Risk and regimes in the bond market: Comments on Atkeson and Kehoe

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July 31, 2008

Abstract

How should we adapt monetary economics and the analysis of monetary policy to account for risk premiums in the term structure of interest rates? I show how risk premiums in the term structure are of first-order importance in analyzing monetary policy via the term structure of interest rates. The switch from a negatively sloping prewar yield curve to a positive slope now reflects the anchoring of the price level under the gold standard. Alas, I see no evidence that the current yield curve has returned to this characteristic inversion, or any other evidence for a regime-shift to "anchored expectations." Taking risk premiums into account, expected future interest rates track current rates, not relatively-stable forward rates as we enter a recession. This adds support for Atkeson and Kehoe's hypothesis that monetary policy reacts to and does not cause risk premiums. Bond risk premiums are earned in compensation for level, not slope risk, and risk premiums do not forecast activity, both providing suggestive evidence for Atkeson and Kehoe's hypothesis.

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1 Regimes and questions.

Figure 1 plots the three month commercial paper rate[1] and Atkeson and Kehoe's long bond yield. Pretty clearly, the big regime shift starts in 1933, when the US, following the UK in 1932, abandoned the Gold standard. You can see other shifts as well: The founding of the Fed and the partial retreat from the Gold standard in 1914 led to the visible decrease in high-frequency short-rate movements and an increase in long-rate volatility. The Fed-Treasury accord, and Paul Volker's policy shift occasioned well-known breaks. Atkeson and Kehoe ask if there is another regime shift in 1990, so I also marked that date. But the biggest single change is, obviously, the shift from the Gold standard (or what was left of it) to an interest-rate targeting regime in 1933.

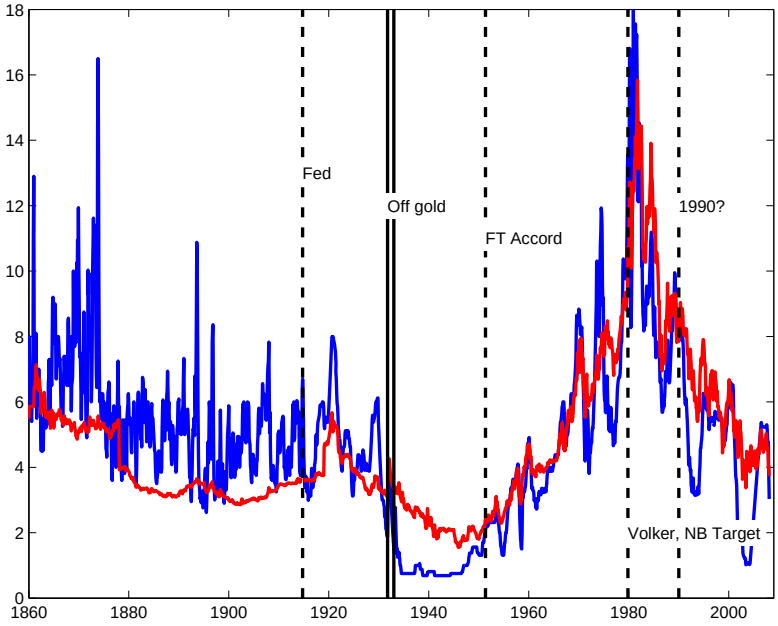

Figure 1: 3 month commerical paper rate and Atkeson-Kehoe long bond yield.

The paper asks "What change in policy and institutions led to these changes in regimes?" (p.2). The answer seems rather obvious – and it's a bit strange that the paper does not mention the Gold standard until the concluding comments, and that in a dismissive way.

Why did abandoning the Gold standard have such a dramatic effect? Figure 2 dramatizes what we all know: the price level was steady under the gold standard, replaced by continual and variable inflation ever since.

The "need for new models" that the paper argues for in this context is merely that we don't have a model *of the Fed* which explains why the Fed chooses one regime or another, or why the Fed allowed inflation to increase in the 1970s and then chose to disinflate in the

[1] I use the version from the NBER macro history website, which has fewer spikes than Atkeson and Kehoe's data series.

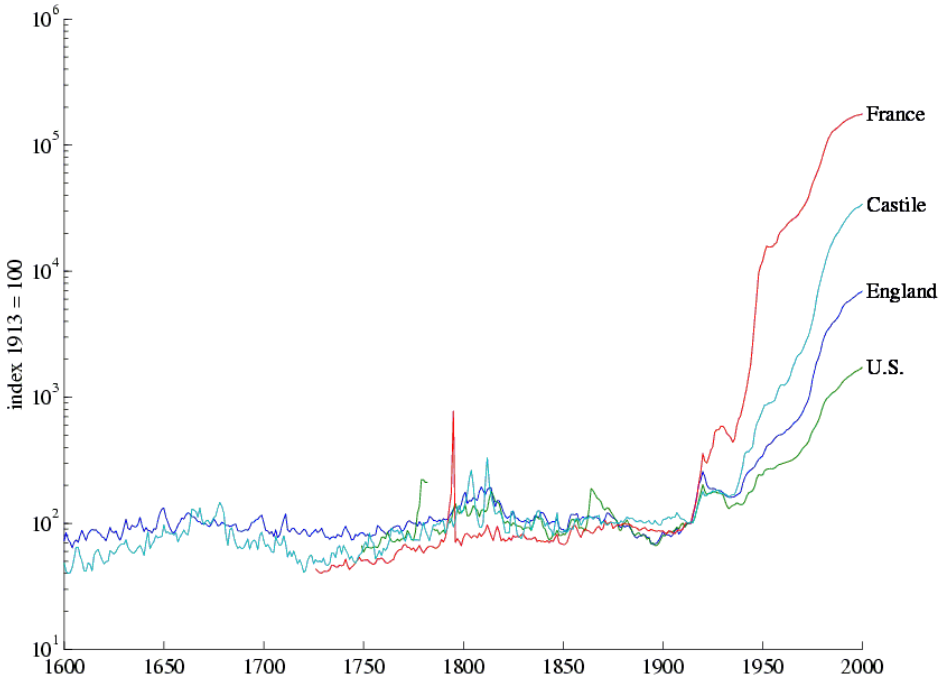

Figure 2: Price level. Source: Tom Sargent's website.

