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More on U.S. Treasury Term Premiums: Spot and Expected Measures

J. Benson Durham

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Abstract

Several studies that use affine term structure models (ATSMs) or survey data suggest that subdued nominal U.S. Treasury yields during the global financial crisis and its aftermath primarily reflected exceptionally low, if not negative, term premiums as distinct from depressed anticipated short rates. However, this literature pays little attention to the length of time market participants anticipated low term premiums to prevail, as captured by the "forward" or "expected" term premium over a given horizon, distinct from the "spot" term premium. Besides the implications for investors at the back end of the term structure, this issue relates to recent policy-related studies that argue that the persistence of interest rate shocks affects real outcomes. Unlike the consensus inference on low spot term premiums, the evidence on expected term premiums is somewhat mixed. Some ATSMs suggest that expected term premiums did drop substantially along with spot measures after 2007, but the simple survey-based estimate reported here notably indicates the opposite.

Key words: Treasury term premium, monetary policy

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1. Introduction

Most studies suggest that the subdued level of longer-dated nominal U.S. Treasury yields on net since the onset of the global financial crisis owes to low if not negative term premiums, rather than depressed anticipated short rates.[1] Low term premiums on balance plausibly reflect unconventional Federal Reserve policy, namely large scale asset purchases (LSAPs) that purport to work through the portfolio rebalancing channel under the assumption of market segmentation (Bernanke 2010; Stein, 2012; Gagnon et al., 2011), possible net flight-to-quality flows that manifest another aspect of "special demand" or a "safety or scarcity premium" for the asset class (e.g., Krishnamurthy and Vissing-Jorgensen, 2011, 2013), or, perhaps apart from LSAPs, reduced uncertainty around the path for monetary policy given explicit forward-rate guidance by the FOMC (e.g., Bauer and Rudebusch, 2012).

However, this literature generally does not distinguish between "spot" and "expected" term premiums. Simply put, spot measures capture the compensation investors require, today, to hold long- as opposed to short-term risk-free debt, whereas the "expected" term premium is what they anticipate demanding sometime in the future. The two do not necessarily correlate positively. Just as near-term expected short rates could decline in response to a surprise ease in monetary policy, while more distant-horizon expected rates increase if that action boosts expected longer-run inflation or growth, investors could require lower duration compensation immediately, perhaps as the central bank announces plans to buy assets, yet build in greater risk premiums for later amid expectations for a possibly problematic withdrawal of that accommodation. This distinction seems relevant in the context of FOMC policy after the financial crisis, because although most analyses suggest that historically low term premiums

[1] Bernanke (2010) suggests that contemporary low longer-term yields largely reflect very low term premiums, owing to asset purchases within the context of the portfolio rebalancing channel.

coincided with unconventional monetary policy. Previous work focuses less acutely if at all on the length of time investors expected low premiums to prevail, which of course requires parsing the very back end of the term structure.

Besides the implications for investors in very long-duration instruments, this issue of the persistence of term premium shocks is relevant to the real effects of monetary policy, conventional or otherwise. Consider two hypothetical accommodative measures. Suppose the first coincides with lower long-term yields that investors expect to last for one month. Assume the second produces an equivalent initial drop anticipated to persist for one year or even two. All else equal, the latter presumably provides more stimulus than the former, and some studies argue that permanency in rate movements matters—the longer rates stay lower, the greater the boost to growth and or inflation (Kiley, 2012; Fuhrer and Olivei, 2011). The same is presumably true for transmission mechanisms that work through (signaling) expected short rates, on the one hand, or term premium channels, on the other.

The evidence, based on two generally distinct methods, is somewhat mixed. First, affine term structure models (ATSMs) readily produce estimates of expected term premiums for any tenor at any horizon. A standard 3-factor Vasicek model suggests that 5-year-ahead 10-year term premiums were very stable over the sample, which implies that term premium shocks after 2007 were not very persistent. However, the 5-factor model based on Adrian et al. (2013) produces highly volatile 5-year-ahead estimates that correlate closely with the corresponding spot measure not only during the crisis period but also the full sample, with the contrary implication that investors perceived declines in term premiums to be much longer-lasting. Adrian et al. (2013) may well be the preferable ATSM-based approach, but to complicate the story, a pure survey-based measure of expected term premiums increased, on net, since 2007.

This model-free result hardly means that the FOMC do not provide substantial support, notably beyond the standard rate expectations channel, in the aftermath of the crisis. Nonetheless, this finding—perhaps the only shred of evidence that any spot or forward term premium measure actually increased in recent years—raises questions about the extent to which investors may have made some allowances for a possibly complicated exit from prolonged policy accommodation.

The remainder of this paper is organized as follows. Section 2 briefly outlines spot and expected term premium estimates from the ATSMs, Section 3 describes the survey-based measure of expected forward term premiums, and Section 4 concludes.

2. Some ATSM-based Estimates of Expected and Spot Term Premiums

Turning to some evidence, ATSMs—the workhorse of the literature on the impact of LSAPs on the yield curve—produce closed-form expressions for time-varying term premiums, which formally comprise the difference between model-implied forward rates (yields) and the model-implied (average) expected short rates. In addition, ATSMs are of course flexible enough to generate estimates of forward rates and term premiums of any tenor for any future horizon. The underlying mechanics of this approach are well-known, but note that any decrease in spot term premiums cannot be "permanent" in the vast majority of applications. By construction, the underlying factors are nearly ubiquitously mean-reverting, and therefore low spot term premiums—a function of those variables—must rebound to historical averages. Of course, the question is just how quickly, which is governed by the model parameters that conceivably could be time-varying but are typically derived from yield patterns observed over ultimately limited samples that include too few rate cycles.

Consider a very a simple 3-factor Vasicek (1977) model that, unlike Kim and Wright (2005), uses no survey data but allows for time-varying term premiums. The top panel of Exhibit 1 shows the estimated spot 10-year term premium, the black line, along with the anticipated measure two and five years ahead, the blue and red lines, respectively. Following the familiar result, spot term premiums reached historical lows during the nadir of the crisis as well as subsequent rounds of Federal Reserve innovations in forward guidance and large scale asset purchases. The 2-year-ahead expected measure also declined around those times, but not nearly as precipitously, and the 5-year-ahead metric barely budged comparatively. Also, strictly speaking and judging by the gap between the black and blue lines, at the extreme spot lows around 2012:Q2, the model suggests that investors expected the term premium to recover about 80 percent of the way back toward its long-run level within two years—i.e., from a negative term premium to about 200 basis points, in turn roughly 50 basis points shy of the 5-year-ahead estimate at the time. Again, these results simply reflect the model's mean-reversion parameters but arguably imply a fairly timely anticipated return to more normal levels.[2]

However, the results shown in the bottom panel of Exhibit 1 based on a 5-factor model from Adrian et al. (2013), which comprises a more satisfactory method that prices the term structure with linear regressions, tell another story about expected premiums. As evidenced by the tight correlation as well as the comparatively very narrow spreads among the spot, 2-year, and 5-year measures throughout the sample, shocks to the term premium appear to take much longer to dissipate. In point of fact, near the lows of 2012:Q2, the gap between the spot and 5-year ahead measure is within a few basis points. This result is broadly consistent with considerable persistence in perceived financial accommodation, and by extension with lower required returns on longer-dated bonds as well as greater monetary stimulus.

