

Discussion of

“The Effects of Foreign Shocks when U.S. Interest Rates are at Zero”

By Martin Bodenstein, Christopher J. Erceg, and Luca Guerrieri

Federal Reserve Board

Roberto M. Billi

Federal Reserve Bank of Kansas City

May 7, 2009

What are the “true” spillover effects of foreign shocks?

- Most models fail to account for the zero lower bound (ZLB) on nominal interest rates:
 - *Overstate* the effectiveness of monetary policy;
 - *Understate* the effects of adverse shocks.
- For example, open-economy models without the ZLB may *understate* the spillover effects of adverse foreign shocks to the U.S. economy.

What are the “true” spillover effects of foreign shocks?

- Most models fail to account for the zero lower bound (ZLB) on nominal interest rates:
 - *Overstate* the effectiveness of monetary policy;
 - *Understate* the effects of adverse shocks.
- For example, open-economy models without the ZLB may *understate* the spillover effects of adverse foreign shocks to the U.S. economy.

What are the “true” spillover effects of foreign shocks?

- Most models fail to account for the zero lower bound (ZLB) on nominal interest rates:
 - *Overstate* the effectiveness of monetary policy;
 - *Understate the effects of adverse shocks.*
- For example, open-economy models without the ZLB may *understate* the spillover effects of adverse foreign shocks to the U.S. economy.

What are the “true” spillover effects of foreign shocks?

- Most models fail to account for the zero lower bound (ZLB) on nominal interest rates:
 - *Overstate* the effectiveness of monetary policy;
 - *Understate* the effects of adverse shocks.
- For example, open-economy models without the ZLB may *understate* the spillover effects of adverse foreign shocks to the U.S. economy.

Framework

- Two-country DSGE model (“SIGMA”):
 - Firms, at home and abroad, practice pricing to market;
 - Households supply labor, purchase final consumption and investment goods, and accumulate financial assets;
 - Governments purchase a fraction of domestic output;
 - Central banks follow a Taylor-type rule.
- In addition, the model directly accounts for the ZLB.

Framework

- Two-country DSGE model (“SIGMA”):
 - **Firms, at home and abroad, practice pricing to market;**
 - Households supply labor, purchase final consumption and investment goods, and accumulate financial assets;
 - Governments purchase a fraction of domestic output;
 - Central banks follow a Taylor-type rule.
- In addition, the model directly accounts for the ZLB.

Framework

- Two-country DSGE model (“SIGMA”):
 - Firms, at home and abroad, practice pricing to market;
 - Households supply labor, purchase final consumption and investment goods, and accumulate financial assets;
 - Governments purchase a fraction of domestic output;
 - Central banks follow a Taylor-type rule.
- In addition, the model directly accounts for the ZLB.

Framework

- Two-country DSGE model (“SIGMA”):
 - Firms, at home and abroad, practice pricing to market;
 - Households supply labor, purchase final consumption and investment goods, and accumulate financial assets;
 - **Governments purchase a fraction of domestic output;**
 - Central banks follow a Taylor-type rule.
- In addition, the model directly accounts for the ZLB.

Framework

- Two-country DSGE model (“SIGMA”):
 - Firms, at home and abroad, practice pricing to market;
 - Households supply labor, purchase final consumption and investment goods, and accumulate financial assets;
 - Governments purchase a fraction of domestic output;
 - **Central banks follow a Taylor-type rule.**
- In addition, the model directly accounts for the ZLB.

Framework

- Two-country DSGE model (“SIGMA”):
 - Firms, at home and abroad, practice pricing to market;
 - Households supply labor, purchase final consumption and investment goods, and accumulate financial assets;
 - Governments purchase a fraction of domestic output;
 - Central banks follow a Taylor-type rule.
- In addition, the model directly accounts for the ZLB.

ZLB amplifies the effects of adverse shocks!

- The model is calibrated to the U.S. economy, and the rest of the world.
- The negative spillover from weakness in foreign economic growth is almost three times larger when the U.S. economy is at the ZLB.

ZLB amplifies the effects of adverse shocks!

- The model is calibrated to the U.S. economy, and the rest of the world.
- The negative spillover from weakness in foreign economic growth is almost three times larger when the U.S. economy is at the ZLB.

Can we put the “S” back into DSGE?

- The paper shows *deterministic* simulations.
- Since this is a DSGE model, why not show *stochastic* simulations?

Can we put the “S” back into DSGE?

- The paper shows *deterministic* simulations.
- Since this is a DSGE model, why not show *stochastic* simulations?

How can we simulate models with the ZLB?

1 Deterministic simulations:

- (*No uncertainty* about the future state of the economy.)
- Fuhrer and Madigan (1997)

2 Stochastic simulations but imposing perfect foresight:

- (Computational "trick": expectations are formed assuming there is no uncertainty about the future state of the economy.)
- Clarida and Westland, Ralfkord and Werning (2000)

3 Stochastic simulations:

- (There is uncertainty about the future state of the economy.)
- Clarida and Gali (2003)

How can we simulate models with the ZLB?

