Monetary Cycles, Financial Cycles, and the Business Cycle

Tobias Adrian, Arturo Estrella, and Hyun Song Shin[2]

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Abstract:

One of the most robust stylized facts in macroeconomics is the forecasting power of the term spread for future real activity. The economic rationale for this forecasting power usually appeals to expectations of future interest rates, which affect the slope of the term structure. In this paper, we propose a possible causal mechanism for the forecasting power of the term spread, deriving from the balance sheet management of financial intermediaries. When monetary tightening is associated with a flattening of the term spread, it reduces net interest margin, which in turn makes lending less profitable, leading to a contraction in the supply of credit. We provide empirical support for this hypothesis, thereby linking monetary cycles, financial cycles, and the business cycle.

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A traditional view in monetary economics is that interest rates are transmitted via the money demand function, and that the level of interest rates affects real consumption and investment. However, beginning in the mid-1980s, the relationship between money and economic activity became highly unstable as rapid changes in the financial system started to change the nature and composition of monetary aggregates.

As a result, theories of monetary transmission that explicitly include quantities have lost prominence. Instead, attention has turned to expectations-based channels of monetary policy, which emphasize the expectations theory of the yield curve and the role of expected future short term interest rates in determining the long-term interest rate.

In this paper, we re-examine the transmission of monetary policy to the real economy by connecting two strands of literature that have thus far been largely separate: the forecasting power of the term spread for future real activity and the balance sheet management of financial intermediaries.

One of the most robust features of macroeconomics is the forecasting power of the term spread for future real activity, with an inverted yield curve being a harbinger of recessions within a 12 to 18 month period (see Arturo Estrella and Gikas Hardouvelis (1989, 1991), Campbell

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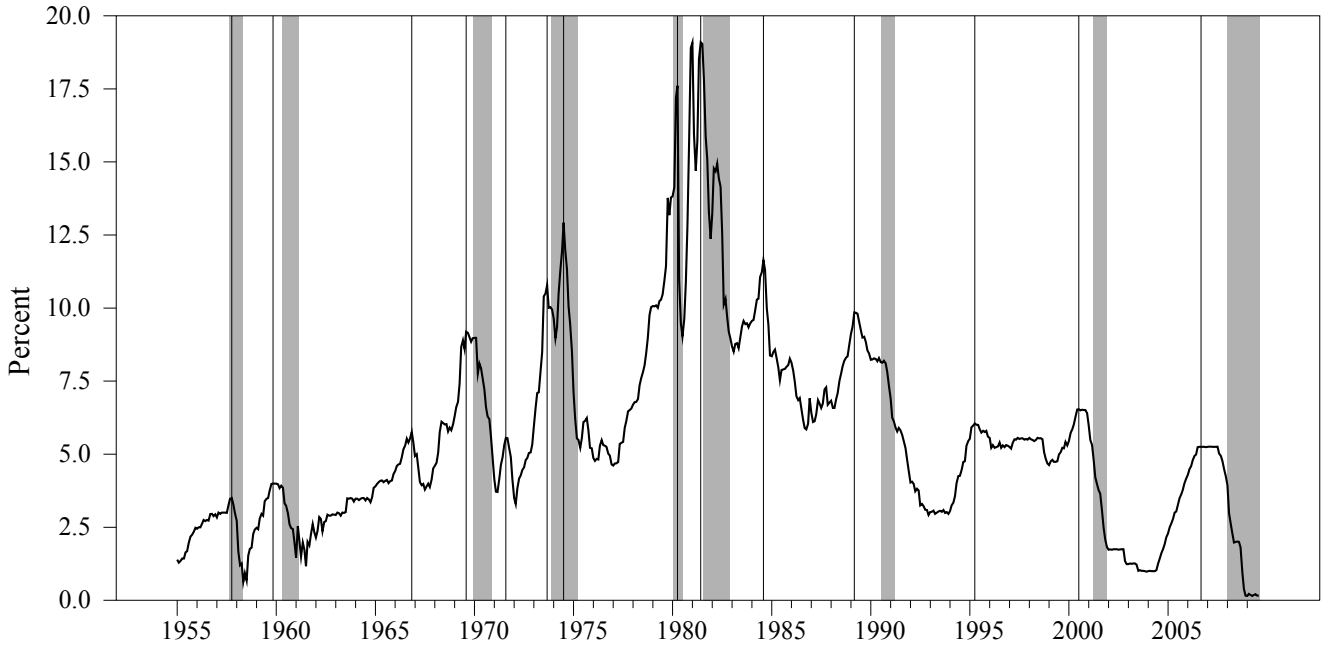
Harvey (1989), and James Stock and Mark Watson (1989, 1993)). Since 1955, twelve recessions have occurred, each of which has been preceded by an inversion of the yield curve. Conversely, there has only been one episode in the United States since 1955 where an inversion of the yield curve in 1966 was not followed by a recession (however, that episode was followed by an increase in unemployment). In addition, the yield curve has been demonstrated to predict recessions even prior to 1955 (Michael Bordo and Joseph Haubrich (2004)), and across countries (Henri Bernard and Stefan Gerlach (1996), and Estrella, Anthony P. Rodrigues, and Sebastian Schich (2003)).