[2] Note however that spot and expected term premiums never appear to correlate negatively.

The methods described in Adrian et al. (2013) seem safely preferable to the simple 3-factor model, but any affine term structure model has inherent limits. Again, a well-known challenge with estimation regards the high persistence yet presumed mean-reversion of bond yields given short samples (Kim and Orphanides, 2012; Bauer and Rudebusch, 2012), which naturally raises the specter of sensitivity to sample extensions. Other empirical challenges include possible peso problems (Gürkaynak and Wright, 2012), and some research also explores bond pricing with learning, as agents slowly recognize regime shifts (Kozicki and Tinsley, 2001) or form expectations in a manner that is decidedly more evolutionary than standard models imply (with common constant mean and conditional volatilities for economic variables) (Laubach et al., 2007; Orphanides and Wei, 2010). In addition, ATSMs are frequently not calibrated to the back end of the term structure, the very section of the yield curve germane to this question.[3] Therefore, there is simply no compelling reason not to consider what some model-free methods, namely exclusive use of survey data,[4] might suggest about the persistence of longer-dated term premiums.

3. Some Expected and (Approximate) Spot Survey Evidence on Term Premiums

There are no survey-based measures that are both direct—e.g., a single question such as "What is the term premium at the following horizon?" or "What compensation do you demand, precisely, to loan to the Treasury over longer as opposed to shorter periods?"—as well as self-contained—i.e., within a given poll and without reference to market quotes—in Blue Chip,

[3] For example, Kim and Wright (2005) as well as Kim and Orphanides (2012) only use maturities up to 10 years to estimate the parameters.

[4] Of course this distinction is somewhat crude given the use of both survey and market data in the estimation of arbitrage-free model parameters (e.g., Orphanides and Kim, 2012). Also, there are perhaps other "model-free" gauges such as spreads between government bond yields and money market rates, under the assumptions that the latter do not embed significant term premiums and that market segmentation prevails (e.g., Krishnamurthy and Vissing-Jorgensen, 2011; Joyce et al., 2011; Bauer and Rudebusch, 2012).

Consensus Economics, Survey of Professional Forecasters, etc.[5] However, conceivably surveys contain some self-contained indirect information about term premiums, without reference to market quotes.[6] To motivate the identifying assumption behind a forward as opposed to an approximate spot measure, consider two questions. First, what 3-month risk-free Treasury bill rate do you expect in 1000 years? Some respondents might sensibly question whether the United States will be issuing obligations, or even exist, at that horizon, but for the sake of illustration a reasonable answer might be around 4 percent, perhaps grounded with respect to contemporary references of potential GDP and common central bank inflation goals. Second, what do you expect 10-year U.S. Treasury yields to be a millennium ahead? The wisest answer might well be none at all, but suppose a plausible response around 5 percent.

What would the difference, if any, between these two possible responses represent? Of course, strict adherents of the (pure) expectations hypothesis for interest rates would render the same answer for both quantities. Millennium-ahead forecasts of bill yields would reflect the perceived equilibrium short rate, and if longer-term interest rates solely comprise the average expected short rate over the tenor of the bond, then the two responses simply cannot differ, unless investors anticipate changes in monetary policy precisely between 1000 and 1010 years ahead, in the case of the projected 10-year yield in 1000 years.

But what would a positive spread—the 100 basis point positive gap between 4 and 5 percent, say—convey about premiums versus expectations? Such responses could be consistent with the view that investors today would expect that their counterparts, even a millennium into

[5] See Durham (2014) for a similar discussion of this survey-based measure.
[6] Piazzesi et al. (2013) also use BCFF data to construct subjective bond risk premia. However, their measure is not "self-contained" in that, similar to Froot (1989), they necessarily use realized yields in their construction of expectation errors. Using nearer-term forecasts at available horizons (i.e., from one to six quarters ahead), they find that bond premia are less volatile and cyclical compared to statistical measures (i.e., regressions of log excess returns on observed variables), given that respondents render projections as if the level and slope of the term structure are more persistent.

the future, would demand some compensation for rolling over shorter-term debt to the U.S. Treasury, presumed to be at the constant equilibrium rate between 1000 and 1010 years ahead. The gap in these long-run forecasts might approximate anticipated term premiums at that horizon.[7]

No existing survey poses such questions. However, some longer-run interest rate forecasts might contain similar information about investors' implied forward premiums. For example, twice a year in June and December the Blue Chip Financial Forecasts (BCFF) survey asks respondents to forecast the 3- and 6-month as well as 1-, 2-, 5-, 10-, and 30-year nominal U.S Treasury yields expected to prevail between six and 10 years ahead, and the Blue Chip Economic Indicators (BCEI) survey similarly polls respondents on 3-month and 10-year yields each March and October.[8] This horizon is neither a millennium projection, of course, nor as distant as the "long run forecasts" found in the quarterly release of the Federal Open Market Committee's (FOMC) Summary of Economic Projections (SEP), which investors commonly interpret as the Federal Reserve's long-run objectives. Indeed, some Blue Chip respondents might take the instructions literally as a 5-year average beginning in six years and ending in 10 years. As such, these forecasts might not reflect equilibrium levels but rather lingering projections from a prolonged if not unprecedented interest rate cycle, such as the period following the recent financial crisis. Then again, many respondents might ignore the explicit horizon, and, as in the SEP, render their "equilibrium" estimates for interest rates beyond the current cycle.

[7] Strictly speaking, evidence of a constant term premium would not be inconsistent with a weak-form version of the expectations hypothesis. But as the following notes, such measures of the term premium appear to be time-varying.
[8] This set of questions first appeared in the December 1996 survey and continued each June and December through the most recent June 2013 Blue Chip Financial Forecast. The expectations are the December 2002 and December 2003 surveys, which do not include these questions. In sum, there are 32 long-run forecasts at the time of writing.

There is no way to know for sure, but these survey data do not seem to imply this latter assumption that longer-run forecast embed information about perceived equilibriums. In addition to the average between six and 10 years ahead, the BCFF includes forecasts for the federal funds rate (and at least seven other nominal Treasury yield tenors) for each year between one and five years hence. The identifying assumption that the 6- through 10-year average forecasts (for any series) approximate an equilibrium expectation implies that projections asymptote to long-run levels by the end of the nearer term, i.e., the 1- to 5-year horizon that captures prevailing perceptions about the trajectory of the current business cycle. If the mean forecast for the federal funds rate for the fifth year is equal to the average forecast for the sixth through the tenth year, then a reasonable inference is that respondents expect no cyclical developments in policy after the fifth year, and thus the longest-horizon forecast indeed closely resembles an equilibrium projection. For example, in the most recent BCFF forecast (June 2013), the mean expected funds rate forecasts were 0.8 percent, 2.0 percent, 3.1 percent, 3.6 percent, and 3.9 percent for calendar years 2015 through 2019, respectively—a steady exit from the nominal zero bound. However, perhaps tellingly, the average forecast for the subsequent period from 2020 through 2014 was 3.8 percent, strictly speaking 10 basis points lower than the 2019 projection and implies that respondents did not necessarily envisage further tightening or "normalization" beyond five years and, in turn, thus rendered an equilibrium funds rate for the 2020 through 2014 period.

