitment.
- What can we learn from data?
- Fiscal policy.
Interesting Paper. Important question. **In a nutshell:**

- **Theory:** Textbook NK model. Central Bank lacks commitment.
- **Equilibrium multiplicity.** Construct an equilibrium that switches between two states. Sunspot: No change in fundamentals, coordination failure.
- Many results in the paper. Two of them subject to recent policy discussions:
  - Raise the inflation target?
  - Expansionary fiscal policy.

**Discussion:**

- Commitment.
- What can we learn from data?
- Fiscal policy.
Interesting Paper. Important question. **In a nutshell:**

- **Theory:** Textbook NK model. Central Bank lacks commitment.
- **Equilibrium multiplicity.** Construct an equilibrium that switches between two states. Sunspot: No change in fundamentals, coordination failure.
- Many results in the paper. Two of them subject to recent policy discussions:
  - Raise the inflation target?
  - Expansionary fiscal policy.

**Discussion:**

- Commitment.
- What can we learn from data?
- Fiscal policy.
Policy Problem: Unconstrained

- Programming problem of Central Bank. No commitment, Markov policy problem, government optimizes given current conditions:

\[ V(s) = \min_{\pi(s), y(s), i(s)} [\pi(s) - \pi^*]^2 + \lambda y(s)^2 + \beta \mathbb{E} V(s') \]

subject to

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' | s} \pi(s') \]
\[ y(s) = \mathbb{E}_{s' | s} y(s') - \sigma (i(s) - \mathbb{E}_{s' | s} \pi(s') - r^n(s)) \]

- Policy problem: Objective. NKPC: Aggregate Supply block. EE: Aggregate demand. The solution is then NKPC + Optimal policy:

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' | s} \pi(s') \]
\[ 0 = \kappa (\pi(s) - \pi^*) + \lambda y(s) \]

- Previous system pins down the allocation. Last step. Given \{\pi, y\} solve for \(i\). What rate is compatible with inflation and output? Euler equation:

\[ i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s' | s} y(s') - y(s) \right] + \mathbb{E}_{s' | s} \pi(s') + r^n(s) \]
Policy Problem: Unconstrained

- Programming problem of Central Bank. No commitment, Markov policy problem, government optimizes given current conditions:

\[ V(s) = \min_{\pi(s), y(s), i(s)} \left[ (\pi(s) - \pi^*)^2 + \lambda y(s)^2 + \beta \mathbb{E} V(s') \right] \]

subject to

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' | s} \pi(s') \]
\[ y(s) = \mathbb{E}_{s' | s} y(s') - \sigma (i(s) - \mathbb{E}_{s' | s} \pi(s') - r^n(s)) \]

- Policy problem: Objective. NKPC: Aggregate Supply block. EE: Aggregate demand. The solution is then NKPC + Optimal policy:

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' | s} \pi(s') \]
\[ 0 = \kappa (\pi(s) - \pi^*) + \lambda y(s) \]

- Previous system pins down the allocation. Last step. Given \( \{\pi, y\} \) solve for \( i \).
What rate is compatible with inflation and output? Euler equation:

\[ i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s' | s} y(s') - y(s) \right] + \mathbb{E}_{s' | s} \pi(s') + r^n(s) \]
Policy Problem: Unconstrained

- Programming problem of Central Bank. No commitment, Markov policy problem, government optimizes given current conditions:

\[
V(s) = \min_{\pi(s), y(s), i(s)} [\pi(s) - \pi^*]^2 + \bar{\lambda} y(s)^2 + \beta \mathbb{E} V(s')
\]

subject to

\[
\begin{align*}
\pi(s) &= \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \\
y(s) &= \mathbb{E}_{s'|s} y(s') - \sigma (i(s) - \mathbb{E}_{s'|s} \pi(s') - r^n(s))
\end{align*}
\]

- Policy problem: Objective. NKPC: Aggregate Supply block. EE: Aggregate demand. The solution is then NKPC + Optimal policy:

\[
\begin{align*}
\pi(s) &= \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \\
0 &= \kappa (\pi(s) - \pi^*) + \lambda y(s)
\end{align*}
\]

