Online Appendices for

Policy Language and Information Effects in the Early Days of Federal Reserve Forward Guidance*

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*The views expressed herein are solely those of the author and do not necessarily reflect the views of the Federal Reserve Bank of Cleveland or the Federal Reserve System.

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A Forward-Looking Language in FOMC Statements

Table A.1: Forward-Looking Language in FOMC Statements from Feb 2000 to Jun 2006

Date	Funds Rate	Forward-Looking Language
02-02-00	5.75	"The Committee remains concerned that over time increases in demand will continue to exceed the growth in potential supply, even after taking account of the pronounced rise in productivity growth. Such trends could foster inflationary imbalances ... [T]he risks are weighted mainly toward conditions that may generate heightened inflation pressures in the foreseeable future."
03-31-00	6.00	Similar to 02-02-00.
05-16-00	6.50	Similar to 02-02-00.
06-28-00	6.50	"[S]igns that growth in demand is moving to a sustainable pace are still tentative and preliminary, ... the risks continue to be weighted mainly toward conditions that may generate heightened inflation pressures in the foreseeable future."
08-22-00	6.50	Similar to 6-28-00.
10-03-00	6.50	"[T]he expansion of aggregate demand has moderated to a pace closer to the enhanced rate of growth of the economy's potential to produce. ... [T]he increase in energy prices ... poses a risk of raising inflation expectations. ... [T]he risks continue to be weighted mainly toward conditions that may generate heightened inflation pressures in the future."
11-15-00	6.50	Similar to 10-03-00.
12-19-00	6.50	"[E]conomic growth may be slowing further. While some inflation risks persist, they are diminished by the more moderate pace of economic activity and by the absence of any indication that longer-term inflation expectations have increased. ... [T]he risks are weighted mainly toward conditions that may generate economic weakness in the foreseeable future."
01-31-01	5.50	"The longer-term advances in technology and accompanying gains in productivity ... exhibit few signs of abating and these gains, along with the lower interest rates, should support growth of the economy over time. ... [T]the risks are weighted mainly toward conditions that may generate economic weakness in the foreseeable future."
03-20-01	5.00	"Although current developments do not appear to have materially diminished the prospects for long-term growth in productivity, excess productive capacity has emerged recently. The possibility that this excess could continue for some time and the potential for weakness in global economic conditions suggest substantial risks that demand and production could remain soft. ... [T]the risks are weighted mainly toward conditions that may generate economic weakness in the foreseeable future."

Table A.1 Continued

Date	Funds Rate	Forward-Looking Language
05-15-01	4.00	"[I]nflation is expected to remain contained. Although measured productivity growth stalled in the first quarter, the impressive underlying rate of increase that developed in recent years appears to be largely intact, supporting longer-term prospects. ... [T]he risks are weighted mainly toward conditions that may generate economic weakness in the foreseeable future."
06-27-01	3.75	Similar to 05-15-01.
08-21-01	3.50	Similar to 05-15-01.
10-02-01	2.50	"The terrorist attacks have significantly heightened uncertainty in an economy that was already weak. ... Nonetheless, the long-term prospects for productivity growth and the economy remain favorable and should become evident once the unusual forces restraining demand abate. ... [T]he risks are weighted mainly toward conditions that may generate economic weakness in the foreseeable future."
11-06-01	2.00	Similar to 10-02-01.
12-11-01	1.75	"Economic activity remains soft, with underlying inflation likely to edge lower from relatively modest levels. ... [W]eakness in demand shows signs of abating, but those signs are preliminary and tentative. ... [T]he risks are weighted mainly toward conditions that may generate economic weakness in the foreseeable future."
01-30-02	1.75	"With the forces restraining the economy starting to diminish, and with the long-term prospects for productivity growth remaining favorable and monetary policy accommodative, the outlook for economic recovery has become more promising. The degree of any strength in business capital and household spending, however, is still uncertain. Hence, ... the risks are weighted mainly toward conditions that may generate economic weakness in the foreseeable future."
03-19-02	1.75	"[T]he economy ... is expanding at a significant pace. Nonetheless, the degree of the strengthening in final demand over coming quarters ... is still uncertain. ... [F]or the foreseeable future ... the risks are balanced with respect to the prospects for both goals."
05-07-02	1.75	Similar to 03-19-02.
06-26-02	1.75	Similar to 03-19-02.
08-13-02	1.75	"The softening in the growth of aggregate demand that emerged this spring has been prolonged ... The current accommodative stance of monetary policy, coupled with still-robust underlying growth in productivity, should be sufficient to foster an improving business climate over time. Nonetheless, ... for the foreseeable future, ... the risks are weighted mainly toward conditions that may generate economic weakness."
09-24-02	1.75	Similar to 08-13-02.
11-06-02	1.25	"[A]n accommodative stance of monetary policy, coupled with still-robust underlying growth in productivity, is providing important ongoing support to economic activity. ... Inflation and inflation expectations remain well contained. ... [T]oday's additional monetary easing should prove helpful as the economy works its way through this current soft spot. With this action ... the risks are balanced with respect to the prospects for both goals in the foreseeable future."

Table A.1 Continued

Date	Funds Rate	Forward-Looking Language
12-10-02	1.25	Similar to 11-06-02.
01-29-03	1.25	Similar to 11-06-02.
03-18-03	1.25	"[T]he Committee does not believe it can usefully characterize the current balance of risks with respect to the prospects for its long-run goals of price stability and sustainable economic growth."
05-06-03	1.25	"[T]he ebbing of geopolitical tensions has rolled back oil prices, bolstered consumer confidence, and strengthened debt and equity markets. These developments, along with the accommodative stance of monetary policy and ongoing growth in productivity, should foster an improving economic climate over time. Although the timing and extent of that improvement remain uncertain, the Committee perceives that over the next few quarters the upside and downside risks to the attainment of sustainable growth are roughly equal. In contrast, over the same period, the probability of an unwelcome substantial fall in inflation, though minor, exceeds that of a pickup in inflation from its already low level. The Committee believes that, taken together, the balance of risks to achieving its goals is weighted toward weakness over the foreseeable future."
06-25-03	1.00	"[A]n accommodative stance of monetary policy, coupled with still robust underlying growth in productivity, is providing important ongoing support to economic activity. ... The economy, nonetheless, has yet to exhibit sustainable growth. With inflationary expectations subdued, the Committee judged that a slightly more expansive monetary policy would add further support for an economy which it expects to improve over time. The Committee perceives that the upside and downside risks to the attainment of sustainable growth for the next few quarters are roughly equal. In contrast, the probability, though minor, of an unwelcome substantial fall in inflation exceeds that of a pickup in inflation from its already low level. On balance, the Committee believes that the latter concern is likely to predominate for the foreseeable future."
08-12-03	1.00	"[A]n accommodative stance of monetary policy, coupled with still-robust underlying growth in productivity, is providing important ongoing support to economic activity. ... [T]he upside and downside risks to the attainment of sustainable growth for the next few quarters are roughly equal. In contrast, the probability, though minor, of an unwelcome fall in inflation exceeds that of a rise in inflation from its already low level. The Committee judges that, on balance, the risk of inflation becoming undesirably low is likely to be the predominant concern for the foreseeable future. In these circumstances, ... policy accommodation can be maintained for a considerable period."
09-16-03	1.00	Similar to 08-12-03.
10-28-03	1.00	Similar to 08-12-03.

Table A.1 Continued

Date	Funds Rate	Forward-Looking Language
12-09-03	1.00	"[A]n accommodative stance of monetary policy, coupled with robust underlying growth in productivity, is providing important ongoing support to economic activity. ... Increases in core consumer prices are muted and expected to remain low. ... [T]he upside and downside risks to the attainment of sustainable growth for the next few quarters are roughly equal. The probability of an unwelcome fall in inflation has diminished in recent months and now appears almost equal to that of a rise in inflation. However, with inflation quite low and resource use slack, ... policy accommodation can be maintained for a considerable period."
01-28-04	1.00	"[A]n accommodative stance of monetary policy, coupled with robust underlying growth in productivity, is providing important ongoing support to economic activity. ... Increases in core consumer prices are muted and expected to remain low. ... [T]he upside and downside risks to the attainment of sustainable growth for the next few quarters are roughly equal. The probability of an unwelcome fall in inflation has diminished in recent months and now appears almost equal to that of a rise in inflation. With inflation quite low and resource use slack, the Committee ... can be patient in removing its policy accommodation."
03-16-04	1.00	Similar to 01-28-04.
05-04-04	1.00	"[A]n accommodative stance of monetary policy, coupled with robust underlying growth in productivity, is providing important ongoing support to economic activity. ... [L]ong-term inflation expectations appear to have remained well contained. ... [T]he upside and downside risks to the attainment of sustainable growth for the next few quarters are roughly equal. Similarly, the risks to the goal of price stability have moved into balance. At this juncture, ... policy accommodation can be removed at a pace that is likely to be measured."
06-30-04	1.25	"[T]he stance of monetary policy remains accommodative and, coupled with robust underlying growth in productivity, is providing ongoing support to economic activity. ... [O]utput is continuing to expand at a solid pace ... Although incoming inflation data are somewhat elevated, a portion of the increase in recent months appears to have been due to transitory factors. ... [T]he upside and downside risks to the attainment of both sustainable growth and price stability for the next few quarters are roughly equal. With underlying inflation still expected to be relatively low, ... policy accommodation can be removed at a pace that is likely to be measured."
08-10-04	1.50	"[T]he stance of monetary policy remains accommodative and, coupled with robust underlying growth in productivity, is providing ongoing support to economic activity. ... The economy nevertheless appears poised to resume a stronger pace of expansion going forward. Inflation has been somewhat elevated this year, though a portion of the rise in prices seems to reflect transitory factors. ... [T]he upside and downside risks to the attainment of both sustainable growth and price stability for the next few quarters are roughly equal. With underlying inflation still expected to be relatively low, the Committee believes that policy accommodation can be removed at a pace that is likely to be measured."

Table A.1 Continued

Date	Funds Rate	Forward-Looking Language
09-21-04	1.75	"[T]he stance of monetary policy remains accommodative and, coupled with robust underlying growth in productivity, is providing ongoing support to economic activity. ... [O]utput growth appears to have regained some traction ... [I]nflation and inflation expectations have eased in recent months. ... [T]he upside and downside risks to the attainment of both sustainable growth and price stability for the next few quarters to be roughly equal. With underlying inflation expected to be relatively low, the Committee believes that policy accommodation can be removed at a pace that is likely to be measured."
11-10-04	2.00	Similar to 09-21-04.
12-14-04	2.25	Similar to 09-21-04.
02-02-05	2.50	Similar to 09-21-04.
03-22-05	2.75	"[T]he stance of monetary policy remains accommodative and, coupled with robust underlying growth in productivity, is providing ongoing support to economic activity. ... Though longer-term inflation expectations remain well contained, pressures on inflation have picked up in recent months and pricing power is more evident. ... [W]ith appropriate monetary policy action, the upside and downside risks to the attainment of both sustainable growth and price stability should be kept roughly equal. With underlying inflation expected to be contained, ... policy accommodation can be removed at a pace that is likely to be measured."
05-03-05	3.00	Similar to 03-22-05.
06-30-05	3.25	Similar to 03-22-05.
08-09-05	3.50	Similar to 03-22-05.
09-20-05	3.75	"Output appeared poised to continue growing at a good pace before the tragic toll of Hurricane Katrina. ... While these unfortunate developments have increased uncertainty about near-term economic performance, it is the Committee's view that they do not pose a more persistent threat. Rather, monetary policy accommodation, coupled with robust underlying growth in productivity, is providing ongoing support to economic activity. Higher energy and other costs have the potential to add to inflation pressures. However, ... longer-term inflation expectations remain contained. ... [W]ith appropriate monetary policy action, the upside and downside risks to the attainment of both sustainable growth and price stability should be kept roughly equal. With underlying inflation expected to be contained, ... policy accommodation can be removed at a pace that is likely to be measured."
11-01-05	4.00	"[M]onetary policy accommodation, coupled with robust underlying growth in productivity, is providing ongoing support to economic activity that will likely be augmented by planned rebuilding in the hurricane-affected areas. The cumulative rise in energy and other costs has the potential to add to inflation pressures; however, ... longer-term inflation expectations remain contained. ... [W]ith appropriate monetary policy action, the upside and downside risks to the attainment of both sustainable growth and price stability should be kept roughly equal. With underlying inflation expected to be contained, ... policy accommodation can be removed at a pace that is likely to be measured."

Table A.1 Continued

Date	Funds Rate	Forward-Looking Language
12-13-05	4.25	"[T]he expansion in economic activity appears solid ... and longer-term inflation expectations remain contained. Nevertheless, possible increases in resource utilization as well as elevated energy prices have the potential to add to inflation pressures. ... [S]ome further measured policy firming is likely to be needed to keep the risks to the attainment of both sustainable economic growth and price stability roughly in balance."
01-31-06	4.50	"[T]he expansion in economic activity appears solid ... and longer-term inflation expectations remain contained. Nevertheless, possible increases in resource utilization as well as elevated energy prices have the potential to add to inflation pressures. ... [S]ome further policy firming may be needed to keep the risks to the attainment of both sustainable economic growth and price stability roughly in balance."
03-28-06	4.75	Similar to 01-31-06.
05-10-06	5.00	"The Committee sees growth as likely to moderate to a more sustainable pace ... and inflation expectations remain contained. Still, possible increases in resource utilization, in combination with the elevated prices of energy and other commodities, have the potential to add to inflation pressures. ... The Committee judges that some further policy firming may yet be needed to address inflation risks but emphasizes that the extent and timing of any such firming will depend importantly on the evolution of the economic outlook as implied by incoming information."
06-29-06	5.25	"[E]conomic growth is moderating ... and inflation expectations remain contained. However, the high levels of resource utilization and of the prices of energy and other commodities have the potential to sustain inflation pressures. Although the moderation in the growth of aggregate demand should help to limit inflation pressures over time, ... some inflation risks remain. The extent and timing of any additional firming that may be needed to address these risks will depend on the evolution of the outlook for both inflation and economic growth, as implied by incoming information."

B Measuring Changes in Expectations with Federal Funds Futures

This appendix describes measuring the changes in federal funds rate expectations around FOMC meetings. Let $f^0_{t-\Delta_1}$ denote the implied funds rate of the current-month futures contract shortly before an FOMC statement release. Payouts in this market are based on the average effective federal funds rate in the calendar month of the contract. Thus,

$$f^0_{t-\Delta_1} = \frac{d_0}{D_0}\bar{r}_{t-1} + \frac{D_0 - d_0}{D_0}\mathbb{E}_{t-\Delta_1}(r_t) + \mu^0_{t-\Delta}, \tag{B.1}$$

where $\bar{r}_{t-1}$ is the average funds rate that has prevailed in the current month, $\mathbb{E}_{t-\Delta_1}(r_t)$ is the rate expected to prevail after the meeting, d_0 is the day in the month of the FOMC meeting, D_0 is the number of days in the month, and $\mu^0_{t-\Delta_1}$ is a term or risk premium. The FOMC statement gives the current federal funds rate, r_t, and I assume that market participants and private forecasters do not expect another funds rate change until the next scheduled meeting. Because there are never two scheduled meetings in the same month,

$$f^0_t = \frac{d_0}{D_0}\bar{r}_{t-1} + \frac{D_0 - d_0}{D_0}r_t + \mu^0_t \tag{B.2}$$

is the implied funds rate of the current-month contract immediately after the release of a statement. The current federal funds rate policy surprise is

$$x^0_t = r_t - \mathbb{E}_{t-\Delta_1}(r_t) = \frac{D_0}{D_0 - d_0}[(f^0_t - f^0_{t-\Delta_1}) - (\mu^0_t - \mu^0_{t-\Delta_1})].$$

Following the literature, I assume that the federal funds futures term premium does not respond to the FOMC statement, implying $\mu^0_t - \mu^0_{t-\Delta_1} = 0$ and

$$x^0_t = \frac{D_0}{D_0 - d_0}(f^0_t - f^0_{t-\Delta_1}). \tag{B.3}$$

To avoid amplifying noise in this measure, I follow Gürkaynak (2005) by using the next month's contract when $D_0/(D_0 - d_0)$ is greater than four. That is, I use $x^0_t = f^1_t - f^1_{t-\Delta_1}$ with no scaling factor. Kuttner (2001), Gürkaynak, Sack, and Swanson (2005), and Nakamura and Steinsson (2018) use similar approaches.

To measure the surprise in the expected path of the federal funds rate, I again follow Gürkaynak (2005) and Gürkaynak, Sack, and Swanson (2005). Define r_{t+1} to be the funds rate that is expected to prevail following the next scheduled FOMC meeting and $f^1_{t-\Delta_1}$ to be the average implied funds rate of the month in which that meeting is held. Then

$$f^1_{t-\Delta_1} = \frac{d_1}{D_1}\mathbb{E}_{t-\Delta_1}(r_t) + \frac{D_1 - d_1}{D_1}\mathbb{E}_{t-\Delta_1}(r_{t+1}) + \mu^1_{t-\Delta_1}, \tag{B.4}$$

where d_1 is the day in the month of the next FOMC meeting, D_1 is the number of days in that month, and $\mu^1_{t-\Delta_1}$ is the corresponding term premium. Shortly after r_t is announced,

$$f^1_{t+\Delta_2} = \frac{d_1}{D_1}r_t + \frac{D_1 - d_1}{D_1}\mathbb{E}_{t+\Delta_2}(r_{t+1}) + \mu^1_{t+\Delta_2}, \tag{B.5}$$

where $\mathbb{E}_{t+\Delta_2}(r_{t+1})$ denotes the expectations for r_{t+1} that are formed shortly after the announcement. This gives market participants some time to read and respond to the FOMC announcement. Then, the expected rate change at the next FOMC meeting because of the current statement is

$$x^1_t = \mathbb{E}_{t+\Delta_2}(r_{t+1}) - \mathbb{E}_{t-\Delta_1}(r_{t+1}) = \frac{D_1}{D_1 - d_1}\left[(f^1_{t+\Delta_2} - f^1_{t-\Delta_1}) - \frac{d_1}{D_1}(r_t - \mathbb{E}_{t-\Delta_1}(r_t)) - (\mu^1_{t+\Delta_2} - \mu^1_{t-\Delta_1})\right].$$

Again, I assume that the federal funds futures term premium does not respond to the FOMC statement. Then, using $x^0_t = r_t - \mathbb{E}_{t-\Delta_1}(r_t)$ yields

$$x^1_t = \frac{D_1}{D_1 - d_1}\left[(f^1_{t+\Delta_2} - f^1_{t-\Delta_1}) - \frac{d_1}{D_1}x^0_t\right]. \tag{B.6}$$

Following this procedure, I can construct

$$x^n_t = \frac{D_n}{D_n - d_n}\left[(f^n_{t+\Delta_2} - f^n_{t-\Delta_1}) - \frac{d_n}{D_n}x^{n-1}_t\right] \tag{B.7}$$

to measure the expected rate change at the nth subsequent FOMC meeting because of the current statement. x^n_t is measured from 10 minutes before the release of the FOMC statement (indicated by Δ_1) to 20 minutes after (indicated by Δ_2). As with the current policy surprise, I use $x^n_t = f^{n+1}_{t+\Delta_2} - f^{n+1}_{t-\Delta_1}$ if $D_n/(D_n - d_n)$ is greater than 4.

C Testing for a Structural Break in Current Federal Funds Rate Surprises

This appendix provides details for testing for a structural break in the current federal funds rate surprises. The vector w_t in Equation (4) has 10 variables. The first is the change in the target federal funds rate on the FOMC meeting day, where the target federal funds rate is pulled from the Federal Reserve Bank of St. Louis's FRED database. The series code is DFEDTAR (Board of Governors of the Federal Reserve System, n.d.). The second variable is the change in the target federal funds rate from 90 days before the corresponding FOMC meeting to the day before the FOMC meeting. Variables three through six measure the current state of the economy. They are the target federal funds rate on the day before the FOMC meeting and the current quarter estimates of GDP growth, inflation measured with the GDP deflator, and the unemployment rate from the Greenbook of the corresponding FOMC meeting. The Greenbook data are from Yuriy Gorodnichenko's website, `https://eml.berkeley.edu/~ygorodni/`, for Coibion et al. (2017). See Gorodnichenko (n.d.). Variables seven through ten measure the change in the state of the business cycle. They are revisions to the current and previous quarter estimates of GDP growth and inflation measured with the GDP deflator from the Greenbook of the corresponding FOMC meeting. These data are also from Yuriy Gorodnichenko's website.

As noted in the body of the paper, I estimate Equation (4) from February 1994 to May 2006. To formally test for a break in the mean of $|\hat{u}_t|$, I follow Andrews (1993). Let T denote the 99 observations in the total sample. Then, I estimate the average of $|\hat{u}_t|$ from $t = 1, \ldots, T_1 - 1$ and again from $t = T_1, \ldots, T$, where T_1 indicates the potential break date. I do this for $T_1 = 17, \ldots, 84$, ensuring that there are always 16 observations (two years) in each sample. With these indexes, I am searching for a break between January 1997 and June 2004.

Let V_1 denote the variance of $|\hat{u}_t|$ from $t = 1, \ldots, T_1 - 1$, and let V_2 denote the variance of $|\hat{u}_t|$ from $t = T_1, \ldots, T$. Then, $V = V_1[T/(T_1 - 1)] + V_2[T/(T - T_1 + 1)]$, and the Wald statistic associated with T_1 is given by

$$W(T_1) = T \left[\frac{1}{T_1 - 1} \sum_{t=1}^{T_1 - 1} |\hat{u}_t| - \frac{1}{T - T_1 + 1} \sum_{t=T_1}^{T} |\hat{u}_t| \right]^2 V^{-1}. \tag{C.1}$$

Figure 3 in the paper plots these Wald statistics from January 1997 and June 2004. The maximum Wald statistic or sup-Wald statistic is 17.2. Let $\pi_0 = 16/99 \approx 0.16$ be the fraction of the full sample where no testing occurs either at the beginning or the end of the sample. Given, $\pi_0 \approx 0.16$, this sup-Wald statistic exceeds Andrews's (1993) 1 percent critical value. Hence, I reject the null hypothesis of no break in the mean of $|u_t|$. Further, the Wald statistics take their maximum value when T_1 corresponds to August 2003. This indicates that the structural break occurs in August 2003.

D Details of Estimation and Inference

This appendix describes the estimation and inference of Equations (6), (7), and (8) by generalized method of moments (Hansen, 1982). I begin with the joint estimation and inference of Equations (6) and (7). Define $z_t = [1, x_t^0]'$. Then, Equations (6) and (7) are

$$x_t^{path} = z_t'\alpha + m_t, \tag{D.1}$$

and

$$\Delta y_t = z_t'\beta + m_t\gamma + e_t, \tag{D.2}$$

where $\Delta y_t = y_t - y_{t-1}$, $\alpha = [\alpha_0, \alpha_1]'$ and $\beta = [\beta_0, \beta_1]'$. The moment conditions for identification are $\mathbb{E}(z_t m_t) = 0$, $\mathbb{E}(z_t e_t) = 0$, and $\mathbb{E}(m_t e_t) = 0$. These moments yield

$$\mathbb{E}[z_t(x_t^{path} - z_t'\alpha)] = 0, \tag{D.3}$$

$$\mathbb{E}[z_t(\Delta y_t - z_t'\beta - (x_t^{path} - z_t'\alpha)\gamma)] = 0, \tag{D.4}$$

and

$$\mathbb{E}[(x_t^{path} - \alpha' z_t)(\Delta y_t - z_t'\beta - (x_t^{path} - z_t'\alpha)\gamma)] = 0. \tag{D.5}$$

There are five parameters and five moments, so the model is just identified. Identification is as follows. Equation (D.3) implies

$$\alpha = [\mathbb{E}(z_t z_t')]^{-1}\mathbb{E}[z_t x_t^{path}], \tag{D.6}$$

Equations (D.4) and (D.6) imply

$$\beta = [\mathbb{E}(z_t z_t')]^{-1}\mathbb{E}[z_t \Delta y_t], \tag{D.7}$$

and Equations (D.5), (D.7), and (D.1) imply

$$\gamma = \{\mathbb{E}[(x_t^{path} - z_t'\alpha)^2]\}^{-1}\mathbb{E}[(x_t^{path} - z_t'\alpha)\Delta y_t] = [\mathbb{E}(m_t^2)]^{-1}\mathbb{E}[m_t \Delta y_t]. \tag{D.8}$$

Define $X = [x_1^{path}, \ldots, x_T^{path}]'$, $Z = [z_1, \ldots, z_T]'$, and $Y = [\Delta y_1, \ldots, \Delta y_T]'$. Then, the estimators are $\hat{\alpha} = (Z'Z)^{-1}Z'X$, $\hat{\beta} = (Z'Z)^{-1}Z'Y$, $\hat{M} = X - Z\hat{\alpha}$, and $\hat{\gamma} = (\hat{M}'\hat{M})^{-1}\hat{M}'Y$.

