



# Financial stability, interest-rate smoothing and equilibrium determinacy<sup>☆</sup>

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## ABSTRACT

This paper examines the interaction between monetary policy and financial stability and provides an assessment of the implications of banks' risk management practices for monetary policy. By considering the desire of the central bank to stabilize different types of the "basis" risk as a contribution to financial stability, we derive a set of plausible interest-rate rules characterized by either backward or forward interest-rate smoothing. The paper investigates the determinacy conditions of the rational expectations equilibria obtained under such rules. Contrary to what previously found in the literature, we find that the practice of smoothing interest rates backward does not in general alleviate problems of equilibrium indeterminacy. Moreover, basis risk stabilization may lead to policy rules embedding "forward" interest-rate smoothing, where a new kind of indeterminacy may arise following excessive concern for financial stability.

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## 1. Introduction

Central banks around the world have recently started to devote increasing attention to the objective of financial stability. This move has been associated, on one side, with the impressive progresses made in the fight against inflation; on the other side, with the many episodes of financial and currency crises that have continued to challenge the international financial system.

The increasing relevance assigned by central banks to how to prevent or reduce the risk of financial crisis and of contagion waves has recently been considered a rationale in support of the stylized fact that interest rates seem to move gradually in response to changes in macroeconomic conditions (notably output gap and inflation). It has been argued that by making interest-rate changes smaller and more predictable, central banks reduce the volatility of banks' profits and lower the risk of bank insolvencies.

In this paper, we ask whether and how financial stability considerations interact with the mandate of central banks to pursue and maintain price stability. In the literature, this topic is currently at the centre of policy and academic debates. Investigations have followed different paths, going from institutional analysis of whether responsibilities for supervising banks and other financial institutions would be a natural assignment for central banks to theoretical and empirical studies of different kinds of central banks' reaction functions. A recent strand of research focused on central banks' practice of smoothing interest-rate movements by showing the optimality of such behaviour. In particular, Woodford (1999) showed that interest-rate smooth-

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ing is an essential ingredient of optimal monetary policy under commitment, and Woodford (2003b) showed that it is optimal to delegate (under discretion) monetary policy to a central bank with an interest-rate smoothing term in the objective function. Moreover, Woodford (2003a) and Bullard and Mitra (2007) showed that interest-rate smoothing can help alleviate problems of indeterminacy (and learning) of stationary rational expectations' equilibria.

In this literature, interest-rate smoothing is simply assumed without any formal link to interest-rate risk management by banks. However, given the hedging practices related to interest-rate risk followed by banks and other financial institutions, it is by no means obvious why central banks should smooth interest rates. We offer a new rationale for such behaviour based on the desire of central banks to stabilize "basis" risk, i.e. the residual risk that remains after all hedging opportunities have been exploited (see Hull, 2000), as a contribution to financial stability.

We show that the desire of central banks to stabilize basis risk may lead to interest-rate rules characterized in equilibrium by either backward or forward interest-rate smoothing. We find that, contrary to the results in Woodford (2003a) and Bullard and Mitra (2007), backward interest-rate smoothing does not in general alleviate indeterminacy problems of rational expectations equilibria. In our analysis, it only makes determinacy easier to be reached in the limiting case of a particularly aggressive response to inflation and output, when the policy rate is assumed to react to expected future (not current) inflation. Moreover, we also show that interest-rate rules embedding excessive concern for financial stability, and leading in equilibrium to high "forward" interest-rate smoothing, may lead to indeterminacy and enhance the trade-off between price and financial stability.

The paper is organized as follows. Section 2 discusses risk management practices used by banks and argues that these lower (although do not eliminate) the necessity for the central banks to smooth interest rates as a contribution to financial stability. Section 3 presents a formal analysis of equilibrium determinacy based on the explicit inclusion of an additional term in otherwise standard interest-rate rules (reacting to current or expected inflation and the output gap), with this additional term reflecting the desire of the central bank to stabilize basis risk. In Section 4 we use a different definition of the basis risk and derive in equilibrium a reaction function which takes into account the expected policy rate. Section 5 summarizes and concludes.