Tobias Adrian and Estrella (2008) link monetary tightening cycles and subsequent economic outcomes to the term spread of interest rates. Figure 1 here updates Figure 1 from Adrian and Estella (2008) with an expanded time series through the end of 2009. In this plot, monetary tightening cycles are defined as local peaks of the effective Fed Funds rate.[4] The plot shows fourteen tightening cycles since 1955. Ten of these tightening cycles were followed by recessions within 18 months after the peak of the Fed Funds rate. Of the four monetary cycles that were not followed by a recession, the peak in 1966 was followed by an increase in unemployment (Milton Friedman (1970) argues that 1967 was, in fact, a recession). The three other tightening cycles were "soft landings"; i.e., they were not followed by recessions.

[4] Adrian and Estrella (2008) compute the end of a monetary tightening cycle when either one of these criteria is met: (1) the federal funds rate is higher than at any time from 12 months before to 9 months after and is at least 50 basis points higher than at the beginning of this period, or (2) the federal funds rate is higher than at any time from 6 months before to 6 months after and is 150 basis points higher than the average at these endpoints. The first criterion by itself identifies most of the cycles, but misses three (Aug. 1971, Sept. 1973, Apr. 1980) that involve quick substantial increases in the funds rate.

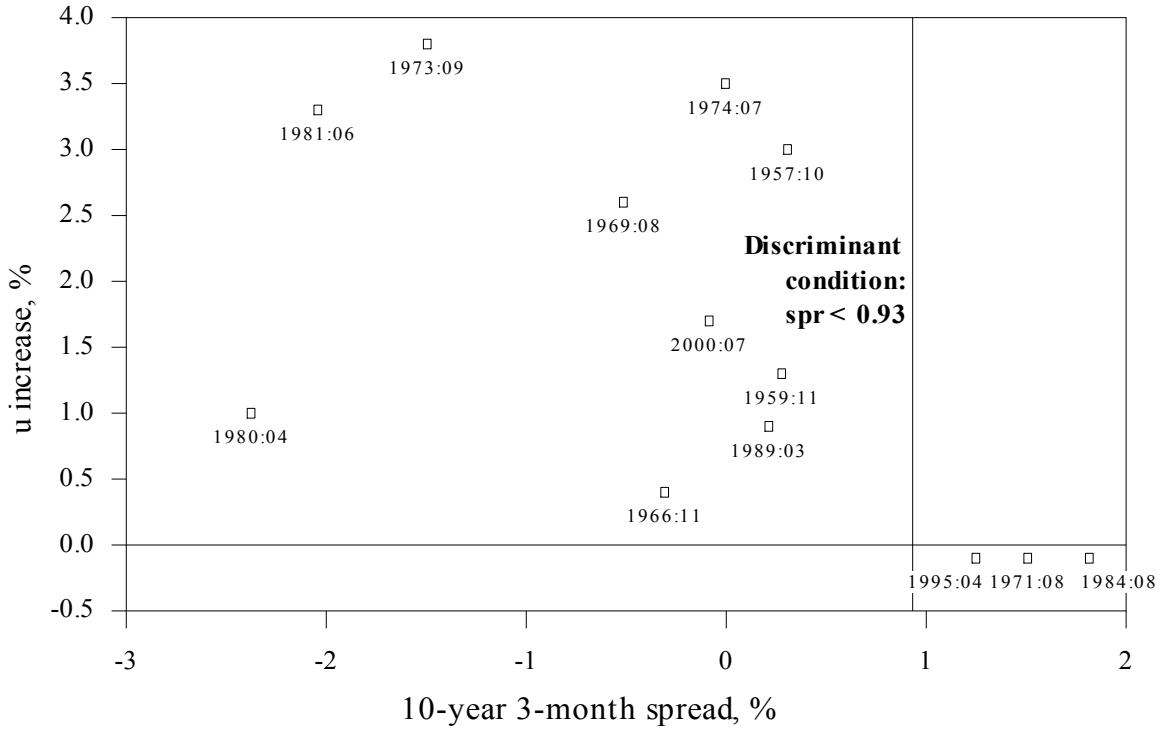
Figure 1: The Fed Funds Rate, Ends of Tightening Cycles (grid), and NBER Recessions (shading)



