Monetary Policy, Financial Stability and Interest Rate Rules

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The paper is focus on…

This paper deals with the empirical properties of interest rate rules, interest rate smoothing, and the operative reaction function used by the central banks pursuing monetary policy and financial stability targets.

The authors consider the implication of banks' risk management practices for monetary policy and explain how the interest rate rules can be derived taking into account the desire of the central bank to stabilize the "basis" risk as a contribution to financial stability.

Keywords

Financial stability can be defined as a condition in which the financial system is capable of withstanding shocks.

About the risks…
financial risks should be assessed and priced reasonably accurately and should also be relatively well managed.

The safeguarding of financial stability requires identifying the main sources of risk and vulnerability such as inefficiencies in the allocation of financial resources from savers to investors and the mis-pricing or mismanagement of financial risks.

Keywords

Basis risk in finance is the risk associated with imperfect hedging using futures. It could arise because of the difference between the asset whose price is to be hedged, and the asset underlying the derivative, or because of a mismatch between the expiration date of the futures and the actual selling date of the asset.

Smoothing refers to a high degree of partial adjustement and limited overall responsiveness of interest rate.

Introduction

Financial stability is currently the focus of most Central banks around the world.

C.b. pays more attention to how to prevent or reduce the risk of a financial crisis and of contagion waves.

- …Therefore interest rates seem to move **gradually** in response to changes in macroeconomic conditions (output gap and inflation).
- It has been argued that by making interest rate changes smaller and more predictable, central banks reduce the volatility of commercial banks' profits and lower the risk of bank insolvencies.

Introduction

A recent strand of research focused on central banks' practice of smoothing interest rate movements showed the optimality of such behaviour (Woodford).

In general, interest rate rules which embed backward interest rate smoothing, **seem to perform empirically well** in a variety of countries and in different data samples .

In this paper the authors justify such behaviour by assuming that central banks will try to stabilize "basis" risk, i.e. the residual risk that remains after all imperfect hedging opportunities have been exploited.

Introduction
Farward or backward looking

This desire of central banks to stabilize basis risk leads to interest rate rules characterized by either “backward” or “forward” interest rate smoothing.

- **Farward-looking** approach uses expected future values to be introduced in the interest rate rules.

- **Backward-looking** approach uses current values.

Risk management, basis risk and monetary policy

Safeguarding the stability of the financial system is a key function of the central bank.

Central bank should carefully consider its interaction with traditional monetary policy targets; in this perspective the observed practice of **smoothing interest rate undertaken by c.b. aims to preserve the stability of financial markets.**

Why smoothing?

Large fluctuations would cause a loss of confidence on the control of the economy and credibility of the central bank’s objectives.

Risk management, basis risk and monetary policy

Sharp changes in short-term policy rate may damage bank's profits because banks borrow short and lend long.

Although financial institution use interest-rate related derivatives in their strategy for managing exposure to interest rate risk, but these hedging instruments do not allow banks to insure against fluctuations in the rate of interest they pay on short-term deposits and reserves ("basis" risk).

Banks remain exposed to the risk of fluctuation in the cost of their deposits with respect to the overnight rate.

Risk management, basis risk and monetary policy

Definition: the overnight rate is the rate at which banks lend money to the maximum duration of 24 hours via overnight deposits.

The overnight deposits are one of the main types of interbank deposits, which are made from one bank to another or to the central bank. Banks who make the deposit, invest in the immediate future their excess liquidity, while banks that receive them can compensate for deficiencies temporary.

In practice the residual basis risk influence monetary policy decisions and induce some caution on the part of central bank.

Interest rate rules
How monetary policy may be conducted?

The authors introduce in the central bank's rule a reaction to the basis risk to rationalize interest rate smoothing, not simply to assuming it , taking into account that banks hadge risks of interest rate using future contracts.

The Baselin model

The authors assume a New Keynesian Phillips curve relating inflation positively to the output gap and the future expected inflation

$$\pi_t = ky_t + \beta E_t \pi_{t+1} \qquad (1)$$

With $0<\beta<1$ and $k>0$

Interest rate rules
How monetary policy may be conducted?