For inference, much of the notation follows chapter 14 of Hamilton (1994). First, collect the moments in Equations (D.3), (D.4), and (D.5) to define

$$h_t = \begin{bmatrix} z_t(x_t^{path} - z_t'\alpha) \\ z_t(\Delta y_t - z_t'\beta - (x_t^{path} - z_t'\alpha)\gamma) \\ (x_t^{path} - \alpha' z_t)(\Delta y_t - z_t'\beta - (x_t^{path} - z_t'\alpha)\gamma) \end{bmatrix} \tag{D.9}$$

so that $\mathbb{E}(h_t) = 0$. Define $g = T^{-1}\sum_{t=1}^{T} h_t$ and $\theta = [\alpha', \beta', \gamma]'$. Then, (D.9) implies

$$D' = \frac{\partial g}{\partial \theta'} = T^{-1}\begin{bmatrix} -Z'Z & \mathbf{0}_{2\times 2} & \mathbf{0}_{2\times 1} \\ Z'Z\gamma & -Z'Z & -Z'X + Z'Z\alpha \\ d_{3,1} & d_{3,2} & d_{3,3} \end{bmatrix} \tag{D.10}$$

where

$$d_{3,1} = -Z'Y + Z'Z\beta + 2(Z'X - Z'Z\alpha)\gamma \tag{D.11}$$

$$d_{3,2} = -Z'X + Z'Z\alpha \tag{D.12}$$

$$d_{3,3} = -X'X + 2X'Z\alpha - \alpha' Z'Z\alpha \tag{D.13}$$

Next, define S to be the long-run covariance matrix of h_t and define $V = (DS^{-1}D')^{-1}$. Then, define $\hat{\theta} = [\hat{\alpha}', \hat{\beta}, \hat{\gamma}]'$, $\hat{h}_t$ to be h_t evaluated at $\hat{\theta}$, and $\hat{D}$ to be D evaluated at $\hat{\theta}$. The above

estimates of $\hat{\alpha}$, $\hat{\beta}$, and $\hat{M}$ imply

$$\hat{D}' = T^{-1} \begin{bmatrix} -Z'Z & \mathbf{0}_{2\times 2} & \mathbf{0}_{2\times 1} \\ Z'Z\hat{\gamma} & -Z'Z & \mathbf{0}_{2\times 1} \\ \mathbf{0}_{1\times 2} & \mathbf{0}_{1\times 2} & -\hat{M}'\hat{M} \end{bmatrix}.$$

Finally, define $\hat{H} = [\hat{h}_1, \ldots, \hat{h}_T]'$. For Equations (6) and (7), I assume that h_t has zero autocorrelation so that $\hat{S} = T^{-1}\hat{H}'\hat{H}$. Given this, $\hat{V} = (\hat{D}\hat{S}^{-1}\hat{D}')^{-1}$, and the standard errors of $\hat{\theta}$ are the square roots of the diagonal elements of $\hat{V}/T$.

For the joint estimation of Equations (6) and (8), I first replace Δy_t with $\Delta_{12} y_{t+12} = y_{t+12} - y_t$ in the above equations. Given that $\Delta_{12} y_{t+12} - z_t'\beta - (x_t^{path} - z_t'\alpha)\gamma$ is serially correlated, it may now be the case that h_t is serially correlated. To account for this, I now compute $\hat{S}$ with the Bartlett kernel as in Newey and West (1987). To compute critical values, I use the fixed-b asymptotics in Sun (2014). Define L to be the truncation parameter for computing $\hat{S}$ and $b = L/T$. Because I am only testing one hypothesis at a time (that is, there is no joint testing that necessitates a Wald test), I define $\kappa = (e^{bc_1} + 1 + bc_1)/2$ and $K = \max\{\text{ceil}(1/(bc_2)), 1\}$, where ceil$(\cdot)$ is the ceiling function, and $c_1 = 1$ and $c_2 = 2/3$ are parameters assigned to the Bartlett kernel. See page 665 of Sun (2014). Then, the t-statistics are distributed from a student-t distribution with K degrees of freedom that is multiplied by $\sqrt{\kappa}$, giving critical values that are larger than the standard normal distribution. As an example, for the February 2000 to June 2003 sample in Table 5, I use $L = 10$, which implies $b = 0.36$, $\kappa = 1.39$ and $K = 5$. Then, the 5 percent level student-t critical value with K degrees of freedom is 2.57. Multiplying this by $\sqrt{\kappa}$ yields 3.03. Hence, for this example, the fixed-b critical value is approximately 3 standard deviations instead of approximately 2 standard deviations as with standard normal critical values.

E Discussion of Forward Guidance Shocks

This appendix discusses the estimated forward guidance shocks from Equation (6) and relates them to the FOMC's forward guidance language. See Figure 4 in the paper for the estimated forward guidance shocks and Appendix A for the forward-looking language from the FOMC's meeting statements. The purpose of this appendix is to show that the estimates of m_t generally correspond well to the FOMC's forward-looking language and provide

reasonable measures of forward guidance surprises. I note that m_t is not a measure of the stance of forward guidance. Rather, it is a measure of market participants' surprise with forward guidance, and interpreting estimates of m_t may involve assessing market expectations immediately prior to the release of FOMC statements.

From February 2000 to June 2003, m_t is driven primarily by the economic outlook. For the first seven meetings of 2000, the FOMC stated that the economic outlook risks were weighted toward "heightened inflation." Given this, market participants naturally expected a higher path for the federal funds rate over and above what could be predicted from current funds rate changes, and m_t is positive for the first seven meetings of 2000. In December 2000, the FOMC switched the economic outlook risks to being weighted toward "weakness," and this assessment persisted through the January 2002 meeting. Correspondingly, estimates of m_t for these meetings are predominantly negative. The estimate at the March 2001 meeting is particularly large in magnitude. In that statement, the FOMC noted that excess productive capacity could continue for some time and that global economic weakness suggested substantial risks that demand and production could remain soft. The FOMC described the risks as "balanced" at the March, May, and June 2002 meetings, and m_t is small in magnitude for each of those meetings. At the August 2002 meeting, the FOMC switched back to describing the risks as weighted toward "weakness," giving a negative m_t. The remaining large values (in magnitude) of m_t for this early sample occur for the May and June 2003 meetings. At the May 2003 meeting, the FOMC stated that the balance of risks is "weighted toward weakness," with an emphasis on a potential fall in inflation, and m_t is negative. The FOMC used similar language in the June 2003 statement, yet m_t is positive. To understand this, the *Wall Street Journal* wrote that many market participants expected a 50 basis point cut in the funds rate, but the FOMC only delivered a 25 point cut (Ip, 2003). The federal funds futures market bears this out with a +13 basis point surprise in the current funds rate. Further, the FOMC "judged that a *slightly* more expansive monetary policy" [emphasis added] would support the economy. Together, the positive surprise in the current rate and the statement of only slightly more accommodative policy pulled up the funds rate path.

From August 2003 to May 2006, forward guidance surprises reflect both economic-outlook and policy-inclination language. For the first four meetings of the sample, the FOMC stated that "policy accommodation can be maintained for a considerable period," and m_t is negative

for three of those four meetings. The exception is December 2003 when the FOMC stated that "[t]he probability of an unwelcome fall in inflation has diminished." In January 2004, the FOMC shifted its policy stance by stating that it "can be patient in removing its policy accommodation," producing a large value of m_t. The next big surprise occurred in June 2004 when the FOMC raised the funds rate by 25 basis points and kept its "measured" language despite recognizing "elevated" inflation data. This reduced expectations of future increases of 50 basis points, pushing m_t negative. In contrast, in the August 2004 statement the FOMC expected a "stronger pace of expansion" despite a recent weak employment report, pushing m_t positive. This was followed in September 2004 by a negative m_t when the FOMC noted that "inflation expectations have eased." The next big movements in March and June 2005 accompany statements that note upward pressure on inflation, yielding positive values of m_t. In December 2005, the FOMC changed its policy-inclination language to read, "some further measured policy firming is likely to be needed." Markets took this as a sign that the tightening cycle was almost over (Ip, 2005), and m_t was negative. However, m_t was positive in January, March, and May 2006 when the FOMC noted possible further policy firming, indicating that the tightening cycle was not over yet.

The forward guidance shocks are intended to be surprises and, hence, serially uncorrelated. However, the above discussion, especially with regard to the first seven meetings of 2000, suggests that this might not be the case. Because of this, I test the null hypothesis that the autocovariances of m_t are zero against the alternative that the autocovariances are different from zero. I do this separately for the February 2000 to June 2003 sample and the August 2003 to May 2006 sample. I note that within each sample, m_t is mean zero by construction. Hence, the first autocovariance is $\gamma(1) = \mathbb{E}(m_t m_{t-1})$. Define, $\xi_{1,t} = m_t m_{t-1}$ for $t = 2, \ldots, T$, where T is the sample size. Then, $\hat{\gamma}(1) = T^{-1} \sum_{t=2}^{T} \xi_{1,t}$, $\hat{W}_1 = T^{-1} \sum_{t=2}^{T} (\xi_{1,t} - \hat{\gamma}(1))^2$, and the t-statistic is $\hat{\gamma}(1)/\sqrt{\hat{W}_1/T}$. In general, for the jth autocovariance, I use $\xi_{j,t} = m_t m_{t-j}$ for $t = j+1, \ldots, T$, $\hat{\gamma}(j) = T^{-1} \sum_{t=j+1}^{T} \xi_{j,t}$, $\hat{W}_j = T^{-1} \sum_{t=j+1}^{T} (\xi_{j,t} - \hat{\gamma}(j))^2$, and a t-statistic of $\hat{\gamma}(j)/\sqrt{\hat{W}_j/T}$. For the February 2000 to June 2003 sample, I find a t-statistic of 1.9 on the first autocovariance. This rejects the null of an autocovariance equal to zero at the 10 percent level, suggesting some evidence of serial correlation. For the second and third autocovariances, I fail to reject the null hypothesis of an autocovariance equal to zero. For the August 2003 to May 2006 sample, I fail to reject the null hypotheses of autocovariances equal to zero for the first three autocovariances.

These results indicate that some evidence of serial correlation in m_t is present from February 2000 to June 2003, but there is no evidence of serial correlation in m_t from August 2003 to May 2006. I note that essentially all of the serial correlation from February 2000 to June 2003 is in the first seven FOMC meetings. In particular, if I drop the first two meetings of the sample, February 2000 and March 2000, then the t-statistic for $\gamma(1)$ falls to 1.4. However, when I drop these observations, the main results in Tables 1 through 5 of the paper are essentially unchanged. Hence, while there is some evidence of serial correlation in m_t early in my sample, I can drop these observations and eliminate the serial correlation without affecting the main results in the paper.

F Separate Identification of Economic-Outlook and Policy-Inclination Forward Guidance

This appendix gives one example for how the effects of the economic-outlook and policy-inclination aspects of forward guidance may be separately identified. In addition, it shows a data limitation that prevents this identification.

This appendix models the economic-outlook and policy-inclination aspects of forward guidance as generating two separate and independent economic shocks. The economic-outlook shock is present from February 2000 to June 2003, and both shocks are present from August 2003 to May 2006. This implies that the variance of m_t should increase from February 2000 to June 2003 to August 2003 to May 2006. However, this variance does not actually increase in the data, and this is the limitation that prevents separate identification.

Rewrite Equations (6) and (7) as

$$x_t^{path} = \alpha_0 + \alpha_1 x_t^0 + m_{1,t} + m_{2,t} \tag{F.1}$$

and

$$\Delta y_t = \beta_0 + \beta_1 x_t^0 + \gamma_1 m_{1,t} + \gamma_2 m_{2,t} + e_t, \tag{F.2}$$

where $\Delta y_t = y_t - y_{t-1}$, $m_{1,t}$ is a measure of economic-outlook forward guidance and $m_{2,t}$ is a measure of policy-inclination forward guidance. I use the following moment assumptions for identification. First, $\mathbb{E}(x_t^0 m_{1,t}) = 0$, $\mathbb{E}(x_t^0 m_{2,t}) = 0$, and $\mathbb{E}(m_{1,t} m_{2,t}) = 0$. These assumptions impose mutual orthogonality of the monetary policy shocks. Second, I assume $\mathbb{E}(m_{1,t}) = 0$

and $\mathbb{E}(m_{2,t}) = 0$. Third, I assume $\mathbb{E}(x_t^0 e_t) = 0$, $\mathbb{E}(m_{1,t} e_t) = 0$ and $\mathbb{E}(m_{2,t} e_t) = 0$, which allows for identification of the parameters in Equation (F.2). Fourth, I assume $\mathbb{E}(m_{1,t}^2) = \sigma_{m_1}^2$, where $\sigma_{m_1}^2$ is the same in both the February 2000 to June 2003 sample and the August 2003 to May 2006 sample. Fifth, I assume that $m_{2,t} = 0$ from February 2000 to June 2003 so that $\mathbb{E}(m_{2,t}^2) = 0$ over this sample. Sixth, I assume that $\mathbb{E}(m_{2,t}^2) = \sigma_{m_2}^2 > 0$ from August 2003 to May 2006. Finally, in addition to these moment conditions, I assume that γ_1 is the same in both the February 2000 to June 2003 sample and the August 2003 to May 2006 sample.

As in Appendix D, define $z_t = [1, x_t^0]'$. Then, $\alpha = [\mathbb{E}(z_t z_t')]^{-1} \mathbb{E}[z_t x_t^{path}]$. Note that α can be estimated over the whole February 2000 to May 2006 sample or separately on the February 2000 to June 2003 and on the August 2003 to May 2006 samples. Given α, $m_{1,t} = x_t^{path} - z_t'\alpha$ on the February 2000 to June 2003 sample. Then, $\sigma_{m_1}^2 = \mathbb{E}[(x_t^{path} - z_t'\alpha)^2]$ and

$$\gamma_1 = \frac{\mathbb{E}(\Delta y_t m_{1,t})}{\mathbb{E}(m_{1,t}^2)} = \frac{\mathbb{E}(\Delta y_t m_{1,t})}{\sigma_{m_1}^2}$$

on the February 2000 to June 2003 sample.

Next, given α, $m_{1,t} + m_{2,t} = x_t^{path} - z_t'\alpha$ on the August 2003 to May 2006 sample. Then, $\sigma_{m_1}^2 + \sigma_{m_2}^2 = \mathbb{E}[(x_t^{path} - z_t'\alpha)^2]$ on the August 2003 to May 2006 sample, and $\sigma_{m_2}^2$ can be estimated by subtracting $\sigma_{m_1}^2$ from the February 2000 to June 2003 sample. Next,

$$\gamma_2 = \frac{\mathbb{E}(\Delta y_t m_{2,t})}{\mathbb{E}(m_{2,t}^2)} = \frac{\mathbb{E}(\Delta y_t m_{2,t})}{\sigma_{m_2}^2}$$

on the August 2003 to May 2006 sample. However, $m_{2,t}$ cannot be directly observed or estimated. Because of this, I use the following approach. Rewrite (F.2) to be

$$\Delta y_t = \beta_0 + \beta_1 x_t^0 + \delta(m_{1,t} + m_{2,t}) + w_t, \tag{F.3}$$

where $w_t = \gamma_1 m_{1,t} + \gamma_2 m_{2,t} - \delta(m_{1,t} + m_{2,t}) + e_t$ and δ has a value such that $\mathbb{E}[(m_{1,t} + m_{2,t}) w_t] =$

0. Then,

$$\begin{aligned}\delta &= \frac{\mathbb{E}[\Delta y_t(m_{1,t}+m_{2,t})]}{\mathbb{E}[(m_{1,t}+m_{2,t})^2]} \\ &= \frac{\mathbb{E}(\Delta y_t m_{1,t})}{\mathbb{E}[(m_{1,t}+m_{2,t})^2]} + \frac{\mathbb{E}(\Delta y_t m_{2,t})}{\mathbb{E}[(m_{1,t}+m_{2,t})^2]} \\ &= \gamma_1 \frac{\sigma^2_{m_1}}{\sigma^2_{m_1}+\sigma^2_{m_2}} + \gamma_2 \frac{\sigma^2_{m_2}}{\sigma^2_{m_1}+\sigma^2_{m_2}},\end{aligned}$$

which decomposes the joint effects of the two aspects of forward guidance into their separate effects scaled by their variance contributions to $m_{1,t}+m_{2,t}$. This implies

$$\gamma_2 = \frac{\sigma^2_{m_1}+\sigma^2_{m_2}}{\sigma^2_{m_2}}\left[\delta - \gamma_1 \frac{\sigma^2_{m_1}}{\sigma^2_{m_1}+\sigma^2_{m_2}}\right].$$

Hence, the effects of policy-inclination forward guidance are identified. Further, γ_1 and $\sigma^2_{m_1}$ are estimated from February 2000 to June 2003, δ and $\sigma^2_{m_1}+\sigma^2_{m_2}$ are estimated from August 2003 to May 2006, and $\sigma^2_{m_2}$ is the difference between $\sigma^2_{m_1}+\sigma^2_{m_2}$ and $\sigma^2_{m_1}$.

The data limitation that prevents the estimation of γ_2 is that the variance of $m_{1,t}$ from February 2000 to June 2003 is larger than the variance of $m_{1,t}+m_{2,t}$ from August 2003 to May 2006. I note this in Section 4 in reference to Figure 4. This result is problematic because it will give an estimate of $\sigma^2_{m_2}$ that is negative from August 2003 to May 2006. Hence, the moment conditions used for separate identification are violated in the data.

Modeling the economic-outlook and policy-inclination aspects of forward guidance as generating two separate and independent economic shocks is not the only way to model forward guidance. For example, Andrade et al. (2019) model forward guidance as an announcement about how long interest rates will be pegged. (Andrade et al. (2019) study the post-2008 zero lower bound period and assume that interest rates are pegged at 0 percent, but they could also model a peg at 1 percent as was the case in 2003 and 2004.) Forward guidance of this nature may give the central bank better control over the whole yield curve – not just the current interest rate – and generate the drop in m_t that is observed in the data. That is, in reference to the model in this appendix, it may cause a drop in $\sigma^2_{m_1}$. Hence, this appendix should be viewed as just one (unsuccessful) attempt to separately identify the economic-outlook and policy-inclination aspects. Other, more fruitful, approaches may be possible.

G The Chow Test via Dummy Variables

This appendix describes the Chow (1960) test via Gujarati (1970a,b) regressions with dummy variables. In addition, it presents the results of the tests.

I begin by estimating the effects of federal funds rate and forward guidance surprises on financial variables and Blue Chip forecasts. Equations (6) and (7) become

$$x_t^{path} = z_t'\alpha + d_t z_t'\delta + m_t, \tag{G.1}$$

and

$$\Delta y_t = z_t'\beta + d_t z_t'\lambda + m_t\gamma + d_t m_t\phi + e_t, \tag{G.2}$$

where $\Delta y_t = y_t - y_{t-1}$ and d_t is a dummy variable that takes the value 0 from February 2000 to June 2003 and the value 1 from August 2003 to May 2006. The moment conditions for identification are $\mathbb{E}(z_t m_t) = 0$, $\mathbb{E}(z_t d_t m_t) = 0$, $\mathbb{E}(z_t e_t) = 0$, $\mathbb{E}(z_t d_t e_t) = 0$, $\mathbb{E}(m_t e_t) = 0$, and $\mathbb{E}(m_t d_t e_t) = 0$. These moments yield

$$\mathbb{E}[z_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)] = 0,$$

$$\mathbb{E}[z_t d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)] = 0,$$

$$\mathbb{E}[z_t(\Delta y_t - z_t'\beta - d_t z_t'\lambda - (x_t^{path} - z_t'\alpha - d_t z_t'\delta)\gamma - d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\phi)] = 0,$$

$$\mathbb{E}[z_t d_t(\Delta y_t - z_t'\beta - d_t z_t'\lambda - (x_t^{path} - z_t'\alpha - d_t z_t'\delta)\gamma - d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\phi)] = 0,$$

$$\mathbb{E}[(x_t^{path} - \alpha' z_t - \delta' z_t d_t)(\Delta y_t - z_t'\beta - d_t z_t'\lambda - (x_t^{path} - z_t'\alpha - d_t z_t'\delta)\gamma - d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\phi)] = 0,$$

and

$$\mathbb{E}[(x_t^{path} - \alpha' z_t - \delta' z_t d_t) d_t(\Delta y_t - z_t'\beta - d_t z_t'\lambda - (x_t^{path} - z_t'\alpha - d_t z_t'\delta)\gamma - d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\phi)] = 0.$$

Using $d_t^2 = d_t$, we have

$$\begin{bmatrix}\alpha \\ \delta\end{bmatrix} = \begin{bmatrix}\mathbb{E}(z_t z_t') & \mathbb{E}(d_t z_t z_t') \\ \mathbb{E}(d_t z_t z_t') & \mathbb{E}(d_t z_t z_t')\end{bmatrix}^{-1} \begin{bmatrix}\mathbb{E}(z_t x_t^{path}) \\ \mathbb{E}(z_t d_t x_t^{path})\end{bmatrix},$$

$$\begin{bmatrix}\beta\\ \lambda\end{bmatrix} = \begin{bmatrix}\mathbb{E}(z_t z_t') & \mathbb{E}(d_t z_t z_t')\\ \mathbb{E}(d_t z_t z_t') & \mathbb{E}(d_t z_t z_t')\end{bmatrix}^{-1} \begin{bmatrix}\mathbb{E}(z_t \Delta y_t)\\ \mathbb{E}(z_t d_t \Delta y_t)\end{bmatrix},$$

and

$$\begin{bmatrix}\gamma\\ \phi\end{bmatrix} = \begin{bmatrix}\mathbb{E}(m_t^2) & \mathbb{E}(d_t m_t^2)\\ \mathbb{E}(d_t m_t^2) & \mathbb{E}(d_t m_t^2)\end{bmatrix}^{-1} \begin{bmatrix}\mathbb{E}(m_t \Delta y_t)\\ \mathbb{E}(m_t d_t \Delta y_t)\end{bmatrix}.$$

For estimation, use the definitions of X, Z, and Y in Appendix D. Define $\tilde{Z} = [d_1 z_1, \ldots, d_T z_T]'$ and $Z_+ = [Z, \tilde{Z}]$. Then, the estimators are as follows: $[\hat{\alpha}', \hat{\delta}']' = (Z_+' Z_+)^{-1} Z_+' X$, $[\hat{\beta}', \hat{\lambda}']' = (Z_+' Z_+)^{-1} Z_+' Y$, and $\hat{M} = X - Z_+[\hat{\alpha}', \hat{\delta}']'$. Define $\tilde{M} = [d_1 \hat{m}_1, \ldots, d_T \hat{m}_T]'$, where $\hat{m}_t$ is the tth element of $\hat{M}$, and $M_+ = [\hat{M}, \tilde{M}]$. Then, $[\hat{\gamma}, \hat{\phi}]' = (M_+' M_+)^{-1} M_+' Y$.