Adrian and Estrella (2008) show that the term spread at the end of the tightening cycles perfectly discriminates between subsequent real outcomes, while various measures of interest rate levels do not. The perfect discrimination between subsequent real outcomes is illustrated in Figure 2, which plots the unemployment increases following peaks of the Fed Funds rate against the 10-year/3-month Treasury term spread.[5] The discriminant condition shows that monetary tightening cycles are followed by increases in unemployment whenever the term spread is below 93 basis points, and it is followed by a decline in unemployment in the three cases when the spread is above that level. The level of the nominal interest rate, the real interest rate, or the deviation of the interest rate from its "natural level" (as estimated by Thomas Laubach and John Williams (2003)) does not discriminate between subsequent real outcomes.

[5] The unemployment increase is measured as the maximum cumulative increase in the unemployment rate since the peak of the Fed Funds rate over the 24 months period after the peak.

Figure 2: The 10-year minus 3-month spread and subsequent unemployment increases



The traditional explanation offered for the forecasting power of the term spread rests on the informational value of the yield curve for future short rates. An inverted yield curve is seen as reflecting expectations of low future short rates which, in turn, are attributed to weakness in expected credit demand, diminished inflation expectations, and central bank policy in response to subdued economic conditions. In this sense, the mechanism is purely informational, rather than offering a causal mechanism.

In this paper, we offer a possible causal mechanism that operates via the role of financial intermediaries and their active management of balance sheets in response to changing economic conditions. Banks and other financial intermediaries typically borrow in order to lend. Since the loans offered by banks tend to be of longer maturity than the liabilities that fund those loans, the

term spread is indicative of the marginal profitability of an extra dollar of loans on intermediaries' balance sheets. For any risk premium prevailing in the market, the compression of the term spread may mean that the marginal loan becomes uneconomic and ceases to be a feasible project from the bank's point of view. There will, therefore, be an impact on the supply of credit to the economy, and, to the extent that the reduction in the supply of credit has a dampening effect on real activity, a compression of the term spread will be a causal signal of subdued real activity. Adrian and Hyun Song Shin (2009 a, b) argue that the reduced supply of credit also has an amplifying effect due to the widening of the risk premiums demanded by the intermediaries, putting a further downward spiral on real activity.

We explore this hypothesis, and present empirical evidence consistent with it. Our results lend weight to an alternative transmission mechanism of monetary policy – the so-called "risk taking channel" that emphasizes the fluctuations in the supply of credit to the economy. We review the relevant literature later in our paper.

I. Empirical Investigation

The connection between financial intermediary balance sheet management, the slope of the yield curve, and real economic activity in the United States is investigated via a vector autoregression (VAR) in Table 1. We include quarterly GDP growth as a measure of real activity from the Bureau of Economic Analysis, the 10-year/3-month term Treasury spread from the Federal Reserve Board, the net interest margin (NIM) of large commercial banks from their Y-9C filings, the quarterly asset growth of shadow banks, the 3-month Treasury yield as a measure of the short term interest rate, and the quarterly change in the Chicago Board Options Exchange Volatility Index (VIX) as a measure of risk. The total assets of shadow banks are defined as the sum of

total assets of asset-backed securities issuers (ABS), finance companies, and funding corporations (each component is pulled from the Federal Reserve's Flow of Funds). The VAR includes one lag of each of the variables, as suggested by the Bayesian Information Criterion, and is estimated over the period from 1990Q3 to 2008Q3, where the starting date is determined by availability of the VIX data.