- Previous system pins down the allocation. Last step. Given \{\pi, y\} solve for \(i\). What rate is compatible with inflation and output? Euler equation:

\[
i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s'|s} y(s') - y(s) \right] + \mathbb{E}_{s'|s} \pi(s') + r^n(s)
\]
Policy Problem: Unconstrained

- Programming problem of Central Bank. No commitment, Markov policy problem, government optimizes given current conditions:

\[ V(s) = \min_{\pi(s), y(s), i(s)} \left[ (\pi(s) - \pi^*)^2 + \lambda y(s)^2 + \beta \mathbb{E} V(s') \right] \]

subject to

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \]
\[ y(s) = \mathbb{E}_{s'|s} y(s') - \sigma (i(s) - \mathbb{E}_{s'|s} \pi(s') - r^n(s)) \]

- **Policy problem**: Objective. NKPC: Aggregate Supply block. EE: Aggregate demand. The solution is then NKPC + Optimal policy:

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \]
\[ 0 = \kappa (\pi(s) - \pi^*) + \lambda y(s) \]

- Previous system pins down the allocation. Last step. Given \( \{\pi, y\} \) solve for \( i \). What rate is compatible with inflation and output? Euler equation:

\[ i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s'|s} y(s') - y(s) \right] + \mathbb{E}_{s'|s} \pi(s') + r^n(s) \]
Policy Problem: Unconstrained

- Programming problem of Central Bank. No commitment, Markov policy problem, government optimizes given current conditions:

\[ V(s) = \min_{\pi(s), y(s), i(s)} [\pi(s) - \pi^*]^2 + \lambda y(s)^2 + \beta \mathbb{E} V(s') \]

subject to

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \]
\[ y(s) = \mathbb{E}_{s'|s} y(s') - \sigma (i(s) - \mathbb{E}_{s'|s} \pi(s') - r^n(s)) \]

- **Policy problem**: Objective. NKPC: Aggregate Supply block. EE: Aggregate demand. The solution is then NKPC + Optimal policy:

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \]
\[ 0 = \kappa (\pi(s) - \pi^*) + \lambda y(s) \]

- Previous system pins down the allocation. **Last step.** Given \{\pi, y\} solve for \(i\). What rate is compatible with inflation and output? Euler equation:

\[ i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s'|s} y(s') - y(s) \right] + \mathbb{E}_{s'|s} \pi(s') + r^n(s) \]
Policy Problem: Unconstrained

- Programming problem of Central Bank. No commitment, Markov policy problem, government optimizes given current conditions:

\[ V(s) = \min_{\pi(s), y(s), i(s)} [\pi(s) - \pi^*]^2 + \lambda y(s)^2 + \beta \mathbb{E} V(s') \]

subject to

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' \mid s} \pi(s') \]
\[ y(s) = \mathbb{E}_{s' \mid s} y(s') - \sigma (i(s) - \mathbb{E}_{s' \mid s} \pi(s') - r^n(s)) \]

- Policy problem: Objective. NKPC: Aggregate Supply block. EE: Aggregate demand. The solution is then NKPC + Optimal policy:

\[ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' \mid s} \pi(s') \]
\[ 0 = \kappa (\pi(s) - \pi^*) + \lambda y(s) \]

- Previous system pins down the allocation. Last step. Given \( \{\pi, y\} \) solve for \( i \). What rate is compatible with inflation and output? Euler equation:

\[ i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s' \mid s} y(s') - y(s) \right] + \mathbb{E}_{s' \mid s} \pi(s') + r^n(s) \]
**Policy Problem: Constrained**

- **Problem**: if \( r^n < 0 \), then \( i < 0 \). Zero lower bound. Thus, constrained policy:

\[
V(s) = \min_{\pi(s), y(s), i(s)} [\pi(s) - \pi^*]^2 + \lambda y(s)^2 + \beta \mathbb{E} V(s')
\]

subject to

\[
\begin{align*}
\pi(s) &= \kappa y(s) + \beta \mathbb{E}_{s'\mid s} \pi(s') \\
y(s) &= \mathbb{E}_{s'\mid s} y(s') - \sigma(i(s) - \mathbb{E}_{s'\mid s} \pi(s') - r^n(s)) \\
i(s) &\geq 0
\end{align*}
\]