For inference, define

$$h_t = \begin{bmatrix}
z_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\\
z_t d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\\
z_t(\Delta y_t - z_t'\beta - d_t z_t'\lambda - (x_t^{path} - z_t'\alpha - d_t z_t'\delta)\gamma - d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\phi)\\
z_t d_t(\Delta y_t - z_t'\beta - d_t z_t'\lambda - (x_t^{path} - z_t'\alpha - d_t z_t'\delta)\gamma - d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\phi)\\
(x_t^{path} - \alpha' z_t - \delta' z_t d_t)(\Delta y_t - z_t'\beta - d_t z_t'\lambda - (x_t^{path} - z_t'\alpha - d_t z_t'\delta)\gamma - d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\phi)\\
(x_t^{path} - \alpha' z_t - \delta' z_t d_t) d_t(\Delta y_t - z_t'\beta - d_t z_t'\lambda - (x_t^{path} - z_t'\alpha - d_t z_t'\delta)\gamma - d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\phi)
\end{bmatrix}$$

so that $\mathbb{E}(h_t) = 0$. Define $g = T^{-1}\sum_{t=1}^{T} h_t$, $\theta = [\alpha', \delta', \beta', \lambda', \gamma, \phi]'$, S to be the long-run covariance matrix of h_t, and $V = (DS^{-1}D')^{-1}$. Then, define $\hat{\theta} = [\hat{\alpha}', \hat{\delta}', \hat{\beta}', \hat{\lambda}', \hat{\gamma}, \hat{\phi}]'$, $\hat{h}_t$ to be h_t evaluated at $\hat{\theta}$, $\hat{D}$ to be D evaluated at $\hat{\theta}$. Then,

$$\hat{D}' = T^{-1}\begin{bmatrix}
-Z_+' Z_+ & \mathbf{0}_{4\times 4} & \mathbf{0}_{4\times 2}\\
Z_+' Z_+ \hat{\gamma} + (\mathbf{1}_{2\times 2} \otimes \tilde{Z}'\tilde{Z})\hat{\phi} & -Z_+' Z_+ & \mathbf{0}_{4\times 2}\\
\mathbf{0}_{2\times 4} & \mathbf{0}_{2\times 4} & -M_+' M_+
\end{bmatrix}.$$

Finally, define $\hat{H} = [\hat{h}_1, \ldots, \hat{h}_T]'$. When estimating Equations (G.1) and (G.2), I assume that h_t has zero autocorrelation so that $\hat{S} = T^{-1}\hat{H}'\hat{H}$. Given this, $\hat{V} = (\hat{D}\hat{S}^{-1}\hat{D}')^{-1}$, and the standard errors of $\hat{\theta}$ are the square roots of the diagonal elements of $\hat{V}/T$.

Next, I estimate the effects of federal funds rate and forward guidance surprises on macroeconomic variables. I modify Equation (D.2) to be

$$y_{t+12} - y_t = z_t'\beta + d_t z_t'\lambda + m_t\gamma + d_t m_t\phi + e_{t+12}. \tag{G.3}$$

Table G.1: Responses of Stock Prices and Volatility to Funds Rate and Forward Guidance Changes

Dependent Variable	Funds Rate		Forward Guidance	
	Early Sample	Dummy	Early Sample	Dummy
S&P 500	-7.90^{***}	-0.18	9.88^{**}	-33.21^{***}
	(2.07)	(16.30)	(4.29)	(7.79)
VIX	3.57^{**}	5.96	-2.22	23.00^{***}
	(1.72)	(14.85)	(3.99)	(7.10)

Notes: The Funds Rate columns display the estimates of β_1 and λ_1 from Equation (G.2). The estimates of β_1 are in the early sample column and the estimates of λ_1 are in the dummy column. The Forward Guidance columns display the estimates of γ and ϕ from Equation (G.2). The estimates of γ are in the early sample column and the estimates of ϕ are in the dummy column. Standard errors are shown in parentheses. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively.

For the joint estimation of Equations (G.1) and (G.3), I first replace Δy_t with $\Delta_{12} y_{t+12} = y_{t+12} - y_t$ in the above matrices. Given that $\Delta_{12} y_{t+12} - z_t'\beta - d_t z_t'\lambda - (x_t^{path} - z_t'\alpha - d_t z_t'\delta)\gamma - d_t(x_t^{path} - z_t'\alpha - d_t z_t'\delta)\phi$ is serially correlated, it may now be the case that h_t is serially correlated. To account for this, I compute $\hat{S}$ with the Bartlett kernel as in Newey and West (1987). To compute critical values, I use the fixed-b asymptotics in Sun (2014). These critical values are computed exactly as in Appendix D. The truncation parameter is 10 and the sample size is 51 so that $b = 0.20$, $\kappa = 1.21$ and $K = 8$.

Tables G.1, G.2, G.3, G.4, and G.5 display the results. In these tables, the estimates of β and γ along with their standard errors are the same as the estimates for February 2000 to June 2003 presented in the body of the paper. This is because the dummy variable is 0 in the early sample and 1 in the late sample. Hence, in the tables, I refer to the estimates of β and γ as the "early sample" results. The coefficient estimates on the dummied variables, $\hat{\lambda}$ and $\hat{\phi}$, give the difference between the estimates for the February 2000 to June 2003 sample and the August 2003 to May 2006 sample presented in the body of the paper. That is, $\hat{\beta} + \hat{\lambda}$ and $\hat{\gamma} + \hat{\phi}$ are the same as the estimates for August 2003 to May 2006 presented in the body of the paper. Hence, I present $\hat{\lambda}$ and $\hat{\phi}$ along with their standard errors in the "dummy" columns of the tables. Proofs of these results for β and λ follow from $\tilde{Z}'Z = Z'\tilde{Z} = \tilde{Z}'\tilde{Z}$, the

Table G.2: Responses of Treasury Yields and Term Premia to Funds Rate and Forward Guidance Changes

Dependent Variable	Funds Rate		Forward Guidance	
	Early Sample	Dummy	Early Sample	Dummy
Treasury Yields:				
2-Year	0.21	2.93***	0.92***	1.37***
	(0.24)	(1.13)	(0.21)	(0.47)
5-Year	0.10	1.95*	0.61***	1.43***
	(0.17)	(1.05)	(0.19)	(0.46)
7-Year	0.08	1.35	0.42**	1.40***
	(0.14)	(0.99)	(0.17)	(0.43)
10-Year	0.09	0.79	0.22	1.35***
	(0.12)	(0.92)	(0.16)	(0.41)
Term Premia:				
2-Year	-0.09	0.64	-0.02	0.76***
	(0.07)	(0.44)	(0.09)	(0.22)
5-Year	-0.10	-0.42	−0.27**	0.75***
	(0.10)	(0.51)	(0.11)	(0.26)
7-Year	-0.08	-0.81	−0.37***	0.75**
	(0.13)	(0.58)	(0.14)	(0.29)
10-Year	-0.05	-1.10	−0.47***	0.79**
	(0.16)	(0.67)	(0.16)	(0.34)
Expected Path of Short-Term Rates:				
2-Year	0.30	2.30***	0.95***	0.61*
	(0.20)	(0.83)	(0.17)	(0.33)
5-Year	0.20	2.36***	0.88***	0.68*
	(0.20)	(0.82)	(0.17)	(0.35)
7-Year	0.16	2.15***	0.80***	0.65**
	(0.19)	(0.75)	(0.16)	(0.33)
10-Year	0.14	1.89***	0.69***	0.56*
	(0.17)	(0.64)	(0.14)	(0.29)

See notes to Table G.1.

Table G.3: Responses of Private-Sector Borrowing Costs to Funds Rate and Forward Guidance Changes

Dependent Variable	Funds Rate		Forward Guidance	
	Early Sample	Dummy	Early Sample	Dummy
Corporate Bond and MBS Yields:				
A (3-Yr)	0.23	2.91***	0.91***	1.06**
	(0.22)	(1.03)	(0.24)	(0.45)
A (10-Yr)	0.17	1.25	0.47**	0.96**
	(0.18)	(0.92)	(0.20)	(0.43)
BBB (3-Yr)	0.30*	2.05	0.97***	1.66***
	(0.18)	(1.43)	(0.17)	(0.58)
BBB (10-Yr)	0.15	1.06	0.42**	1.40***
	(0.17)	(1.14)	(0.21)	(0.52)
MBS (30-Yr)	0.21	1.32	0.46***	1.70***
	(0.13)	(1.26)	(0.15)	(0.45)
Corporate Yield Spreads and OAS:				
BBB - A	0.08	-0.87	0.05	0.59*
(3-Yr)	(0.09)	(0.81)	(0.13)	(0.34)
BBB - A	-0.02	-0.19	-0.06	0.43**
(10-Yr)	(0.07)	(0.46)	(0.13)	(0.20)
OAS	-0.04	0.74**	0.00	0.54***
	(0.05)	(0.32)	(0.07)	(0.15)

See notes to Table G.1.

equation for a partitioned matrix, $Z'Z - Z'\tilde{Z}$ is the inner product of Z and Z for February 2000 to June 2003, $Z'Y - \tilde{Z}'Y$ is the inner product of Z and Y for February 2000 to June 2003, $Z'\tilde{Z}$ is the inner product of Z and Z for August 2003 to May 2006, $\tilde{Z}'Y$ is the inner product of Z and Y for August 2003 to May 2006, and

$$(Z'\tilde{Z} - Z'\tilde{Z}(Z'Z)^{-1}Z'\tilde{Z})^{-1} - (Z'Z - Z'\tilde{Z})^{-1} = (Z'\tilde{Z})^{-1}.$$

The proofs of these results for γ and ϕ are the same but with $\hat{M}$ and $\tilde{M}$ in place of Z and $\tilde{Z}$, respectively.

I note that the reported levels of statistical significance are higher in Table G.5 than in

Table G.4: Responses of Private Forecasts to Funds Rate and Forward Guidance Changes

	Funds Rate		Forward Guidance	
Dependent Variable	Early Sample	Dummy	Early Sample	Dummy
GDP Growth	-0.08	2.75	1.43^{***}	-2.24^{**}
	(0.26)	(2.73)	(0.46)	(0.98)
CPI Inflation	0.00	-2.23^{*}	0.34	-0.74
	(0.26)	(1.24)	(0.33)	(0.66)
Unemp. Rate	0.20	-0.13	-0.49^{*}	0.79
	(0.19)	(0.76)	(0.26)	(0.55)

See notes to Table G.1.

Table G.5: Responses of Macroeconomic Variables to Funds Rate and Forward Guidance Changes

	Funds Rate		Forward Guidance	
Dependent Variable	Early Sample	Dummy	Early Sample	Dummy
PCE Growth	0.37	0.70	$2.88^{\dagger}$	-13.39^{**}
	(1.51)	(7.54)	(2.26)	(4.52)
CPI Inflation	-0.42	-12.52	7.06^{*}	$-6.56^{\dagger}$
	(2.01)	(21.47)	(3.00)	(4.61)
Unemp. Change	0.87	-0.92	4.01^{**}	7.49^{***}
	(2.01)	(2.40)	(1.13)	(1.74)
IP growth	-5.65	22.73	-9.87	-0.23
	(6.84)	(26.57)	(8.53)	(9.51)

Notes: The Funds Rate columns display the estimates of β_1 and λ_1 from Equation (G.3). The estimates of β_1 are in the early sample column, and the estimates of λ_1 are in the dummy column. The Forward Guidance columns display the estimates of γ and ϕ from Equation (G.3). The estimates of γ are in the early sample column, and the estimates of ϕ are in the dummy column. Standard errors are shown in parentheses. The symbols †, *, **, and *** denote statistical significance at the 32 percent, 10 percent, 5 percent, and 1 percent levels, respectively.

Table 5. For example, the forward guidance coefficient on PCE is statistically significant at the 32 percent level in Table G.5, but not in Table 5. This is due to the fixed-b critical values. While I use a Bartlett kernel truncation parameter of $L = 10$ to compute standard errors in both tables, the sample size for the early sample is 28 in Table 5, and the sample size is 51 when estimating all parameters in Table G.5. Hence, the value of b changes from 0.36 for Table 5 to 0.20 for Table G.5, and the critical values are lower for Table G.5. This highlights the conservative approach to statistical inference reported in Table 5.

H Leave-One-Out Analysis for Stock Prices

This appendix contains a leave-one-out analysis to study the robustness of the estimates of the effects of current federal funds rate and forward guidance surprises on stock prices. I begin by following a similar analysis in Bernanke and Kuttner (2005). Define $\Delta\hat{b}_t$ to be the change in the estimate of $[\beta_1, \gamma]'$ when observation t is excluded. Let $\hat{V}$ be the matrix estimated in Appendix D, and let $\hat{V}_{4:5,4:5}$ be the 2×2 matrix corresponding to the estimates of $[\beta_1, \gamma]'$. I compute $T\Delta\hat{b}_t\hat{V}^{-1}_{4:5,4:5}\Delta\hat{b}_t$ for all observations in both of my samples, where T is 28 and 23 in the February 2000 to June 2003 and the August 2003 to May 2006 samples, respectively. There are six observations that produce particularly large values of $T\Delta\hat{b}_t\hat{V}^{-1}_{4:5,4:5}\Delta\hat{b}_t$. These are March 2001, November 2001, November 2002, June 2004, August 2004, and September 2005. Leaving out these observations causes large joint changes to the estimates of $[\beta_1, \gamma]'$ relative to their estimated variances.

To see why these observations are influential, Figures H.1 and H.2 show scatter plots of the percent changes in stock prices with the current federal funds rate surprises and the forward guidance surprises for both samples. These figures parallel Figures 5 and 6 in the body of the paper. Note that the current federal funds rate and forward guidance surprises are orthogonal by construction. Hence, the estimated slope of one of these independent variables is not affected by the inclusion of the other variable. Thus, the slopes and regression lines in the scatter plots can be interpreted as being from a univariate regression even though they were estimated from the bivariate regression in (7).

Both the November 2001 and November 2002 observations have large values (in magnitude) of the current federal funds rate surprises. September 2005 has a large current federal funds rate surprise relative to the other observations in the August 2003 to May 2006 sample.

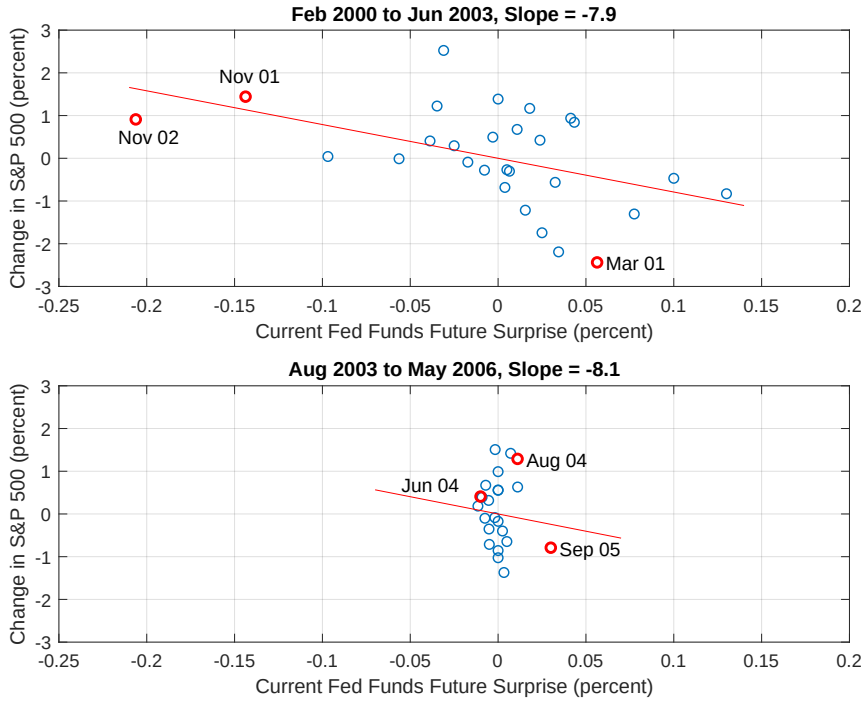


Figure H.1: Scatter plots of percent change in S&P 500 on current federal funds rate surprises.

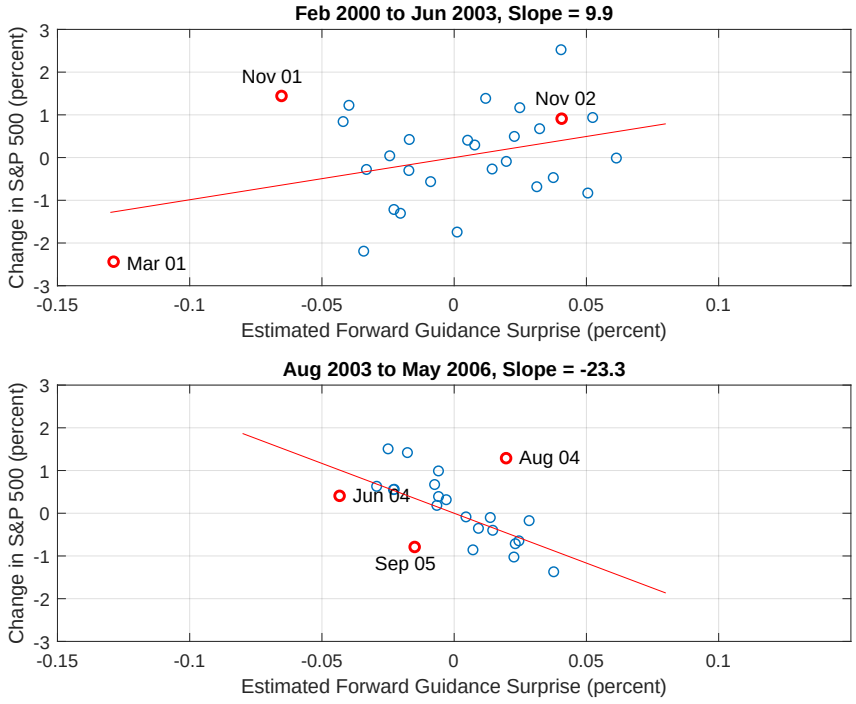


Figure H.2: Scatter plots of percent change in S&P 500 on forward guidance surprises.

Hence, each of these observations has high leverage when estimating the effects of surprise federal funds rate changes on stock prices. Similarly, the March 2001, November 2001, and June 2004 observations all have large values (in magnitude) of forward guidance surprises within their respective samples. This gives these observations high leverage when estimating the effects of forward guidance surprises on stock prices. The August 2004 observation does not have particularly large values of either the current federal funds rate surprise or the forward guidance surprise; however, it has a large regression error, helping to make it an influential observation.

I now show the effects of leaving out these observations. Figures H.3 and H.4 show the estimated effects of current federal funds rate surprises on stock prices and the associated t-statistics when leaving out each observation. For the February 2000 to June 2003 sample, the November 2002 observation is the most influential in terms of changing the point estimate. However, leaving this observation out does not change the broader result that a surprise increase in the federal funds rate causes stock prices to fall. Excluding no one observation changes this result, and indicates that the estimate of β_1 is robust on the February 2000 to June 2003 sample.

For the August 2003 to June 2006 sample, the September 2005 observation is the most influential. Leaving out this observation flips the sign of β_1, showing that the full-sample estimate of -8.08 is very sensitive to this observation. The August 2004 observation is modestly influential, but leaving it out does not change the sign nor statistical significance of the estimate.

Figures H.5 and H.6 show the estimated effects of forward guidance surprises on stock prices and the associated t-statistics when leaving out each observation. For the February 2000 to June 2003 sample, the March 2001 observation is the most influential in terms of changing the point estimate. Removing this observation causes the point estimate to fall from 9.88 to 6.41. Further, excluding this estimate causes the t-statistic to fall below 1.64, indicating that the estimate is not statistically significant at the 10 percent level. These results indicate that while the positive effect of forward guidance surprises on stock prices still remains, it is not estimated precisely. November 2001 and Novermber 2002 are also influential observations, but removing them does not change the general results.

For the August 2003 to June 2006 sample, the June 2004, August 2004, and September 2005 observations are all influential. However, removing each of these observations actually

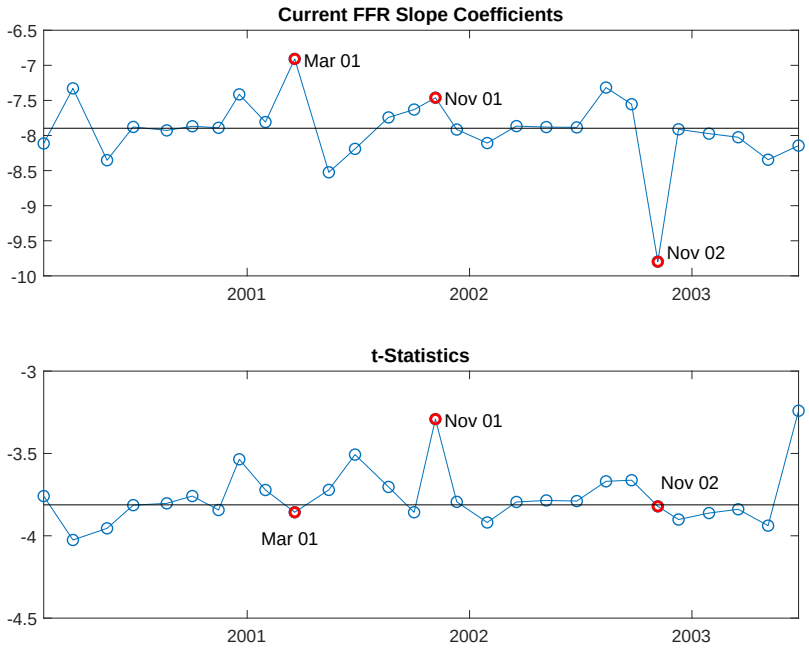


Figure H.3: The top panel shows estimates of β_1 when each given observation is left out. The black line gives the full-sample estimate of -7.90. The bottom panel gives the corresponding t-statistics, and the black line gives the full-sample t-statistic of -3.81.

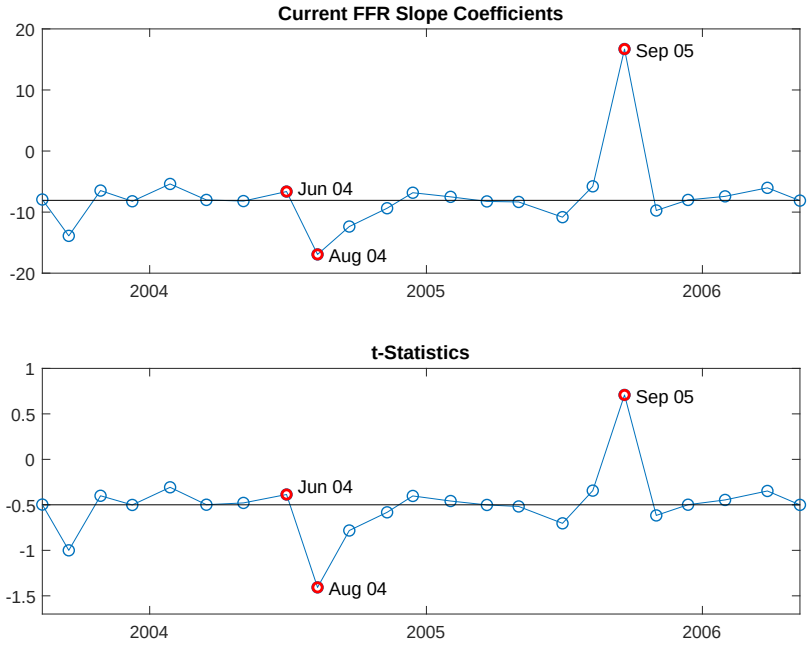


Figure H.4: The top panel shows estimates of β_1 when each given observation is left out. The black line gives the full-sample estimate of -8.08. The bottom panel gives the corresponding t-statistics, and the black line gives the full-sample t-statistic of -0.50.