Over the last thirty years, the U.S. financial system has undergone a major transformation, transitioning from a primarily bank-based financial system to one based on market-based intermediaries holding marketable securities. In line with the growth of this market-based financial system, the evidence in Adrian and Shin (2009a, b) points to the importance of the total assets of the shadow banking system in conveying information on the credit conditions ruling in the economy. For this reason, we use the total asset growth of shadow banks, rather than commercial banks, as our measure of total lending. Unfortunately, information on the net interest margin is only available for commercial banks. Therefore, we conduct our empirical investigation using a hybrid set of variables – the balance sheet data from the shadow banks, but the profitability information from the commercial banks. To the extent that the pricing conditions apply similarly throughout the economy, our mixed use of data will still be able to capture the interactions we are interested in.

Table 1 exhibits the following logic: an increase in the term spread tends to increase net interest margin. This is fairly mechanical as the term spread directly impacts net interest margin for newly originated loans funded with shorter-term liabilities. Higher net interest margin --- a major source of profits for financial intermediaries --- leads to an increase in total assets of financial intermediaries: as lending becomes more profitable, the supply of credit is expanded and intermediaries' balance sheets grow. Larger asset growth of intermediaries, in turn, predicts

higher GDP growth, which we interpret as a shift in the supply of credit curve. One detail to be held in mind is that the term spread indicates the profitability of the *marginal* loan that is added to the balance sheet, while the net interest margin is an *average* concept that applies to the stock of all loans and liabilities on the balance sheet. Thus, we would expect the net interest margin to trail the term spread.

Table 1: Macro-Financial Intermediary VAR

	GDP Growth	Term Spread	Net Interest Margin	Asset Growth	Short Rate	VIX Change
GDP Growth (lag)	0.106	-0.329***	-0.026	0.911*	0.411***	1.933*
Term Spread (lag)	0.041	0.958***	**0.038***	-0.729**	0.029	-1.173
Net Interest Margin (lag)	0.241	-0.302	0.804***	**1.822***	0.241	1.451
Asset growth (lag)	**0.112*****	0.012	0.002	-0.066	0.058**	-0.742**
Short Rate (lag)	-0.032	-0.019	0.015	-0.093	0.965***	0.199
VIX Change (lag)	-0.002	0.004	0.002	0.037	-0.015*	-0.442***
Constant	0.024	1.620*	0.598**	-3.028	-1.540**	-4.197
Observations	73	73	73	73	73	73