1980s. I think this part of the call for new theory will fall flat for most economists, who are content to think of the Fed as making mistakes here and there and learning from experience. To most of us, it would be an equally empty call that we need "new economic theory" to explain why people didn't use the internet in 1930. The internet, like the Taylor rule, simply hadn't been invented yet. The much more interesting "call for new models" involves risk premia, which I discuss below.

The paper goes on to what I feel are more interesting "regime" questions:

1. Is there any evidence for a regime change around 1980? Can we see in interest rates a difference between an "uncontrolled inflation" regime and a "disinflation" regime? (Or "indeterminate" vs. "determinate" in new-Keynesian language.) Atkeson and Kehoe don't ask about 1980, but everyone else does so it makes sense for us to ask this question.

2. Can we see the emergence of an "anchored long-term expectations" regime around 1990?

3. If so, are interest rates returning to the sort of behavior we saw before 1933?

2 The standard approach

The standard reading of interest rate history is pretty straightforward. An interest rate target stabilizes the very short-run behavior of short-term rates. The short rate follows a well-known history involving policy, inflation, and recessions. Long rates simply follow as expectations of future short rates. Since the Fed can't move short rates forever, long rates are revealing measures of inflation expectations. A long-term price level commitment, or a sufficiently inflation-phobic Fed then leads to stable long rates. This view seems to provide a pretty good description of the gold standard transition as seen in Figure 1.

For a closer look at the postwar data, Figure 3 and Figure 4 present the Federal Reserve's constant-maturity yield series.

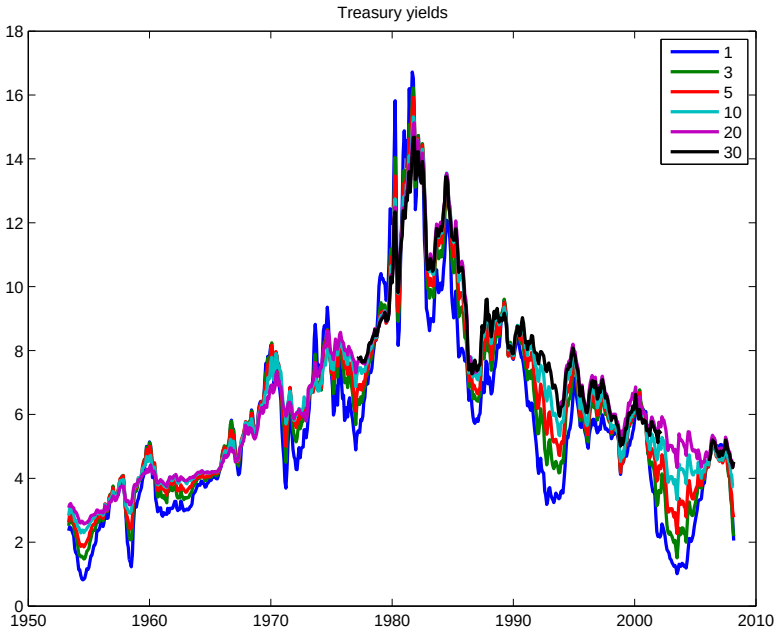

Figure 3: Federal reserve constant-maturity yields.

Now, "anchored expectations" really is the central question of the moment. Was Greenspan skilled or lucky? Has the Fed learned a lesson, and changed its behavior in fundamental ways – and did people come to believe this around 1990? Or, did the Fed simply face a lucky set of shocks, so that if faced with the shocks of the 1970s, it would take us down the same path? For example, does the Fed distinguish "supply" from "demand" shocks, and has it learned not to respond to the former? Or is it following a mechanical response to output and inflation, and are we just a few adverse "supply shocks" away from 1979 inflation? Does it assess the state of inflation expectations – how far out the Phillips curve is – when deciding on policy? Is there an "inflation target", a solid commitment to bring inflation back to 1-2%, quickly? OK, one more chocolate donut to get us through the morning, but will we really start that diet tomorrow? Reading Fed statements doesn't give much hope on these questions, but perhaps the data do – and especially long-term inflation

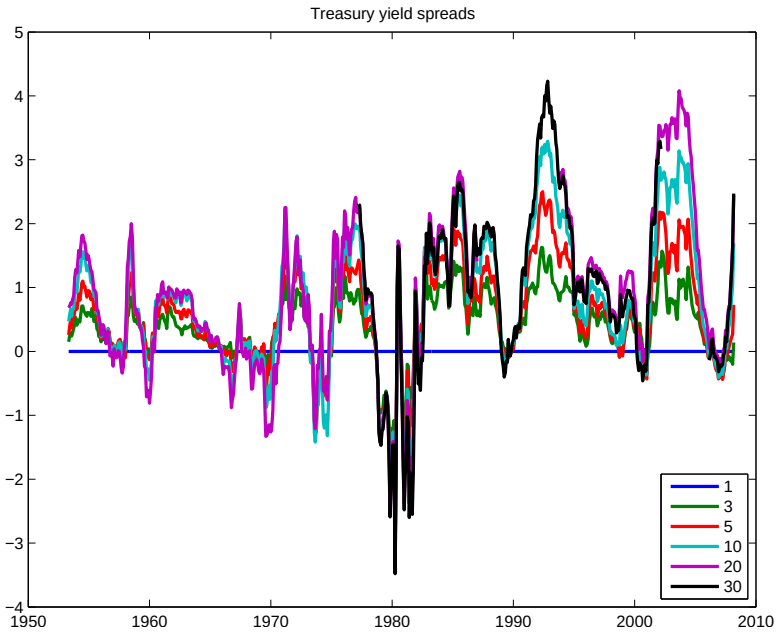

Figure 4: Spread of Federal Reserve constant maturity yields over the one-year yield.

expectations read through long-term interest rates.