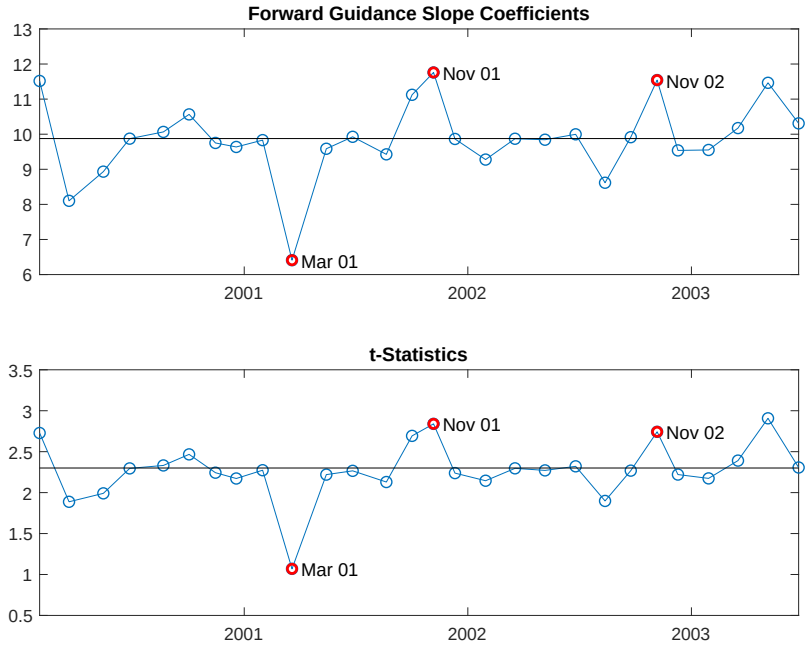


Figure H.5: The top panel shows estimates of γ when each given observation is left out. The black line gives the full-sample estimate of 9.88. The bottom panel gives the corresponding t-statistics, and the black line gives the full-sample t-statistic of 2.30.

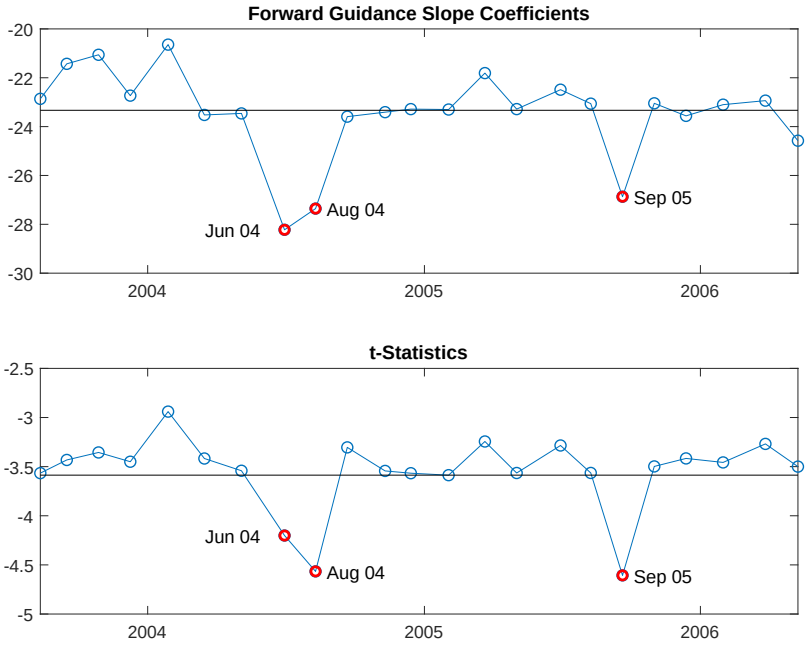


Figure H.6: The top panel shows estimates of γ when each given observation is left out. The black line gives the full-sample estimate of -23.33. The bottom panel gives the corresponding t-statistics, and the black line gives the full-sample t-statistic of -3.59.

Table H.1: Responses of Stock Prices to Funds Rate and Forward Guidance Changes without Influential Observations

Dependent Variable	Feb 2000 to May 2006			Feb 2000 to Jun 2003			Aug 2003 to May 2006		
	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2
S&P 500	-8.01^{***}	-0.59	0.10	-8.21^{***}	10.51	0.23	3.21	-34.62^{***}	0.74
	(2.95)	(5.87)		(3.08)	(7.42)		(27.90)	(4.66)	

Notes: The Funds Rate columns display the estimates of β_1, and the Forward Guidance columns display the estimates of γ from Equation (7). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

increases the magnitude of both the estimated slope coefficient and the t-statistic. Further, there is no one observation that materially attenuates the slope coefficient or t-statistic. This suggests that the estimate of γ is robust on the August 2003 to June 2006 sample.

I conclude my analysis by treating the six influential observations as outliers and removing them from the sample. This parallels Bernanke and Kuttner (2005), who also show results that exclude outliers. Table H.1 shows the results without the six influential observations. For the February 2000 to June 2003 sample, the point estimates for both the federal funds rate and forward guidance are very similar to the estimates in Table 1. The estimate on the funds rate is statistically significant without the influential observations. However, the estimate on forward guidance is no longer statistically significant. Given the small change in the point estimates between Tables 1 and H.1, this suggests that the influential observations should not really be viewed as outliers. Rather, they are just large (in magnitude) observations that provide the variation in the data needed for precise estimation.

Table H.1 shows different estimates for the August 2003 to May 2006 sample than Table 1. The sign on the funds rate estimate has changed. Figure H.4 suggests that result is largely driven by removing the September 2005 observation. It is also the case that the slope on forward guidance has become larger in magnitude. Figure H.6 shows that removing each influential observation one at a time increases the magnitude of the slope on forward guidance. Hence, removing them jointly causes a big increase in this magnitude. Despite the changes in the point estimates for the August 2003 to May 2006 sample, the pattern in the effects of forward guidance remains the same. Forward guidance that increases the path of the funds rate causes a large and statistically significant decrease in the S&P 500 whether or not the influential observations are included.

I Analysis of Economic Uncertainty

This appendix studies the changes in economic uncertainty from February 2000 to May 2006. I consider four measures of uncertainty. The first two are real and macroeconomic uncertainty from Ludvigson, Ma, and Ng (2019) and Jurado, Ludvigson, and Ng (2015). Real uncertainty is measured as a weighted average of the root expected forecast error for 73 real activity variables. Macroeconomic uncertainty is essentially the same but also includes data on prices and some financial variables. Data are from Sydney C. Ludvigson's website: `https://www.sydneyludvigson.com/data-and-appendixes` (Ludvigson, n.d.). Both uncertainty measures are observed monthly and are available for monthly forecast horizons for $h = 1, 3, 12$.

The third and fourth measures of uncertainty are from Rossi and Sekhposyan (2015a,b). They measure uncertainty by where a forecast error from the Survey of Professional Forecasters (SPF) falls in the historical distribution of forecast errors. They present results for the SPF's GDP growth forecasts. They also have results for the SPF's inflation forecasts, measured with the GDP price deflator, in their replication files. The data and replication files for both the GDP growth uncertainty and inflation uncertainty measures are at the *American Economic Review* website: `https://www.aeaweb.org/articles?id=10.1257/aer.p20151124`. Both GDP growth and inflation uncertainty are observed quarterly, and I use quarterly forecast horizons for $h = 0, 3$.[1]

Figure I.1 shows Ludvigson, Ma, and Ng's (2019) and Jurado, Ludvigson, and Ng's (2015) measures of real and macroeconomic uncertainty from July 1960 to December 2018 for the $h = 3$ month horizon. Other horizons show similar patterns. The grey shaded region is the sample studied in this paper, and the vertical dashed line is August 2003. While the focus of the paper is February 2000 to May 2006, I show the longer sample to provide context. Visually, real uncertainty does not appear particularly elevated from February 2000 to July 2003, especially compared to the recessionary periods in 1974–75, 1980, and 2008–09. Macroeconomic uncertainty appears moderately elevated from February 2000 to July 2003. However, it is still well below macroeconomic uncertainty in 1974–75, 1980, and 2008–09.

To formally test differences between the February 2000 to July 2003 and August 2003 to

[1] Rossi and Sekhposyan (2015a) show results for GDP growth uncertainty for quarterly forecast horizons for $h = 0, 4$. Because of some missing inflation data at the $h = 4$ horizon, I use the $h = 3$ horizon and use this same horizons for GDP growth for consistency.

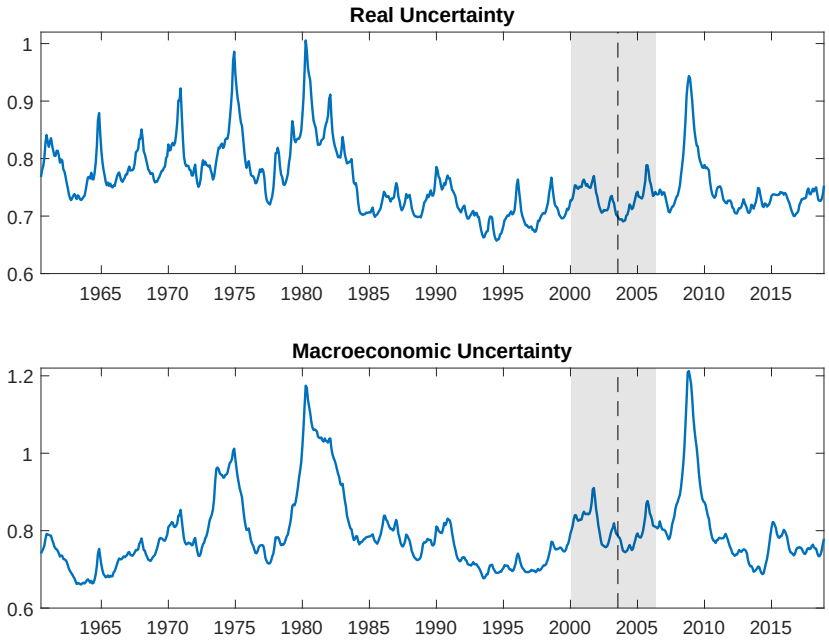


Figure I.1: Monthly measures of real and macroeconomic uncertainty. Forecast horizon is $h = 3$ month. The grey shaded region is the main sample in this paper, and the vertical dashed line is August 2003.

May 2006 samples, I estimate the regression

$$un_t = \phi_0 + \phi_1 d_t + w_t, \tag{I.1}$$

where un_t is a measure of uncertainty and d_t is a dummy variable that takes a value of 1 from February 2000 to July 2003 and a value of 0 from August 2003 to May 2006. This implies that ϕ_0 gives the sample average of uncertainty from August 2003 to May 2006 and $\phi_0 + \phi_1$ gives the sample average of uncertainty from February 2000 to July 2003. Hence, ϕ_1 is the difference in the averages between the two samples, and I test the null hypothesis that $\phi_1 = 0$ against the alternative that $\phi_1 \neq 0$.

Because the measures of uncertainty are autocorrelated, I adjust the test statistics by following Lazarus et al. (2018). I compute standard errors and, hence, t-statistics with the Barlett kernel (Newey and West, 1987) with the truncation point given by $L = 1.3T^{1/2}$. I also provide fixed-b critical values, where $b = L/T$, computed following Sun (2014). Table I.1 shows the results. Over February 2000 to May 2006 sample, the differences between the February 2000 to July 2003 and August 2003 to May 2006 samples are not statistically

Table I.1: Tests of Differences in Uncertainty

	Real Uncertainty			Macro Uncertainty		
	$h=1$	$h=3$	$h=12$	$h=1$	$h=3$	$h=12$
early sample avg.	0.623	0.735	0.871	0.684	0.819	0.931
late sample avg.	0.616	0.728	0.868	0.657	0.791	0.913
difference	0.007	0.007	0.003	0.027	0.028	0.018
t-stats	0.450	0.498	0.394	1.235	1.258	1.475
10% Critical Values						
standard normal	1.645	1.645	1.645	1.645	1.645	1.645
fixed-b	1.926	1.926	1.926	1.926	1.926	1.926

Notes: Early sample is February 2000 to July 2003. Late sample is August 2003 to May 2006. The difference between the early and late samples is equivalent to ϕ_1 in Equation (I.1). t-statistics use the Bartlett kernel as described in this appendix. Fixed-b critical values are computed following Sun (2014).

significant, even at the 10 percent level. Note that this is the case whether one uses standard normal critical values or fixed-b critical values.

Figure I.2 shows Rossi and Sekhposyan's (2015a) measures of GDP growth and inflation uncertainty from 1968:Q4 to 2013:Q2 for the $h = 3$ quarter horizon. This horizon is smoother than the $h = 0$ quarter horizon, and patterns are easier to see. The grey shaded region is the sample studied in this paper, and the vertical dashed line is 2003:Q3. Visually, GDP growth uncertainty appears elevated from 2000:Q1 to 2003:Q2 compared to that of 2003:Q3 to 2006:Q2. In contrast, inflation uncertainty appears generally lower from 2000:Q1 to 2003:Q2 compared to that of 2003:Q3 to 2006:Q2.

To formally test the difference between the 2000:Q1 to 2003:Q2 and the 2003:Q3 to 2006:Q2 samples, I follow the same approach as before by estimating Equation (I.1) and with inference following the recommendations in Lazarus et al. (2018). Table I.2 shows the results. GDP growth uncertainty is higher from 2000:Q1 to 2003:Q2 than from 2003:Q3 to 2006:Q2; however, this difference is only statistically significant at the $h = 3$ quarters horizon. Inflation uncertainty is lower from 2000:Q1 to 2003:Q2 than from 2003:Q3 to 2006:Q2, and this difference is statistically significant for both horizons.

J Robustness Checks

This appendix provides a number of robustness checks on the main results in Section 5. Appendix J.1 provides results if unscheduled FOMC meetings are included. Appendix J.2

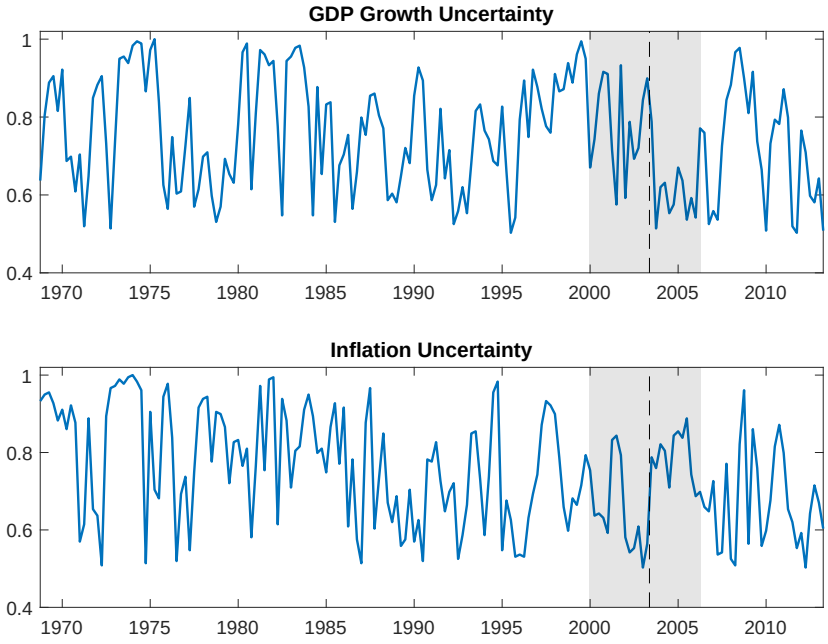


Figure I.2: Quarterly measures of GDP growth and inflation uncertainty. Forecast horizon is $h = 3$ quarters. The grey shaded region is the main sample in this paper, and the vertical dashed line is 2003:Q3.

Table I.2: Tests of Differences in Uncertainty

	GDP Uncertainty		Infl. Uncertainty	
	$h = 0$	$h = 3$	$h = 0$	$h = 3$
early sample avg.	0.708	0.776	0.676	0.648
late sample avg.	0.676	0.619	0.762	0.786
difference	0.032	0.157	-0.086	-0.138
t-stats	0.470	6.478	-4.015	-3.476
10% Critical Values				
standard normal	1.645	1.645	1.645	1.645
fixed-b	2.114	2.114	2.114	2.114

Notes: Early sample is 2000:Q1 to 2003:Q2. Late sample is 2003:Q3 to 2006:Q2. The difference between the early and late samples is equivalent to ϕ_1 in Equation (I.1). t-statistics use the Bartlett kernel as described in this appendix. Fixed-b critical values are computed following Sun (2014).

provides results when percent changes in the S&P 500 are measured at higher frequencies. Appendix J.3 compares my policy surprises to Gürkaynak, Sack, and Swanson (2005) and provides results using their principal components estimation of policy surprises. Appendix J.4 then compares my estimated responses of Treasury yields to current federal funds rate shocks to those estimated in Gürkaynak, Sack, and Swanson (2005). Appendix J.5 provides results when changes in Treasury yields are measured at higher frequencies. Appendix J.6 provides results if the policy surprises use only regular trading hours tick data, but no electronic trading hours data. Appendix J.7 provides results if the 30-minute windows that are used for measuring the policy surprises are expanded to 50 minutes. Appendix J.8 provides results when changes in financial market variables are extended to one or two days following an FOMC meeting. Appendix J.9 provides results when Equation (8) in the paper is generalized to allow for horizons other than 12 months.

J.1 Main Results with Unscheduled FOMC Meetings

This appendix shows the results from Section 5, but with unscheduled interest rate changes and the associated FOMC statements included in the sample. These unscheduled policy changes occurred on January 3, 2001, and April 18, 2001. Following the previous literature (Gürkaynak, Sack, and Swanson, 2005; Campbell et al., 2012; Swanson, 2017), I do not include the policy change on September 17, 2001. These unscheduled changes occur only in the February 2000 to June 2003 sample. Hence, the results for the August 2003 to May 2006 sample do not change, and I do not discuss them here.

Table J.1 shows the estimates of β_1 and γ for stock prices and volatility when the unscheduled policy changes are included. It parallels Table 1 in the paper. The estimates in Tables 1 and J.1 are generally similar. For the February 2000 to May 2006 and February 2000 and June 2003 samples, an increase in the current federal funds rate causes decreases in stock prices and increases in expected volatility. These results are similar to those presented in Table 1; however, the magnitudes are slightly larger in Table J.1.

With regard to forward guidance for the whole sample, the effect on the stock market is very similar to what is shown in Table 1. The effect on the VIX is now negative in Table J.1, but it is small in magnitude and statistically insignificant as in Table 1. For the February 2000 to June 2003 sample, the effect of forward guidance on the stock market in Table J.1 is slightly smaller in magnitude than what is in Table 1. However, both tables have positive

Table J.1: Responses of Stock Prices and Volatility to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
S&P 500	-9.92^{***}	4.03	0.51	-9.99^{***}	7.34^{**}	0.65	-8.08	-23.33^{***}	0.39
	(1.25)	(3.16)		(1.28)	(3.13)		(16.17)	(6.51)	
VIX	4.64^{***}	-1.04	0.21	4.48^{***}	-4.29^{*}	0.35	9.53	20.78^{***}	0.30
	(1.43)	(2.99)		(1.43)	(2.37)		(14.75)	(5.87)	

Notes: The Funds Rate columns display the estimates of β_1, and the Forward Guidance columns display the estimates of γ from Equation (7). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

and statistically significant effects. In Table J.1, the effect of forward guidance on the VIX has become larger in magnitude in the February 2000 to June 2003 sample, and it is now statistically significant at the 10 percent level.

Table J.2 shows the estimates of β_1 and γ for Treasury yields, term premia, and the expected path of short-term rates. It parallels Table 2 in the paper. For Treasury yields, the effects of current federal funds rate shocks are small and statistically insignificant for both the February 2000 to May 2006 and February 2000 to June 2003 samples. This is similar to Table 2. However, the effects of forward guidance become larger and more statistically significant for 5-year, 7-year, and 10-year yields. This suggests that the unscheduled changes have larger effects on long-term bonds.

For term premia, the effects of current federal funds rate shocks become larger in magnitude and statistically significant when unscheduled policy changes are included. However, these unscheduled policy changes attenuate the effects of forward guidance on term premia, causing them to be small and not statistically significant in Table J.2.

Comparing the changes from Table 1 to Table J.1 and from Table 2 to Table J.2, the unscheduled policy changes appear to slightly change the effects of forward guidance. These unscheduled changes cause the response of the VIX index to become larger in magnitude but the responses of Treasury term premia to become smaller in magnitude. Overall, these unscheduled policy changes do not change the larger interpretation of the results. Table J.1 continues to suggest that forward guidance from February 2000 to June 2003 had information effects. However, Table J.2 suggests that these information effects on term premia may be smaller than suggested by Table 2.

Table J.2: Responses of Treasury Yields and Term Premia to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Treasury Yields:									
2-Year	0.15	1.09***	0.46	0.12	0.89***	0.46	3.15***	2.29***	0.68
	(0.17)	(0.17)		(0.17)	(0.14)		(1.10)	(0.42)	
5-Year	-0.06	0.97***	0.40	-0.08	0.82***	0.38	2.04**	2.05***	0.61
	(0.21)	(0.20)		(0.22)	(0.21)		(1.04)	(0.42)	
7-Year	-0.09	0.82***	0.34	-0.11	0.69***	0.33	1.43	1.83***	0.56
	(0.20)	(0.20)		(0.21)	(0.22)		(0.98)	(0.39)	
10-Year	-0.10	0.62***	0.25	-0.11	0.50**	0.23	0.88	1.57***	0.49
	(0.18)	(0.19)		(0.18)	(0.22)		(0.91)	(0.37)	
Term Premia:									
2-Year	-0.05	0.12**	0.08	-0.06	0.05	0.07	0.55	0.74***	0.40
	(0.03)	(0.06)		(0.03)	(0.06)		(0.44)	(0.20)	
5-Year	−0.18**	0.04	0.23	−0.18**	0.00	0.28	-0.51	0.48**	0.18
	(0.08)	(0.12)		(0.08)	(0.15)		(0.50)	(0.23)	
7-Year	−0.19**	-0.04	0.20	−0.18**	-0.06	0.25	-0.89	0.38	0.14
	(0.08)	(0.14)		(0.08)	(0.17)		(0.57)	(0.26)	
10-Year	−0.17**	-0.11	0.15	−0.16**	-0.14	0.19	−1.15*	0.32	0.13
	(0.08)	(0.15)		(0.08)	(0.18)		(0.65)	(0.30)	
Expected Path of Short-Term Rates:									
2-Year	0.21	0.96***	0.60	0.17	0.84***	0.63	2.60***	1.56***	0.67
	(0.14)	(0.14)		(0.15)	(0.12)		(0.80)	(0.28)	
5-Year	0.12	0.93***	0.56	0.10	0.82***	0.58	2.56***	1.56***	0.65
	(0.15)	(0.13)		(0.15)	(0.12)		(0.79)	(0.31)	
7-Year	0.10	0.86***	0.55	0.08	0.76***	0.57	2.32***	1.45***	0.65
	(0.14)	(0.12)		(0.14)	(0.11)		(0.73)	(0.28)	
10-Year	0.08	0.73***	0.53	0.05	0.65***	0.55	2.03***	1.25***	0.64
	(0.12)	(0.11)		(0.12)	(0.10)		(0.62)	(0.26)	

See notes to Table J.1.