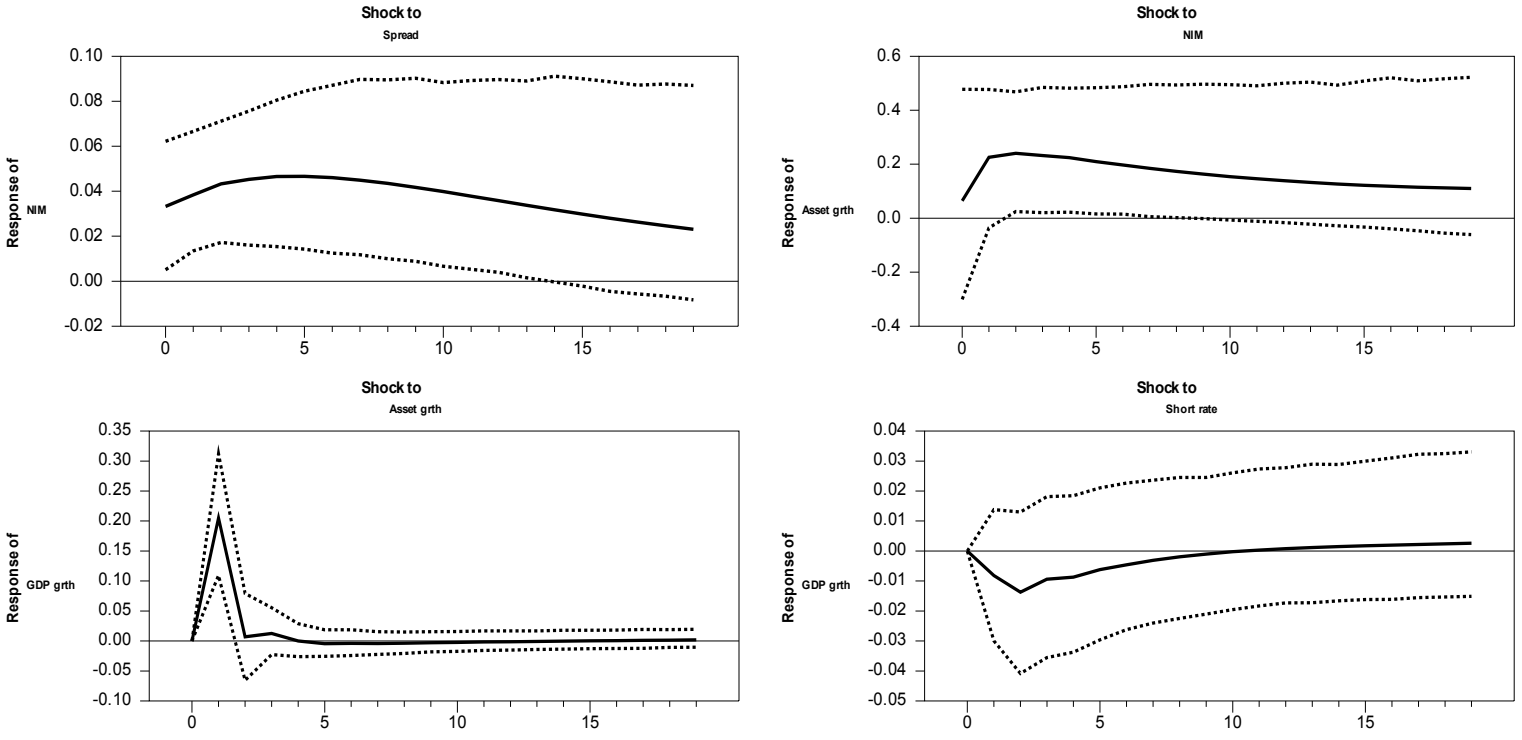
*** p<0.01, ** p<0.05, * p<0.1

Since the VAR in Table 1 includes only one lag of each variable, the significance levels of the coefficients may also be interpreted as a set of Granger causality tests. These tests are consistent with our hypothesis of a causal chain that runs from the term spread to net interest margin to lending volume and finally to real growth.

We also confirm and extend these results by examining impulse response functions. For identification, we apply a Cholesky decomposition using the contemporaneous ordering of variables as listed in Table 1, though the results are not very sensitive to the choice of ordering. Results are presented in Figure 3, which includes all the impulse responses, and in Figure 3a,

which focuses on the impulse responses corresponding to the causal chain in our basic hypothesis. The figures also include 90% confidence bands computed by Monte Carlo integration.