Alas, I see very little evidence for regime shifts in these plots. A regime shift is a change in the stochastic process, not a just a peculiar draw of shocks. The short interval of high volatility during the nonborrowed reserve targeting era might qualify. There is a shift from upward to downward trend in 1980, but if one simply superimposes slowly increasing expected inflation before 1980 and slowly decreasing expected inflation afterwards, the remaining series seem largely unaffected. This is clear in the spreads graph, Figure 4. Perhaps the last two troughs are a bit longer and deeper than those of the 1970s, but it's not clear what that means.

The best case for "anchored expectations" that I can see is that long-term yields didn't fall into the last trough quite as much as they did in earlier troughs, and are therefore somewhat "smoother." Looking at prewar data makes us realize how small any such change is. The famous "conundrum" was the claim that in the last flattening of the yield curve in 2005, was flatter than usual, or even inverted, and surprisingly so, perhaps signaling lower inflation. That feature doesn't even show up in these graphs. The last inversion was exactly the same size as the previous two, and smaller than we saw at the peaks of the 1970s and 1980s. Now, it looks like a prescient expectation of the 2007-2008 rate cuts. (A larger puzzle is why a Fed Chairman would ever say a flattening yield curve is a "conundrum," rather than a "sign of anchored inflation expectations, removing a risk premium from every voter's mortgage, and you're welcome.")

The paper presents no tests or other evidence that the time-series behavior of yields is different before and after either 1980 or 1990. It would be easy enough to complement graph-staring with quantitative analysis, but I think we can see the project is rather hopeless, or

that any statistics which find such a change would involve a good deal of filtering skulduggery to focus attention on particular frequencies.

Are we returning to something like the pre-1932 regime? Certainly not. A long-run stable *price level* is a very different regime from a long-run stable *inflation rate*. In the latter, inflation shocks are passed through; in the former a shock to inflation requires a subsequent period of deflation. The difference is crucial for the real risk of a nominal 30 year bond. Despite its potential salutary effects on long-term bond yields, there is not a peep out of the Fed of interest in the latter project.

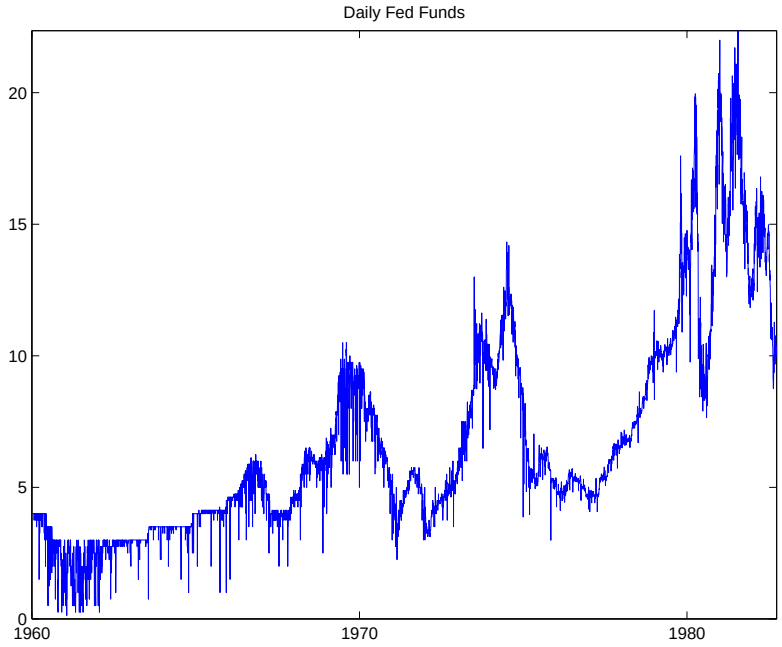

Figure 5: Daily Federal Funds rate (pre-target data).

Also, there is no evidence whatsoever that we are returning to a regime with a highly volatile short rate. Exactly the opposite has happened: The Fed has finally removed most of the high frequency fluctuations in the overnight Federal funds rate, as we can see in Figures 5 and 6. (The big reduction in Figure 6 comes from the change in reserve accounting in 1999.) Other central banks have eliminated these spikes by converting fully to interest-rate target operating procedures.

3 Risk premiums

Regime-spotting is fun, but it's a distraction. The central, important, novel, and interesting contribution of this paper is to investigate how *risk premiums* in the term structure change our picture of monetary policy and the economy. The big points I see in the paper are

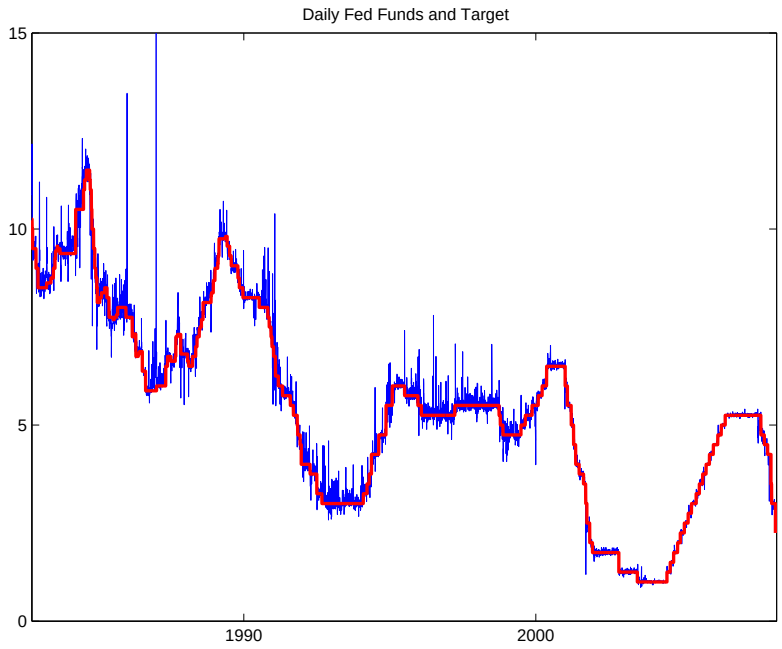

Figure 6: Daily Federal Funds Rate and Target

- We *do* need large and time-varying risk premiums to understand interest rate data.
- The nature of risk premiums can potentially tell us a lot about the regime question.
- Our view of monetary policy must change in important ways to accommodate risk premiums.
- Example: Does policy affect risk premiums or do risk premiums affect policy? Do we understand the correlation as premium responses to monetary policy shocks, or vice versa?