Besides the most recent observation, the histogram in the top panel of Exhibit 2 shows that for 28 of 32 surveys, the projected federal funds rate for the fifth year ahead is, like the June poll, within 10 basis points of the average expected federal funds rate between six and 10 years ahead. Also, despite the notably prolonged recent cycle, the difference in forecasts at those

horizons is within this narrow range, which after all possibly includes measurement errors, for every survey since 2007. Moreover, as the simple scatter plot and OLS regression estimate in the lower panel of Exhibit 2 indicates, there is no relation between the forecasted directional trajectory of the funds rate from one to five years ahead and any spread between the fifth-year forecast and the average between six and 10 years, which is a reasonable prior under the suspicion that forecasters' cyclical views inform their longer-run equilibrium forecasts. Indeed, the estimated coefficient, although clearly statistically insignificant, is perversely negative (owing to an outlier, the June 2003 survey).

Leaving aside the identifying assumption, what do these survey data say? Exhibit 3 includes the surface or cross-sectional time-series of responses from December 1996 through June 2013 from the BCFF survey. For starters, the surface is not flat, which is noteworthy along two dimensions, pun intended. First, with respect to each cross section, the expected yield curve between six and 10 years ahead is always upward sloping—indeed, even the anticipated spread between six and three months bills is positive for every single observation, as it is between all adjacent points (e.g., between the 1- and 2-year yield forecasts, the 5- and 10-year projections, etc.). Thus, unless investors from December 1996 through June 2013 consistently expected the Federal Reserve to be tightening monetary policy between six and 10 years hence, this positive slope suggests that investors expected positive term premiums into the future, notably in violation of the pure expectations hypothesis. This reflects the common observation that the U.S. Treasury yield curve has almost always been positive-sloping, which in turn implies positive term premiums under the assumption that investors most likely have not almost always expected policy tightening.

Turning to the second dimension from the surface of responses, the level and slope of the projected average term structures six to 10 years ahead, after all a substantially lengthy horizon, change notably over time. Of course, this observation again could reflect that possibility that respondents' nearer-term forecasts seep into their longer-run or equilibrium estimates, but alternatively under the indentifying assumption, this time variation might reflect actual changes in forecasted risk preferences expected to prevail in the future, which violates the weaker form of the expectations hypothesis. And, considering such variation at a particular point along the term structure to approximate the 10-year term premium, the solid black lines in Exhibit 4 show the forecasted average 10-year yield between six and 10 years ahead, the dashed black lines are the projected 3-month bill rates over the same horizon, and the red lines are the spreads between these two points along the forecasted yield curve (a proxy for the expected forward term premium), based on the BEFF and BCEI surveys in the top and bottom panels, respectively. In general, both interest rate forecast series decline over the sample, but again clearly not in lockstep, which implies some variation in the forward term premium. In particular, in contrast to the common perception that Treasury term premiums have plummeted on net since the start of the financial crisis, owing on balance to substantial flight-to-quality flows as well as unconventional monetary policy measures, these survey-based forward term premiums have increased on net since the beginning of 2007 and remain around mean or above-average levels.[9]

But what about a simple survey-based spot measure, or more precisely a much nearer-term expected forward estimate? Common back-of-the-envelope gauges of the term premium comprise the difference between observed market yields and survey forecasts of short rates over corresponding tenors, with some necessary assumptions that align the timing of the surveys and

[9] This inference is not sensitive to the particular tenors used in the calculations—e.g., the gap between 10- and 5-year yield forecasts follows a very similar trajectory.

quotes (e.g., Ilmanen, 2011). However, a self-contained measure from the same bi-annual BCFF without market quotes is instructive. Start from the general notion that the *T*-year zero-coupon premium is the difference between yields and expected average short rates over the common horizon, *T*, simply following (ignoring Jensen's inequality)

$$y_0^{T-year} - \frac{1}{T}\int_{t=0}^{T} E\{r_t\} \tag{1}$$

and consider as an illustration, say, the June 2013 survey, which includes forecasts of the 10-year U.S. Treasury yield for 2015 as a proxy for y_0^{T-year}—with the corresponding buy-and-hold period from 2015 through 2024—and 3-month U.S. Treasury bill rate forecasts for each year in the same 10-year tenor—i.e., from 2015 through 2024—as proxies for $E\{r_t\}$. Such an estimate is of course not a true spot metric, given the 10-year yield for 2015 is a forecast in the June 2013 survey, but this gauge is closer to the Kim and Wright (2005) 10-year spot term premium than the forward estimate in Exhibit 4.[10] Turning to the data, Exhibit 5 compares the forward and approximate spot BCFF measures directly, again including 32 surveys from March 1996 through June 2013. The correlation between the BCFF series is weakly positive, at around 0.37, but the two appear to diverge toward the end of the sample, particularly given the last few surveys. Indeed, the most notable distinction is that while the forward measure is, again, elevated from 2007, the spot estimate nudges lower—largely consistent with the consensus, at least on net given the last three surveys or so (although not as coincident with the initial rounds of LSAPs). As such, the survey evidence is ambiguous regarding the last few years.

Before making further inferences, some further consideration of the validity of the measures seems warranted. As with any "model-free" estimate, the survey-based forward term

[10] The two measures are both forward term premiums based on the expected 10-year yield, alternatively beginning in approximately one and five years.

premium rests on strong simplifying assumptions, however persuasive the simple evidence in Exhibit 2. Also, neither the forward nor spot estimates impose any arbitrage-free structure. Nonetheless, some additional survey data might address whether there is any intuition behind these results. As noted previously, closed-form affine model solutions suggest that the partial derivative of term premiums with respect to the volatility parameters is positive. In other words, investors demand greater compensation to hold longer-term debt, the greater their uncertainty about the trajectory of short-term rates over the horizon. Briefly, the very surveys that produce these term premium estimates include some relevant information on this score. Both the BCFF and BCEI surveys report not only the mean responses for the 6- through 10-year horizons but also the difference between the top and bottom ten answers for each U.S. Treasury maturity point, as well as for the federal funds rate. This range in responses strictly reflects disagreement rather than uncertainty per se, but a worthwhile question is whether the magnitude of the range of anticipated policy rates between six and 10 years ahead correlates with the implied term premium measure at that horizon.