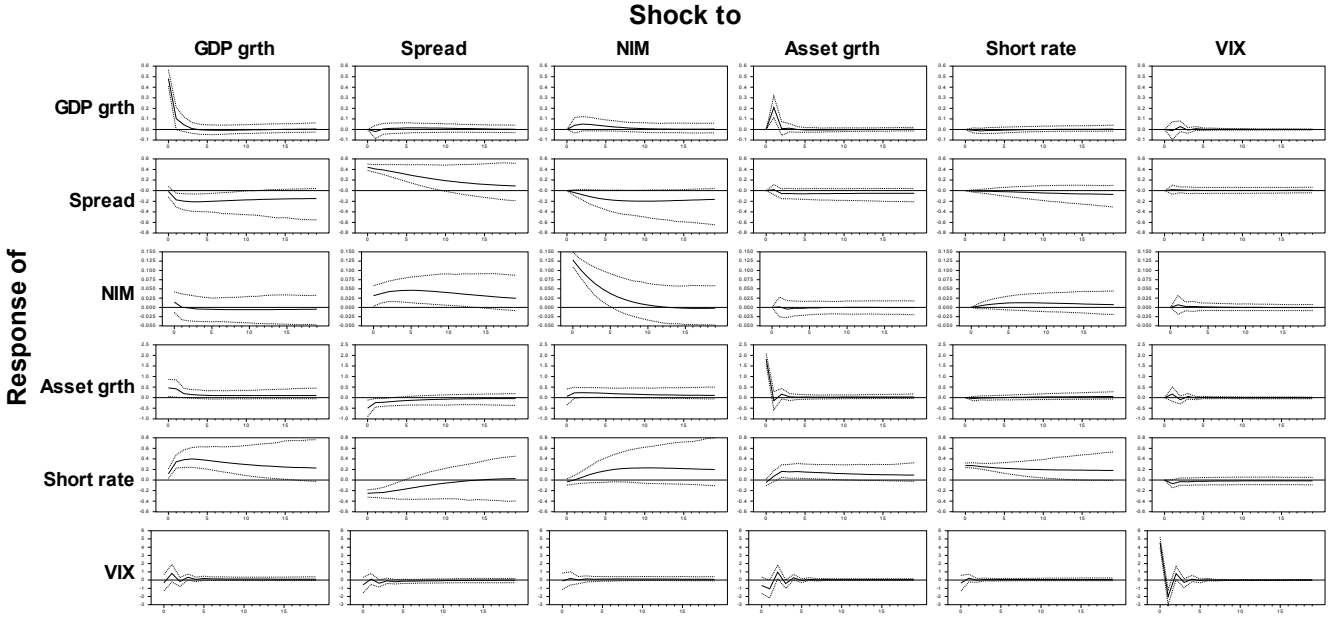
Figure 3a: Selected Impulse Response Functions



A positive shock to the term spread leads to statistically significant increases in net interest margin over a considerable horizon, as shown in the upper left graph in Figure 3a. The shape of these responses is also consistent with the fact that average net interest margin tends to trail marginal changes in the term spread, as argued before. In the upper right graph, a positive shock to net interest margin tends to increased lending by the shadow banking sector. In this case, the response is statistically significant after two quarters, perhaps also due to the use of average net interest margin. Finally, a shock to asset growth in shadow banking (lower left) has a quick and significant effect on real economic growth. For comparison, the graph in the lower

right shows that the empirical response of real GDP growth to an increase in the short-term interest rate is negative, as traditional theory would suggest, but not at all significant.[6]

Figure 3: Impulse Response Functions



II. Probit Results

Table 2 provides an explanation for the forecasting power of the term spread. Column (1) presents the classic Estrella and Hardouvelis (1991) probit regression with the recession dummy as the dependent variable, and the four-quarter lag of the term spread as the independent

[6] These findings from our VAR are at variance with an older literature that examines the link between levels and slopes of interest rates and bank profitability (see Flannery (1983) and Hancock (1985)). The extent to which our results are due to the different time period or due to our estimation methodology is a question for future research.

variable. The estimation period is 1985Q1 to 2008Q3. The regression shows that the term spread is a highly significant forecasting variable, giving rise to a 34% pseudo R-squared over the sample period.

Column (2) of Table 2, estimated from 1990Q1 to 2008Q3, shows that recessions are associated with low net interest margin in the previous quarter, and with contemporaneous low shadow bank asset growth and low GDP growth. In fact, 63% of the recession variable is explained by these three variables.

Table 2: Probit Regressions

	Recession		
	(1)	(2)	(3)
Spread(t-4)	-2.148***		
Net Interest Margin (t-1)		-5.851*	
Asset Growth		-0.393*	
GDP Growth		-4.306*	
Short rate		-0.733	
VIX		0.065	
Spread Decomposition			
$Spread^{NIM}$ (t-4)			-4.751*
$Spread^{Asset\ growth}$ (t-4)			-5.550*
$Spread^{GDP\ growth}$ (t-4)			-7.842*
$Spread^{Short\ rate}$ (t-4)			12.898
$Spread^{VIX}$ (t-4)			-0.758
Constant	-0.233	25.187*	3.351
Observations	95	75	75
R-squared	34%	63%	63%