- The solution is then \( NKPC + \) Optimal policy (when possible, slackness) + EE:

\[
\begin{align*}
\pi(s) &= \kappa y(s) + \beta \mathbb{E}_{s'\mid s} \pi(s') \\
0 &= [\kappa (\pi(s) - \pi^*) + \lambda y(s)] i(s) \\
i(s) &= \frac{1}{\sigma} \left[ \mathbb{E}_{s'\mid s} y(s') - y(s) \right] + \mathbb{E}_{s'\mid s} \pi(s') + r^n(s)
\end{align*}
\]

- **Consequence of the shadow \( i < 0 \)**: Loose the policy equation when ZLB binds – need \( E. \) Equation.
Policy Problem: Constrained

- Problem: if $r^n < 0$, then $i < 0$. Zero lower bound. Thus, constrained policy:

  $$ V(s) = \min_{\pi(s), y(s), i(s)} \left[ (\pi(s) - \pi^*)^2 + \overline{\lambda}(s)^2 + \beta \mathbb{E}V(s') \right] $$

  subject to

  $$ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' | s} \pi(s') $$

  $$ y(s) = \mathbb{E}_{s' | s} y(s') - \sigma (i(s) - \mathbb{E}_{s' | s} \pi(s') - r^n(s)) $$

  $$ i(s) \geq 0 $$

- The solution is then NKPC + Optimal policy (when possible, slackness) + EE:

  $$ \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' | s} \pi(s') $$

  $$ 0 = [\kappa(\pi(s) - \pi^*) + \lambda y(s)] i(s) $$

  $$ i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s' | s} y(s') - y(s) \right] + \mathbb{E}_{s' | s} \pi(s') + r^n(s) $$

- Consequence of the shadow $i < 0$: Loose the policy equation when ZLB binds – need $E$. Equation.
Policy Problem: Constrained

- Problem: if \( r^n < 0 \), then \( i < 0 \). Zero lower bound. Thus, constrained policy:

\[
V(s) = \min_{\pi(s), y(s), i(s)} [\pi(s) - \pi^*]^2 + \lambda y(s)^2 + \beta \mathbb{E} V(s')
\]

subject to

\[
\pi(s) = \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \\
y(s) = \mathbb{E}_{s'|s} y(s') - \sigma (i(s) - \mathbb{E}_{s'|s} \pi(s') - r^n(s)) \\
i(s) \geq 0
\]

- The solution is then NKPC + Optimal policy (when possible, slackness) + EE:

\[
\pi(s) = \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \\
0 = [\kappa (\pi(s) - \pi^*) + \lambda y(s)] i(s) \\
i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s'|s} y(s') - y(s) \right] + \mathbb{E}_{s'|s} \pi(s') + r^n(s)
\]

- Consequence of the shadow \( i < 0 \): Loose the policy equation when ZLB binds – need \( \mathbb{E} \) equation.
**Policy Problem: Constrained**

- **Problem:** if \( r^n < 0 \), then \( i < 0 \). Zero lower bound. Thus, constrained policy:

  \[
  V(s) = \min_{\pi(s), y(s), i(s)} \left[ (\pi(s) - \pi^*)^2 + \lambda y(s)^2 + \beta \mathbb{E} V(s') \right]
  \]

  subject to

  \[
  \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \\
  y(s) = \mathbb{E}_{s'|s} y(s') - \sigma (i(s) - \mathbb{E}_{s'|s} \pi(s') - r^n(s)) \\
  i(s) \geq 0
  \]

- **The solution** is then NKPC + Optimal policy (when possible, slackness) + EE:

  \[
  \pi(s) = \kappa y(s) + \beta \mathbb{E}_{s'|s} \pi(s') \\
  0 = [\kappa (\pi(s) - \pi^*) + \lambda y(s)] i(s) \\
  i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s'|s} y(s') - y(s) \right] + \mathbb{E}_{s'|s} \pi(s') + r^n(s)
  \]