Table J.3: Responses of Private-Sector Borrowing Costs to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Corporate Bond and MBS Yields:									
A (3-Yr)	0.11	1.12***	0.45	0.07	0.97***	0.45	3.14***	1.98***	0.60
	(0.21)	(0.18)		(0.21)	(0.18)		(1.01)	(0.39)	
A (10-Yr)	-0.08	0.82***	0.28	-0.10	0.72***	0.28	1.41	1.44***	0.34
	(0.22)	(0.22)		(0.22)	(0.25)		(0.90)	(0.38)	
BBB (3-Yr)	0.14	1.17***	0.48	0.12	0.99***	0.53	2.35*	2.62***	0.61
	(0.20)	(0.19)		(0.21)	(0.17)		(1.42)	(0.55)	
BBB (10-Yr)	-0.07	0.83***	0.26	-0.09	0.70***	0.26	1.20	1.81***	0.38
	(0.22)	(0.22)		(0.22)	(0.25)		(1.13)	(0.48)	
MBS (30-Yr)	0.08	0.85***	0.33	0.05	0.63***	0.32	1.53	2.16***	0.51
	(0.17)	(0.18)		(0.17)	(0.18)		(1.26)	(0.42)	
Corporate Yield Spreads and OAS:									
BBB - A	0.04	0.05	0.02	0.05	0.02	0.04	-0.79	0.64**	0.31
(3-Yr)	(0.03)	(0.08)		(0.03)	(0.07)		(0.80)	(0.31)	
BBB - A	0.01	0.01	0.00	0.01	-0.03	0.00	-0.21	0.38**	0.24
(10-Yr)	(0.03)	(0.08)		(0.03)	(0.08)		(0.46)	(0.16)	
OAS	0.08	0.13	0.14	0.07	0.07	0.12	0.69**	0.54***	0.44
	(0.04)	(0.06)		(0.04)	(0.06)		(0.31)	(0.13)	

See notes to Table J.1.

Table J.3 shows the estimates of β_1 and γ for private borrowing costs. It parallels Table 3 in the paper. For corporate bond yields and MBS yields, the effects of current federal funds rate shocks are generally smaller and less statistically significant in Table J.3 than in Table 3 for the February 2000 to May 2006 and February 2000 to June 2003 samples. However, the effects of forward guidance surprises become larger and more statistically significant for 10-year corporate bond yields and MBS yields from February 2000 to June 2003 when unscheduled policy changes are included. This is consistent with the effects of unscheduled policy changes on Treasury yields in Table J.2.

For corporate spreads and OAS, the effects of current federal funds rate and forward guidance surprises are small and not statistically significant in both Tables 3 and H.3 in both the February 2000 to May 2006 and February 2000 to June 2003 samples.

Table J.4: Responses of Private Forecasts to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
GDP Growth	0.14	1.03**	0.14	0.10	1.26***	0.22	2.67	-0.82	0.12
	(0.13)	(0.40)		(0.14)	(0.46)		(2.72)	(0.86)	
CPI Inflation	-0.03	0.22	0.01	-0.03	0.23	0.02	−2.23*	-0.40	0.11
	(0.12)	(0.25)		(0.11)	(0.29)		(1.21)	(0.57)	
Unemp. Rate	0.11	−0.52**	0.07	0.14*	−0.43*	0.07	0.08	0.30	0.02
	(0.10)	(0.22)		(0.07)	(0.25)		(0.74)	(0.49)	

See notes to Table J.1.

Table J.5 shows the estimates of β_1 and γ for macroeconomic variables. It parallels Table 5 in the paper. For both the February 2000 to May 2006 and February 2000 to June 2003 samples, the estimates for forward guidance are attenuated from Table 5 to Table J.5. However, these estimates still show a pattern of information effects.

Overall, the results presented here and in Section 5 are generally similar. From February 2000 to June 2003, a forward guidance shock that increases the path of the federal funds rate causes increases in stock prices, increases in GDP growth forecasts, and decreases in unemployment rate forecasts. All of these results are consistent with information effects. While the unscheduled policy changes may change some results for the VIX index and Treasury term premia, they do not change the larger results that information effects are present from February 2000 to June 2003.

J.2 High-Frequency Stock Price Results

This appendix studies the effects of the current federal funds rate and forward guidance shocks on the S&P 500 index at higher frequencies than presented in the body of the paper. In the body of the paper, I use daily changes (previous day close to current day close) in 100 times the natural log of the S&P 500 index price as my dependent variable. At this frequency, news other than the FOMC meeting statements may influence the S&P 500. In particular, morning announcements of macroeconomic data may confound my results, especially given my small sample sizes. Gürkaynak, Sack, and Swanson (2005) discuss the effects of macroeconomic data on FOMC days.

Table J.5: Responses of Macroeconomic Variables to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006			Feb 2000 to Jun 2003			Aug 2003 to May 2006		
	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2
PCE Growth	$0.86^{\dagger}$	-0.18	0.01	0.60	0.21	0.01	1.07	-10.51^{*}	0.15
	(0.46)	(1.64)		(0.55)	(1.16)		(7.33)	(3.82)	
CPI Inflation	1.96^{***}	4.98^{***}	0.12	1.30^{*}	$3.63^{\dagger}$	0.13	-12.94	0.51	0.03
	(0.51)	(1.26)		(0.54)	(2.16)		(21.38)	(3.44)	
Unemp. Change	-2.32^{***}	-4.28^{**}	0.14	$-1.48^{\dagger}$	-2.71^{*}	0.11	-0.05	3.49^{*}	0.23
	(0.60)	(1.22)		(0.64)	(0.93)		(1.74)	(1.24)	
IP Growth	5.10^{**}	-0.38	0.03	2.54	-7.70	0.03	17.08	$-10.10^{\dagger}$	0.08
	(1.83)	(6.40)		(2.00)	(6.01)		(24.92)	(4.37)	

Notes: The Funds Rate columns display the estimates of β_1, and the Forward Guidance columns display the estimates of γ from Equation (8). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The symbols, †, *, **, and ***, denote statistical significance at the 32 percent, 10 percent, 5 percent, and 1 percent levels, respectively.

To study the effects of morning announcements of macroeconomic data on my results, I consider shorter windows to measure the percent change in the S&P 500. All high-frequency S&P 500 index price data is from `https://www.tickdata.com/` (Standard & Poor's, n.d.). For all analysis in this section, I use minute-by-minute data. I treat the last observed tick in a given minute to be the S&P 500 price for that minute. The first window that I use measures the percent change in the S&P 500 from 10 minutes before an FOMC statement release until 4pm of that same day.[2] This is approximately a 2-hour window on each FOMC meeting day, and I refer to this as the 2-hour window. The second window that I use measures the percent change in the S&P 500 from 10 minutes before an FOMC statement release until 20 minutes after. I refer to this a the 30-minute window.

I consider the 30-minute window for measuring the percent change in the S&P 500 price index because this window is also used by Gürkaynak, Sack, and Swanson (2005) and Swanson (2017). I also consider the 2-hour window because several studies indicate that FOMC statements have effects on stocks that last longer than 20 minutes. In particular, Chung, Elder, and Kim (2013) find an impairment of liquidity after FOMC policy announcements for the stocks included in the S&P 500 index that lasts for about one and half hours. This

[2]For February 2000 to September 2002 in my sample, I have data all the way through the end of 4pm. For November 2002 to May 2006, I only have data through the end of 3:59pm.

Table J.6: Responses of Stock Prices to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
S&P 500 (daily)	-7.88^{***} (2.10)	4.08 (4.69)	0.18	-7.90^{***} (2.07)	9.88^{**} (4.29)	0.34	-8.08 (16.17)	-23.33^{***} (6.51)	0.39
S&P 500 (2-hour)	-10.41^{***} (2.61)	5.29 (4.80)	0.26	-10.34^{***} (2.57)	10.28^{**} (4.61)	0.39	-19.23^{*} (9.98)	-21.26^{***} (5.58)	0.48
S&P 500 (30-min)	-1.46 (1.81)	-2.09 (1.67)	0.07	-1.34 (1.72)	-1.26 (1.61)	0.07	-12.24^{*} (6.48)	-10.45^{***} (2.74)	0.53

Notes: The Funds Rate columns display the estimates of β_1, and the Forward Guidance columns display the estimates of γ from Equation (7). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

implies that the S&P 500 may need some time beyond 20 minutes to fully incorporate information in FOMC announcements. Indeed, Lunde and Zebedee (2009) document elevated intraday volatility of the S&P 500 index following FOMC announcements through the market close. Rosa (2011) provides evidence that equity indices incorporate information about FOMC statements within about 40 minutes of the announcement.

Table J.6 presents the results for the three different windows. The first two rows of results are for percent changes in the S&P 500 with a daily window. These rows are the same as in Table 1 of the paper. The second two rows of results are for percent changes in the S&P 500 with a 2-hour window. These results are very similar to the results with a daily window – especially for the forward guidance columns. These results indicate that morning releases of macroeconomic data are not having material effects on my S&P 500 results.

The last two rows of results of Table J.6 are for percent changes in the S&P 500 with a 30-minute window. The results in these rows are quite different from the daily and 2-hour windows – especially for the February 2000 to June 2003 sample. To better understand what is driving these differences, Figures J.1 and J.2 plot the minute-by-minute S&P 500 index prices on the 6 dates that correspond to the influential observations in Appendix H. I focus on these dates because macroeconomic data announcements on these dates may have the most influence on the results in the paper. In both Figures J.1 and J.2, the S&P 500 index price becomes notably more volatile following the FOMC statement release. This volatility

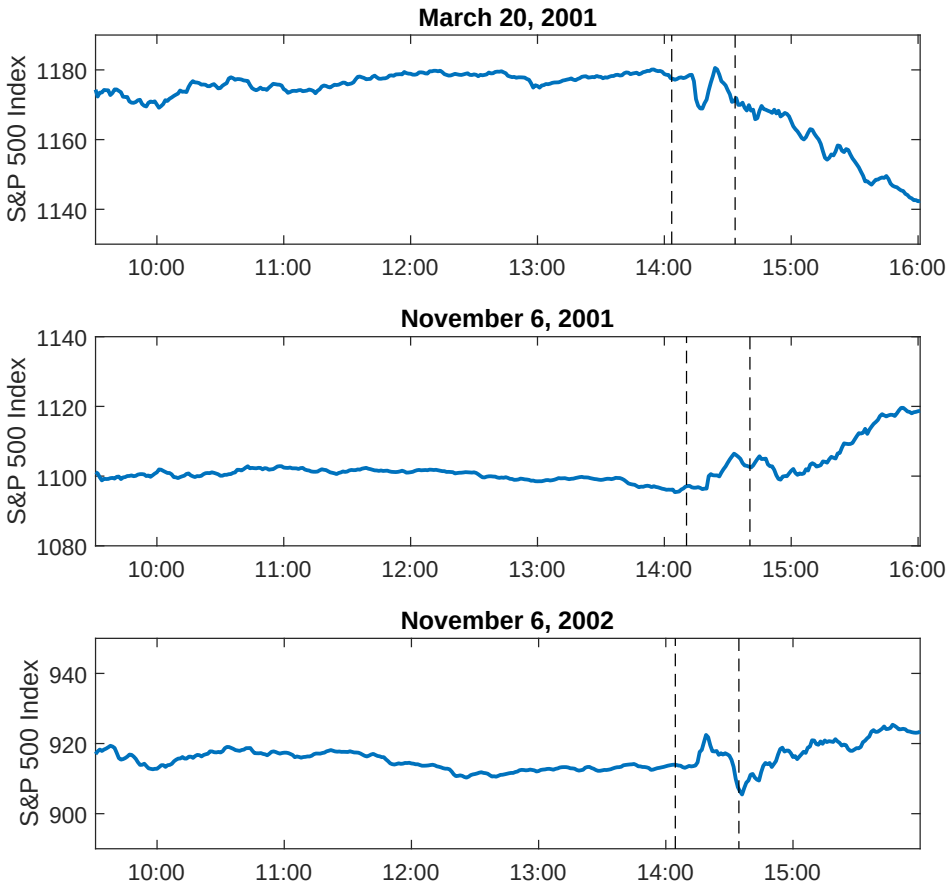


Figure J.1: Minute-by-minute S&P 500 index prices for the influential observations in the February 2000 to June 2003 sample. Vertical dashed lines indicate 10 minutes before and 20 minutes after the release of an FOMC meeting statement.

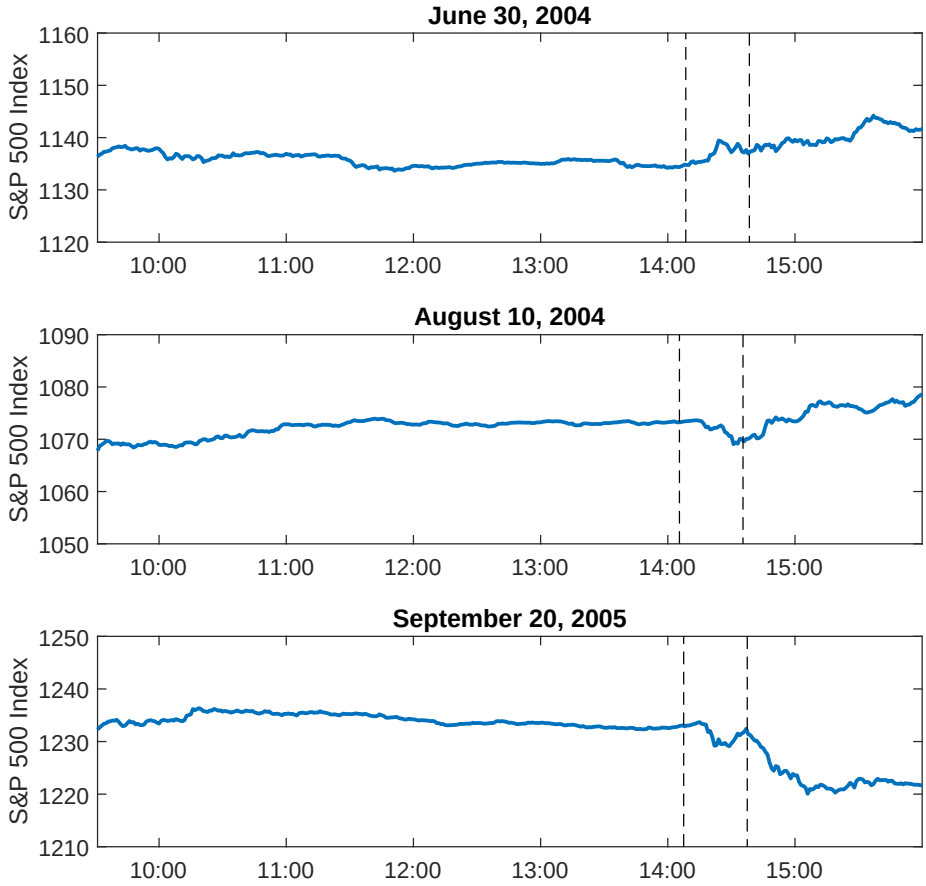


Figure J.2: Minute-by-minute S&P 500 index prices for the influential observations in the August 2003 to May 2006 sample. Vertical dashed lines indicate 10 minutes before and 20 minutes after the release of an FOMC meeting statement.

continues well beyond 20 minutes after the FOMC statement release, and the 30-minute and 2-hours give quite different measures of the percent change in the S&P 500. The fact that S&P 500 index prices continue to change more than 20 minutes following an FOMC statement is consistent with the papers I cite above (Lunde and Zebedee, 2009; Rosa, 2011; Chung, Elder, and Kim, 2013). Further, given the findings of Chung, Elder, and Kim (2013) that there is an impairment of liquidity for the stocks in the S&P 500, it is likely that the 2-hour window better incorporates the effects of FOMC statements than the 30-minute window.

In addition to showing that S&P 500 index prices continue to change more than 20-minutes after and FOMC statement release, Figures J.1 and J.2 show that the S&P 500 index price changed very little prior to the FOMC statement release on the 6 influential days in my sample. This is consistent with earlier research that finds low volatility of stock prices prior to FOMC announcements (Bomfim, 2003; Rosa, 2011). This low volatility of S&P 500 prices prior to FOMC announcements combined with the high volatility for more than 20 minutes after is what drives the very similar results between the daily and 2-hour windows in Table J.6.

J.3 Comparison to Gürkaynak, Sack, and Swanson (2005)

This appendix compares my estimates of forward guidance surprises to the path factor estimated in Gürkaynak, Sack, and Swanson (2005) (GSS). I do this in two steps. First, I discuss the estimates directly and reconcile some key differences. Second, I re-compute my results using estimates of GSS's path factor for my sample periods. These results are very similar to my main results in Section 5.

GSS estimate two factors for each FOMC announcement: a target factor and a path factor. They start by taking the first two principal components of five financial contracts: the current federal funds futures contract, the three-month-ahead federal funds futures contract, the two-, three-, and four-quarter-ahead eurodollar futures contracts. Their federal funds futures contracts are adjusted to account for the timing of FOMC meetings as described in Appendix B. Next, they rotate the two principal components so that the second component is orthogonal to the current federal funds futures contract. Hence, the first component is the "target" factor and the second component is the "path" factor. Finally, they normalize the scale of the factors. The scale of the target factor is normalized so that a change of

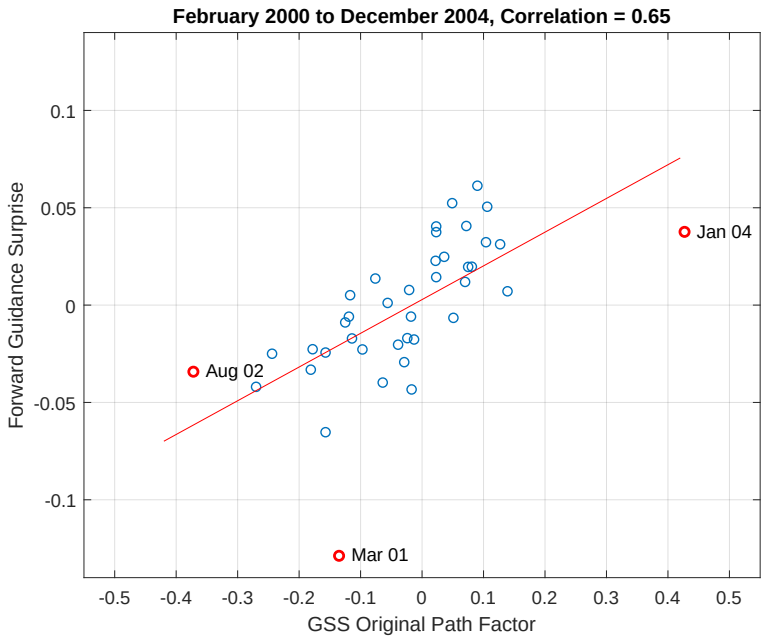


Figure J.3: Scatterplot of my forward guidance surprises and the path factor from Gürkaynak, Sack, and Swanson (2005). The least squares regression line is shown in red.

0.01 in the target factor corresponds to a 1 basis point change in the current federal funds futures contract. Second, they scale the path factor so that its effect on the four-quarter-ahead eurodollar futures rate is exactly the same as the target factor. GSS's sample is FOMC announcement days from February 1990 to December 2004, including days with intermeeting policy changes but excluding September 17, 2001.

The principal components approach used by GSS accomplishes two goals that are also accomplished by my econometric model in Section 4. First, it reduces the dimension of the data from five futures contracts to two factors. (In my case, the dimension reduction is from four futures contracts to two policy surprises.) Second, it ensures that the two factors are orthogonal so that the results can be interpreted easily. However, an important difference may be that my econometric model only uses futures contracts with 5- or 6-month horizons, but GSS use futures contracts with 3- and 4-quarter horizons. Hence, the horizon of my forward guidance surprise and their path factor is different. However, as shown in this appendix, these differences will be small in practice.

Similar to my estimate of forward guidance surprises, GSS provide evidence that the path factor has been associated with changes in the FOMC statement. Hence, the two measures

should be positively correlated. Figure J.3 shows that this is indeed the case. This figure is a scatterplot of my estimates of forward guidance surprises and GSS's estimated path factor, which taken from their data appendix. I make three notes about Figure J.3. First, because GSS show all of their results in basis points rather than percent, I divide their path factor by 100. Second, despite this re-scaling by 100, GSS's path factor is still in different units than my forward guidance surprise. This is due to their normalization that the path factor has the same effect as the target factor on the four-quarter-ahead eurodollar futures rate. Hence, the least squares regression line, which is shown in red, does not have a slope equal to one, nor should it. Third, my forward guidance estimates and GSS's original path factor overlap for the sample of February 2000 to December 2004, excluding their intermeeting estimates. For this sample, Figure J.3 shows that there is a clear positive relationship between the two estimates, with a correlation between the two estimates of 0.65.

In Figure J.3, I also highlight three important observations: March 2001, August 2002, and January 2004. March 2001 is the largest (in magnitude) negative forward guidance surprise in my sample. While it is also a negative path surprise in GSS, it is not as large in magnitude and is quite far from the least squares regression line. The regression error is -0.11. August 2002 and January 2004 are the largest (in magnitude) negative and positive path surprises for GSS from February 2000 to December 2004. August 2002 also causes a relatively large negative forward guidance surprise in my sample and is not too far from the least squares regression line. The regression error is 0.03. January 2004 also causes a relatively large positive forward guidance surprise in my sample, but it is a little farther from the least squares regression line. The regression error is 0.04.

While the correlation between my forward guidance surprise and GSS's path factor is relatively high, reconciling the large (in magnitude) observations is important. To do this, I first note that my forward guidance surprises are estimated on the subsamples of February 2000 to June 2003 and August 2003 to May 2006. In contrast, GSS's path factor is estimated from February 1990 to December 2004. Given the changes in FOMC communication and the empirical break in the federal funds futures data that I document in Section 3.2, I re-estimate GSS's path factor on the February 2000 to June 2003 and August 2003 to May 2006 subsamples, excluding intermeeting policy changes.[3] Figure J.4 shows the results. The relationship between my forward guidance estimates and the path factor continues to be

[3]I am very grateful to Aeimit Lakdawala for sharing the data to allow me to do this.

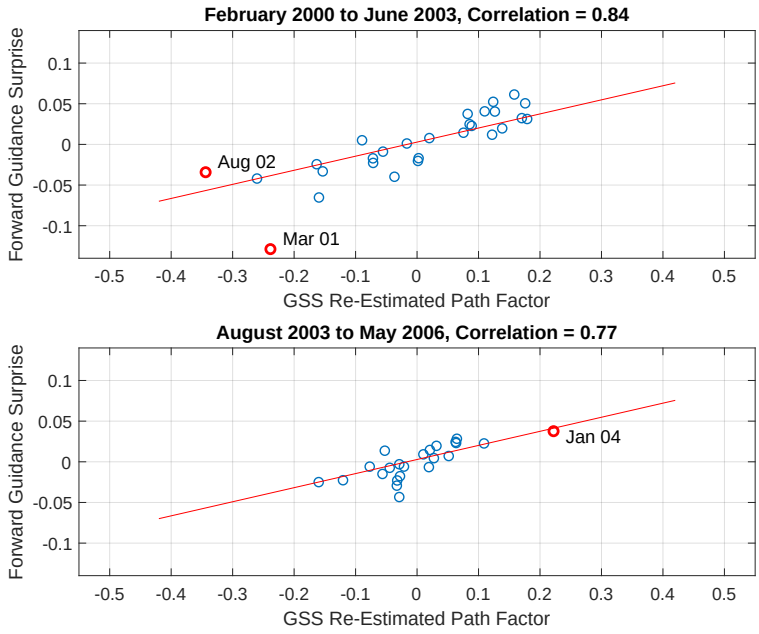


Figure J.4: Scatterplot of my forward guidance surprises and estimates of the path factor, estimated on the February 2000 to June 2003 and August 2003 to May 2006 subsamples. Least squares regression lines are shown in red.

positive. Further, the correlations within each subsample are higher than the correlation in Figure J.3. These results show that sample period alone reconciles much of the difference between my estimates of forward guidance and GSS's path factor. In particular, August 2002 and January 2004 observations are now much closer to the least squares regression lines, with regression errors of 0.01 and -0.01, respectively. Further, the March 2001 observation is now large (in magnitude) and negative for both my estimate of forward guidance and the estimate of the path factor, although it remains relatively far from the least squares regression line, with a regression error of -0.07.