A IS curve relating output gap positively to its future expected value and negatively to the current real interest rate.

$$y_t = E_t y_{t+1} - \sigma(r_t - r_t^n - E_t \pi_{t+1}) \qquad (2)$$

With $\sigma > 0$

All variables are expressed in log-deviation from their long run level:

- **r_t** nominal short term interest rate empirically approximated by the overnight interest rate
- **r_t^n** natural rate of interest, exogenous and stochastic

Backward interest rate smoothing

We close the model by assuming that monetary policy is formulated in terms of a feedback rule for setting the nominal short-term interest rate; also we assume that banks and other financial institutions manage risk by using futures.

$$r_t = \phi_\pi \pi_t + \phi_y y_t + \phi_{BR}[(\log P_t^A - \log F_t) - (\log P_{t-1}{}^A - \log F_{t-1})] \quad (3)$$

- $\boldsymbol{F_t}$ is the price of a one-period eurodollar future contract
- $\boldsymbol{P_t^A}$ is the is the price of the asset underlying such future (a one-period eurodollar deposit)
- the last term is important and captures the intention of the central bank to stabilize *basis risk* because of the contribution that this policy might give to banking and financial stability.

Backward interest rate smoothing

For simplify the analysis, we assume that the central bank smoothes the ratio of P_t^A over F_t instead of the spread.

When banks take a long position in the interbank market they might decide whether to hedge or not their investment: if we consider a hedge put in place at time t_{-1}, the hedging risk is the uncertainty associated with the spread realized at time t and is termed as ''basis risk''.

The basis is the difference between the spot price of the activity to be covered and the futures price of contracts used for hedging and basic risk is caused by uncertainty about the extent that the base will have when the hedging transaction will be closed.

Backward interest rate smoothing

According to the policy rule expressed in the previous equation, the **central bank is concerned about the deviation of the spread between the price ratio of the future and of the underlying asset from its past level**, with stabilizing basis risk as a contribution to financial stability.

By considering a one period future contract, it is possible to show that the central bank by setting the short-term interest rate according to the first equation of policy rule, affects the basis risk by smoothing the basis over time, and in order to see this we introduce an assumption:

$$F_t = P_t^A e^{\log R_t} \qquad (4)$$

Backward interest rate smoothing

this means that futures (F_t) and forward prices ($P_t{}^A\, e^{\log Rt}$) are perfect substitute, and it also follows that:

$$\log P_t^A - \log F_t = -\log R_t; \qquad (5)$$

$$\log P_{t-1}{}^A - \log F_{t-1} = -\log R_{t-1}$$

And substituting this result in the first expression, we obtain the following policy rule:

$$r_t = \rho r_{t-1} + \Phi_\pi \pi_t + \Phi_y y_t \qquad (6)$$

ρ (0≤ρ<1) coefficient measures the degree of inertia in the central bank's response to macroeconomic shocks.

Backward interest rate smoothing

Previous rule can be also rewritten as:

$$r_t = \rho r_{t-1} + (1-\rho)\cdot(\phi_\pi \pi_t + \phi_y y_t)$$

where we have a partial adjustment mechanism between the operating target, which specifies the reaction of monetary policy to changes in macroeconomic conditions, and the lagged interest rate. **Exist a trade off between the objective of financial stability and the one of macroeconomic stabilization**; expected inflation replaces current inflation in the interest rate rule to estimate.

Backward interest rate smoothing

In conclusion, our analytical framework derives the partial adjustment mechanism implied by "backward" interest-rate smoothing from a Taylor-type rule augmented with a reaction to the change of the basis.

From the last expression of policy rule is possible to see that as $\boldsymbol{\Phi_{BR} \rightarrow +\infty}$, that implies monetary policy following a super-inertial interest rate rule, with no reaction to deviations of inflation or output from their trend level , the current interest rate tends to the previous period level (t-1) and the change of the basis tends to zero.

Then rational agents expecting this behavior from the central bank will find the basis risk reduced to zero.

An alternative definition of basis risk

We have assumed that the interest rate rule is increased with a term that captures the intention of the central bank to stabilize one possible source of basis risk (the last term of equation 3).

Here we consider a *second type of basis risk*, which is related to the differences that might arise between the Libor rate (London interbank offered rate) and the average overnight rate in a hedging situation.