- **Consequence of the shadow** \( i < 0 \): Loose the policy equation when ZLB binds – need \( \mathbb{E} \). Equation.
Policy Problem: Constrained

- **Problem:** if \( r^n < 0 \), then \( i < 0 \). Zero lower bound. Thus, constrained policy:

\[
V(s) = \min_{\pi(s), y(s), i(s)} [\pi(s) - \pi^*]^2 + \bar{\lambda}y(s)^2 + \beta \mathbb{E} V(s')
\]

subject to

\[
\pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' | s} \pi(s')
\]

\[
y(s) = \mathbb{E}_{s' | s} y(s') - \sigma (i(s) - \mathbb{E}_{s' | s} \pi(s') - r^n(s))
\]

\[
i(s) \geq 0
\]

- **The solution** is then NKPC + Optimal policy (when possible, slackness) + EE:

\[
\pi(s) = \kappa y(s) + \beta \mathbb{E}_{s' | s} \pi(s')
\]

\[
0 = [\kappa (\pi(s) - \pi^*) + \lambda y(s)] i(s)
\]

\[
i(s) = \frac{1}{\sigma} \left[ \mathbb{E}_{s' | s} y(s') - y(s) \right] + \mathbb{E}_{s' | s} \pi(s') + r^n(s)
\]

- **Consequence of the shadow \( i < 0 \):** Loose the policy equation when ZLB binds – need \( \mathbb{E} \). Equation.
Figure 1: Aggregate demand and aggregate supply in the low state

(a) Model with sunspot shock
(b) Model with fundamental shock

Note: In the left panel, S marks low-state output gap and inflation in the sunspot equilibrium and NS marks low-state output gap and inflation the no-sunspot equilibrium. In the right panel, F marks low-state output gap and inflation in the fundamental equilibrium. Inflation is expressed in annualized terms.
Sunspot vs Fundamental: Raise the target? Depends...

Figure 2: The effect of increasing the central bank’s inflation target

(a) Model with sunspot shock

(b) Model with fundamental shock

Note: Solid lines: $\pi^* = 0$; dashed lines: $\pi^* = 1/400$. In the left (right) panel, $S$ ($F$) marks output gap and inflation in the sunspot (fundamental) equilibrium in the baseline and $S'$ ($F'$) marks outcomes in the sunspot (fundamental) equilibrium in the case of a higher $\pi^*$. $NS$ marks output gap and inflation in the no-sunspot equilibrium in the baseline, and $NS'$ marks outcomes in the no-sunspot equilibrium in the case of a higher $\pi^*$. Inflation is expressed in annualized terms.
1. Commitment

- Optimal policy with **commitment**. Key: *ability to make and fulfill promises*. Central Banks are currently engaged in: Forward Guidance, Unconventional monetary policy, Long run targeting...

- Some of these policies involve some degree of commitment to future policies. Why it matters? Werning (2012). NK model in a liquidity trap.
  - Optimal policy lack of commitment. Recession. Even Depression.

- **Question**: What do we know about the existence of the self-fulfilling liquidity trap with commitment? About the policies to mitigate this trap (fiscal and monetary)?

- **Hard problem. History matters.**
1. Commitment

- Optimal policy with commitment. Key: ability to make and fulfill promises. Central Banks are currently engaged in: Forward Guidance, Unconventional monetary policy, Long run targeting...

- Some of these policies involve some degree of commitment to future policies. Why it matters? Werning (2012). NK model in a liquidity trap.
  - Optimal policy lack of commitment. Recession. Even Depression.

- Question: What do we know about the existence of the self-fulfilling liquidity trap with commitment? About the policies to mitigate this trap (fiscal and monetary)?

1. Commitment

- **Optimal policy with commitment.** Key: *ability to make and fulfill promises.* Central Banks are currently engaged in: Forward Guidance, Unconventional monetary policy, Long run targeting...

- Some of these policies involve some degree of commitment to future policies. Why it matters? Werning (2012). NK model in a liquidity trap.
  - **Optimal policy lack of commitment.** Recession. Even Depression.