Exhibit 6 shows simple scatter plots of the forward and approximate spot term premium estimates for each of the 32 surveys, against the difference between the top average and bottom average responses for the federal funds rate. Regarding the forward measure, indicated in the top panel, visual inspection suggests a positive relation between the proxy for long-run uncertainty about policy (perceptions rather than attitudes toward risk) and long-run duration compensation, as expected. Even though the limited number of observations hardly affords satisfactory statistical power, the p value (0.000) nonetheless indicates significance well within standard confidence bands, and the R-squared of the simple OLS regression is almost 0.40.[11] Also, the

[11] For example, for a more complete econometric specification of ATSM-based term premiums, see Durham (2008) or Li and Wei (2012).

slope (0.59) seems economically meaningful, and as such this survey evidence is scarcely inconsistent with intuition and formal theory. By contrast, although the evidence on the approximate spot measure in the lower panel indicates the same general relation, the estimates are notably weaker considering a lower R-squared (0.08), a lower slope (0.36), and a p value (0.113) that suggests statistical insignificance, albeit again given few observations. As a further caveat any inference that the forward measure follows intuition whereas the spot metric does not, the remaining unexplained variance likely owes to the fundamental under-specification of the univariate model, particularly the absence of any proxy for the market price of risk, which in theory might not perhaps relate to flights-to-quality per se during the latter sample period but special demand associated with asset purchases.

There are a number of standard caveats regarding the use of survey data, including small cross-sections and inconsistent samples over time as well as possible "irrational" forecasts (e.g., Froot, 1989).[12] Nonetheless, in sum these survey data might contain some useful information about investors' longer-run perceptions of duration risk, and the fact that the forward metric has on net increased rather than decreased since the onset of the financial crisis is noteworthy. Also, considering both measures, a complicated story—perhaps related to the transmission of unconventional monetary policy through supply or signaling channels—must reconcile investors' increased perceptions of anticipated interest rate risk on 10-year yields beginning in six years, with simultaneously decreased spot term premiums for that tenor. A possible explanation is that, just as term premiums mean revert by construction in common Gaussian

[12] Froot (1989) infers using survey data that the failure of the expectations hypothesis for long bonds owes to expectation errors. Also, Bacchetta et al. (2009) find across multiple financial markets that expectation errors from surveys are predictable in markets with significant excess return predictability (i.e., in foreign exchange, stock, and bond markets but not the money market). However, the use of survey data in this application differs because, although long-run forecasts of each maturity may be biased or prove erroneous, this term premium proxy of course comprises the spread(s) between those projections.

affine term structure models (e.g., Kim and Wright, 2005), the survey data similarly imply a steep expected trajectory from low spot premiums toward historical norms, or perhaps elevated levels around the 5-year horizon that could be consistent with some unmooring of investors' perceptions of the Federal Reserve's reaction function or perhaps concern about the long-run implications of unconventional balance sheet measures.

4. Discussion

Published analyses based on ATSMs and surveys largely conclude that U.S. Treasury term premiums fell dramatically over the course of the financial crisis and its aftermath, but few studies distinguish spot from expected term premiums. To be sure, the back end of the term structure beyond, say, 10 years embeds the required information, and ATSMs again are useful tools to disentangle the signals. The evidence based on this method is naturally sensitive to model assumptions and corresponding parameter estimates, but at least one method (Adrian et al., 2013) implies considerable persistence in term premium shocks, not only during the financial crisis but also for the remainder of the sample. However, the pure survey-based approach implies the near opposite, as expected term premiums five years ahead increased with the simultaneous decrease in the approximate spot measure from 2007.

Even so, the survey-based results do not necessarily imply that Federal Reserve policies did not ease monetary conditions and stimulate the economy—lower spot and nearer-horizon term premiums of course reflect greater financial market accommodation. Instead, in addition to the obvious issue of expected returns toward the back end of the U.S. Treasury term structure, they simply may address whether market participants anticipated eventual shifts in broad

financial conditions, over and above any channel that works through expected short rates in the short to medium run.

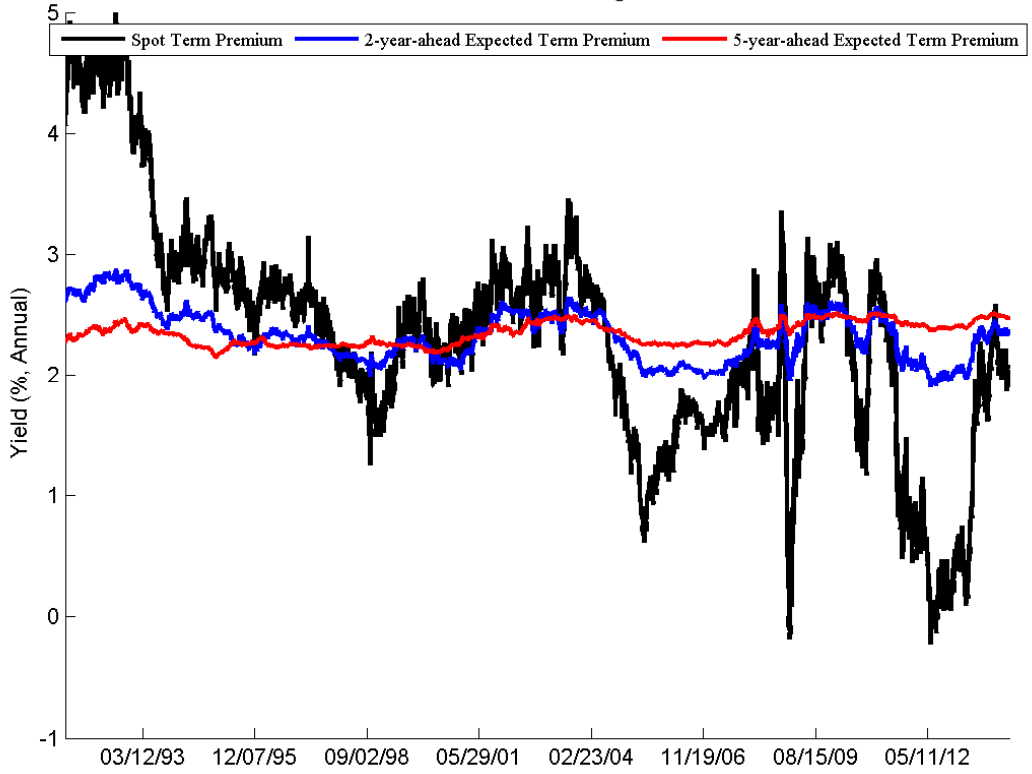
Also, this inference may reflect some recent evidence regarding the term structure of equity risk premiums or required stock returns, derived from an arbitrage-free method, over the course of the financial crisis and the subsequent policy response (e.g., Durham, 2013). That is, just as spot term premiums declined during this period, very near-term equity risk premiums fell sharply from their peaks in late 2008, on balance, over the following few years. Also, the recent upward-sloping term structure of required returns could connote that equity investors became increasingly less comfortable with shares the longer the horizon, a forecast period that not implausibly includes expectations of an unwind of substantial accommodation.