*** p<0.01, ** p<0.05, * p<0.1

The key insight of Table 2 can be seen in column (3), also estimated from 1990Q1 to 2008Q3. To produce column (3), we first construct five orthogonal components of the term spread: the first is correlated with the net interest margin three quarters in the future; the second is correlated with shadow bank asset growth four quarters in the future, but orthogonal to future net interest margin; the third component is correlated with GDP growth four quarters in the future, but orthogonal to future net interest margin and future asset growth; the fourth component is correlated with future short rates, but orthogonal to future net interest margin, future asset growth, and future GDP growth; and, finally, the fifth component is that part of the term spread correlated with future VIX, but orthogonal to future net interest margin, future asset growth, future GDP growth, and the future short rate (the OLS regressions that are used to construct the five components are reported in Table 3).

The interpretation of column (3) of Table 2 is that the term spread forecasts recessions **because** it forecasts lower future net interest margin, lower future asset growth, and lower future GDP growth. Significantly, there is no additional effect of future short rates that appears significant. Note that by construction, the R-squared of the regression with the five term spread components is equal to the R-squared of regressing the recession indicator directly onto the five variables.

Our results should be contrasted with the literature from the 1990s that examined the consequences of commercial bank lending for the real economy. That earlier literature proved inconclusive, with no clear evidence of a "credit crunch" on the real economy (see Ben Bernanke and Cara Lown (1991) and Anil Kashyap and Jeremy Stein (1994)). One possible reason for the inconclusive results is that commercial banks play the role of a buffer for long-standing customers with pre-arranged credit lines, or for longer-term relationship reasons. The increase of

assets on commercial banks' balance sheets in the recent crisis (from the end of 2007 to the middle of 2009) bears out this buffer role of commercial banks. It is for this reason that the total assets of the market-based intermediaries, such as the shadow banks, can be seen to hold more reliable information on overall credit conditions.

Table 3: Constructing the Term Spread Components

	Term Spread				
	Spread	$Resid^{NIM}$	$Resid^{Asset}$	$Resid^{GDP}$	$Resid^{Short}$
NIM(t+3)	1.231***				
Asset growth(t+4)		0.071			
GDP growth(t+4)			0.549**		
Short rate(t+4)				-0.057	
VIX(t+4)					-0.085***
Constant	-2.595*	-0.228	-0.747**	0.269	1.440***
Observations	96	95	95	95	75
R-squared	7%	2%	6%	1%	26%

*** p<0.01, ** p<0.05, * p<0.1

III. Implications for Monetary Policy

The evidence that we have documented is supportive of the following transmission channel for monetary policy. The extent to which variations in short term interest rates lead to real economic outcomes depends primarily on the impact on the slope of the yield curve: whenever tighter policy leads to a term spread below a threshold level of 93 basis points, increases in unemployment tend to follow.

Our interpretation of this evidence is an economic mechanism that operates via the balance sheet management of financial intermediaries, who borrow short and lend long. Tighter policy leads to a compression of net interest margin and causes intermediaries to reduce lending.

The flatter the term spread at the end of the tightening cycle, the greater the subsequent reduction in lending activity. This has a direct effect on the supply of credit to the real economy.

While the probit regressions presented in Section II document the linkage of the term spread to declines in GDP via intermediary balance sheet management, the VAR results of Section I show that the logic works in both directions. A steep yield curve may be conducive to recovery from an economic slowdown in that it helps to restore the profitability of new lending and, thus, increases the supply of credit to the real economy.

Our empirical evidence is consistent with the "risk taking channel" of monetary policy (see Adrian and Shin (2009b) and Claudio Borio and Haibin Zhu (2008)). The key ingredient to the risk taking channel is that variations in monetary policy affect the effective "risk appetite" of financial intermediaries, thus shifting the supply curve for credit to the real economy. The risk taking channel is distinct from "credit channels" of monetary policy transmission (see Bernanke and Alan Blinder (1992) for the credit channel tied to reserve holdings and Kenneth Kuttner and Patricia Mosser (2002) for an overview of a broader set of credit channels of monetary policy transmission). There has been a renewed focus on the lender in the latest literature (Mark Gertler and Nobuhiro Kiyotaki (2009), and Markus Brunnermeier and Yuliy Sannikov (2009)). Our paper joins this recent group of papers and provides further corroboration of the importance of the supply of credit and its impact on the real economy. The emphasis of these latter papers, and the current paper, is on the *supply* of credit and the balance sheet condition of the *lender*, rather than the *demand* for credit due to fluctuations in the creditworthiness of the *borrower*.