- **Question:** What do we know about the existence of the self-fulfilling liquidity trap with commitment? About the policies to mitigate this trap (fiscal and monetary)?

- **Hard problem.** History matters.
1. Commitment

- Optimal policy with commitment. Key: ability to make and fulfill promises. Central Banks are currently engaged in: Forward Guidance, Unconventional monetary policy, Long run targeting...

- Some of these policies involve some degree of commitment to future policies. Why it matters? Werning (2012). NK model in a liquidity trap.
  - Optimal policy lack of commitment. Recession. Even Depression.

- Question: What do we know about the existence of the self-fulfilling liquidity trap with commitment? About the policies to mitigate this trap (fiscal and monetary)?

2. Real Explanations for a Liquidity Trap


- Among other reasons (for pushing real rates down)
  - large crisis and deleveraging
  - aging population
  - scarcity of safe assets
  - excess savings from corporations
  - inequality
  - downward trend in the price of capital goods

- Negative real rates: competing explanation. We need to think about both scenarios. Reality, probably a combination of both.
2. Real Explanations for a Liquidity Trap


- Among other reasons (for pushing real rates down)
  - large crisis and deleveraging
  - aging population
  - scarcity of safe assets
  - excess savings from corporations
  - inequality
  - downward trend in the price of capital goods

- Negative real rates: competing explanation. We need to think about both scenarios. Reality, probably a combination of both.
2. Real Explanations for a Liquidity Trap


- Among other reasons (for pushing real rates down)
  - large crisis and deleveraging
  - aging population
  - scarcity of safe assets
  - excess savings from corporations
  - inequality
  - downward trend in the price of capital goods

- Negative real rates: competing explanation. We need to think about both scenarios. Reality, probably a combination of both.
3. Data: What kind of Liquidity Trap?

- How can data + model help us to distinguish between these two scenarios?
  - Caramp Singh (2020), bond premium cyclicality. Yes the US.

- Some of the policies have literally the opposite effect. Good news for Identification?

- Example: Hawkish Dovish Fed chair. Asset prices. COVID.
3. Data: What kind of Liquidity Trap?

- How can data + model help us to distinguish between these two scenarios?
  - Caramp Singh (2020), bond premium cyclicality. Yes the US.

- Some of the policies have literally the opposite effect. Good news for Identification?

- Example: Hawkish Dovish Fed chair. Asset prices. COVID.
4. Fiscal Policy

- Fiscal policy in a liquidity trap?
  - Textbook answer. Very effective.
  - This paper: hold on, multiplicity, contractionary.

- Comments
  - But if the US is in a self-fulfilling liquidity trap. Recent tax cuts?
  - Fiscal consolidation? If an expansion is contractionary, what about a consolidation?

4. Fiscal Policy

- Fiscal policy in a liquidity trap?
  - Textbook answer. Very effective.
  - This paper: hold on, multiplicity, contractionary.

- Comments
  - But if the US is in a self-fulfilling liquidity trap. Recent tax cuts?
  - Fiscal consolidation? If an expansion is contractionary, what about a consolidation?

4. Fiscal Policy

- Fiscal policy in a liquidity trap?
  - Textbook answer. Very effective.
  - This paper: hold on, multiplicity, contractionary.

- Comments
  - But if the US is in a self-fulfilling liquidity trap. Recent tax cuts?
  - Fiscal consolidation? If an expansion is contractionary, what about a consolidation?

Summing Up

- **Interesting topic.** Fun to read paper.

- Important question. Unintended consequences of some of the Central bank policies. We need to think about robust policies.

- Authors have a complete agenda in this topic. Looking forward to the next iterations.
Summing Up

- **Interesting topic.** Fun to read paper.

- **Important question.** Unintended consequences of some of the Central bank policies. We need to think about **robust policies**.

- Authors have a complete agenda in this topic. Looking forward to the next iterations.
Summing Up

- Interesting topic. Fun to read paper.

- Important question. Unintended consequences of some of the Central bank policies. We need to think about robust policies.

- Authors have a complete agenda in this topic. Looking forward to the next iterations.