

9 Monetary Policy and the Term Structure of Interest Rates: An Overview of Some Recent Research

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1 INTRODUCTION

Many central banks, including the Federal Reserve, rely on interest rates both as sources of information for determining monetary policy and as operating instruments for conducting policy. This situation is in distinct contrast to that of one or two decades ago, when the quantities of various monetary and reserve aggregates were often the main informational and operational focus of central banks. Currently, interest rates largely have supplanted money on both the left-hand-side (LHS) and the right-hand-side (RHS) of the monetary policy reaction function.

The details of this transition vary somewhat from country to country, but the US experience is typical. In the postwar period, the ultimate objectives of the Federal Reserve – namely full employment and stable prices – have remained unchanged; however, the Federal Reserve has modified its operational and intermediate objectives for monetary policy several times in response to changes in its understanding of the economic environment. In the 1950s and 1960s, the Federal Reserve had a day-to-day operational interest in bank reserves and money market interest rates while maintaining near-term goals for the supply of bank credit. In 1970, the Federal Reserve formally adopted monetary targets in an attempt to use an intermediate nominal objective or anchor to resist slowly rising inflation. Still, in the decade following, monetary policy was conducted at an operational level through an implicit targeting of the federal funds rate. However, from 1979 through the early 1980s, even in an operational role for defining the stance of monetary policy, the use of interest rates was ostensibly replaced by the use

of a narrow monetary reserve aggregate. This final, brief period, when money appeared to be on both the LHS and RHS of the monetary reaction function, was the high-water mark for money in the United States.

By the late 1980s, money had once again been eclipsed in importance by interest rates as both an informational and operational indicator in the conduct of US monetary policy. Indeed, the Federal Reserve Board's new empirical macroeconomic model of the US economy contains roughly 300 equations but includes not a single money supply variable for either informational or operational purposes (see Brayton *et al.*, 1997). Also, the popular Taylor (1993) Rule description of Federal Reserve behaviour assumes that the stance of monetary policy is well represented by the Fed funds rate.

This shift from money to interest rates was spurred by two developments. First, there was a breakdown of the traditional relationships between (narrow and broad) measures of money and economic activity. For example, the income velocities of the monetary base, M1, M2 and M3 all show distinct breaks starting in the 1980s. These changes, which were brought on by deregulation and by innovations in payment technologies, made policy makers very sceptical about the usefulness of money as a tool for policy (see, for example, Kohn, 1996). Second, there was an increasing sophistication in financial markets and at central banks regarding how information about the future could be embedded in the prices of financial instruments. For example, in the United States, the market for Fed funds futures, which has traded only since 1988, provides particularly clear readings on future policy rates over the next few months (see, for example, Rudebusch, 1993). In addition, the past decade has seen the emergence of various derivatives as well as inflation-indexed debt.

Thus, interest rates have become preeminent in monetary policy. One aspect of interest rates that has become particularly important for the operation of monetary policy is the term structure relationship of short- and long-term rates. For central banks, there are two crucial questions regarding the term structure: (1) How should information in the term structure be interpreted and used for conducting monetary policy? (2) How will central bank actions, especially those expressed as changes in a short-term interest rate, affect the term structure of interest rates and, in turn, the rest of the economy? This chapter reviews some of the issues and recent evidence involved in answering these questions.

2 INTERPRETING THE TERM STRUCTURE

One way in which interest rates have been playing a larger role in monetary policy is as informational indicators. For example, current expectations about future inflation may help determine how the economy will perform in later years. Therefore, central banks are interested in obtaining information about current expectations from forward-looking financial markets in part to help predict future paths for inflation and output.

In obtaining such information, central banks have relied heavily on the expectations theory of the term structure. This theory states that longer-term interest rates are set according to market expectations of future shorter-term rates; specifically, rates will be set so that a representative investor is indifferent between holding a long-term bond or a sequence of short-term bonds covering the same length of time. For example, as a first approximation, the current two-month interest rate should equal the average of the current one-month rate and the market's expectation of the one-month rate that will prevail one month from now – the so-called one-month forward rate.