Our results shed light on the recent debate about the "interest rate conundrum." When the FOMC raised the Fed Funds target by 425 basis points between June 2004 and June 2006 (from from 1 to 5.25 percent), the 10-year Treasury yield only increased by 38 basis points over

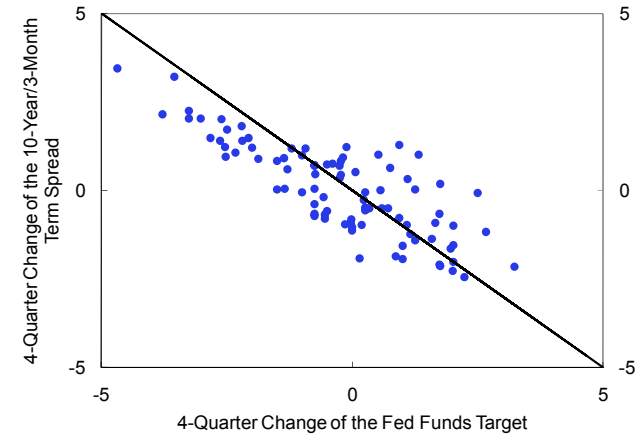
that same time period (from 4.73 to 5.11 percent). Alan Greenspan (2005) referred to this behavior of longer term yields as a conundrum for monetary policy makers. In the traditional, expectations driven view of monetary transmission, policy works as increases in short term rates lead to increases in longer term rates, which ultimately matter for real activity.

Our findings suggest that the monetary tightening of the 2004-2006 period ultimately did achieve a slowdown in real activity not because of its impact on the level of longer term interest rates, but rather because of its impact on the slope of the yield curve. In fact, while the level of the 10-year yield only increased from 38 basis points between June 2004 and 2006, the term spread declined 325 basis points (from 3.44 to .19 percent). The fact that the slope flattened meant that intermediary profitability was compressed, thus shifting the supply of credit, and hence inducing changes in real activity. The .19 percent at the end of the monetary tightening cycle is below the threshold of .92 percent, and, as a result, a recession occurred within 18 months of the end of the tightening cycle (the NBER dated the start of the recession as December 2007). The 18 month lag between the end of the tightening cycle, and the beginning of the recession is within the historical length.

In our view, a tightening of monetary policy induced by higher short-term rates does not require that long-term rates rise as well in order to obtain real effects. The flattening of the yield curve produced by a rise in short-term rates may be sufficient to affect bank profitability, bank lending, and subsequent real economic activity. Thus, a long-term rate "conundrum" may be perfectly compatible with effective monetary tightening. In fact, monetary policy may be even more powerful, through the channel identified in this article, if long-term rates remain stable in the face of tightening at the short end.

As a result of this discussion, the important impact of changes in the Fed Funds target is not on the level of longer term interest rates, but rather on the slope of the yield curve. In fact, Figure 4 below shows that there is a near perfect negative one-to-one relationship between 4-quarter changes of the Fed Funds target and 4-quarter changes of the term spread (the plot uses data from 1987q1 to 2008q3). Variations in the target affect real activity **because** they change the profitability of financial intermediaries, thus shifting the supply of credit.

Figure 4: Changes in the Fed Funds Target and the Term Spread



Source: Federal Reserve Board

The insights of this paper restore a connection between "quantities" and "prices" in the transmission of monetary policy. However, in contrast to the traditional monetary literature, the crucial ingredient to the relation between quantities and prices is not the money demand function, but rather the connection between interest rate policy and financial intermediary balance sheet management (see Adrian and Shin (2009 b, c)). The key quantities that determine the transmission of monetary policy are intermediary asset growth. Liquidity matters---but, in our framework---liquidity should be defined as the growth rate of assets on key intermediary balance sheets, not the quantity of money.

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