Finally, with regard to estimation and the ATSM-based approach, Kim and Orphanides (2005) demonstrate some key advantages in using survey data to pin down the expected short rate path.[13] However, they only use forecasts of the 3-month bill rate and no other longer-dated tenor from the BCFF or BCEI surveys.[14] Unfortunately, these forecasts are only available twice a year, but an alternative nonetheless might be to inform the Kalman filter estimation survey data evenly across the term structure. Given the results in Exhibit 4, a sensible prior might be that these survey data might push term premium (expected short rate) estimates across the yield curve somewhat higher (lower).

[13] However, Bauer and Rudebusch (2012) argue that information from surveys does not satisfactorily address small-sample bias given their low frequency and possible misrepresentation of rational short rate forecasts.

[14] Kim and Orphanides (2012) compare monthly Blue Chip near-term forecasts of 5- and 10-year yields with those based on their forecasts. They do not use distant-horizon forecasts of longer-dated tenors in their Kalman-filter-based maximum likelihood estimates. Some previous estimations incorporate long-run survey forecasts of longer-dated tenors for non-U.S. data. For example, Guimarães (2012), who finds that contemporary low U.K. 10-year government bond yields owes to lower expected real rates (rather than real or inflation risk premiums) uses Consensus Economics forecasts of average 5-year inflation five years ahead in addition to 1-, 2-, and 3-year-ahead forecasts of the policy rate.

Exhibit 1
United States: 3-Latent-Factor ATSM (04/22/1991--05/06/2014)
Estimated 10-year Zero-Coupon Term Premium: Spot and Expected
Parameters Estimated through 7/2011



United States: ATSM (04/01/1992--04/30/2014)
Estimated 10-year Zero-Coupon Term Premium: Spot and Expected
Adrian et al. (2013)

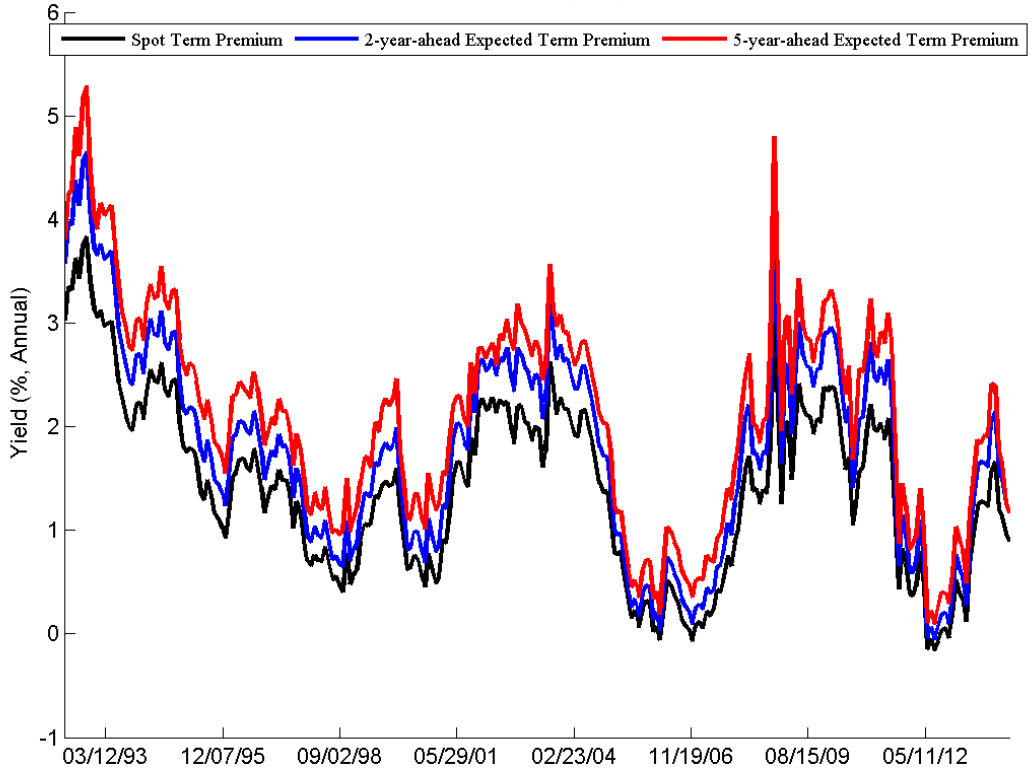
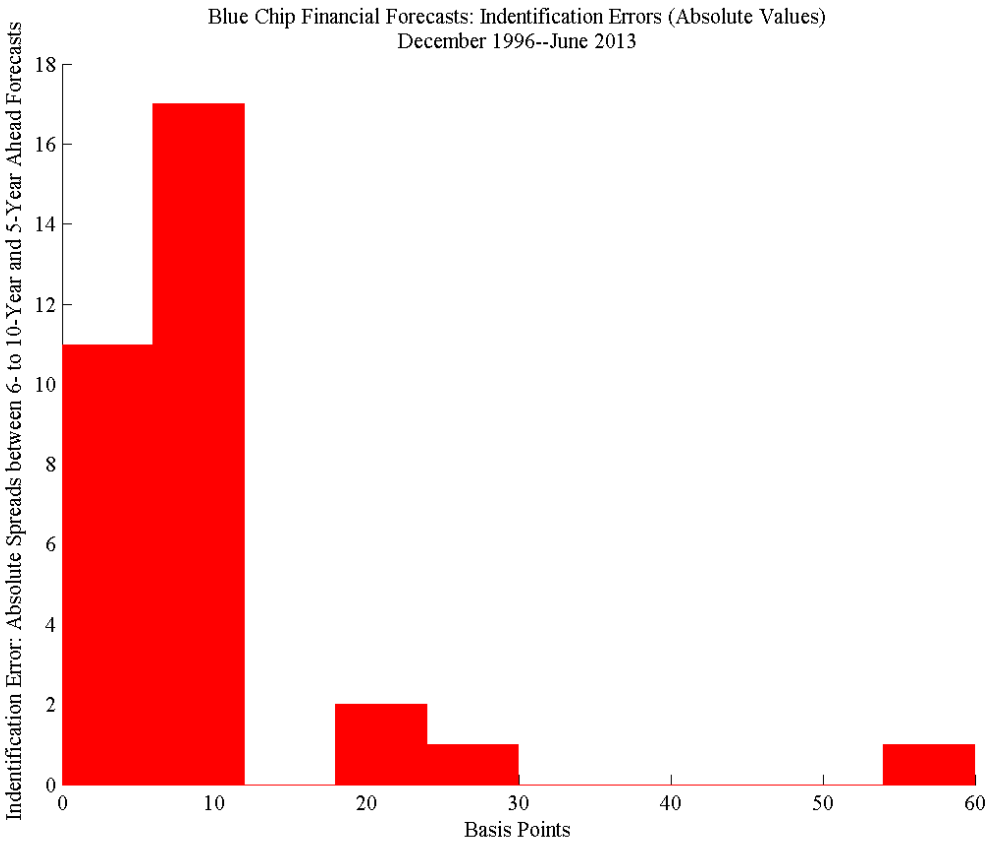