As discussed in Appendix H, the March 2001 observation is influential in my sample when estimating the effects of forward guidance on stock prices. To ensure that the difference between my estimate of forward guidance in March 2001 and the estimated path factor in March 2001 do not influence the results for stock prices or the other dependent variables in this paper, I re-estimate all of my results using the target and path factor as in GSS. To parallel Tables 1 through 5 in the paper, I use three samples for my estimates, February 2000 to May 2006, February 2000 to June 2003, and August 2003 to May 2006.

Table J.7: Responses of Stock Prices and Volatility to the Target and Path Factors

Dependent Variable	Feb 2000 to May 2006 Target Factor	Path Factor	R^2	Feb 2000 to Jun 2003 Target Factor	Path Factor	R^2	Aug 2003 to May 2006 Target Factor	Path Factor	R^2
S&P 500	-5.67^{***}	-0.26	0.08	-7.49^{***}	2.90^{**}	0.33	-12.58	-7.26^{***}	0.54
	(1.73)	(1.28)		(2.20)	(1.46)		(16.71)	(0.91)	
VIX	1.74	1.94^{**}	0.12	2.74^{*}	-0.05	0.05	10.45	7.12^{***}	0.48
	(1.23)	(0.77)		(1.56)	(1.13)		(16.85)	(1.04)	

Notes: The Target Factor columns display the regression coefficients of the dependent variables on the target factor. The Path Factor columns display the regression coefficients of the dependent variables on the path factor. Heteroskedasticity-robust standard errors are shown in parentheses. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table J.7 shows the results for stock prices and volatility. It parallels Table 1 in the paper. The results in Table J.7 and Table 1 are very close. Because the target factor is normalized so that a 0.01 change corresponds to a 1 basis point change in the current federal funds futures contract, it has comparable units to my current federal funds rate surprise. Hence, the estimated coefficients for the target factor are generally similar to the coefficients for the funds rate in Table 1. This is especially true for the February 2000 to June 2003 subsample.

I note again that because of the normalization of the path factor in GSS, the units for the path factor and my measure of forward guidance are different. Hence, the coefficients are not comparable. However, the signs of the coefficients in Tables J.7 and Table 1 show the same pattern for stock prices. For the February 2000 to May 2006 sample, the coefficient is small in magnitude but not statistically significant. I note that I use heteroskedasticity-robust standard errors as in GSS. For the February 2000 to June 2003 sample, the coefficient is positive and statistically significant at the 5 percent level. For the August 2003 to May 2006 sample, the coefficient is negative, about 2.5 times the magnitude of the February 2000 to June 2003 coefficient, and statistically significant at the 1 percent level. This pattern of results is consistent with everything described in Subsection 5.1. Hence, switching to the GSS target and path factor approach does not change the stock price results. Further, the differences in the March 2001 estimates displayed in Figure J.4 have very little impact on these results despite March 2001 being an influential observation.

The pattern of results for the VIX does change a little from Table 1 to Table J.7. However, apparent in both tables is the main result that forward guidance has a small (in magnitude)

and statistically insignificant effect on the VIX from February 2000 to June 2003 but a large, positive, and statistically significant effect from August 2003 to May 2006.

Table J.8 shows the results for Treasury yields, term premia, and the expected path of short-term rates. It parallels Table 2 in the paper. The responses of Treasury yields are similar in Tables J.8 and 2. The target factor has a statistically insignificant effect on yields for the February 2000 to May 2006 and the February 2000 to June 2003 sample. However, the path factor has a positive and statistically significant effect on yields in both of these samples. Further, the path factor has a larger effect in the August 2003 to May 2006 sample than in the February 2000 to June 2003 sample.

The results for term premia do change slightly from Table 2 to Table J.8. In Table J.8, term premia have negative responses to the path factor at longer horizons in the February 2000 to June 2003 sample. This is similar to Table 2 except that the responses are not statistically significant in Table J.8. For the August 2003 to May 2006 sample, term premia have statistically significant positive responses to the path factor for short horizons, a results that matches Table 2.

The expected path of short-term interest rates has positive responses to the path factor in all three samples. As in Table 2, the responses of Treasury yields for the February 2000 to June 2003 and the August 2003 to May 2006 samples become more similar after removing the term premia. However, the responses are still slightly larger for the the August 2003 to May 2006 sample in both Tables J.8 and 2.

Table J.9 shows the results for private-sector borrowing costs, and parallels Table 3 in the paper. Similar to Table 3, corporate bond and MBS yields have positive responses to the path factor in all three samples in Table J.9. In both tables, responses are larger for shorter horizons and for the August 2003 to May 2006 sample. Also similar to Table 3, Table J.9 shows that corporate yield spreads and the OAS have essentially no response to the path factor from February 2000 to June 2003. However, they have positive and statistically significant responses from August 2003 to May 2006.

Table J.10 shows the results for Blue Chip forecasts, and parallels Table 4 in the paper. As in Table 4, statistical power is low in Table J.10, and statistical significance is sporadic. However, I discuss the signs of the responses to compare the results in Table J.9 to the results in Table 4. Table J.10 indicates that there is an event-study activity puzzle in the February 2000 to May 2006 and February 2000 to June 2003 samples. Both GDP growth

Table J.8: Responses of Treasury Yields and Term Premia to the Target and Path Factors

Dependent Variable	Feb 2000 to May 2006 Target Factor	Feb 2000 to May 2006 Path Factor	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Target Factor	Feb 2000 to Jun 2003 Path Factor	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Target Factor	Aug 2003 to May 2006 Path Factor	Aug 2003 to May 2006 R^2
Treasury Yields:									
2-Year	0.24	0.33***	0.54	0.19	0.29***	0.42	2.53***	0.65***	0.72
	(0.16)	(0.03)		(0.16)	(0.05)		(0.65)	(0.07)	
5-Year	0.09	0.27***	0.46	0.07	0.22***	0.30	1.61***	0.59***	0.66
	(0.13)	(0.03)		(0.13)	(0.05)		(0.58)	(0.07)	
7-Year	0.06	0.23***	0.39	0.05	0.17***	0.22	1.16**	0.51***	0.60
	(0.12)	(0.03)		(0.11)	(0.05)		(0.56)	(0.07)	
10-Year	0.04	0.18***	0.28	0.05	0.11**	0.12	0.77	0.44***	0.52
	(0.13)	(0.03)		(0.12)	(0.06)		(0.54)	(0.07)	
Term Premia:									
2-Year	−0.12*	0.06***	0.17	-0.11	0.01	0.07	0.51*	0.22***	0.49
	(0.07)	(0.02)		(0.07)	(0.03)		(0.26)	(0.04)	
5-Year	-0.17	0.01	0.08	-0.12	-0.04	0.10	-0.34	0.14***	0.18
	(0.11)	(0.03)		(0.09)	(0.04)		(0.31)	(0.04)	
7-Year	-0.16	-0.02	0.06	-0.11	-0.07	0.11	−0.60*	0.10*	0.10
	(0.14)	(0.03)		(0.12)	(0.05)		(0.36)	(0.05)	
10-Year	-0.14	-0.03	0.05	-0.08	-0.09	0.11	−0.75*	0.07	0.07
	(0.17)	(0.03)		(0.15)	(0.06)		(0.43)	(0.05)	
Expected Path of Short-Term Rates:									
2-Year	0.37***	0.27***	0.64	0.30**	0.28***	0.63	2.02***	0.43***	0.66
	(0.12)	(0.02)		(0.12)	(0.04)		(0.47)	(0.05)	
5-Year	0.25*	0.26***	0.59	0.19	0.26***	0.56	1.95***	0.45***	0.66
	(0.13)	(0.02)		(0.13)	(0.04)		(0.46)	(0.05)	
7-Year	0.21*	0.24***	0.59	0.16	0.24***	0.54	1.77***	0.42***	0.67
	(0.12)	(0.02)		(0.12)	(0.04)		(0.42)	(0.04)	
10-Year	0.18	0.21***	0.57	0.14	0.20***	0.52	1.51***	0.37***	0.66
	(0.11)	(0.02)		(0.11)	(0.03)		(0.35)	(0.04)	

See notes to Table J.7.

Table J.9: Responses of Private-Sector Borrowing Costs to the Target and Path Factors

Dependent Variable	Feb 2000 to May 2006 Target Factor	Path Factor	R^2	Feb 2000 to Jun 2003 Target Factor	Path Factor	R^2	Aug 2003 to May 2006 Target Factor	Path Factor	R^2
Corporate Bond and MBS Yields:									
A (3-Yr)	0.28*	0.32***	0.52	0.21	0.32***	0.50	2.61***	0.54***	0.58
	(0.16)	(0.04)		(0.15)	(0.06)		(0.79)	(0.08)	
A (10-Yr)	0.13	0.21***	0.28	0.12	0.17**	0.18	1.07	0.41***	0.36
	(0.19)	(0.05)		(0.18)	(0.07)		(0.68)	(0.10)	
BBB (3-Yr)	0.33**	0.34***	0.54	0.31***	0.28***	0.47	1.77**	0.75***	0.66
	(0.13)	(0.05)		(0.12)	(0.07)		(0.81)	(0.09)	
BBB (10-Yr)	0.09	0.24***	0.30	0.11	0.17**	0.17	0.85	0.53***	0.44
	(0.20)	(0.05)		(0.18)	(0.07)		(0.71)	(0.10)	
MBS (30-Yr)	0.19	0.25***	0.40	0.17	0.16***	0.27	1.35*	0.57***	0.50
	(0.17)	(0.04)		(0.15)	(0.05)		(0.79)	(0.11)	
Corporate Yield Spreads and OAS:									
BBB - A	0.05	0.02	0.01	0.10	-0.05	0.09	−0.84*	0.21**	0.46
(3-Yr)	(0.11)	(0.05)		(0.09)	(0.05)		(0.46)	(0.08)	
BBB - A	-0.04	0.03	0.03	-0.02	0.00	0.00	-0.22	0.12***	0.34
(10-Yr)	(0.08)	(0.04)		(0.08)	(0.06)		(0.29)	(0.03)	
OAS	-0.04	0.02	0.03	-0.05	-0.01	0.02	0.63**	0.11**	0.28
	(0.06)	(0.03)		(0.06)	(0.04)		(0.25)	(0.04)	

See notes to Table J.7.

and CPI inflation forecasts are revised up in response to a positive path factor surprise, and the unemployment rate is revised down. This is similar to Table 4. In contrast, no such puzzle exists in the August 2003 to May 2006 sample. Both GDP growth and CPI inflation forecasts are revised down in response to a positive path factor surprise, and the unemployment rate is revised up. This is also similar to Table 4.

Table J.11 shows the results for macroeconomic variables. The dependent variable is $y_{t+12} - y_t$ so that Table J.11 parallels Table 5 in the paper. As in Table 5, I use the Barlett kernel with a truncation parameter of 10 to estimate the standard errors. I also use fixed-b critical values to indicate levels of statistical significance (Sun, 2014). Similar to Table 5, statistical power is low and statistical significance is sporadic. However, results for the path factor in Table J.11 generally parallel results for forward guidance in Table 5. From February

Table J.10: Responses of Private Forecasts to the Target and Path Factors

Dependent Variable	Feb 2000 to May 2006 Target Factor	Feb 2000 to May 2006 Path Factor	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Target Factor	Feb 2000 to Jun 2003 Path Factor	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Target Factor	Aug 2003 to May 2006 Path Factor	Aug 2003 to May 2006 R^2
GDP Growth	0.13	0.18*	0.06	-0.05	0.36**	0.17	1.53	-0.13	0.05
	(0.21)	(0.10)		(0.24)	(0.17)		(2.62)	(0.30)	
CPI Inflation	0.02	0.01	0.00	-0.02	0.08	0.02	-0.53	-0.22	0.09
	(0.29)	(0.08)		(0.28)	(0.11)		(1.13)	(0.14)	
Unemp. Rate	0.11	-0.07	0.02	0.13	-0.04	0.01	1.09**	0.02	0.06
	(0.22)	(0.08)		(0.16)	(0.09)		(0.51)	(0.17)	

See notes to Table J.7.

2000 to May 2006, information effects appear to be present as an increase in the path factor causes an increase in inflation and a decrease in the unemployment rate. These inflation an unemployment responses appears to be driven by the February 2000 to June 2003 subsample. In contrast, an increase in the path factor increases the unemployment rate in the August 2003 to May 2006 sample.

Overall, despite the differences in the horizons of the futures contracts used to construct my forward guidance surprise and the GSS path factor, the results with two approaches are very similar. This is true if the two measures are compared directly as in Figure J.4 or if they are used as independent variables in regressions as shows in Tables J.7 through J.11. Hence, my results appear to capture the full impact of forward guidance and are robust to increasing the horizon over which forward guidance is measured.

J.4 Robustness of Treasury Yield Estimates

My estimated responses of Treasury yields to the federal funds rate shock shown in Table 2 are lower than those estimated by GSS as shown in their Table 1. This appendix reconciles these differences. There are three important differences between my data and GSS's. First, GSS use as their dependent variables changes in on-the-run bond yields in 30-minute windows around FOMC announcements. In contrast, I use daily changes in continuously compounded zero-coupon yields from Gürkaynak, Sack, and Wright (2007) as my dependent variable. The Gürkaynak, Sack, and Wright (2007) data are not available at higher frequencies, and I use them so that I can use Adrian, Crump, and Moench's (2013) decomposition of Treasury

Table J.11: Responses of Macroeconomic Variables to the Target and Path Factors

	Feb 2000 to May 2006			Feb 2000 to Jun 2003			Aug 2003 to May 2006		
Dependent Variable	Target Factor	Path Factor	R^2	Target Factor	Path Factor	R^2	Target Factor	Path Factor	R^2
PCE Growth	0.50 (1.68)	0.10 (0.64)	0.00	0.61 (1.54)	0.01 (0.65)	0.00	-10.75 (7.97)	-0.78 (0.89)	0.05
CPI Inflation	0.52 (1.84)	$1.31^{\dagger}$ (0.78)	0.06	-0.01 (2.11)	1.23 (1.11)	0.07	$-20.40^{\dagger}$ (10.94)	0.15 (0.73)	0.09
Unemp. Change	-0.44 (1.47)	$-0.97^{\dagger}$ (0.65)	0.04	0.45 (1.82)	-0.58 (0.48)	0.02	$2.68^{\dagger}$ (1.72)	0.70^{*} (0.25)	0.16
IP Growth	-2.92 (4.94)	-0.29 (1.77)	0.00	-4.41 (5.84)	$-5.00^{\dagger}$ (2.95)	0.08	15.60 (19.45)	-1.42 (1.60)	0.04

Notes: The Target Factor columns display the coefficients of the dependent variables on the target factor. The Path Factor columns display the regression coefficients of the dependent variables on the path factor. Standard errors are in parentheses. See the text of this appendix for details. The symbols, †, *, **, and ***, denote statistical significance at the 32 percent, 10 percent, 5 percent, and 1 percent levels, respectively.

yields into term premia and the future path of short-term rates, the latter of which is also only available at a daily frequency.

Second, GSS include intermeeting policy changes in their baseline results, while I exclude them. Third, GSS include days on which employment reports are announced on the same day as the FOMC meeting. In their paper, the narrow window for both the independent and dependent variable removes the employment report effect. In my sample, no such observations exist. However, if I were to extend my sample back to match theirs, as I will do below, the daily changes in continuously compounded zero-coupon Treasury yields will be affected by the employment report announcements.

Table J.12 compares the estimated responses of Treasury yields adjusting for the three differences between my data and GSS's data. The first column in Table J.12 shows the estimates from Table 1 of GSS. I note that GSS's data sample is from July 1991 to December 2004. The second column shows the estimated responses of Treasury yields to federal funds rate changes using daily changes in continuously compounded zero-coupon yields as the dependent variable. Making this change reduces the magnitude of the estimated responses and increases the standard errors. The third column is the same as the second column but days with employment reports and intermeeting policy changes have been removed from the

Table J.12: Responses of Treasury Yields to Funds Rate Changes

Dependent Variable	GSS	Daily Change	No Emp or Inter	Baseline
2-Year Treasury	0.46*** (0.09)	0.32*** (0.11)	0.28** (0.12)	0.26 (0.23)
5-Year Treasury	0.26*** (0.08)	0.15 (0.13)	0.13 (0.11)	0.13 (0.16)
10-Year Treasury	0.13** (0.06)	0.04 (0.11)	-0.03 (0.10)	0.10 (0.11)

The GSS column shows the results from Table 1 of Gürkaynak, Sack, and Swanson (2005). The sample in GSS is July 1991 to December 2004. The Daily Change column shows estimates from July 1991 to December 2004 with daily changes in continuously compounded zero-coupon yields as the dependent variable. The No Emp or Inter column shows the same estimates but with employment report days and intermeeting changes removed from the sample. Baseline shows the results from Table 2 of this paper.

sample. Removing these observations slightly attenuates the estimated responses of 2-year and 5-year Treasury yields. 10-year yields have a negative but statistically insignificant response. The fourth column of Table J.12 shows my baseline results from Table 2 of this paper.

Comparing columns 3 and 4, we see that the point estimates for 2-year and 5-year Treasuries are very similar. Hence, using the daily changes in continuously compounded zero-coupon yields and excluding days with employment reports and intermeeting policy changes reconciles the difference in point estimates between my baseline results and GSS's results. I note that the standard errors for my baseline results are larger. However, this is natural given my smaller sample size. For column 3, the number of observations is 106. For column 4, it is 51. This difference in sample explains much of the differences in the standard errors.

J.5 High-Frequency Treasury Yield Results

This appendix studies the effects of the current federal funds rate and forward guidance shocks on Treasury yields at higher frequencies than presented in the body of the paper. In the body of the paper, I use daily changes in continuously compounded zero-coupon

yields from Gürkaynak, Sack, and Wright (2007) as my dependent variable. At this daily frequency, news other than the FOMC meeting statements may influence the Treasury yields. In particular, Treasury auctions and morning announcements of macroeconomic data may confound my results, especially given my small sample sizes. Indeed, Table J.12 in Appendix J.4 indicates that daily changes in the Gürkaynak, Sack, and Wright (2007) yields can give different estimated effects of fed funds rate surprises than the high frequency changes in on-the-run bond yields used by Gürkaynak, Sack, and Swanson (2005).

In an effort to reduce the influence of Treasury auctions and morning announcements of macroeconomic data on my results, I consider shorter windows to measure the change in Treasury yields than the daily windows used in my baseline analysis. All high-frequency Treasury yields in this appendix are for on-the-run securities. My data sources are GovPX for the years 2000 to 2001 (NEX, n.d.) and BrokerTec for 2002 to 2007 (CME Group, n.d.). For all analysis in this section, I use minute-by-minute data. The trade data are processed in the same manner as in Section 3.1 of Fleming, Mizrach, and Nguyen (2018). I treat the last observed tick in a given minute to be the Treasury yield for that minute.[4] The first window that I use measures the change in Treasury yields from 10 minutes before an FOMC statement release until 4pm of that same day. This is approximately a 2-hour window on each FOMC meeting day, and I refer to this as the 2-hour window. The second window that I use measures the change in Treasury yields from 10 minutes before an FOMC statement release until 20 minutes after. I refer to this as the 30-minute window. These windows parallel the windows that I use in Appendix J.2 for studying high-frequency percent changes in the S&P 500.

Table J.13 presents the responses of 2-, 5- and 10-year Treasury yields for the three different windows. The daily windows are the same as in Table 2 in the paper. I make four remarks about the results for the 2-hour windows. First, the estimated effects of funds rate surprises in the February 2000 to May 2006 and the February 2000 to June 2003 samples are similar to those with the daily window and are all statistically insignificant. Second, the estimated effects of funds rate surprises in the August 2003 to May 2006 sample are smaller than the estimated effects with daily windows. However, as discussed in the paper, the variation in the funds rate surprises is tiny in the August 2003 to May 2006 sample, and estimates are largely driven by the September 2005 observation. Third, the estimated

[4] I am very grateful to Michael Fleming, Francisco Ruela, and the Federal Reserve Bank of New York for the assistance with this data.

Table J.13: Responses of Treasury Yields to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006			Feb 2000 to Jun 2003			Aug 2003 to May 2006		
	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2
2-Year Treasury Yields:									
Daily	0.26	1.23***	0.43	0.21	0.92***	0.37	3.15***	2.29***	0.68
	(0.23)	(0.25)		(0.24)	(0.21)		(1.10)	(0.42)	
2-hour	0.31	1.76***	0.67	0.28	1.56***	0.73	1.93*	2.76***	0.65
	(0.27)	(0.20)		(0.28)	(0.16)		(0.99)	(0.48)	
30-min	0.42***	1.30***	0.66	0.40***	1.06***	0.80	1.30*	2.19***	0.59
	(0.13)	(0.21)		(0.13)	(0.14)		(0.75)	(0.55)	
5-Year Treasury Yields:									
Daily	0.13	0.90***	0.30	0.10	0.61***	0.21	2.04**	2.05***	0.61
	(0.16)	(0.23)		(0.17)	(0.19)		(1.04)	(0.42)	
2-hour	0.15	1.30***	0.47	0.13	1.01***	0.55	1.26	2.63***	0.55
	(0.19)	(0.26)		(0.21)	(0.20)		(1.07)	(0.58)	
30-min	0.22**	0.93***	0.37	0.21**	0.60***	0.51	0.65	2.35***	0.50
	(0.09)	(0.25)		(0.08)	(0.15)		(0.88)	(0.70)	
10-Year Treasury Yields:									
Daily	0.10	0.48***	0.13	0.09	0.22	0.05	0.88	1.57***	0.49
	(0.11)	(0.18)		(0.12)	(0.16)		(0.91)	(0.37)	
2-hour	0.07	0.80***	0.27	0.06	0.58***	0.28	0.37	1.94***	0.44
	(0.13)	(0.20)		(0.14)	(0.17)		(0.93)	(0.50)	
30-min	0.19**	0.60***	0.26	0.19***	0.34***	0.40	-0.30	1.79***	0.44
	(0.08)	(0.20)		(0.07)	(0.12)		(0.85)	(0.56)	

Notes: The Funds Rate columns display the estimates of β_1, and the Forward Guidance columns display the estimates of γ from Equation (7). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

effects of forward guidance are larger than with the daily window for all samples. In particular, forward guidance has statistically significant effects on 10-year Treasury yields in the February 2000 to June 2003 sample. Fourth, the pattern that forward guidance has large effects in the August 2003 to May 2006 sample compared to the February 2000 to June 2003 sample holds for both the daily and 2-hour windows. Overall, switching from daily windows to 2-hour windows has minimal effect on the funds rate results but some material effect on the forward guidance results. However, switching from daily to 2-hour windows does not change the main point of the paper that the strength of information effects changed from the February 2000 to June 2003 sample to the August 2003 to May 2006 sample. The larger coefficients on forward guidance in the August 2003 to May 2006 sample compared to the February 2000 to June 2003 sample still allow for the differing term premia results presented in Table 2 of the paper.

I make two remarks about the results for the 30-minute windows. First, the estimated effects of fed funds rate surprises are larger in the February 2000 to May 2006 and the February 2000 to June 2003 samples than with daily or 2-hour windows. These estimates are very similar to those in the GSS column in Table J.12 of Appendix J.4 and are all statistically significant. Second, the estimated effects of forward guidance are all smaller than with the 2-hour windows but generally similar to daily windows. One exception is the estimate for 10-year yields in the February 2000 to June 2003 sample, which is statistically significant with 30-minute windows but not statistically significant for daily windows. Overall, switching from daily windows to 30-minute windows does not materially change how I interpret information effects in the February 2000 to June 2003 sample compared to the Aug 2003 to May 2006 sample.

