Discussion of Evans and Honkapohja, “Robust Learning Stability.”

James Bullard
President and CEO
Federal Reserve Bank of St. Louis

28 May 2008
Frontiers in Monetary Theory and Policy—IMES, BOJ

1 Views expressed are those of the author and do not necessarily reflect official positions of the FOMC or the Federal Reserve System.
Learning and monetary policy

- Rational expectations is a cornerstone of modern macroeconomic theory.
Learning and monetary policy

- Rational expectations is a cornerstone of modern macroeconomic theory.
- Rational expectations equilibrium is at the heart of the learning literature.
Learning and monetary policy

- Rational expectations is a cornerstone of modern macroeconomic theory.
- Rational expectations equilibrium is at the heart of the learning literature.
- But rational expectations is not a practical assumption.
Learning and monetary policy

- Rational expectations is a cornerstone of modern macroeconomic theory.
- Rational expectations equilibrium is at the heart of the learning literature.
- But rational expectations is not a practical assumption.
- Actual private sector expectations are unlikely to be precisely consistent with REE.
Learning and monetary policy

- Rational expectations is a cornerstone of modern macroeconomic theory.
- Rational expectations equilibrium is at the heart of the learning literature.
- But rational expectations is not a practical assumption.
- Actual private sector expectations are unlikely to be precisely consistent with REE.
- That is still all right ...
Learning and monetary policy

- Rational expectations is a cornerstone of modern macroeconomic theory.
- Rational expectations equilibrium is at the heart of the learning literature.
- But rational expectations is not a practical assumption.
- Actual private sector expectations are unlikely to be precisely consistent with REE.
- That is still all right ...
  - ... so long as small expectational deviations from RE dissipate, instead of accumulating.
Learning and monetary policy

- Rational expectations is a cornerstone of modern macroeconomic theory.
- Rational expectations equilibrium is at the heart of the learning literature.
- But rational expectations is not a practical assumption.
- Actual private sector expectations are unlikely to be precisely consistent with REE.
- That is still all right ...
  - ... so long as small expectational deviations from RE dissipate, instead of accumulating.
- That condition is known as *expectational stability*. 
What the literature has shown

- REE may or may not be expectationally stable in New Keynesian models.
What the literature has shown

• REE may or may not be expectationally stable in New Keynesian models.

• In the simplest New Keynesian model, the Taylor Principle is associated with E-stability.
What the literature has shown

- REE may or may not be expectationally stable in New Keynesian models.
- In the simplest New Keynesian model, the Taylor Principle is associated with E-stability.
  - Failure of the Taylor Principle is associated with expectational instability.
What the literature has shown

- REE may or may not be expectationally stable in New Keynesian models.
- In the simplest New Keynesian model, the Taylor Principle is associated with E-stability.
  - Failure of the Taylor Principle is associated with expectational instability.
- That result assumes
REE may or may not be expectationally stable in New Keynesian models.

In the simplest New Keynesian model, the Taylor Principle is associated with E-stability.

- Failure of the Taylor Principle is associated with expectational instability.

That result assumes

- contemporaneous data specification of the policy rule.
What the literature has shown

- REE may or may not be expectationally stable in New Keynesian models.
- In the simplest New Keynesian model, the Taylor Principle is associated with E-stability.
  - Failure of the Taylor Principle is associated with expectational instability.
- That result assumes
  - contemporaneous data specification of the policy rule.
  - decreasing gain in the learning rule.
What the literature has shown

- REE may or may not be expectationally stable in New Keynesian models.
- In the simplest New Keynesian model, the Taylor Principle is associated with E-stability.
  - Failure of the Taylor Principle is associated with expectational instability.
- That result assumes
  - contemporaneous data specification of the policy rule.
  - decreasing gain in the learning rule.
- *Comforting.*
What the authors do

- Instrument rules plus various forms of “optimal” policy.
What the authors do

- Instrument rules plus various forms of "optimal" policy.
- Replace decreasing gain with constant gain.
What the authors do

- Instrument rules plus various forms of “optimal” policy.
- Replace decreasing gain with constant gain.
  - Agents are trying to robustly track the changing environment in which they operate.
What the authors do

- Instrument rules plus various forms of “optimal” policy.
- Replace decreasing gain with constant gain.
  - Agents are trying to robustly track the changing environment in which they operate.
- Concentrate on operational rules in the sense of McCallum.
What the authors do

- Instrument rules plus various forms of “optimal” policy.
- Replace decreasing gain with constant gain.
  - Agents are trying to robustly track the changing environment in which they operate.
- Concentrate on operational rules in the sense of McCallum.
  - Keep policymaker information in line with reality.
What the authors do