Exhibit 2


Blue Chip Financial Forecasts: Indentification Errors (Absolute Values)
December 1996--June 2013
Indentification Error: Absolute Spreads between 6- to 10-Year and 5-Year Ahead Forecasts
Basis Points
0
2
4
6
8
10
12
14
16
18
0
10
20
30
40
50
60

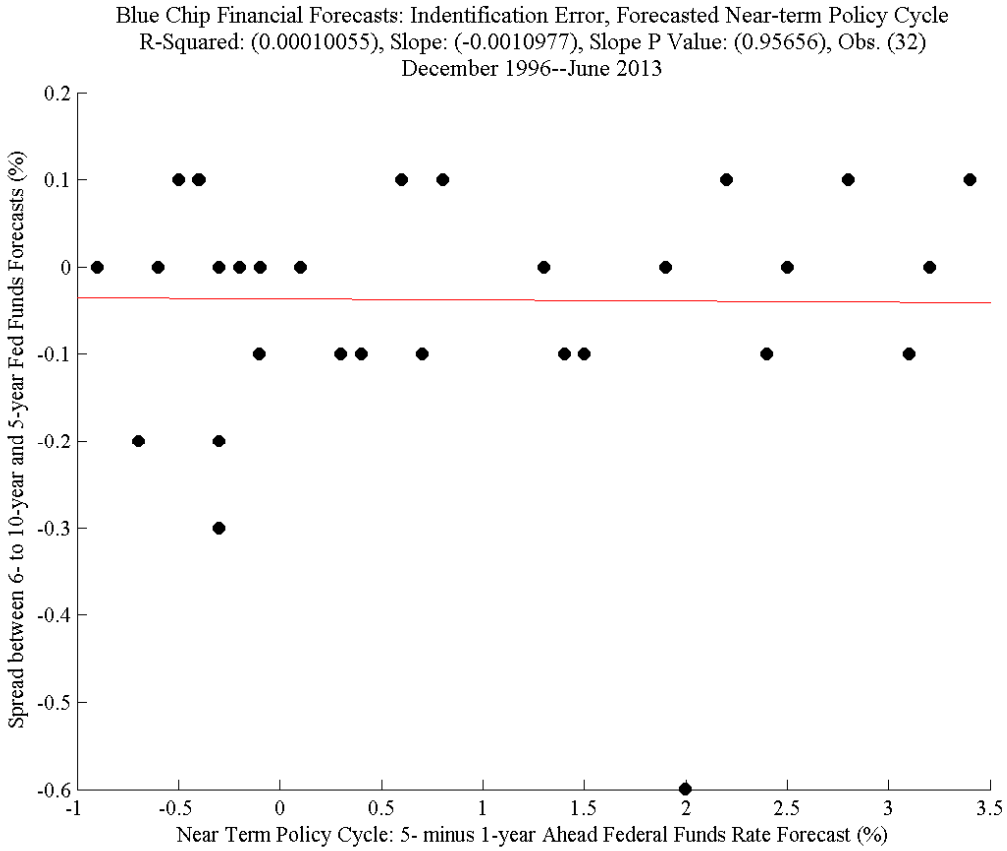

Blue Chip Financial Forecasts: Indentification Error, Forecasted Near-term Policy Cycle
R-Squared: (0.00010055), Slope: (-0.0010977), Slope P Value: (0.95656), Obs. (32)
December 1996--June 2013
Spread between 6- to 10-year and 5-year Fed Funds Forecasts (%)
Near Term Policy Cycle: 5- minus 1-year Ahead Federal Funds Rate Forecast (%)
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5

Exhibit 3

Blue Chip Financial Forecasts: Yield Curve Projections, Five to 10 years Ahead (Average)
3-Month, 6-Month, 1-, 2-, 5-, 10-, and 30-Year Forecasted Yields: (December 1996--June 2013)

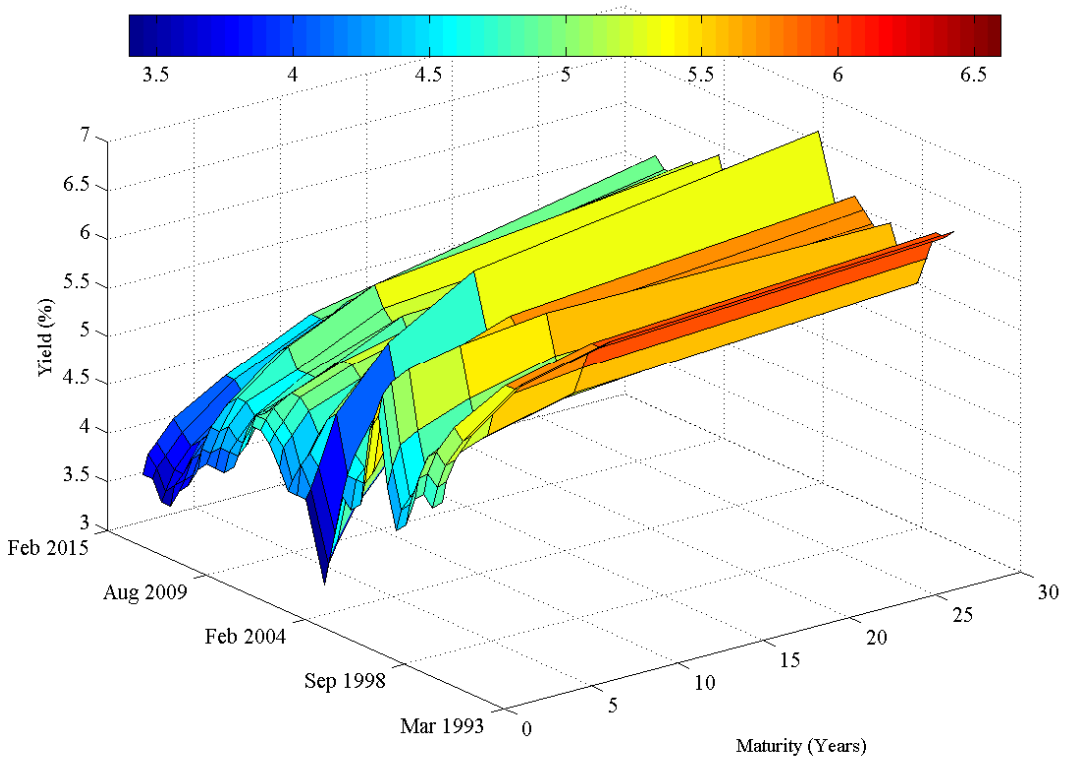
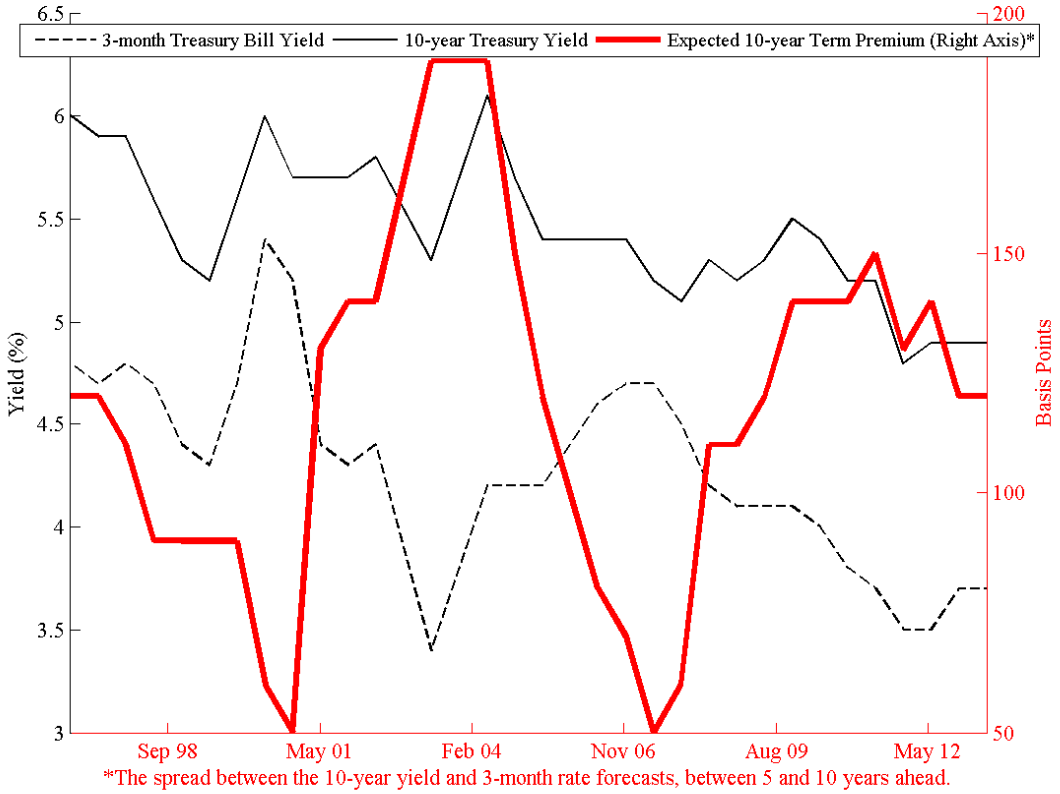