Tests of the expectations theory of the term structure typically examine whether the spread between current long and short rates predict future changes in the short rate. The evidence from such tests (see, for example, Rudebusch, 1995; Campbell, 1995) appears to depend, in part, on the maturity of the rates examined. In Rudebusch (1995), I attempt to explain various disparate pieces of evidence on the predictive content of the US yield curve with an explicit model relating the term structure to the behaviour of the Federal Reserve. This model exhibits three key attributes: (1) daily deviations of the spot Fed funds rate from its target, (2) gradual adjustment of the Fed's target rate, and (3) persistent targets. This empirical model of interest rate targeting, even with the maintained hypothesis of rational expectations, can explain the US evidence on the varying predictive power of the short end of the yield curve.

The emphasis on the interaction of process of making monetary policy and the term structure of interest rates also lies at the heart of the tests of the expectations hypothesis in Gerlach and Smets (1997) and Kugler (1997). These two studies consider very different sections of the yield curve – Gerlach and Smets consider maturities less than or equal to twelve months, while Kugler employs the ten-year bond rate. Still, in both studies, the underlying

mechanism at work is the way in which the predictability of central bank actions can influence tests of the expectations hypothesis. Much of course then depends on the precise nature of the central bank reaction function (for example, Rudebusch, 1995). In particular, note that the Kugler study relies on the policy reaction function proposed by McCallum (1994), in which a short-term rate is set according to the level of an interest rate term spread. Although Goodfriend (1993), for example, argues that inflation expectations obtained from the term structure have had a major influence on the conduct of monetary policy by the Fed, overall, little empirical evidence has been gathered to support such a reaction function.

Despite some ambiguity in the empirical support for the expectations hypothesis, central banks uniformly take it to be a useful tool in understanding the yield curve. One area of particular interest for central banks is the short end of the term structure – say, maturities of less than six months. At this horizon, interest rates primarily reflect market expectations about very near-term monetary policy settings of the short rate (as described in Rudebusch, 1995). Central banks are interested in forward rates at this short horizon in part to understand market expectations of the immediate path of the policy rate. Given such expectations, central banks can evaluate whether their near-term policy intentions are being appropriately communicated to markets.

Besides obtaining near-term interest rate expectations, central banks also are interested in the term structure at the five- to ten-year horizon in order to get an indication of the market's inflation expectations. According to common wisdom, to a first approximation, the nominal yield on a bond equals the real yield plus the average expected inflation rate (the so-called Fisher equation). Assuming that changes in real interest rates are known (or can be ignored), then changes in nominal rates can be translated into changes in inflation expectations. Central banks are keenly aware of the importance of such inflation expectations both as inputs to forecasts of future inflation and economic activity and as measures of the credibility of the central bank's current stance of monetary policy in achieving the long-run goal of price stability.

Ayuso and Núñez (1997) provide an excellent overview of the various practical issues faced by central banks trying to obtain expectations from the yield curve. In particular, the problem of obtaining forward rates from a given set of securities prices has elicited much recent research – for example, Bliss (1996), Dahlquist and

Svensson (1996), Söderlind and Svensson (1996). As stressed by Ayuso and Núñez, interpreting the term structure is not without some ambiguity, in part, because the application of the expectations theory to obtain interest rate expectations from the term structure is not always straightforward. For example, an investor considering the choice between a long-term bond and a sequence of short-term bonds may demand a premium in the latter case for facing the interest rate uncertainty involved in the period-by-period rollover of debt. Thus, in general, the two-month rate equals the average of the current and future one-month rates plus a term premium.

An unobservable term premium that varies over time certainly hinders the process of interpreting the term structure. Still, it appears that a time-varying term premium is probably not too severe a problem for obtaining interest rate expectations at short horizons – especially with high-frequency (say, daily) data – which are often the focus of particular interest to central banks. There is not much solid evidence on this issue, but that seems to be the impression of Ayuso and Núñez. Also, Drudi and Violi (1997) provide a more formal factor-model decomposition of the term structure and argue that fluctuations in term premia are small.