- Instrument rules plus various forms of “optimal” policy.
- Replace decreasing gain with constant gain.
  - Agents are trying to robustly track the changing environment in which they operate.
- Concentrate on operational rules in the sense of McCallum.
  - Keep policymaker information in line with reality.
- In particular, contemporaneous values of output and inflation are not known when policy decisions are made.
Main findings

- There are many recommended good or “optimal” policies for this model ...
Main findings

- There are many recommended good or “optimal” policies for this model ...
  - ... but most produce expectational instability in this setting.
Main findings

- There are many recommended good or “optimal” policies for this model ...
  - ... but most produce expectational instability in this setting.
- Policymakers following these recommended approaches in this environment would be surprised to find that the economy does not coordinate on the intended equilibrium.
Main findings

- There are many recommended good or “optimal” policies for this model ...
  - ... but most produce expectational instability in this setting.
- Policymakers following these recommended approaches in this environment would be surprised to find that the economy does not coordinate on the intended equilibrium.
- To obtain expectational stability, use the expectations-based rules of Evans-Honkapohja (2003, 2006).
How to think about E-stability

- Stability is not a common mode of analysis in macroeconomics and monetary policy.
How to think about E-stability

- Stability is not a common mode of analysis in macroeconomics and monetary policy.
- The actual learning dynamics would only be observed in an unstable situation.
How to think about E-stability

- Stability is not a common mode of analysis in macroeconomics and monetary policy.
- The actual learning dynamics would only be observed in an unstable situation.
  - Otherwise convergence occurs.
How to think about E-stability

- Stability is not a common mode of analysis in macroeconomics and monetary policy.
- The actual learning dynamics would only be observed in an unstable situation.
  - Otherwise convergence occurs.
  - We are talking about locally to the REE.
How to think about E-stability

- Stability is not a common mode of analysis in macroeconomics and monetary policy.
- The actual learning dynamics would only be observed in an unstable situation.
  - Otherwise convergence occurs.
  - We are talking about locally to the REE.
  - If policy is executed correctly ...
How to think about E-stability

- Stability is not a common mode of analysis in macroeconomics and monetary policy.
- The actual learning dynamics would only be observed in an unstable situation.
  - Otherwise convergence occurs.
  - We are talking about locally to the REE.
  - If policy is executed correctly ...
  - ... observers would see only the REE values of key macro variables.
How to think about E-stability

- Stability is not a common mode of analysis in macroeconomics and monetary policy.
- The actual learning dynamics would only be observed in an unstable situation.
  - Otherwise convergence occurs.
  - We are talking about locally to the REE.
  - If policy is executed correctly ...
  - ... observers would see only the REE values of key macro variables.
  - Learning would appear to be unimportant, even though it is enforcing the REE.
How to think about E-stability

- Stability is not a common mode of analysis in macroeconomics and monetary policy.
- The actual learning dynamics would only be observed in an unstable situation.
  - Otherwise convergence occurs.
  - We are talking about locally to the REE.
  - If policy is executed correctly ...
  - ... observers would see only the REE values of key macro variables.
  - Learning would appear to be unimportant, even though it is enforcing the REE.
- One analogy: off-equilibrium play in games.
How to think about E-stability

- Stability is not a common mode of analysis in macroeconomics and monetary policy.
- The actual learning dynamics would only be observed in an unstable situation.
  - Otherwise convergence occurs.
  - We are talking about locally to the REE.
  - If policy is executed correctly ...
  - ... observers would see only the REE values of key macro variables.
  - Learning would appear to be unimportant, even though it is enforcing the REE.
- One analogy: off-equilibrium play in games.
- Another analogy: default punishment in models with endogenous debt constraints.
Some might worry that the unstable case is “not really observed.”
Expectational instability

- Some might worry that the unstable case is “not really observed.”
- Indeed, we would not expect to see a lot of these cases ...
Expectational instability

- Some might worry that the unstable case is "not really observed."
- Indeed, we would not expect to see a lot of these cases ...
- ... policymakers would have to abandon their policies.
Expectational instability

- Some might worry that the unstable case is “not really observed.”
- Indeed, we would not expect to see a lot of these cases ...
- ... policymakers would have to abandon their policies.
- *But consider Figure 2 in the paper.*
Expectational instability

- Some might worry that the unstable case is “not really observed.”
- Indeed, we would not expect to see a lot of these cases ...
- ... policymakers would have to abandon their policies.
- *But consider Figure 2 in the paper.*
- Inflation and the output gap behave as if the REE has been attained for many periods.
Expectational instability

- Some might worry that the unstable case is “not really observed.”
- Indeed, we would not expect to see a lot of these cases ... 
- ... policymakers would have to abandon their policies.
- *But consider Figure 2 in the paper.*
- Inflation and the output gap behave as if the REE has been attained for many periods.
- But eventually, expectational errors accumulate and drive the economy away from the targeted equilibrium.
Expectational instability