I think the most useful thing I can do as discussant is to tell you (briefly) what I know about bond risk premiums and how they bear on the regime and policy issues.

3.1 Unconditional risk premiums

You can see an intriguing pattern in unconditional risk premiums from Figure 1:

- *On the gold standard, long rates were, on average below short rates. Afterwards, long rates have been, on average, above short rates.*

We often treat the average "upward sloping yield curve" as a constant of nature. It is not. It is not written in stone that banks will try to borrow short and lend long. It is really

not written in stone that banks, investment banks and special purpose vehicles will try to finance dodgy mortgages by rolling over monthly, and sometimes even overnight, debt! A pre-1932 hedge fund would *sell* long-term debt and *buy* commercial paper.

The change in the average slope of the yield curve makes abundant economic sense:

- *If inflation is steady and real rates vary, then long-run nominal debt is safer for long-run investors. If inflation varies and real rates are steady, then rolling over short-term nominal debt is less risky for long-run investors.*

We *expect* a falling yield curve under a gold standard or anchored-inflation regime; we expect a risk premium for *short-term* bonds. We often refer to short-term (money-market, overnight, or three-month) rates as the "riskfree" rate. This is also not a constant of nature, written in stone – it is a result of an all-too-familiar regime with abundant inflation variation. (Short-term instruments may always be the most "liquid", but that is a separate issue.)

Contrariwise, then, if we see a move to flatter or downward-sloping yield curves, this is evidence for a move to a regime with less long-run inflation risk.

- *The average slope of the yield curve can inform us about a change in regime.*

Do movements in the yield curve suggest an "anchored expectations" regime? I see no such evidence in Figures 3 and Figure 4. If anything, the average yield curve is more upward sloping, since the dips have lasted longer and the long rates stayed flatter through them, and the periods of inversion have been smaller and shorter.

The risk premium can potentially distinguish "anchored expectations" from a stable price level. A commitment to a stable *price level* should have a much larger effect on the risk premium. For example, if the expected inflation rate is constant, $\pi_t = E\pi + \varepsilon_t$, then the real value of a 30 year bond has variance $30\sigma_\varepsilon^2$. If the expected price level is constant, $p_t = Ep + \varepsilon_t$, then the real value of a 30 year bond has variance σ_ε^2. Conversely, this calculation shows the potentially important advantages of a price-level, rather than inflation-rate commitment. TIPS exist (though economists may hold 100% of them), but most debt is still nominal. A price-level commitment can remove an unwanted risk premium from, for example, 30 year mortgage rates.

Of course, the risk premium depends not just on the *variance*, but on the *covariance* – the risks (inflation if long, real-rate if short) of long-term investing must covary with marginal utility in order to generate a premium, and to fully connect monetary regimes and risk premiums, we need to understand why people care about inflation risk. In a neutral model with varying inflation, yield curves still slope down. In a previous *Macro Annual* paper on this subject Piazzesi and Schneider (2007) construct a model in which inflation risk is real, and does deliver a positively-sloped yield curve. Measuring risk premiums and testing whether they have declined is also the sort of question one can and should address quantitatively, rather than just by staring at graphs, but this has not been done yet.

3.2 Conditional risk premiums

Risk premiums are not constant:

- *Expected bond returns vary through time. Expected returns are high in recessions.*

The evidence for time-varying risk premiums comes from regressions. For example, Cochrane and Piazzesi (2008, Table 1) regress the excess returns from holding long-term bonds, less the one-year rate, on five forward rates,

$$rx_{t+1} = a + \beta_1 y_t^{(1)} + \beta_2 f_t^{(2)} + ...\beta_5 f_t^{(5)} + \varepsilon_{t+1},$$

obtaining R^2 values as high as 0.44. The expectations hypothesis – long yield is average of expected future short yields – is the same thing as the statement that expected returns on different maturities are the same, so by finding that returns are forecastable, we also find that current long rates do not correspond to expected future spot rates.

In the context of Figure 3 and Figure 4, look at any of the episodes in which the one-year rate falls for an extended period of time. During this entire period, the long rates are "forecasting" a rise in short rates. Early in the periods, that forecast is wrong – short rates keep going down, and long-term bond holders make money. Late in the periods, the forecast is right – short rates do rise. The regression shows a fact you can see in the graphs if you look hard: given a typical period of upward sloping yield curve, short rates almost never come up *faster* than long rates predict. The regressions say you can reliably make money in the initial periods of low short rates and high long rates. This finding is no surprise: it is a recession, nobody wants to hold risk. The same pattern extends to stocks (variables that forecast bond returns also forecast stock returns) and foreign exchange (low interest rates relative to foreign rates forecast good returns for holding exchange rate risk). We seem to see a single, large, business-cycle related variation in risk premium.

We are entering one of these episodes as I write in the Spring of 2008. The Fed is practically begging banks to borrow at low short rates and hold longer term debt. They are so far proving remarkably unwilling to do so, certainly compared to their behavior a year ago. This is the smell of "increasing risk aversion" to holding all sorts of risky assets.

Now the big question:

- *Are time-varying risk premiums important to understanding monetary big pictures, or are they just some little short-term finance phenomenon that tacks an epicycle on the same big picture? (As, for example, liquidity premiums seem to be.)*

There is evidence that the expectations hypothesis works better in the long run. For example, Fama and Bliss (1987) regressions show that, although the two-year forward rate does nothing to predict interest rate changes, the *five* - year forward rate forecasts five year interest rate changes exactly as the expectations hypothesis predicts. I think risk premiums have been ignored in macroeconomic discussions on this general feeling that the overall level

of long term yields and the connection to monetary policy can be well-enough understood via the expectations hypothesis.