However, a time-varying term premium is more likely to be an important consideration at the long maturities used by central banks to obtain inflation expectations. Furthermore, movements in real interest rates at long horizons may be unclear, so that the translation of nominal forward rates to inflation expectations may be especially uncertain. However, a relatively recent development – namely, inflation-indexed debt – may help alleviate this second problem. The US Treasury has started to issue such debt, which should help pin down movements in the real interest rate. Indeed, the Bank of England has used indexed debt, which has been issued in Great Britain for over a decade, to obtain estimates of real rates and inflation expectations. As described by Deacon and Derry (1994), the Bank of England has found that the difference between the nominal and real term structure provides a useful measure of inflation expectations.

3 AFFECTING THE TERM STRUCTURE

Besides interpreting the term structure of interest rates, central banks also are interested in altering it through shifts in monetary

policy. In the common textbook description of the transmission of monetary policy, as encapsulated for example in the so-called *IS-LM* model, the supply of money plays an important role. The equilibrium of money supply by the central bank and money demand by the public (the *LM* curve) provides an interest rate, which in turn helps to determine the demand for output (via the *IS* curve). In contrast, many central banks have simply taken a short-term interest rate as their direct operating instrument. In this case, the monetary transmission mechanism operates from the short-term rate to real spending on goods and services (simply the *IS* curve). Of course, none of the important sectors of real spending – housing, investment or consumption – depends directly on the overnight Fed funds rate. Instead, spending depends on longer-term interest rates. In this way, gauging how changes in the short rate induced by the central bank affect the entire term structure of longer-term rates will be a crucial link in understanding the monetary transmission mechanism.

Cook and Hahn (1989) provide some of the earliest information on the effects of central bank actions on the term structure. They searched for the days on which the *Wall Street Journal* reported that the Fed had changed the federal funds rate. Then, for those days, they correlated the actual changes in longer-term rates with the funds rate changes. They found a substantial correlation that diminished, but never disappeared, as the maturity of the longer-term security was increased. For example, even the yield on a ten-year bond would typically rise ten–fifteen basis points on the day that the funds rate was increased by a percentage point. As the instrument of Fed policy, the federal funds rate in essence is the tip of the term structure tail that wags the dog of the economy.

Nilsen (1997) provides, in part, a comprehensive update of Cook and Hahn's results to a more recent period (1985–92) in the United States, and finds that the basic pattern of the results remains intact. (Also, see Thornton, 1996.) Favero *et al.* (1997) also conduct an investigation of the response of the term structure to monetary policy that is similar in spirit. They, however, focus on the reaction of forward rates, which provides a clearer indication of the horizon at which monetary policy effects are most influential. In addition, they compare results for both Germany and the United States.

Of course, even the movements in a given longer-term rate that follow policy actions of a uniform size will not always be the same. According to the expectations hypothesis, these movements reflect

both the immediate change in the funds rate as well as market expectations about future policy actions, which may vary with the exact circumstances. For example, as described in Campbell (1995), the ten-year rate jumped by almost twice as much as the increase in the funds rate at the time of the Fed tightening in February 1994 – substantially more than usual.

Trying to clarify the source of some of this variability in the relationship between the short policy rate and longer rates is the goal of Chadha and Ganley (1997) and Buttiglione *et al.* (1997). Again, what matters for determining the policy reaction of the term structure to the policy rate is the markets' expectations about the entire future path of policy. As stressed by Chadha and Ganley (1997), these expectations depend on the credibility of the central bank's commitment to the inflation target. Buttiglione *et al.* (1997) provide further support by showing how the size of the term structure response varies with plausible factors underpinning credibility, such as the fiscal position of the government.

4 CONCLUDING REMARKS

In the United States and other countries, central banks are concerned about both how to interpret information from the term structure of interest rates and how their actions affect the term structure. It appears that while short-term forward rates can give fairly accurate readings of interest rate expectations in the short run, longer-term rates give less clear readings of inflation expectations. As for monetary policy's effects on the term structure, although longer-term rates do tend to react when the Fed funds rate moves, the size of this response can vary substantially.

Finally, it is important to stress that the process of obtaining expectations information by central banks from financial markets is still expanding. Obtaining forward rates from the term structure is simply the first step. Rather than focusing on forward rates, which are based on mean expectations of future rates, central banks also will be interested in the entire probability distribution of expectations, which can be obtained from options contracts. (Söderlind and Svensson, 1996, provide a masterful introduction.)

Note

The views expressed herein are those of the author and are not necessarily shared by anyone else in the Federal Reserve System.

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