J.6 Main Results with Only Regular Trading Hours Data

As discussed in Subsection 3.1, to measure my policy surprises, I use Fed Funds Futures data from both the regular trading hours (rth) data from the trading floor and the electronic trading hours (eth) data from the electronic trading platform. Because the eth data became available in 2003, it is possible that the introduction of this new data changed the measurement of the policy surprises and, hence, the estimated responses to forward guidance in a way that confounds my analysis. To address this issue, this appendix shows the results from Section 5 when only rth data is used.

Table J.14: Responses of Stock Prices and Volatility to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006			Feb 2000 to Jun 2003			Aug 2003 to May 2006		
	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2
S&P 500	-7.83^{***}	4.30	0.18	-7.90^{***}	9.88^{**}	0.34	-8.15	-29.64^{***}	0.50
	(2.07)	(4.76)		(2.07)	(4.29)		(12.73)	(4.86)	
VIX	3.91^{**}	2.20	0.06	3.57^{**}	-2.22	0.09	14.99	22.89^{***}	0.32
	(1.73)	(4.59)		(1.72)	(3.99)		(11.21)	(6.72)	

Notes: The Funds Rate columns display the estimates of β_1 and the Forward Guidance columns display the estimates of γ from Equation (7). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Before showing and discussing the results, I note two caveats. First, because the eth data became available only at the end of 2003, excluding it does not affect the results for the February 2000 to June 2003 sample. Hence, I only discuss changes to the August 2003 to May 2006 sample in this appendix. Second, the electronic trading platform became very popular, especially in 2005 and 2006, and the rth data became sparser in these years. Because of this, rth data in 2005 and 2006 are not very reliable for producing 30-minute changes around FOMC announcements. In particular, the rth data may not provide a good indication of market expectations shortly before the FOMC statement is released. As a result, some of the estimated effects of forward guidance lose statistical significance. However, I note that the general pattern of the estimated effects of forward guidance stays essentially the same.

Conceptually, because the regular trading platform becomes less popular later in my sample due to the introduction of the electronic trading platform, it is possible that using only the rth data would also introduce a change in the measurement of the policy surprises. Hence, the results in this appendix should not be viewed as being more consistent across the sample periods. Rather, the results presented in the appendix are simply a check that the rth data yield generally similar results to the merged rth and eth data for the August 2003 to May 2006 sample and that merging the two data series is a reasonable way to handle the introduction of the electronic trading platform.

Table J.14 shows the estimates of β_1 and γ for stock prices and volatility when the unscheduled policy changes are included. It parallels Table 1 in the paper. The estimates in Tables 1 and J.14 are generally similar. However, the magnitudes of the estimates of γ are slightly larger for the August 2003 to May 2006 sample in Table J.14 compared to Table

Table J.15: Responses of Treasury Yields and Term Premia to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Treasury Yields:									
2-Year	0.30	1.21***	0.42	0.21	0.92***	0.37	3.21***	2.21***	0.67
	(0.23)	(0.25)		(0.24)	(0.21)		(1.05)	(0.52)	
5-Year	0.16	0.88***	0.28	0.10	0.61***	0.21	2.28**	1.99***	0.58
	(0.16)	(0.22)		(0.17)	(0.19)		(1.01)	(0.49)	
7-Year	0.13	0.68***	0.21	0.08	0.42**	0.12	1.72*	1.76***	0.51
	(0.12)	(0.20)		(0.14)	(0.17)		(0.95)	(0.47)	
10-Year	0.12	0.45***	0.12	0.09	0.22	0.05	1.20	1.51***	0.42
	(0.11)	(0.18)		(0.12)	(0.16)		(0.87)	(0.45)	
Term Premia:									
2-Year	-0.07	0.10	0.04	-0.09	-0.02	0.05	0.60	0.73***	0.35
	(0.07)	(0.10)		(0.07)	(0.09)		(0.38)	(0.25)	
5-Year	-0.11	−0.17*	0.07	-0.10	−0.27**	0.16	-0.29	0.48*	0.13
	(0.09)	(0.09)		(0.10)	(0.11)		(0.38)	(0.28)	
7-Year	-0.09	−0.28***	0.10	-0.08	−0.37***	0.20	-0.61	0.36	0.11
	(0.13)	(0.11)		(0.13)	(0.14)		(0.41)	(0.32)	
10-Year	-0.07	−0.37***	0.12	-0.05	−0.47***	0.21	−0.83*	0.29	0.10
	(0.16)	(0.12)		(0.16)	(0.16)		(0.46)	(0.37)	
Expected Path of Short-Term Rates:									
2-Year	0.37*	1.11***	0.61	0.30	0.95***	0.62	2.61***	1.48***	0.70
	(0.19)	(0.18)		(0.20)	(0.17)		(0.70)	(0.35)	
5-Year	0.26	1.05***	0.54	0.20	0.88***	0.53	2.56***	1.51***	0.68
	(0.19)	(0.19)		(0.20)	(0.17)		(0.70)	(0.37)	
7-Year	0.23	0.96***	0.53	0.16	0.80***	0.51	2.33***	1.41***	0.68
	(0.18)	(0.17)		(0.19)	(0.16)		(0.65)	(0.34)	
10-Year	0.19	0.82***	0.51	0.14	0.69***	0.50	2.02***	1.21***	0.67
	(0.16)	(0.15)		(0.17)	(0.14)		(0.55)	(0.31)	

See notes to Table J.14.

1. With this said, the pattern of results is similar in Tables J.14 and 1, and there is clear evidence that forward guidance had standard theoretical effects in the August 2003 to May 2006 sample.

Table J.15 shows the estimates of β_1 and γ for Treasury yields, term premia, and the expected path of short-term rates. It parallels Table 2 in the paper. For the August 2003 to May 2006 sample, the results in Tables J.15 and Table 2 are very similar. Hence, for Treasury yields and term premia, using only the rth data has no material effect on the results.

Table J.16 shows the estimates of β_1 and γ for private borrowing costs. It parallels Table 3 in the paper. The results for corporate bond yields and MBS yields are very similar in Tables J.16 and Table 3 for the August 2003 to May 2006 sample. The results for OAS are also very similar across these tables. Hence, using only rth data has no material effect on the variables.

In contrast, the results for corporate yield spreads have weakened for the August 2003 to May 2006 sample. The point estimates in Table J.16 are slightly lower and the standard errors are slightly larger than in Table 3. However, estimates of the responses of the spreads are still positive, and the 3-year spread still has a larger response than the 10-year spread. Hence, the pattern of results is the same in Tables J.16 and Table 3; they are just less precisely estimated in Table J.16.

Table J.17 shows the estimates of β_1 and γ for private forecasts. It parallels Table 4 in the paper. For the whole February 2000 to May 2006 sample, the results are very similar across the two tables. That is, strong information effects are present in the whole sample, even when using only rth data. For the August 2003 to May 2006 sample, the event-study activity puzzle does not appear in Table J.17. An increase in the expected funds rate path from forward guidance causes a decrease in expected inflation and an increase in expected unemployment just as in Table 4. The only notable difference between Tables J.17 and 4 is that γ is positive for GDP growth for the August 2003 to May 2006 sample in Table J.17. However, this estimate is small in magnitude and very imprecisely estimated. Overall, there is no evidence of strong information effects from forward guidance in Table J.17 or Table 4.

Table J.18 shows the estimates of β_1 and γ for macroeconomic variables. It parallels Table 5 in the paper. For the August 2003 to May 2006 sample, no evidence of information effects from forward guidance is present in Table J.18. A surprise increase in the expected path of the funds rate from forward guidance causes subsequent decreases in consumption

Table J.16: Responses of Private-Sector Borrowing Costs to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Corporate Bond and MBS Yields:									
A (3-Yr)	0.30	1.16***	0.40	0.23	0.91***	0.35	2.89***	1.99***	0.59
	(0.20)	(0.24)		(0.22)	(0.24)		(0.83)	(0.46)	
A (10-Yr)	0.21	0.68***	0.19	0.17	0.47**	0.14	1.40*	1.48***	0.33
	(0.17)	(0.19)		(0.18)	(0.20)		(0.77)	(0.44)	
BBB (3-Yr)	0.36**	1.23***	0.43	0.30*	0.97***	0.47	2.40*	2.57***	0.54
	(0.17)	(0.23)		(0.18)	(0.17)		(1.31)	(0.71)	
BBB (10-Yr)	0.19	0.67***	0.15	0.15	0.42**	0.10	1.51	1.72***	0.33
	(0.15)	(0.22)		(0.17)	(0.21)		(1.07)	(0.58)	
MBS (30-Yr)	0.27**	0.81***	0.26	0.21	0.46***	0.22	1.91	2.07***	0.45
	(0.12)	(0.21)		(0.13)	(0.15)		(1.24)	(0.49)	
Corporate Yield Spreads and OAS:									
BBB - A	0.06	0.07	0.02	0.08	0.05	0.04	-0.49	0.58	0.20
(3-Yr)	(0.09)	(0.13)		(0.09)	(0.13)		(0.65)	(0.40)	
BBB - A	-0.02	-0.02	0.00	-0.02	-0.06	0.01	0.11	0.24	0.08
(10-Yr)	(0.07)	(0.12)		(0.07)	(0.13)		(0.44)	(0.23)	
OAS	-0.02	0.11	0.03	-0.04	0.00	0.01	0.83**	0.50***	0.46
	(0.05)	(0.07)		(0.05)	(0.07)		(0.35)	(0.11)	

See notes to Table J.14.

Table J.17: Responses of Private Forecasts to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
GDP	-0.06	1.27***	0.15	-0.08	1.43***	0.21	0.29	0.12	0.00
Growth	(0.26)	(0.41)		(0.26)	(0.46)		(2.64)	(0.93)	
CPI	0.00	0.24	0.01	0.00	0.34	0.03	-0.18	-1.05	0.10
Inflation	(0.28)	(0.29)		(0.26)	(0.33)		(0.66)	(0.83)	
Unemp.	0.20	−0.59**	0.08	0.20	−0.49*	0.07	0.83	0.05	0.05
Rate	(0.24)	(0.23)		(0.19)	(0.26)		(0.46)	(0.57)	

See notes to Table J.14.

Table J.18: Responses of Macroeconomic Variables to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
PCE Growth	0.30	2.38	0.02	0.37	2.88	0.03	-9.39	-4.33	0.06
	(1.55)	(3.12)		(1.51)	(2.26)		(8.72)	(4.60)	
CPI Inflation	0.03	7.88***	0.12	-0.42	7.06†	0.19	-0.57	-4.70	0.02
	(1.92)	(1.89)		(2.01)	(3.00)		(14.42)	(4.08)	
Unemp. Change	0.34	−6.22**	0.09	0.87	−4.01**	0.07	0.79	3.15†	0.15
	(1.66)	(2.08)		(2.01)	(1.13)		(1.32)	(1.54)	
IP Growth	-3.92	2.21	0.01	-5.65	-9.87	0.04	1.93	-5.94	0.02
	(5.74)	(9.53)		(6.84)	(8.53)		(26.06)	(6.28)	

Notes: The Funds Rate columns display the estimates of β_1 and the Forward Guidance columns display the estimates of γ from Equation (8). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The symbols, †, *, **, and ***, denote statistical significance at the 32 percent, 10 percent, 5 percent, and 1 percent levels, respectively.

and prices and a subsequent increase in the unemployment rate. As in Table 5, these results in Table J.18 are consistent with standard theoretical effects. Further, as in Table 5, the macroeconomic data used to estimate the coefficients in Table J.18 are noisy and the estimates are imprecise.

Overall, the results presented here and in Section 5 are generally similar. From August 2003 to May 2006, there is no evidence that forward guidance had strong information effects, and standard theoretical effects dominate the estimates. Hence, using only rth does not materially change the main results of the paper.

J.7 Main Results with a Longer Observation Window

The premise of this paper is that the nature of FOMC forward guidance language can affect how the private sector responds to forward guidance. Under this premise, traders in the federal funds futures market need to be able to read the FOMC statement, understand the forward guidance language, and then trade based on their understanding. It is possible that the 30-minute window that I use to measure the policy surprises is not long enough for traders to be able to do this. In this appendix, I show the results from Section 5, but with the policy surprises measured with a longer window.

Table J.19: Responses of Stock Prices and Volatility to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006			Feb 2000 to Jun 2003			Aug 2003 to May 2006		
	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2
S&P 500	-8.44^{***}	3.88	0.20	-8.44^{***}	9.76^{**}	0.38	-7.98	-19.80^{***}	0.36
	(2.09)	(4.27)		(2.08)	(4.31)		(12.20)	(6.76)	
VIX	4.23^{**}	1.55	0.07	4.14^{**}	-3.35	0.13	8.67	18.07^{***}	0.29
	(1.75)	(3.93)		(1.78)	(3.62)		(11.05)	(4.74)	

Notes: The Funds Rate columns display the estimates of β_1 and the Forward Guidance columns display the estimates of γ from Equation (7). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

For this appendix, I measure the policy surprises with a 50-minute window, beginning 10 minutes before the FOMC announcement and now extending 40 minutes after the announcement, instead of just 20 minutes. This window hopefully gives traders in the federal funds futures market more time to analyze the FOMC statement and make trades. I note that I only extend the window by 20 minutes because of data limitations. FOMC statements are usually released within a minute or two of 2:15pm eastern time. However, the rth data, which is my only data source for much of my sample, has trading hours until only 3pm eastern time. Hence, the 50-minute window that I use in this appendix runs from approximately 2:05pm eastern to 2:55pm eastern, just before the close of trading. In practice, this window will be very similar to Gürkaynak, Sack, and Swanson's (2005) one-hour window, which began 15 minutes before an announcement and ended 45 minutes after an announcement.

The results with the longer observation window are presented in Tables J.19 through J.23. These tables parallel Tables 1 through 5 in Section 5 of the paper. Overall, the results in Tables J.19 through J.23 are so similar to the results in Tables 1 through 5, that I do not discuss them one by one. Rather, I simply note that the main results are robust to a longer observation window and that the federal funds futures market appears to incorporate information from the FOMC statement into market prices very quickly. This fact is also noted by Gürkaynak, Sack, and Swanson (2005) and motivates their use of 30-minute windows as well as one-hour windows.

In addition to checking the robustness of Tables 1 through 5 in Section 5 of the paper, I also check the robustness of Tables J.6 and J.13 above. In those tables, I compute the responses of the S&P 500 and Treasury yields in roughly 2-hour windows from 10 minutes

Table J.20: Responses of Treasury Yields and Term Premia to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Treasury Yields:									
2-Year	0.28	1.17***	0.46	0.23	0.90***	0.40	2.37**	2.05***	0.68
	(0.22)	(0.21)		(0.24)	(0.18)		(0.97)	(0.37)	
5-Year	0.14	0.87***	0.32	0.11	0.60***	0.22	1.42*	1.86***	0.62
	(0.16)	(0.20)		(0.18)	(0.18)		(0.82)	(0.36)	
7-Year	0.12	0.68***	0.24	0.10	0.43**	0.14	0.95	1.65***	0.57
	(0.13)	(0.19)		(0.14)	(0.17)		(0.74)	(0.32)	
10-Year	0.10	0.48***	0.15	0.09	0.24	0.07	0.54	1.41***	0.42
	(0.11)	(0.17)		(0.12)	(0.16)		(0.64)	(0.29)	
Term Premia:									
2-Year	-0.07	0.11	0.05	-0.08	-0.01	0.04	0.40	0.64***	0.38
	(0.07)	(0.09)		(0.07)	(0.09)		(0.31)	(0.15)	
5-Year	-0.11	-0.12	0.06	-0.10	−0.23**	0.14	−0.49*	0.43**	0.19
	(0.09)	(0.09)		(0.09)	(0.11)		(0.28)	(0.17)	
7-Year	-0.10	−0.21**	0.08	-0.08	−0.32***	0.17	−0.78**	0.33*	0.15
	(0.12)	(0.10)		(0.13)	(0.12)		(0.31)	(0.19)	
10-Year	-0.08	−0.28***	0.09	-0.06	−0.40***	0.18	−0.96***	0.27	0.14
	(0.16)	(0.11)		(0.16)	(0.14)		(0.36)	(0.23)	
Expected Path of Short-Term Rates:									
2-Year	0.35*	1.05***	0.63	0.32	0.90***	0.63	1.97***	1.41***	0.68
	(0.18)	(0.14)		(0.20)	(0.13)		(0.71)	(0.27)	
5-Year	0.25	0.98***	0.56	0.21	0.83***	0.54	1.91***	1.43***	0.66
	(0.19)	(0.15)		(0.20)	(0.14)		(0.70)	(0.30)	
7-Year	0.22	0.90***	0.54	0.18	0.75***	0.52	1.73***	1.32***	0.66
	(0.17)	(0.14)		(0.19)	(0.13)		(0.64)	(0.28)	
10-Year	0.18	0.77***	0.52	0.15	0.65***	0.50	1.50***	1.14***	0.64
	(0.15)	(0.12)		(0.17)	(0.11)		(0.54)	(0.26)	

See notes to Table J.19.

Table J.21: Responses of Private-Sector Borrowing Costs to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Corporate Bond and MBS Yields:									
A (3-Yr)	0.29	1.13***	0.44	0.23	0.90***	0.38	2.48***	1.79***	0.62
	(0.20)	(0.21)		(0.22)	(0.23)		(0.78)	(0.30)	
A (10-Yr)	0.19	0.65***	0.20	0.18	0.43**	0.13	0.93	1.35***	0.36
	(0.17)	(0.19)		(0.19)	(0.21)		(0.62)	(0.29)	
BBB (3-Yr)	0.34**	1.17***	0.47	0.31*	0.91***	0.47	1.65	2.30***	0.59
	(0.16)	(0.21)		(0.17)	(0.17)		(1.11)	(0.44)	
BBB (10-Yr)	0.16	0.68***	0.18	0.15	0.40**	0.11	0.62	1.70***	0.41
	(0.16)	(0.22)		(0.17)	(0.22)		(0.75)	(0.37)	
MBS (30-Yr)	0.24**	0.82***	0.30	0.22	0.47***	0.25	1.19	1.81***	0.46
	(0.12)	(0.19)		(0.13)	(0.15)		(1.08)	(0.33)	
Corporate Yield Spreads and OAS:									
BBB - A	0.06	0.04	0.01	0.08	0.01	0.03	-0.83	0.51**	0.32
(3-Yr)	(0.09)	(0.12)		(0.09)	(0.12)		(0.51)	(0.23)	
BBB - A	-0.03	0.03	0.01	-0.03	-0.02	0.00	-0.30	0.36***	0.30
(10-Yr)	(0.07)	(0.11)		(0.07)	(0.12)		(0.29)	(0.12)	
OAS	-0.03	0.14*	0.06	-0.04	0.03	0.01	0.52*	0.52***	0.49
	(0.05)	(0.07)		(0.05)	(0.07)		(0.27)	(0.11)	

See notes to Table J.19.

Table J.22: Responses of Private Forecasts to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
GDP	-0.03	1.02**	0.12	-0.07	1.41***	0.22	2.36	-0.93	0.16
Growth	(0.26)	(0.44)		(0.26)	(0.46)		(2.03)	(0.65)	
CPI	-0.01	0.20	0.01	0.03	0.20	0.01	-1.48	-0.16	0.07
Inflation	(0.28)	(0.28)		(0.26)	(0.34)		(0.75)	(0.48)	
Unemp.	0.23	−0.53**	0.08	0.21	−0.46*	0.06	0.49	0.22	0.03
Rate	(0.25)	(0.23)		(0.20)	(0.27)		(0.35)	(0.38)	

See notes to Table J.19.

Table J.23: Responses of Macroeconomic Variables to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
PCE Growth	0.45	1.77	0.01	0.47	$3.51^{\dagger}$	0.04	0.20	-10.87^{*}	0.21
	(1.56)	(3.46)		(1.55)	(2.21)		(5.12)	(3.49)	
CPI Inflation	-0.82	8.74^{***}	0.17	-0.59	7.42^{*}	0.23	-9.25	1.71	0.03
	(2.19)	(1.86)		(2.14)	(2.69)		(14.63)	(3.28)	
Unemp. Change	1.01	-6.62^{**}	0.13	1.00	-4.52^{**}	0.10	-0.28	$2.77^{\dagger}$	0.19
	(1.88)	(2.28)		(2.07)	(1.15)		(1.33)	(1.24)	
IP Growth	-5.23	2.78	0.01	-5.66	-8.93	0.04	17.94	-14.59^{**}	0.20
	(5.92)	(8.64)		(6.78)	(8.18)		(18.16)	(3.71)	

Notes: The Funds Rate columns display the estimates of β_1 and the Forward Guidance columns display the estimates of γ from Equation (8). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The symbols, †, *, **, and ***, denote statistical significance at the 32 percent, 10 percent, 5 percent, and 1 percent levels, respectively.

Table J.24: Responses of Stock Prices to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
S&P 500 (daily)	-8.44^{***}	3.88	0.20	-8.44^{***}	9.76^{**}	0.38	-7.98	-19.80^{***}	0.36
	(2.09)	(4.27)		(2.08)	(4.31)		(12.20)	(6.76)	
S&P 500 (2-hour)	-10.95^{***}	5.02	0.28	-10.83^{***}	10.09^{**}	0.41	-15.63^{**}	-18.54^{***}	0.47
	(2.59)	(4.44)		(2.59)	(4.55)		(6.63)	(5.54)	
S&P 500 (30-min)	-1.64	-1.38	0.06	-1.47	-0.90	0.07	-8.56	-8.05^{***}	0.41
	(1.75)	(1.42)		(1.68)	(1.50)		(5.23)	(2.80)	

Notes: The Funds Rate columns display the estimates of β_1, and the Forward Guidance columns display the estimates of γ from Equation (7). Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table J.25: Responses of Treasury Yields to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
2-Year Treasury Yields:									
Daily	0.28	1.17***	0.46	0.23	0.90***	0.40	2.37**	2.05***	0.68
	(0.22)	(0.21)		(0.24)	(0.18)		(0.97)	(0.37)	
2-hour	0.33	1.61***	0.66	0.31	1.47***	0.73	1.36*	2.38***	0.61
	(0.27)	(0.17)		(0.28)	(0.16)		(0.78)	(0.55)	
30-min	0.42***	1.20***	0.66	0.41***	1.03***	0.83	0.81	1.79***	0.50
	(0.12)	(0.17)		(0.12)	(0.12)		(0.51)	(0.60)	
5-Year Treasury Yields:									
Daily	0.14	0.87***	0.32	0.11	0.60***	0.22	1.42*	1.86***	0.62
	(0.16)	(0.20)		(0.18)	(0.18)		(0.82)	(0.36)	
2-hour	0.16	1.18***	0.46	0.15	0.96***	0.55	0.73	2.22***	0.50
	(0.19)	(0.22)		(0.21)	(0.19)		(0.77)	(0.66)	
30-min	0.21**	0.82***	0.33	0.21**	0.54***	0.47	0.20	1.91**	0.42
	(0.10)	(0.21)		(0.09)	(0.13)		(0.52)	(0.75)	
10-Year Treasury Yields:									
Daily	0.10	0.48***	0.15	0.09	0.24	0.07	0.54	1.41***	0.49
	(0.11)	(0.17)		(0.12)	(0.16)		(0.64)	(0.29)	
2-hour	0.07	0.73***	0.27	0.07	0.56***	0.29	0.02	1.63***	0.39
	(0.14)	(0.18)		(0.14)	(0.17)		(0.63)	(0.55)	
30-min	0.17*	0.55***	0.25	0.18**	0.33***	0.39	-0.57	1.46**	0.38
	(0.09)	(0.17)		(0.07)	(0.12)		(0.48)	(0.60)	

See notes to Table J.24.

before an FOMC statement to 4pm and in 30-minute windows from 10-minutes before an FOMC statement to 20 minutes after. For the S&P 500, I found material differences between the 2-hour and 30-minute windows, which is consistent with earlier research (Lunde and Zebedee, 2009; Rosa, 2011; Chung, Elder, and Kim, 2013). Given that a 2-hour window may be more appropriate for measuring percent changes in the S&P 500, I want to make sure that a longer window is not also appropriate for the fed funds futures market when estimating the effects of forward guidance on stock prices and Treasury yields.