This is not true, and that is one major point of this paper. Let me show you another way to make this point. Cochrane and Piazzesi (2008) extend risk-premium regressions to produce a yield-curve decomposition – to calculate at any date how much of a long-term bond yield or forward rate corresponds to expected future spot rates, and how much corresponds to a risk premium. (These calculations are a somewhat more sophisticated version of Atkeson and Kehoe's calculation on p. 14. The main difference is that Atkeson and Kehoe model expected returns as an AR(1). We find that slope and curvature movements forecast future expected returns as well as past expected returns, so we forecast expected returns with a VAR involving all term structure factors. We also impose the structure of an arbitrage-free model.)

Figures 7 and 8 presents two of our preliminary results. In the expectations hypothesis view, the 5 and 10 year forward rates are equal to the expected one year rate 4 and 9 years in the future. The red line presents our estimate of the actual expected future one-year interest rates. The vertical distance between these expected interest rates and the forward rates represents the forward premium. (Yields paint a similar picture). You can see that risk premiums are not a small affair:

- *Including time-varying risk premiums gives a dramatically different view of interest rates.*

For example, consider the two dips in the early 1990s and 2000s. In the conventional view, the short rate drops, but it is expected to return within 5 years (top) or at least 10 years (bottom), as the 5 and 10 year forward rates barely budge during the episodes. In fact, taking account of risk premiums, we see that the 5 and 10 year expected interest rates fall just as fast as the one year rate. In the early parts of recessions, the spread between forward and current spot rate is *entirely* due to risk premium, and *not at all* due to expected changes in interest rates. After a while, though, the recession ends, and it becomes clear that short rates will rise quickly. Risk premiums fall and the forward rate now reflects expected future interest rates.

Are these volatile interest-rate forecasts reasonable? In the early 2000s, economists, the Fed, and commentators were writing about deflation, helicopter drops, liquidity effects, zero bounds on nominal rates and avoiding the Japanese experience[2]. An expectation that the low interest rate environment might last quite a while, rather than be quickly reversed,seems

[2] A small sampling, taken from a quick search of NBER working papers includes Auerbach and Obstfeld (2004) "Monetary And Fiscal Remedies For Deflation," Atkeson and Kehoe (2004) "Deflation And Depression: Is There An Empirical Link?," Svensson (2003) "Escaping From A Liquidity Trap And Deflation: The Foolproof Way And Others," Buiter (2004), "Deflation: Prevention and Cure", Eggertsson and Woodford (2004), "Policy Options In A Liquidity Trap," Buiter(2003) "Helicopter Money: Irredeemable Fiat Money and the Liquidity Trap," Eggertsson and Woodford. (2003) "The Zero Bound On Interest Rates And Optimal Monetary Policy."

Good examples from the Fed include Ben Bernanke (2002) "Deflation: Making Sure 'It' Doesn't Happen Here" and (2003) "An unwelcome fall in inflation?" The FOMC (2003) May 6 statement, for example, echoed this view: "The Federal Open Market Committee decided to keep its target for the federal funds rate

at least plausible. As I write we are entering another one of these episodes. What is the chance that interest rates will quickly rise, so that banks who took the Fed's offer to borrow short and lend long will end up losing money? If you think this is unlikely, then you think there is a risk premium, and that expected future interest rates are below long rates.

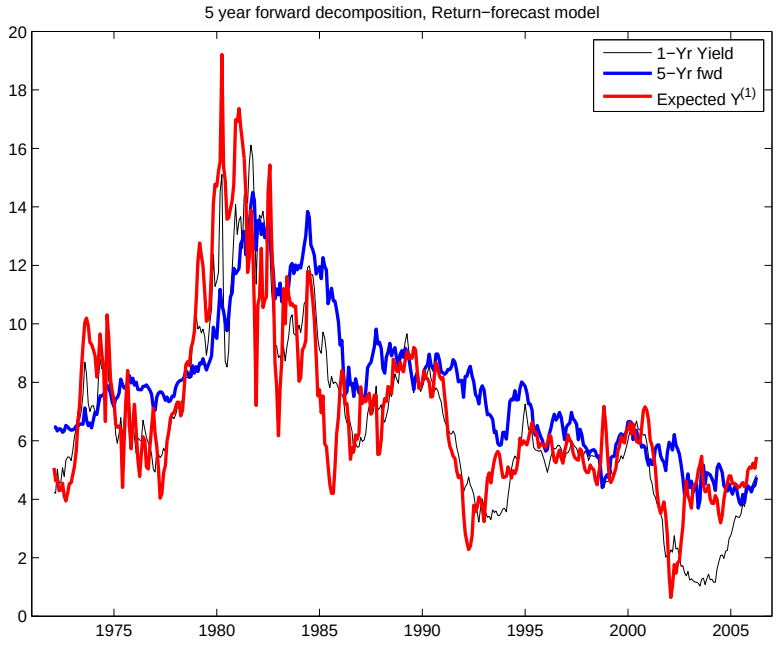

Figure 7: Current one-year rate $y_t^{(1)}$, 5 year forward rate $f_t^{(5)}$, and expected one-year rate $E_t y_{t+4}^{(1)}$ computed from estimated affine model in Cochrane and Piazzesi (2008).

In sum, we see a major difference in the interpretation of long-term yield data.

- *Expected future interest rates follow current rates more closely than they follow forward rates (or long yields).*

Just by staring at the graph, I have to disagree with Atkeson and Kehoe's main conclusion however.

- *Expected future interest rates, measured including risk premiums, still vary a great deal, arguing against a shift to "anchored expectations"*

Taking account of risk premium makes the case for anchored expectations much worse. Perhaps, if we treat the forward rates lines of Figures 7 and 8 as direct expectation measures, we might think that long-horizon expected interest rates are becoming more stable over time.

unchanged at 1-1/4 percent.... the probability of an unwelcome substantial fall in inflation, though minor, exceeds that of a pickup in inflation from its already low level..."