1 Deterministic simulations:

- (*No uncertainty about the future state of the economy.*)
- Fuhrer and Madigan (1997)

2 Stochastic simulations but imposing perfect foresight:

- (There is uncertainty about the future state of the economy, but agents know the future state of the economy)
- Coenen and Wieland (2008), Fuhrer and Taylor (2008), Taylor (2009)

3 Stochastic simulations:

- (There is uncertainty about the future state of the economy)
- Fuhrer and Taylor (2008)

How can we simulate models with the ZLB?

1 Deterministic simulations:

- (*No uncertainty* about the future state of the economy.)
- Fuhrer and Madigan (1997)

2 Stochastic simulations but imposing perfect foresight:

- (Computational “trick”: expectations are formed assuming there is *no uncertainty* about the future state of the economy.)
- Coenen and Pfister, Ralfkühner and Wollmer (2008)

3 Stochastic simulations:

- (There is *uncertainty* about the future state of the economy.)
- Fuhrer and Williams (2005)

How can we simulate models with the ZLB?

1 Deterministic simulations:

- (*No uncertainty* about the future state of the economy.)
- Fuhrer and Madigan (1997)

2 Stochastic simulations but imposing perfect foresight:

- (Computational “trick”: expectations are formed assuming there is *no uncertainty* about the future state of the economy.)
- Orphanides and Wieland, Reifschneider and Williams (2000)

3 Stochastic simulations:

- (There is *uncertainty* about the future state of the economy.)
- Fuhrer and Williams (2005)

How can we simulate models with the ZLB?

- 1 Deterministic simulations:
 - (*No uncertainty* about the future state of the economy.)
 - Fuhrer and Madigan (1997)
- 2 Stochastic simulations but imposing perfect foresight:
 - (Computational “trick”: expectations are formed assuming there is *no uncertainty* about the future state of the economy.)
 - Orphanides and Wieland, Reifschneider and Williams (2000)
- 3 Stochastic simulations:

How can we simulate models with the ZLB?

- 1 Deterministic simulations:
 - (*No uncertainty* about the future state of the economy.)
 - Fuhrer and Madigan (1997)
- 2 Stochastic simulations but imposing perfect foresight:
 - (Computational “trick”: expectations are formed assuming there is *no uncertainty* about the future state of the economy.)
 - Orphanides and Wieland, Reifschneider and Williams (2000)
- 3 Stochastic simulations:
 - (There is *uncertainty* about the future state of the economy.)

How can we simulate models with the ZLB?

1 Deterministic simulations:

- (*No uncertainty* about the future state of the economy.)
- Fuhrer and Madigan (1997)

2 Stochastic simulations but imposing perfect foresight:

- (Computational “trick”: expectations are formed assuming there is *no uncertainty* about the future state of the economy.)
- Orphanides and Wieland, Reifschneider and Williams (2000)

3 Stochastic simulations:

- (There is *uncertainty* about the future state of the economy.)
- Adam and Billi (2006-)

How can we simulate models with the ZLB?

- 1 Deterministic simulations:
 - (*No uncertainty* about the future state of the economy.)
 - Fuhrer and Madigan (1997)
- 2 Stochastic simulations but imposing perfect foresight:
 - (Computational “trick”: expectations are formed assuming there is *no uncertainty* about the future state of the economy.)
 - Orphanides and Wieland, Reifschneider and Williams (2000)
- 3 Stochastic simulations:
 - (There is *uncertainty* about the future state of the economy.)
 - Adam and Billi (2006-)

How can we simulate models with the ZLB?

- 1 Deterministic simulations:
 - (*No uncertainty* about the future state of the economy.)
 - Fuhrer and Madigan (1997)
- 2 Stochastic simulations but imposing perfect foresight:
 - (Computational “trick”: expectations are formed assuming there is *no uncertainty* about the future state of the economy.)
 - Orphanides and Wieland, Reifschneider and Williams (2000)
- 3 Stochastic simulations:
 - (There is *uncertainty* about the future state of the economy.)
 - Adam and Billi (2006-)

Benefits and limitations of stochastic simulations.

1 Deterministic simulations:

- Least difficult to implement.

2 Stochastic simulations but imposing perfect foresight:

- Provide estimates of uncertainty, confidence intervals, etc.
- Uncertainty: likelihood of default, etc.

3 Stochastic simulations:

- Allow the study of policy design when there is uncertainty about the future state of the economy (GII) estimates, the typical long-run mean inflation rate, etc.
- This approach is more useful than the use of the uncertainty

Benefits and limitations of stochastic simulations.

1 Deterministic simulations:

- Least difficult to implement.