The one-period eurodollar future rate R_t^{EF} can be expressed as:

$$R_t^{EF} = E_t R_{t+1}^{E} + \theta_t \qquad (7)$$

An alternative definition of basis risk

Where

- $E_t \, R^E_{t+1}$ is the expected future level of the underlying interest rate (the one-period eurodollar Libor rate R^E_{t+1})

- θ is a risk premium

An alternative definition of basis risk

To express the expectations in terms of the federal funds rate rather than the Libor rate we can rewrite the last expression:

$$R_t^{EF} = E_t \bar{r}_{t,t+1} + E_t\left(R_{t+1}^{E} - \bar{r}_{t,t+1}\right) + \theta_t \qquad (8)$$

where

- $r_{t,t+1}$ is the average of the daily Fed funds rates from *t* to *t+1* when the futures contract is expiring

- $E_t\ (R^E_{t+1} - r_{t,t+1})$ reflects another type of basis risk

The excess expected return of the Libor rate over the average overnight rate will be positive.

An alternative definition of basis risk

Using the expectations hypothesis we can rewrite the expression for the basis risk as

$$E_t\left(R_{t+1}^{E} - R_t^{E}\right) \tag{9}$$

and a central bank trying to stabilise this type of basis risk, then insert the new basis risk in the interest rate rule:

$$r_t = \phi_\pi \pi_t + \phi_y y_t + \phi_{BR} E_t(\log R_{t+1}^{E} - \log R_t^{E}) \tag{10}$$

An alternative definition of basis risk

For simplify the analysis, we assume that the central bank stabilises the ratio of R^{E}_{t+1} over R^{E}_{t}, instead of the spread (the spread is an ex ante measure related to basis risk in a hedging situation)

After substituting with the Fed fund rate and collecting terms we can re write the policy rule as

$$r_t = \rho E_t r_{t+1} + \Phi_\pi \pi_t + \Phi_y y_t \qquad (11)$$

In equilibrium, the interest rate rule implies "forward" interest rate smoothing; a similar specification could be obtained by replacing current with expected inflation in the original policy function of the central bank.

An alternative definition of basis risk

In this section the authors provides a financial stability motivation for including “backward” or “forward” interest rate smoothing terms in the central bank’s interest rate rule

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Estimation

In this section, the authors evaluate the empirical performance of different specifications of interest rate rules. Their objective is to assess the **relevance of the expected future rate** in the policy rule of the Federal Reserve.

The estimation approach is based on Generalized Method of moments (GMM) considering standard interest rules with inertia (backward smoothing) for the period 1987-2005 and than introducing the expected future rate in the interest rate rules considered.

The data used are: Federal Funds interest rate, output gap and inflation.

Estimation

Table 1 - Estimation of the Federal Reserve's interest rate rule

	Backward-looking specification		Forward-looking specification	
	Standard inertial rule	*With expected future rate*	*Standard inertial rule*	*With expected future rate*
	(1)	(2)	(3)	(4)
ρ_1	1.40	0.92	1.41	0.95
	20.59	*15.27*	*20.74*	*17.16*
Φ	1.77	-0.55	1.06	-0.72
	1.50	*-1.98*	*0.63*	*-1.82*
Φ_π	1.70	0.36	1.81	0.34
	3.21	*3.85*	*2.59*	*2.65*
Φ_y	1.29	0.25	1.30	0.21
	4.87	*3.29*	*4.39*	*2.45*
ρ_2	-0.47	-0.19	-0.48	-0.20
	-7.69	*-4.44*	*-7.37*	*-4.82*
μ		0.26		0.25
		8.51		*8.80*
Adj. R^2	0.98	0.99	0.98	0.99
S.E.	0.34	0.25	0.33	0.26
J-statistic	0.62	0.91	0.69	0.84

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Estimation

The estimations reported in Table 1 show that the introduction of the expected future interest rate improves substantially the goodness of fit of the estimated policy rules. The coefficient of the expected future interest rate is statistically significant (at the 1 percent level) and positive, as expected.

Adj R^2 , standard error and j-statistic values show the statistical significance and confirm the goodness of the estimation with expected future rate.

The empirical evidence supports the presence of the expected future interest rate as an additional argument of the Fed's interest rate rule.

Conclusions

This paper tries to link bank risk management practices and interest rate policy decisions by central banks to reach monetary and financial stability.

The desire to stabilize basis risk leads central banks to smooth interest rates, either backward or forward.

The estimates of different interest rate rules suggest that embedding backward and forward interest rate smoothing allows to improve the econometric specification and provides a better explanation of the conduct of the Federal Reserve.