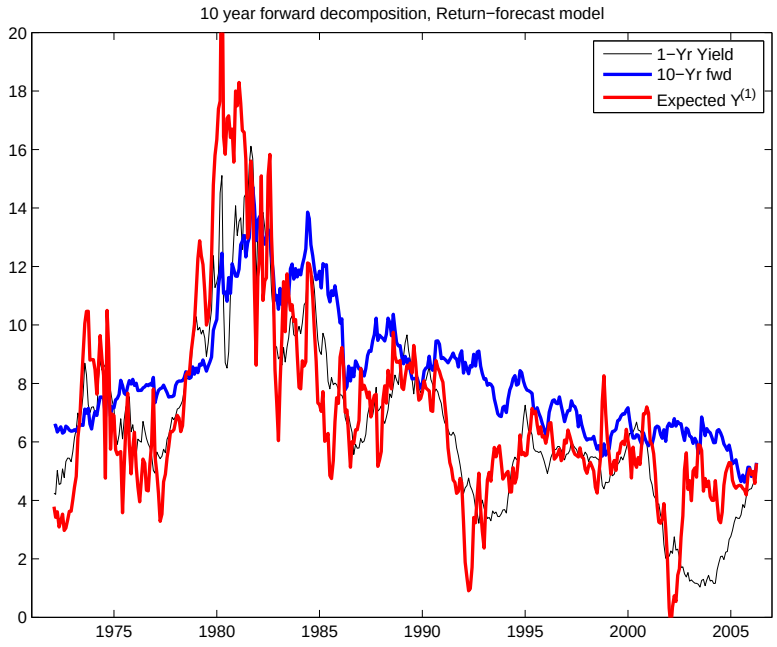

Figure 8: Current one-year rate $y_t^{(1)}$, 10 year forward rate $f_t^{(10)}$, and expected one-year rate $E_t y_{t+9}^{(1)}$ computed from estimated affine model in Cochrane and Piazzesi (2008).

But the actual expected interest rates are much more volatile, even at a 10 year horizon. (Once again, this is the sort of question that's amenable to statistical analysis and not just staring at graphs.)

The fall in the 10-year forward rate in 2005 which you can see in Figure 8 was really the centerpiece of the "conundrum" discussion. The central question was whether this movement

was a fall in expected inflation or a risk premium, and what that meant for monetary policy.[3] Yes, the graph can be read that much of the fall corresponded to a decline in risk premium – or a failure of the short rate to rise as fast as it had in past events. However, there was nothing "unprecedented" about it – risk premiums are always low in booms, as they were in 1989 and 1996. Therefore, I do not see any regime shift towards anchored expectations even in this widely-reported event. (Also, ocular standard errors suggest there is not much point to worrying about the last 50 basis points of such decompositions anyway.)

[3]In February 2005 Chairman Alan Greenspan (2005a) said

> In the current episode, however, the more-distant forward rates declined at the same time that short-term rates were rising. Indeed, the tenth-year tranche, which yielded 6-1/2 percent last June, is now at about 5-1/4 percent. During the same period, comparable real forward rates derived from quotes on Treasury inflation-indexed debt fell significantly as well, suggesting that only a portion of the decline in nominal forward rates in distant tranches is attributable to a drop in long-term inflation expectations....
>
> For the moment, the broadly unanticipated behavior of world bond markets remains a conundrum.

In June (Greenspan 2005b) he elaborated

> The pronounced decline in U.S. Treasury long-term interest rates over the past year despite a 200-basis-point increase in our federal funds rate is clearly without recent precedent. The yield on ten-year Treasury notes currently is at about 4 percent, 80 basis points less than its level of a year ago...

The remainder of the speech contained a list of "forces" that might be at work, including demands of large players including foreign governments. The latter are economically the same as changes in risk premiums.

Governor Donald Kohn (2005) elaborated, including our "anchored" discussion:

> Nothing better illustrates the need to properly account for risk premiums than the current interest rate environment: To what extent are long-term interest rates low because investors expect short-term rates to be low in the future... and to what extent do low long rates reflect narrow term premiums, perhaps induced by well-anchored inflation expectations or low macroeconomic volatility? Clearly, the policy implications of these two alternative explanations are very different.

Chairman Bernanke (2006) made clear how we separate yield curves into "expectation" and "risk premium" components, and how stories about "demands" by various agents are the same thing as a risk premium:

> As I have noted, each of the forward interest rates implicit in the term structure can be usefully decomposed into two parts: (1) the spot interest rate that market participants currently expect to prevail at the corresponding date in the future and (2) the additional compensation that investors require for the risk of holding longer-term instruments, known as the term premium. With the economic outlook held constant, changes in the net demand for long-term securities have their largest effect on the term premium. In particular, if the demand for long-dated securities rises relative to the supply, then investors will generally accept less compensation to hold longer-term instruments–that is, the term premium will decline.
>
> According to several of the most popular models, a substantial portion of the decline in distant-horizon forward rates over recent quarters can be attributed to a drop in term premiums. ...the decline in the premium since last June 2004 appears to have been associated mainly with a drop in the compensation for bearing real interest rate risk.

Is there evidence that this conditional risk premium has changed over time? It's hard enough to estimate forecasting regressions; estimating changes in such regressions is obviously tough.

- *The evidence we have is that, if anything, time-varying risk premiums are increasing.*

You can see this in the larger and longer-lasting swings in spreads seen in Figure 4 and the larger premiums (difference between forward rate and expected inflation) in Figures 7 and 8. Cochrane and Piazzesi (2005) present a table (Table 8a) of subsample results, which I partially reproduce below. The 1990s are the R^2 champion.

	All f	$\gamma^\top f$ only	
	R^2	$\gamma^\top f$	R^2
1964:01-2003:12	0.35	1.00	0.35
1964:01-1979:08	0.31	0.73	0.26
1979:08-1982:10	0.78	0.77	0.24
1982:10-2003:12	0.23	0.85	0.22
1964:01-1969:12	0.31	0.73	0.26
1970:01-1979:12	0.22	0.65	0.16
1980:01-1989:12	0.43	1.09	0.35
1990:01-1999:12	0.71	1.57	0.43
2000:01-2003:12	0.65	0.60	0.34

Subsample analysis of average return-forecasting regressions. The first column presents the R^2 of the regression

$$\overline{rx}_{t+1} = \gamma^\top f_t + \overline{\varepsilon}_{t+1}.$$

The second set of columns report the coefficient estimate b and R^2 from

$$\overline{rx}_{t+1} = b\left(\gamma^\top f_t\right) + \varepsilon_{t+1}$$

using the γ parameter from the full sample regression. Sample: 1964-2003.