2 Stochastic simulations but imposing perfect foresight:

- Provide estimates of *probabilities*: confidence bands, standard deviations, likelihood of deflation, etc.

3 Stochastic simulations:

- Allow the study of policy design when there is uncertainty about the future state of the economy (GDP, π) estimates, the Federal Reserve's money inflation rate, etc.
- The approach is used to study the effects of monetary policy

Benefits and limitations of stochastic simulations.

1 Deterministic simulations:

- Least difficult to implement.

2 Stochastic simulations but imposing perfect foresight:

- Provide estimates of *probabilities*: confidence bands, standard deviations, likelihood of deflation, etc.

3 Stochastic simulations:

- Allow the study of policy designs when there is uncertainty about the future state of the economy (e.g. *IMR* estimates, the Federal Reserve's *Greenbook* reports).
- Allow the study of policy designs when there is uncertainty about the future state of the economy (e.g. *IMR* estimates, the Federal Reserve's *Greenbook* reports).

Benefits and limitations of stochastic simulations.

1 Deterministic simulations:

- Least difficult to implement.

2 Stochastic simulations but imposing perfect foresight:

- Provide estimates of *probabilities*: confidence bands, standard deviations, likelihood of deflation, etc.

3 Stochastic simulations:

- Allow the study of *policy design* when there is uncertainty about the future state of the economy—Billi (2009) estimates the “optimal long-run mean inflation rate”;
• “The optimal long-run mean inflation rate is negative” (p. 10).

Benefits and limitations of stochastic simulations.

- 1 Deterministic simulations:
 - Least difficult to implement.
- 2 Stochastic simulations but imposing perfect foresight:
 - Provide estimates of *probabilities*: confidence bands, standard deviations, likelihood of deflation, etc.
- 3 **Stochastic simulations:**
 - Allow the study of *policy design* when there is uncertainty about the future state of the economy—Billi (2009) estimates the “optimal long-run mean inflation rate”;
 - Such approach, however, suffers the curse of dimensionality.

Benefits and limitations of stochastic simulations.

- ① Deterministic simulations:
 - Least difficult to implement.
- ② Stochastic simulations but imposing perfect foresight:
 - Provide estimates of *probabilities*: confidence bands, standard deviations, likelihood of deflation, etc.
- ③ Stochastic simulations:
 - Allow the study of *policy design* when there is uncertainty about the future state of the economy—Billi (2009) estimates the “optimal long-run mean inflation rate”;
 - Such approach, however, suffers the curse of dimensionality.

Benefits and limitations of stochastic simulations.

- 1 Deterministic simulations:
 - Least difficult to implement.
- 2 Stochastic simulations but imposing perfect foresight:
 - Provide estimates of *probabilities*: confidence bands, standard deviations, likelihood of deflation, etc.
- 3 Stochastic simulations:
 - Allow the study of *policy design* when there is uncertainty about the future state of the economy—Billi (2009) estimates the “optimal long-run mean inflation rate”;
 - **Such approach, however, suffers the curse of dimensionality.**

Stochastic simulations (imposing perfect foresight) of FRB/US model with ZLB.

TABLE 1
MACROECONOMIC PERFORMANCE UNDER THE TAYLOR RULE

	Inflation Rate				
	0	1	2	3	4
Percent of time funds rate bounded at zero ¹	14	9	5	1	<1
Mean duration of periods funds rate bounded ²	6	5	4	3	2
Constant bias adjustment to target inflation	.7	.3	.1	.0	.0
Standard deviation of:					
Output gap	3.6	3.2	3.0	2.9	2.9
Inflation	2.0	1.9	1.9	1.9	1.9
Federal funds rate	2.3	2.4	2.5	2.5	2.5

1. Percent of quarters funds rate \leq 5 basis points.

2. Mean number of consecutive quarters funds rate \leq 5 basis points.

Source: Reifschneider and Williams (2000)

Are the spillover effects of foreign shocks even larger?

- The paper shows that not accounting for the ZLB *understates* the spillover effects of adverse foreign shocks to the U.S. economy.
- At the same time, deterministic simulations *understate* the effects of adverse shocks.
- Thus, the true spillover effects may be even larger than the paper suggests.

Are the spillover effects of foreign shocks even larger?

- The paper shows that not accounting for the ZLB *understates* the spillover effects of adverse foreign shocks to the U.S. economy.
- **At the same time, deterministic simulations *understate* the effects of adverse shocks.**
- Thus, the true spillover effects may be even larger than the paper suggests.

Are the spillover effects of foreign shocks even larger?

- The paper shows that not accounting for the ZLB *understates* the spillover effects of adverse foreign shocks to the U.S. economy.
- At the same time, deterministic simulations *understate* the effects of adverse shocks.
- Thus, the true spillover effects may be even larger than the paper suggests.