Exhibit 4

Blue Chip Financial Forecasts: Five to 10 years Ahead

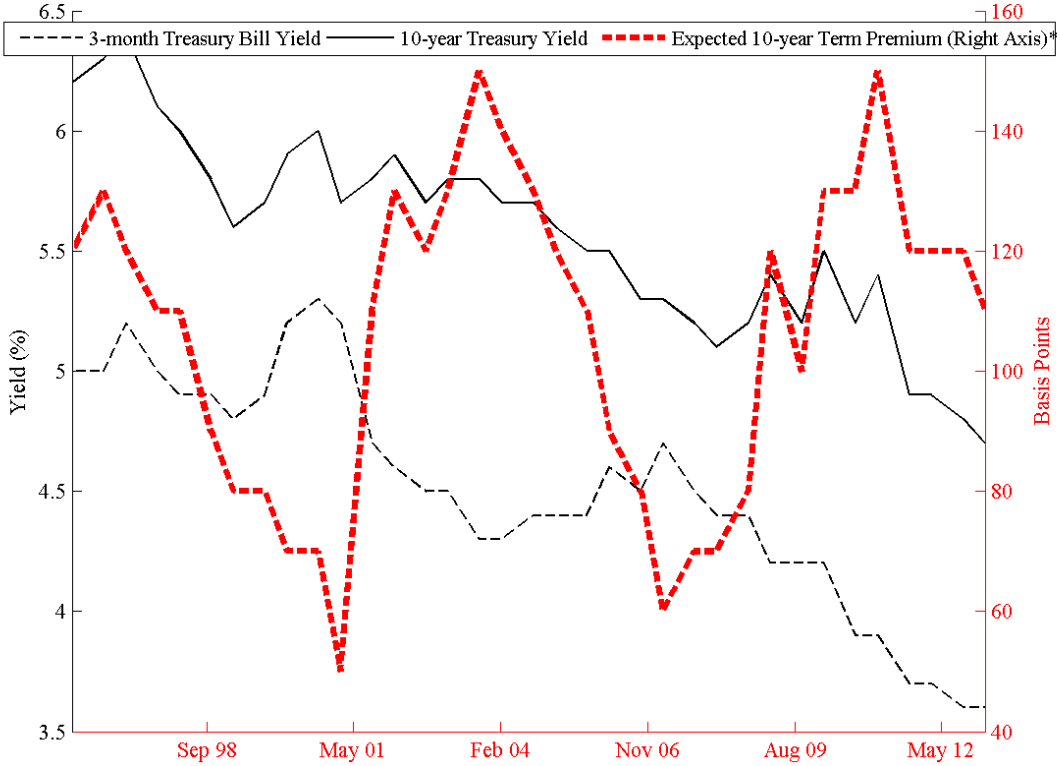
December 1996--June 2013



*The spread between the 10-year yield and 3-month rate forecasts, between 5 and 10 years ahead.

Blue Chip Economic Indicators Survey, Long-Run Forecasts: Six to 10 years Ahead

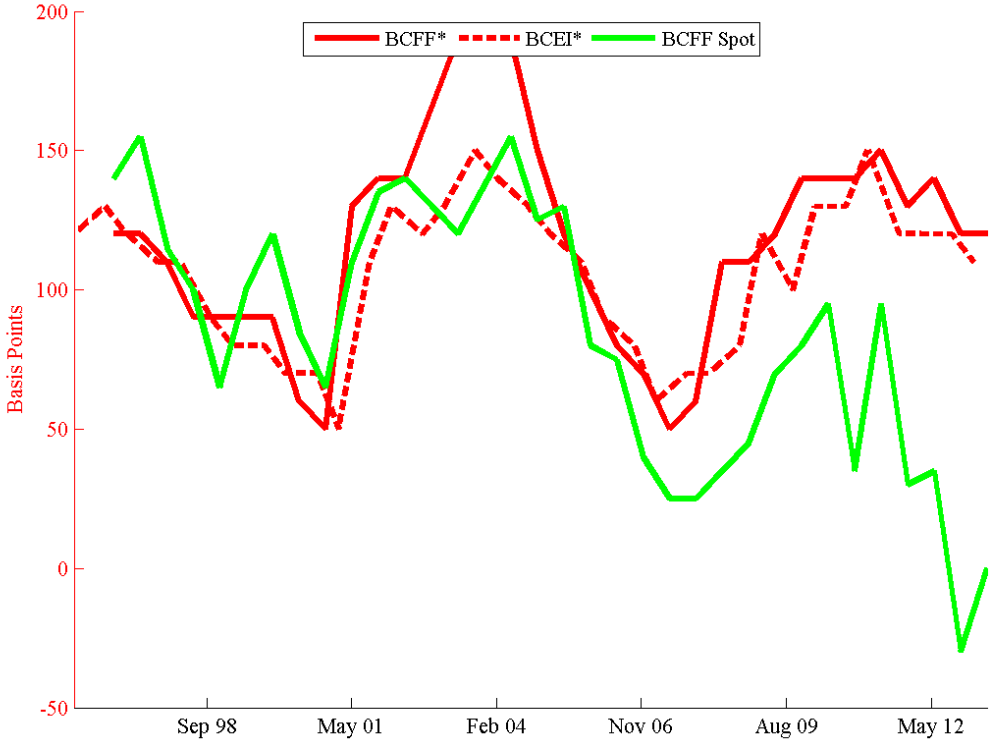
March 1996--March 2013



*The spread between the 10-year yield and 3-month rate forecasts, between 5 and 10 years ahead.