It would be really nice to know if this aspect of the term structure is the same before and after the gold standard. A glance at Figure 1 suggests that there are time-varying risk premiums in early bond data as well, as there are persistent movements in the spread between short and long rates. Again, regressions need to be run.

3.3 Monetary policy

Atkeson and Kehoe's main point, really, is that graphs like 7 and 8 force us to rethink monetary policy. The view "policy chooses the short rate, and long rates follow by expectations hypothesis" is clearly untenable.

The obvious question is, in a period such as the current one, "Is the sharp decline in interest rates a monetary policy *shock*, or *action*, which *causes* risk premiums to rise? If so, how in the world does monetary policy cause a *risk premium* to rise so much? Or is it a *response*, part of the "systematic" or "rule" part of policy? Or is there some feedback?"

Atkeson and Kehoe advocate a fascinating view: it is a response. In their view, recessions come for reasons unrelated to the Fed, and risk premiums rise. If the Fed did not lower interest rates, long rates would have to rise dramatically[4]. The Fed stabilizes long rates (and lots of other things!) by lowering short rates in *response* to the increased risk premium, or to the macroeconomic conditions that set it off:

> Since most ..movements in the short rate at business cycle [frequencies] are movements in risk, how do we introduce time-varying risk into our monetary models?
>
> ...One approach..models time-varying risk as an exogenous feature of the real economy...The second approach...models the Fed as an active player in generating this time-varying risk...it is essential to sort out which way the causality runs: From risk to the Fed or from the Fed to risk.
>
> The exogenous risk approach suggests a new view of monetary policy. Under it, the Fed must continually adjust the short term nominal interest rate in response to time variation.

They come to this view by a survey of theory; finding no theories by which monetary policy can generate such a large risk premium, they conclude it must be a response to that premium. If I were not so sympathetic, I would point out that real theories have just as much trouble generating such a large time-varying risk premium as well.

Since none of us is writing models or running regressions, though, let me sketch an alternative possibility. Surely, no risk premium comes out of money supply and demand,

[4]Chairman Bernanke (2006) seems to agree:

> What does the historically unusual behavior of long-term yields imply for the conduct of monetary policy? The answer, it turns out, depends critically on the source of that behavior. To the extent that the decline in forward rates can be traced to a decline in the term premium, perhaps for one or more of the reasons I have just suggested, the effect is financially stimulative and argues for greater monetary policy restraint, all else being equal.....
>
> However, if the behavior of long-term yields reflects current or prospective economic conditions, the implications for policy may be quite different–indeed, quite the opposite. The simplest case in point is when low or falling long-term yields reflect investor expectations of future economic weakness. Suppose, for example, that investors expect economic activity to slow at some point in the future. If investors expect that weakness to require policy easing in the medium term, they will mark down their projected path of future spot interest rates, lowering far-forward rates and causing the yield curve to flatten or even to invert....

I read the first paragraph as exactly the sort of response Atkeson and Kehoe argue for: if the risk premium declines, the Fed should raise interest rates (and vice versa).

and how often you and I go to the ATM machine. But you and I do not get to borrow at the overnight federal funds rate, nor can we even short one year treasury bills. The main effect of drastically lowering short term rates in the quite restricted overnight market is precisely to give a greater premium to the restricted set of intermediaries who can borrow overnight and lend to you and me. *Generating* a "risk premium" seems entirely the point of current monetary policy.

And this is the sort of issue one can at least begin to analyze by running policy-rule regressions. Let me show you two known facts that bear on the issue, however.

3.3.1 Risk premiums and GDP growth.

The observation that the term structure slope forecasts GDP growth, starting with Estrella and Hardouvelis (1991) has evolved much as risk premium forecasting has evolved past slope measures such as Fama and Bliss (1987). Ang, Piazzesi and Wei (2006, Table 8) find

$$y_{t+4} - y_t = a + 1.15(5.00)EH_t - 0.47(0.30)RP_t + \varepsilon_{t+4}$$

(t statistics in parentheses) Here, EH = expectations hypothesis and RP = risk premium in the 20 quarter term spread. Similarly, Rudebusch, Sack and Swanson (2007) (Table 2) report

$$y_{t+4} - y_t = 0.38(4.22) + 0.96(5.62)(exsp_t - exsp_{t-4}) - 0.59(-1.93)(tp_t - tp_{t-4}) + \varepsilon_{t+4}$$

(t statistics in parentheses). Here, $y = GDP$, *exsp* is the expectations-hyptothesis component of the 10 year rate, and *tp* is the term premium component of the 10 year rate.

The lesson I learn from these regressions is that the second coefficient is zero. (Cochrane 2007 discusses this issue in a bit more detail.)

- *Expected* interest rates, largely driven by the slope of the yield curve, forecasts GDP growth; risk premiums do not. The risk premium, largely driven by *curvature* of the forward curve, forecasts bond returns; the expectations component does not.

As in Figures 7 and 8, risk premiums are high early in a recession, and precisely when we are not sure how long it will last.

3.3.2 Compensation for shocks

One last piece of evidence that bears on these issues

- *Interest rate risk premiums are earned entirely in compensation for the risk of "level" shocks. In particular, they do not correspond to covariances with slope, curvature, or expected-returns shocks.*

Expected returns are earned as compensation for risk – as compensation for the fact that returns are low in specific, high marginal utility states of the world. The question is, what is the nature of shocks that generate this risk premium? In equations,

$$E_t\left(rx_{t+1}^{(n)}\right) \approx cov_t(rx_{t+1}^{(n)}, v_{t+1}) \times \lambda_t \tag{1}$$

(I write $\approx$ because we use logs for bond data, which introduces a small $1/2\sigma^2$ term. One return n earns a higher premium than another because it has a larger covariance with a shock v_{t+1}. The λ or "market price of risk" is the same for all n.) In Cochrane and Piazzesi (2008) we find that bond risk premiums are entirely driven by covariance with level shocks, and not at all by the other shocks to the yield curve, including slope, expected-return, and curvature.