• Some might worry that the unstable case is “not really observed.”
• Indeed, we would not expect to see a lot of these cases ... ... policymakers would have to abandon their policies.
• *But consider Figure 2 in the paper.*
• Inflation and the output gap behave as if the REE has been attained for many periods.
• But eventually, expectational errors accumulate and drive the economy away from the targeted equilibrium.
• Does it happen?
Expectational instability

- Some might worry that the unstable case is “not really observed.”
- Indeed, we would not expect to see a lot of these cases ...
- ... policymakers would have to abandon their policies.
- *But consider Figure 2 in the paper.*
- Inflation and the output gap behave as if the REE has been attained for many periods.
- But eventually, expectational errors accumulate and drive the economy away from the targeted equilibrium.
- Does it happen?
  - Consider the breakdown of Bretton Woods.
Expectational instability

- Some might worry that the unstable case is “not really observed.”
- Indeed, we would not expect to see a lot of these cases ...
- ... policymakers would have to abandon their policies.
- *But consider Figure 2 in the paper.*
- Inflation and the output gap behave as if the REE has been attained for many periods.
- But eventually, expectational errors accumulate and drive the economy away from the targeted equilibrium.
- Does it happen?
  - Consider the breakdown of Bretton Woods.
  - And maybe we should worry about Sweden, as we will see below.
Taylor-type rules

- Some potential for instability in the calibrated case.
Taylor-type rules

- Some potential for instability in the calibrated case.
- Taylor rule fairs better than some other recommended rules studied later in the paper.
Taylor-type rules

- Some potential for instability in the calibrated case.
- Taylor rule fairs better than some other recommended rules studied later in the paper.
- Instability requires the combination of operational rules with constant gain learning.
Duffy and Xiao

- The Duffy/Xiao rule is a Taylor-type rule.
Duffy and Xiao

- The Duffy/Xiao rule is a Taylor-type rule.
- It represents optimal policy under discretion if the policymaker has a preference for interest rate smoothing.
Duffy and Xiao

• The Duffy/Xiao rule is a Taylor-type rule.
• It represents optimal policy under discretion if the policymaker has a preference for interest rate smoothing.
  • Results for commitment case similar.
Duffy and Xiao

- The Duffy/Xiao rule is a Taylor-type rule.
- It represents optimal policy under discretion if the policymaker has a preference for interest rate smoothing.
  - Results for commitment case similar.
- The rule is

\[
  i_t = \frac{\varphi \lambda}{\alpha_i} \pi_t + \frac{\varphi \alpha_x}{\alpha_i} x_t. \tag{1}
\]
Duffy and Xiao

- The Duffy/Xiao rule is a Taylor-type rule.
- It represents optimal policy under discretion if the policymaker has a preference for interest rate smoothing.
  - Results for commitment case similar.
- The rule is
  \[ i_t = \frac{\varphi \lambda}{\alpha_i} \pi_t + \frac{\varphi \alpha_x}{\alpha_i} x_t. \]  
- Produces determinacy if \( \alpha_i \) sufficiently large.
Duffy and Xiao

- The Duffy/Xiao rule is a Taylor-type rule.
- It represents optimal policy under discretion if the policymaker has a preference for interest rate smoothing.
  - Results for commitment case similar.
- The rule is
  \[ i_t = \frac{\phi \lambda}{\alpha_i} \pi_t + \frac{\phi \alpha_x}{\alpha_i} x_t. \]  
  (1)
- Produces determinacy if \( \alpha_i \) sufficiently large.
- Produces expectational instability if \( \alpha_i \) sufficiently small.
Duffy and Xiao

- The Duffy/Xiao rule is a Taylor-type rule.
- It represents optimal policy under discretion if the policymaker has a preference for interest rate smoothing.
  - Results for commitment case similar.
- The rule is
  \[ i_t = \frac{\varphi \lambda}{\alpha_i} \pi_t + \frac{\varphi \alpha_x}{\alpha_i} x_t. \] (1)
- Produces determinacy if \( \alpha_i \) sufficiently large.
- Produces expectational instability if \( \alpha_i \) sufficiently small.
- Similar results for Duffy/Xiao under commitment.
Duffy and Xiao

• The Duffy/Xiao rule is a Taylor-type rule.
• It represents optimal policy under discretion if the policymaker has a preference for interest rate smoothing.
  • Results for commitment case similar.
• The rule is
  \[ i_t = \frac{\varphi \lambda}{\alpha_i} \pi_t + \frac{\varphi \alpha_x}{\alpha_i} x_t. \]  
  (1)
• Produces determinacy if \( \alpha_i \) sufficiently large.
• Produces expectational instability if \( \alpha_i \) sufficiently small.
• Similar results for Duffy/Xiao under commitment.
• Worrisome.
Duffy and Xiao