Exhibit 5

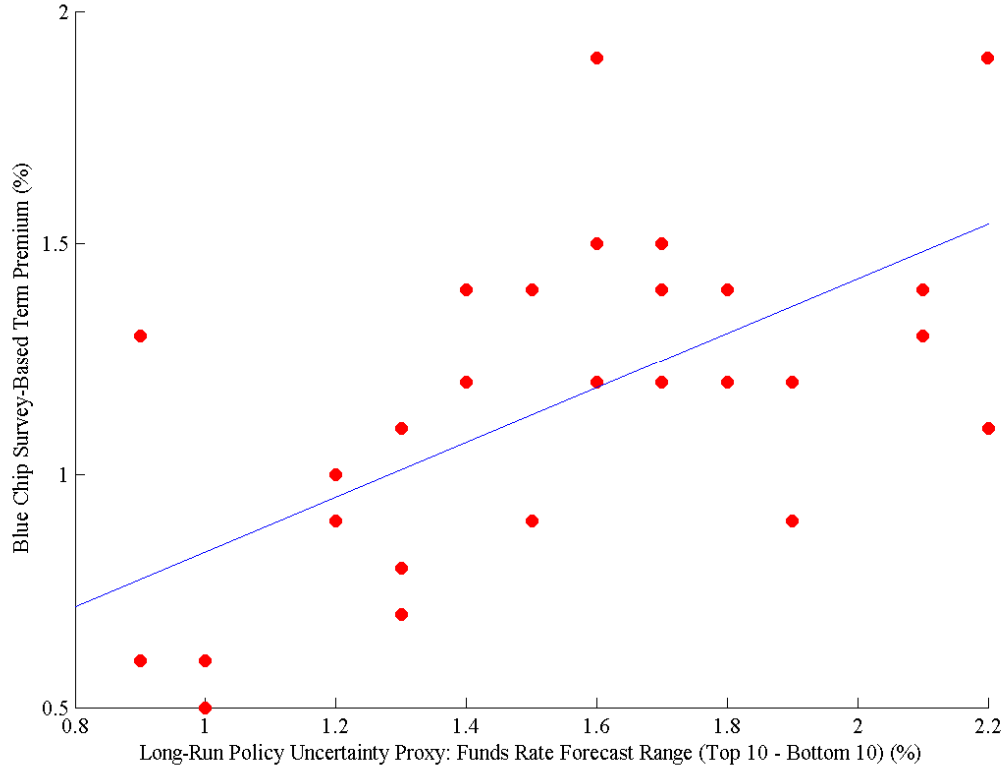
Blue Chip Financial Forecasts (BCFF) and Economic Indicators (BCEI) Surveys
Spot and Forward 10-year Term Premiums* (March 1996--June 2013)
BCFF Term Premiums Correlation: (0.37277)



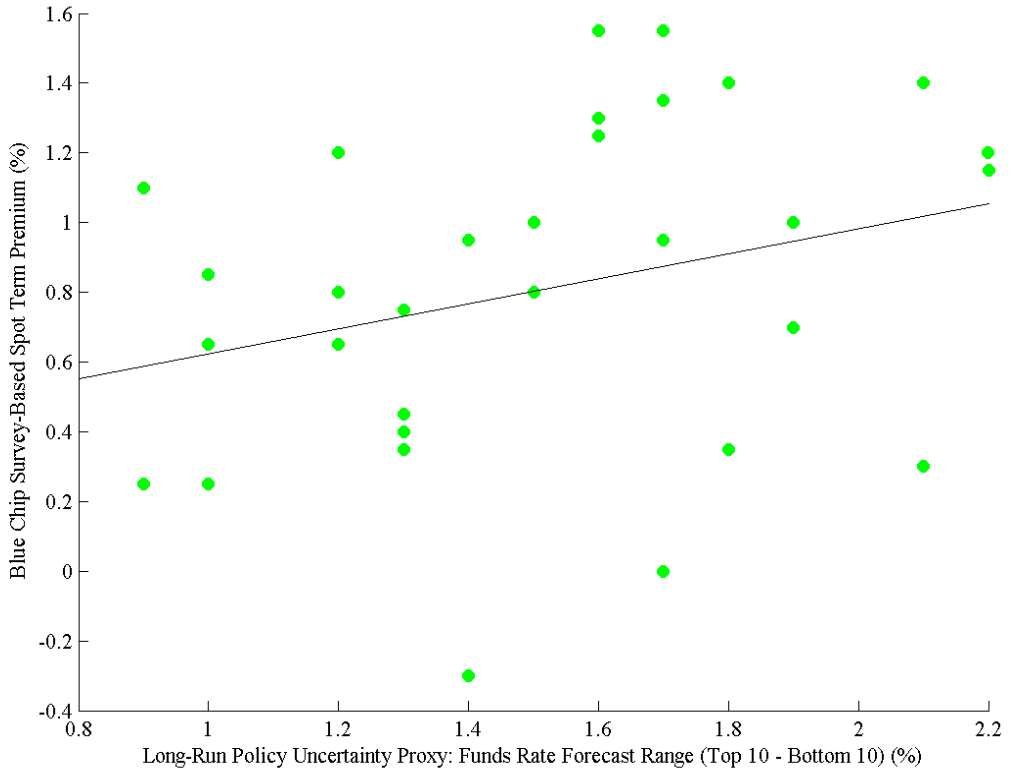
*The spread between the 10-year yield and 3-month rate forecasts, between 5 and 10 years ahead.

Exhibit 6

Blue Chip Financial Forecasts: Six to 10 Years Ahead: Term Premium Estimate, Range of Federal Funds Rates Forecasts
R-Squared: (0.39537), Slope: (0.59018), Slope P Value: (0.0001161), Obs. (32)
December 1996--June 2013



Blue Chip Financial Forecasts: Spot Term Premium Estimate, Range of Federal Funds Rates Forecasts
R-Squared: (0.081587), Slope: (0.35873), Slope P Value: (0.11303), Obs. (32)
December 1996--June 2013



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