This kind of finance work paves the way to macroeconomic understanding. Macroeconomic events that show up as shocks to the level of interest rates generate risk premiums. Macroeconomic events that show up as shocks to the slope or other dimensions of the term structure do not. A random walk technology shock can raise interest rates at all horizons, generating a "level" shock. Expected inflation might do so as well.

3.3.3 Implications for monetary policy

These last two observations suggest to me a way to start thinking about the Atkeson-Kehoe endogeneity hypothesis.

If monetary policy does not affect risk premiums, then we might expect monetary policy shocks to give rise to a "slope" movement in the term structure – sending short yields down (a "liquidity effect"), but long yields either up ("expected inflation effect") or flat in an anchored-expectations regime. (This is another possible way to measure regime).

Thus, we are beginning to see a united view:

- *Slope movements in the term structure, monetary policy shocks, GDP forecasts, no change in risk premiums seem to go together.*
- *High-end curvature movements in the term structure, increasing risk premiums in the term structure, the onset of recessions, and monetary policy* ***responses*** *seem to go together.*

In terms of modeling, monetary policy changes interest rates and the slope of the term structure by changing the path of marginal utility growth. $P_t^{(1)} = E_t\left[u'(c_{t+1})/u'(c_t)\right]; P_t^{(2)} = E_t\left[u'(c_{t+2})/u'(c_t)\right]$. If a monetary policy shock generates no risk premium, it must not affect $u'(c_t)$. (Fundamentally, $E(R_{t+1} - R_t^f) = cov\left[R_{t+1}, u'(c_{t+1})\right] \times \lambda$) Thus, the Atkeson-Kehoe view says that monetary policy affects interest rates $1/P_t^{(1)}$ and the slope of the term structure (measures of $P_t^{(2)} - P_t^{(1)}$) only by affecting *future* expected marginal utility, with no effect on *current* marginal utility.

All of this is almost true, but not completely. First, most estimates, such as Evans and Marshall (1998), do find that monetary policy shocks mostly have a substantial slope effect on the term structure. Other estimates, and Cochrane and Piazzesi (2002) in particular, find that there is a level effect as well – monetary policy shocks move short rates more than long rates, but they move long rates as well, so they have combined level and slope effects. (The main difference is that we find longer-lasting effects in policy movements that are not anticipated by the bond markets, rather than just looking at the usual VAR shock identification.) If so, then expected returns are in fact earned in part for exposure to monetary policy shocks. Second, though a rise in slope has no effect on *current* expected returns, it does forecast *future* expected returns. Both considerations suggest at least some feedback. Third, of course, all of these facts are preliminary and need a lot of digesting. For example, Ang Piazzesi and Wei's (2006) measurement of "expected interest rates" is a good deal different than the measurement in Cochrane and Piazzesi (2008). And fourth, all facts are not really digested until there is some theory to understand them, which is a long way off.

3.4 Implications for models

Much of Atkeson and Kehoe's paper discusses the failings of models to produce substantial risk premiums in response to monetary shocks. Though the paper is clear, the following discussion seemed not to recognize the stark choice. We *either* need new models that can generate risk premiums in response to monetary policy shocks *or* we need to regard much variation in interest rates as a *response* to risk premiums generated elsewhere, which is pretty much Atkeson and Kehoe's conclusion. If we choose the latter course, the only "new theory of monetary policy" that we need is a new theory of the policy *rule,* a new theory *of the Fed*, not a new theory of monetary policy *effects*, or a new theory of the *economy.* Similarly, the paper generated much needless heat over whether "theory" could explain the rise and fall of inflation. The standard theory *of the economy* does so quite well; Atkeson and Kehoe couldn't find a theory *of the Fed* which did so, and simply labeling this absence a "lack of theory" generated confusion.

If we end up with Atkeson and Kehoe's view, much of the standard view of monetary policy *shocks* will remain. However, the often forgotten fact that monetary policy shocks explain trivial fractions of output variation and nonexistent fractions of inflation variation will remain. We will see the Fed as essentially pretty helpless, forced to move interest rates up and down in response to risk premiums. The main change will be a different view of the rule, one which puts greater weight on risk premia and less weight on output and inflation.

3.5 Summary

I have brought four risk premium facts, and opined about their implications for the economics of monetary policy and for reading regimes from bond data.

1. Unconditional risk premiums: Prewar data show a negative slope, which is what we

expect when price-level uncertainty is removed from long-term bonds. I do not see an "anchoring" in the slope since 1990.

2. Conditional risk premiums – expected bond returns change over time. Forward rates are *not* expected interest rates, with big differences in the early stage of recessions. We see even less evidence for "anchoring." The AK hypothesis: perhaps the interest rate decline is a *response* to risk premiums.

3. Output vs. risk premium forecasts. Slope variables forecast output growth, risk premium variables do not. Risk premium variables forecast bond returns, slope variables do not.

4. Compensation for risk. Expected bond returns are earned entirely as compensation for "level" – not monetary policy? – shocks.

4 Agenda

Let me sum up with the main point of agreement:

- *Risk premiums are important for the term structure, and for understanding monetary policy*

More deeply, when we think of Federal Reserve policy these days, it has essentially nothing to do with how you and I pay for coffee, and how often we go to the ATM machine. The Fed is affecting, regulating, and acting through *financial* markets, which are inherently markets for risk. Even calling it "monetary policy" seems an antiquated misnomer, we should probably call it "financial policy." *How* we will integrate Fed policy and risk premiums, which causes which and why, remains to be answered.

The main point of disagreement:

- *I see no evidence in the term structure of interest rates that we have moved to a substantially different, "anchored expectations" regime, and certainly no evidence that we have moved to the equivalent of a "prewar" or gold-standard regime with an anchored price level.*

We are both guilty of basing these conclusions on graph-staring rather than quantitative theoretical and empirical evaluation of this issue. Like many good conference papers, Atkeson and Kehoe raise more questions than they answer; they give a roadmap for interesting theoretical and empirical work to come. While that work remains to be done, I'm ready for stagflation: I'm still buying TIPs, and I still have my bell-bottom jeans and wide-lapel suit.

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