- The Duffy/Xiao rule is a Taylor-type rule.
- It represents optimal policy under discretion if the policymaker has a preference for interest rate smoothing.
  - Results for commitment case similar.
- The rule is
  \[ i_t = \frac{\varphi \lambda}{\alpha_i} \pi_t + \frac{\varphi \alpha_x}{\alpha_i} x_t. \]  
  (1)
- Produces determinacy if \( \alpha_i \) sufficiently large.
- Produces expectational instability if \( \alpha_i \) sufficiently small.
- Similar results for Duffy/Xiao under commitment.
- Worrisome.
- The expectations-based approach of Evans and Honkapohja solves this problem and provides robust expectational stability.
Commitment

- No interest rate smoothing, timeless perspective, goal is to implement the FOC.
Commitment

- No interest rate smoothing, timeless perspective, goal is to implement the FOC.
- Svensson and Woodford (2005) recommended rule equation (18) in the paper.
Commitment

- No interest rate smoothing, timeless perspective, goal is to implement the FOC.
- Svensson and Woodford (2005) recommended rule equation (18) in the paper.
- Operational versions can be associated with instability under learning for reasonable gain parameters.
Commitment

- No interest rate smoothing, timeless perspective, goal is to implement the FOC.
- Svensson and Woodford (2005) recommended rule equation (18) in the paper.
- Operational versions can be associated with instability under learning for reasonable gain parameters.
- Worrisome for Sweden? Figure 2?
Commitment

- No interest rate smoothing, timeless perspective, goal is to implement the FOC.
- Svensson and Woodford (2005) recommended rule equation (18) in the paper.
- Operational versions can be associated with instability under learning for reasonable gain parameters.
- Worrisome for Sweden? Figure 2?
- There is nothing optimal about instability.
Woodford NRE

- Woodford (2008) has considered an alternative approach to checking the robustness of policy to the possibility that expectations may not be fully rational.
Woodford NRE

- Woodford (2008) has considered an alternative approach to checking the robustness of policy to the possibility that expectations may not be fully rational.
- Avoids committing to a particular recursive algorithm to describe learning.
Woodford NRE

- Woodford (2008) has considered an alternative approach to checking the robustness of policy to the possibility that expectations may not be fully rational.
- Avoids committing to a particular recursive algorithm to describe learning.
- But, expectational stability still plays a role in that analysis.
Bayesian approaches

- Many feel that recursive learning should be Bayesian.
### Bayesian approaches

- Many feel that recursive learning should be Bayesian.
- Bullard and Suda (2008).
A Bayesian approach

- Many feel that recursive learning should be Bayesian.
- Bullard and Suda (2008).
- Standard recursive learning exercise, but replace classical econometricians with Bayesian econometricians.
## Bayesian approaches

- Many feel that recursive learning should be Bayesian.
- Bullard and Suda (2008).
- Standard recursive learning exercise, but replace classical econometricians with Bayesian econometricians.
- Main results still hold:
Bayesian approaches

- Many feel that recursive learning should be Bayesian.
- Bullard and Suda (2008).
- Standard recursive learning exercise, but replace classical econometricians with Bayesian econometricians.
- Main results still hold:
  - “extra” term in the actual law of motion.
Bayesian approaches

- Many feel that recursive learning should be Bayesian.
- Bullard and Suda (2008).
- Standard recursive learning exercise, but replace classical econometricians with Bayesian econometricians.
- Main results still hold:
  - “extra” term in the actual law of motion.
  - expectational stability conditions unchanged.
Bayesian approaches

- Many feel that recursive learning should be Bayesian.
- Bullard and Suda (2008).
- Standard recursive learning exercise, but replace classical econometricians with Bayesian econometricians.
- Main results still hold:
  - “extra” term in the actual law of motion.
  - expectational stability conditions unchanged.
- Stability still an issue.
Responding to expectations

- Policymakers seem to do this at times ...
Responding to expectations

- Policymakers seem to do this at times ... 
  - but it is not that clear how to map this idea into reality.
Responding to expectations

- Policymakers seem to do this at times ...
  - but it is not that clear how to map this idea into reality.
- Measurement issues.
Responding to expectations

- Policymakers seem to do this at times ...
  - but it is not that clear how to map this idea into reality.
- Measurement issues.
- Potential games.
Final thoughts

- Very nice paper in a very nice conference.
Final thoughts

- Very nice paper in a very nice conference.
- Thanks to the Bank of Japan for inviting me to participate.
Final thoughts

- Very nice paper in a very nice conference.
- Thanks to the Bank of Japan for inviting me to participate.
- I appreciate the attention to stability issues, which I think are insufficiently analyzed in macroeconomics.
Final thoughts

- Very nice paper in a very nice conference.
- Thanks to the Bank of Japan for inviting me to participate.
- I appreciate the attention to stability issues, which I think are insufficiently analyzed in macroeconomics.
- Instability can produce the “big ticket losses” that policymakers really worry about.