## 2. Risk management and the contribution of monetary policy to financial stability

In the literature, the definition of financial stability has been neither unique nor homogeneous.<sup>1</sup> Nonetheless, safeguarding the stability of the financial system has always been considered a proper function of the central bank,<sup>2</sup> and central banks should carefully consider the interaction of a financial stability objective with their traditional monetary policy targets. In this perspective, many authors have interpreted the observed practice of smoothing interest rates undertaken by central banks as directed to preserve the stability of financial markets.<sup>3</sup> By responding slowly over a period of several months to changes in macroeconomic conditions, the

central bank reduces the size of unanticipated changes in short-term interest rates that banks and other participants in financial markets have to face. This reduces the chance that a bank's profits from its loan portfolio will be put under pressure or that its balance sheet will be weakened. The main reason why sharp changes in short-term policy rates may damage banks' profits is that banks tend to borrow short and lend long. However, maturity transformation has been long undertaken by commercial banks that can use a wide variety of instruments to deal with the risks associated to interest-rate changes. In particular, financial institutions have increasingly used interest-rate related derivatives as part of their strategy for managing exposure to interest-rate risk.<sup>4</sup> As Driffill et al. (2006) notice, interest-rate futures and swaps do not remove all the risk arising from maturity mismatch. In particular, these hedging instruments do not allow banks to insure against fluctuations in the rate of interest they pay on short-term deposits and reserves, which is related to the overnight rate. As an example, banks may use futures contracts to switch interest payments based on the 3-month Libor rate with those based on the average overnight rate over the same period. But they remain exposed to the risk of fluctuation in the cost of their deposits with respect to the overnight rate: this residual risk is known as basis risk (Hull, 2000).<sup>5</sup> While basis risk has been highlighted in the literature as something with which financial institutions should be concerned,<sup>6</sup> only recently it has been considered as possibly relevant for the monetary authorities (see Poole, 2004; Greenspan, 2005). Although in theory the risks to banking and financial stability posed by movements in short-term interest rates should have only a limited influence on monetary policy decisions, in practice the residual basis risk may still induce some caution on the part of the central bank. This caution may enhance financial stability in the short run but may as well undermine it in the longer term if banks perceive it as a kind of implicit insurance and take on riskier actions (moral hazard).<sup>7</sup> In any case, it is somehow peculiar that considerations about the risk management of interest-rate risk by banks – and in particular the concern for basis risk as an important source of interest-rate risk exposure – are totally absent in the literature that analyses the nexus between monetary policy and financial stability.

In the following, we analyze how monetary policy may be conducted by central banks that care about financial stability but are also aware of the instruments that banks may use to hedge against the risk of sharper policy decisions. We will focus on determinacy issues and on the potential risks to macroeconomic stability stemming from the response of monetary policy to futures prices movements, given the presence of a particular type of financial stability objective, i.e. basis risk stabilization, in the central bank reaction function.

<sup>4</sup> Also, overdraft facilities or lines of credit are often made at variable interest rates, while fixed term loans are generally made at rates that allow for default risk and account only for a relatively small fraction of banks' portfolios.

<sup>5</sup> In the interbank market, banks have the possibility of switching between a one-period Eurodollar deposit – i.e. lending to another bank for a one-period horizon – and a strategy of rolling over loans in the overnight market. 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. When the price of the asset increases by more (less) than the futures price, the basis increases (decreases). This is referred to as a strengthening (weakening) of the basis.

<sup>6</sup> See for instance Basle Committee on Banking Supervision (1997), Federal Reserve (1997), Wright and Houpt (1996).

<sup>7</sup> It may then be argued that proper regulation of financial markets and supervision of financial institutions is a more appropriate policy response, rather than interest rate smoothing, to ensure that banks operate with sufficient margins of capital and liquid reserves (Smith and van Egteren, 2005).

<sup>1</sup> See for example Mishkin (1999) and Crockett (1997).

<sup>2</sup> In different institutional arrangements this responsibility has been assigned either *only* to the central bank or *also* to the central bank, via some sharing mechanism with other financial regulatory and supervisory agencies or government bodies (see Di Noia and Di Giorgio, 1999).

<sup>3</sup> See the empirical evidence reviewed in Clarida et al. (1998, 2000).

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