I show the results in Tables J.24 and J.25. These Tables parallel Tables J.6 and J.13 in Appendices J.2 and J.5 above. Overall, the results change very little when moving from a 30-minute federal funds futures window to a 50-minute federal funds futures window. Due to data limitations, I am not able to use a longer window when computing changes in the fed funds futures market; however, these results are suggestive that the window length for the federal funds futures market is not having a material impact on the results.

J.8 Financial Market Results with Different Horizons

In this appendix, I consider a generalization of Equation (7) by using $y_{t+h} - y_{t-1}$ as the dependent variable for $h = 1, 2$. The intent is to give financial markets one or two additional days to react to the FOMC statement. As discussed above in Appendix J.2, the S&P 500 may give materially different results when using 2-hour windows than when using 30-minute windows. In Appendix J.5, I also document that 2-hour and 30-minute windows can lead to some differences in Treasury yield results. Hence, financial markets may need even longer windows after the FOMC announcement to fully respond.

One important concern with this exercise is that lengthening the event window allows more shocks to impact the dependent variables, reducing the signal coming from the monetary policy shocks. This may reduce the statistical power of the regressions similar to what I discuss in Section 5.4 of the paper.

Tables J.26 shows results for the S&P 500 and the VIX when the dependent variables take the form $y_{t+1} - y_{t-1}$. I refer to these as 1-day after responses. Tables J.27 shows results for the S&P 500 and the VIX when the dependent variables take the form $y_{t+2} - y_{t-1}$. I refer to these as 2-day after responses. These tables parallel Table 1 in the paper.

For the S&P 500, the 1-day and 2-day after responses to forward guidance have similar signs as in Table 1: forward guidance has a positive coefficient from February 2000 to June

Table J.26: 1-Day After Responses of Stock Prices and Volatility to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006			Feb 2000 to Jun 2003			Aug 2003 to May 2006		
	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2
S&P 500	-5.82	3.08	0.04	-5.38	8.99	0.07	−34.40*	-13.97	0.19
	(6.16)	(9.81)		(6.27)	(10.48)		(18.75)	(10.76)	
VIX	3.48	-1.02	0.02	2.75	-9.32	0.07	48.74	18.37*	0.27
	(4.62)	(7.55)		(4.80)	(6.91)		(15.58)	(10.99)	

Notes: The Funds Rate columns display the estimates of β_1, and the Forward Guidance columns display the estimates of γ from Equation (7) in the paper. Standard errors are shown in parentheses. See the text and Appendix D for details about estimation and inference. The stars, *, **, and ***, denote statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table J.27: 2-Day After Responses of Stock Prices and Volatility to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006			Feb 2000 to Jun 2003			Aug 2003 to May 2006		
	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2	Funds Rate	Forward Guid.	R^2
S&P 500	-6.72	4.36	0.04	-6.19	10.93	0.08	−43.84**	-18.29	0.19
	(7.50)	(10.76)		(7.52)	(11.38)		(18.77)	(15.10)	
VIX	4.21	-1.75	0.02	3.50	-13.30	0.09	41.24***	25.15**	0.30
	(3.87)	(10.22)		(3.82)	(9.45)		(14.59)	(11.10)	

See notes to Table J.26

2003 and a negative coefficient from August 2003 to May 2006. I note here that standard errors on these coefficients are very large and that these coefficients are not statistically different from zero. Further, the R^2 values are lower in Tables J.26 and J.27 than in Table 1. This is the low statistical power problem discussed above. While Chung, Elder, and Kim (2013) do document a reduction in liquidity of stocks in the S&P 500 index immediately following an FOMC announcement, they ultimately conclude "that although liquidity remains low for about 1.5 hours after scheduled announcements, it tends to recover prior to the market close." Hence, the results in Table 1 or the 2-hour window in Table J.6 likely best reflect the effects of forward guidance on stock prices. At worst, Tables J.26 and J.27 show the same pattern of responses but with less precise estimation.

For the VIX, the effects of forward guidance are comparable from Table 1 to Table J.26 to Table J.27. In all three tables, forward guidance has a negative but not statistically signif-

Table J.28: 1-Day After Responses of Treasury Yields and Term Premia to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Treasury Yields:									
2-Year	0.64*	1.47***	0.42	0.62*	1.16***	0.36	2.22	2.89***	0.71
	(0.34)	(0.29)		(0.36)	(0.29)		(1.72)	(0.47)	
5-Year	0.69**	1.32***	0.33	0.69**	1.01***	0.31	0.46	2.89***	0.55
	(0.28)	(0.33)		(0.30)	(0.35)		(1.68)	(0.44)	
7-Year	0.73***	1.14***	0.30	0.74***	0.83**	0.30	-0.43	2.77***	0.50
	(0.26)	(0.33)		(0.27)	(0.34)		(1.64)	(0.41)	
10-Year	0.75***	0.93***	0.25	0.77***	0.60*	0.28	-1.20	2.62***	0.46
	(0.25)	(0.32)		(0.25)	(0.32)		(1.59)	(0.38)	
Term Premia:									
2-Year	0.08	0.19	0.03	0.08	-0.06	0.02	0.03	1.40***	0.59
	(0.10)	(0.19)		(0.10)	(0.16)		(0.79)	(0.18)	
5-Year	0.27	0.11	0.05	0.29	−0.12	0.09	−1.81*	1.30***	0.31
	(0.21)	(0.23)		(0.21)	(0.23)		(0.94)	(0.28)	
7-Year	0.35	0.03	0.06	0.38	−0.19	0.12	−2.47**	1.27***	0.28
	(0.28)	(0.26)		(0.26)	(0.26)		(1.02)	(0.34)	
10-Year	0.43	-0.03	0.07	0.47	−0.28	0.14	−2.99***	1.32***	0.28
	(0.33)	(0.29)		(0.32)	(0.30)		(1.13)	(0.39)	
Expected Path of Short-Term Rates:									
2-Year	0.56*	1.28***	0.53	0.53*	1.22***	0.54	2.19*	1.49***	0.48
	(0.31)	(0.18)		(0.32)	(0.22)		(1.14)	(0.46)	
5-Year	0.43	1.21***	0.46	0.40	1.12***	0.44	2.27**	1.59***	0.53
	(0.32)	(0.20)		(0.33)	(0.25)		(1.11)	(0.43)	
7-Year	0.38	1.11***	0.45	0.36	1.02***	0.42	2.04**	1.49***	0.53
	(0.29)	(0.19)		(0.31)	(0.23)		(1.03)	(0.40)	
10-Year	0.32	0.96***	0.43	0.30	0.88***	0.41	1.79**	1.30***	0.53
	(0.26)	(0.17)		(0.27)	(0.21)		(0.88)	(0.34)	

See notes to Table J.26.

Table J.29: 2-Day After Responses of Treasury Yields and Term Premia to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Treasury Yields:									
2-Year	0.39	1.35***	0.29	0.36	1.12***	0.28	3.03	2.57***	0.40
	(0.33)	(0.30)		(0.34)	(0.31)		(2.41)	(0.94)	
5-Year	0.62*	1.28***	0.26	0.61*	1.07***	0.27	0.93	2.71***	0.34
	(0.33)	(0.37)		(0.34)	(0.40)		(2.42)	(0.93)	
7-Year	0.76**	1.12***	0.26	0.77**	0.90**	0.29	-0.02	2.67***	0.33
	(0.32)	(0.37)		(0.33)	(0.41)		(2.26)	(0.86)	
10-Year	0.89***	0.90**	0.26	0.91***	0.64	0.33	-0.78	2.60***	0.33
	(0.32)	(0.36)		(0.33)	(0.40)		(2.07)	(0.78)	
Term Premia:									
2-Year	0.22	0.07	0.06	0.21	-0.17	0.13	0.46	1.38***	0.42
	(0.14)	(0.17)		(0.14)	(0.16)		(0.95)	(0.33)	
5-Year	0.54**	0.08	0.15	0.57**	-0.12	0.28	-1.68	1.42***	0.24
	(0.24)	(0.25)		(0.23)	(0.27)		(1.15)	(0.49)	
7-Year	0.69**	0.02	0.18	0.73**	-0.19	0.33	−2.37*	1.44**	0.23
	(0.29)	(0.28)		(0.29)	(0.31)		(1.25)	(0.56)	
10-Year	0.84**	-0.06	0.20	0.89**	-0.30	0.37	−2.85**	1.53**	0.22
	(0.35)	(0.31)		(0.34)	(0.34)		(1.38)	(0.64)	
Expected Path of Short-Term Rates:									
2-Year	0.18	1.28***	0.34	0.14	1.29***	0.40	2.56	1.19	0.24
	(0.29)	(0.22)		(0.29)	(0.23)		(1.73)	(0.75)	
5-Year	0.08	1.21***	0.30	0.04	1.19***	0.36	2.61	1.30*	0.25
	(0.29)	(0.23)		(0.30)	(0.24)		(1.78)	(0.77)	
7-Year	0.07	1.10***	0.29	0.03	1.09***	0.34	2.35	1.23*	0.26
	(0.27)	(0.22)		(0.28)	(0.23)		(1.65)	(0.71)	
10-Year	0.05	0.96***	0.29	0.02	0.93***	0.33	2.07	1.06*	0.26
	(0.23)	(0.19)		(0.24)	(0.20)		(1.45)	(0.62)	

See notes to Table J.26.

icant coefficient from February 2000 to June 2003 and a positive and statistically significant coefficient from August 2003 to May 2006. In contrast to the S&P 500, the R^2 values do not materially change across the tables.

Tables J.28 and J.29 show the 1-day after and 2-day after responses for Treasury yields, term premia, and expected paths of short-term rates. These tables parallel Table 2 in the paper. Overall, the pattern of results in Tables J.28 and J.29 is similar to the results in Table 2. First, forward guidance has positive coefficients on Treasury yields, with larger coefficients from August 2003 to May 2006 than from February 2000 to June 2003. Second, forward guidance has a positive coefficient on term premia from August 2003 to May 2006. Third, forward guidance has a negative coefficient on term premia from February 2000 to June 2003. However, these coefficients are not statistically significant for the 1-day and 2-day after responses. Fourth, because of the opposite signs on the coefficients for term premia, the estimated coefficients of forward guidance on the expected path of short-term rates are more similar across the two samples than the estimated coefficients of forward guidance on Treasury yields directly. Finally, the R^2 values are smaller for the 2-day after responses than the 1-day after responses.

Tables J.30 and J.31 show the 1-day after and 2-day after responses for private borrowing costs. These tables parallel Table 3 in the paper. In general, the pattern of results in Tables J.30 and J.31 is similar to the results in Table 3. First, the coefficients on forward guidance are positive, and the coefficients are larger from August 2003 to May 2006 than from February 2000 to June 2003. Second, there is no increase in BBB - A spreads from February 2000 to June 2003 in response to forward guidance, but there is an increase in these spreads from August 2003 to May 2006, with larger and statistically significant effects occurring at the 3-year horizon. One result that is different in Tables J.30 and J.31 compared to Table 3 in the paper is that there is a statistically significant increase in the OAS spread from February 2000 to June 2003 in Tables J.30 and J.31. This positive coefficient is still smaller than the coefficient from August 2003 to May 2006.

J.9 Macroeconomic Results with Different Horizons

In this appendix, I consider a generalization of Equation (8) by using $y_{t+h} - y_t$ as the dependent variable for $h = 1, \ldots, 24$. Hence, this section studies the robustness of the results for macroeconomic variables to different choices of h. As discussed in the paper,

Table J.30: 1-Day After Responses of Private-Sector Borrowing Costs to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Corporate Bond and MBS Yields:									
A (3-Yr)	0.61**	0.93***	0.26	0.61**	0.81**	0.25	0.56	1.59***	0.33
	(0.30)	(0.30)		(0.31)	(0.36)		(1.13)	(0.47)	
A (10-Yr)	0.81***	0.73***	0.31	0.84***	0.64**	0.39	−2.21*	1.39***	0.31
	(0.25)	(0.25)		(0.25)	(0.29)		(1.18)	(0.42)	
BBB (3-Yr)	0.61**	1.02***	0.27	0.60**	0.84***	0.24	1.10	2.36***	0.59
	(0.29)	(0.29)		(0.30)	(0.31)		(1.70)	(0.50)	
BBB (10-Yr)	0.77***	0.63*	0.20	0.81***	0.44	0.24	-2.17	1.78***	0.36
	(0.28)	(0.33)		(0.28)	(0.37)		(1.35)	(0.41)	
MBS (30-Yr)	0.78***	1.37***	0.34	0.78***	0.95***	0.33	0.10	3.14***	0.53
	(0.28)	(0.34)		(0.29)	(0.35)		(1.74)	(0.45)	
Corporate Yield Spreads and OAS:									
BBB - A	0.00	0.09	0.01	-0.01	0.04	0.00	0.54	0.76*	0.18
(3-Yr)	(0.07)	(0.15)		(0.07)	(0.13)		(1.36)	(0.41)	
BBB - A	-0.03	-0.10	0.01	-0.03	-0.20	0.04	0.04	0.40	0.09
(10-Yr)	(0.08)	(0.14)		(0.09)	(0.13)		(0.65)	(0.29)	
OAS	-0.06	0.49***	0.20	-0.06	0.39**	0.16	0.00	0.84***	0.27
	(0.11)	(0.13)		(0.10)	(0.18)		(0.53)	(0.21)	

See notes to Table J.26.

Table J.31: 2-Day After Responses of Private-Sector Borrowing Costs to Funds Rate and Forward Guidance Changes

Dependent Variable	Feb 2000 to May 2006 Funds Rate	Feb 2000 to May 2006 Forward Guid.	Feb 2000 to May 2006 R^2	Feb 2000 to Jun 2003 Funds Rate	Feb 2000 to Jun 2003 Forward Guid.	Feb 2000 to Jun 2003 R^2	Aug 2003 to May 2006 Funds Rate	Aug 2003 to May 2006 Forward Guid.	Aug 2003 to May 2006 R^2
Corporate Bond and MBS Yields:									
A (3-Yr)	0.54*	0.95***	0.21	0.51	0.74*	0.22	2.80	1.94**	0.28
	(0.30)	(0.36)		(0.31)	(0.40)		(2.00)	(0.94)	
A (10-Yr)	0.85***	0.86***	0.34	0.86***	0.71*	0.43	-0.24	1.87***	0.25
	(0.32)	(0.31)		(0.33)	(0.38)		(1.57)	(0.67)	
BBB (3-Yr)	0.40	1.26***	0.26	0.35	1.00***	0.25	3.39	2.49***	0.41
	(0.28)	(0.32)		(0.29)	(0.31)		(2.34)	(0.90)	
BBB (10-Yr)	0.77**	0.92**	0.24	0.78**	0.73*	0.27	-0.14	2.04***	0.27
	(0.37)	(0.39)		(0.37)	(0.42)		(1.89)	(0.73)	
MBS (30-Yr)	0.79**	1.29***	0.29	0.79**	0.97**	0.32	0.39	2.95***	0.36
	(0.34)	(0.39)		(0.35)	(0.43)		(2.34)	(0.89)	
Corporate Yield Spreads and OAS:									
BBB - A (3-Yr)	-0.15	0.31	0.07	-0.16	0.26	0.07	0.59	0.55**	0.13
	(0.16)	(0.20)		(0.17)	(0.25)		(1.04)	(0.26)	
BBB - A (10-Yr)	-0.09	0.07	0.01	-0.09	0.02	0.01	0.09	0.17	0.03
	(0.09)	(0.22)		(0.09)	(0.25)		(0.53)	(0.20)	
OAS	-0.07	0.55***	0.20	-0.08	0.51**	0.20	0.00	0.78***	0.20
	(0.10)	(0.16)		(0.11)	(0.20)		(0.80)	(0.28)	

See notes to Table J.26.

the coefficients in Equation (8) can be interpreted as cumulated impulse response functions (IRFs) and so the generalization in this appendix can be interpreted as estimating those cumulative IRFs from horizon 1 to 24. Throughout this appendix, I refer to these coefficients as the IRFs.

Figures J.5 though J.8 show the IRFs to forward guidance surprises. The top panel in each figure shows estimates from the February 2000 to June 2003 sample and the bottom panel in each figure shows estimates from the August 2003 to May 2006 sample. The horizon $h = 12$ displays the results from Table 5 in the paper.

I begin by discussing results for the February 2000 to June 2003 sample. In general, the IRFs for PCE growth and CPI inflation are positive regardless of horizon. However, as noted in the paper, statistical power is low and statistical significance is sporadic. The IRF of the unemployment rate is generally negative regardless of horizon. The level of statistical significance is generally higher than for PCE or CPI but falls off rapidly as the IRF horizon extends beyond one year. Taken together, the IRFs of PCE growth, CPI inflation and the unemployment rate are consistent with forward guidance having strong information effects from February 2000 to June 2003. The IRF for IP growth is mixed with regard to information effects. At short horizons, the IRF is positive, which is consistent with information effects. At longer horizons, the IRF turns negative. However, the IRF becomes very imprecisely estimated beyond 3 months.

I now discuss results for the August 2003 to May 2006 sample. In general, the IRFs for PCE growth and IP growth are negative regardless of horizon. However, as with the February 2000 to June 2003 sample, statistical significance is sporadic. The IRF of the unemployment rate is positive regardless of horizon, but statistical significance is also sporadic. Taken together, the IRFs of PCE growth, IP growth and the unemployment rate are consistent with forward guidance having standard effects from August 2003 to May 2006. The IRF for CPI inflation is volatile and imprecisely estimated for the August 2003 to May 2006 sample.

Overall, the patterns displayed in Figures J.5 to J.8 align with those in Table 5 of the paper. That is, these Figures show that choosing some horizon other than $h = 12$, especially some shorter horizon where statistical power is generally larger, would not change the pattern of results displayed in Table 5.

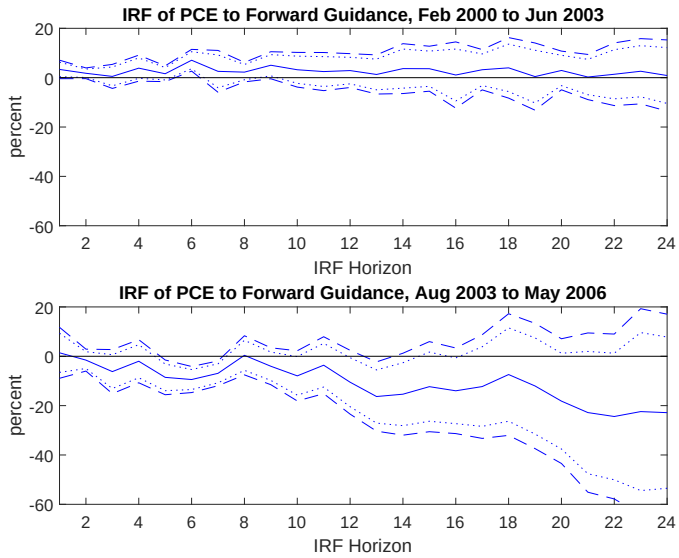


Figure J.5: Solid lines are estimates of γ from Equation (8) of the paper interpreted as cumulative IRFs to forward guidance surprises. The dependent variable is $y_{t+h} - y_t$ where y_t is 100 times the natural log of real personal consumption expenditure and h is the IRF horizon. Dotted and dashed lines are the 90 and 95 percent confidence intervals, respectively.

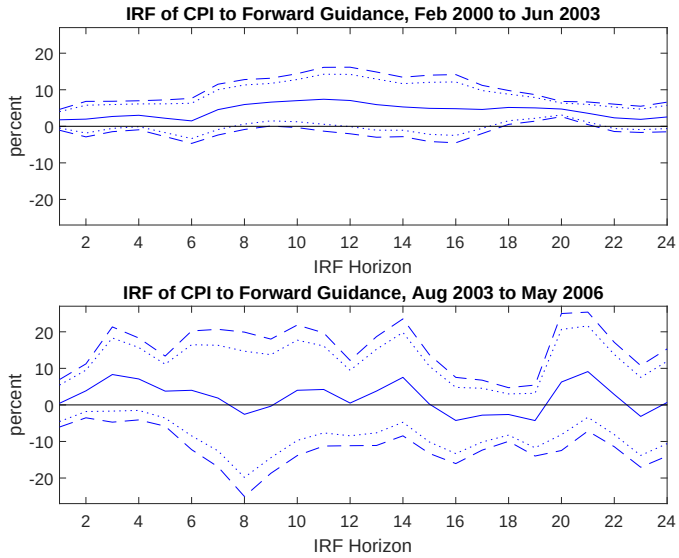


Figure J.6: Solid lines are estimates of γ from Equation (8) of the paper interpreted as cumulative IRFs to forward guidance surprises. The dependent variable is $y_{t+h} - y_t$ where y_t is 100 times the natural log of the CPI index and h is the IRF horizon. Dotted and dashed lines are the 90 and 95 percent confidence intervals, respectively.

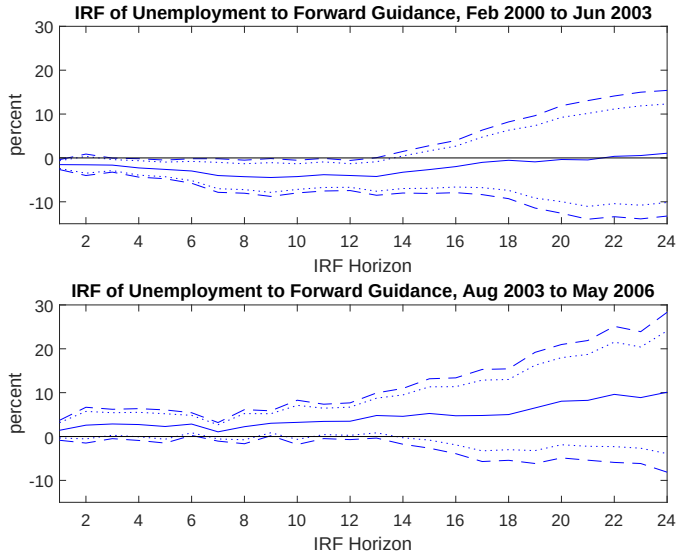


Figure J.7: Solid lines are estimates of γ from Equation (8) of the paper interpreted as cumulative IRFs to forward guidance surprises. The dependent variable is $y_{t+h} - y_t$ where y_t is the unemployment rate and h is the IRF horizon. Dotted and dashed lines are the 90 and 95 percent confidence intervals, respectively.

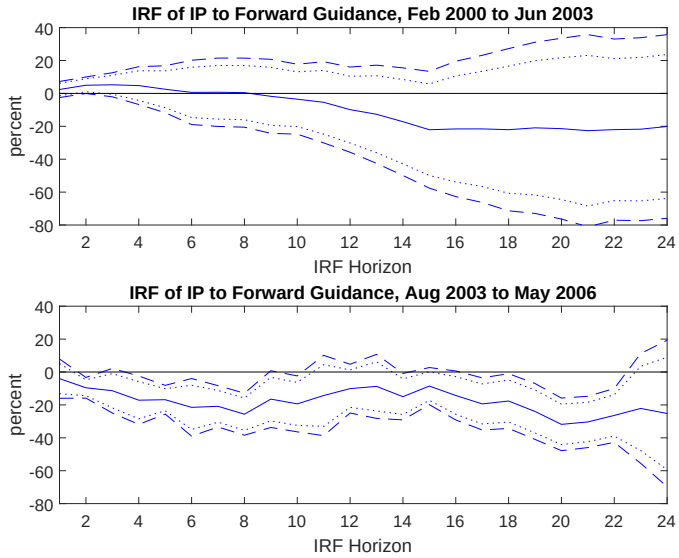


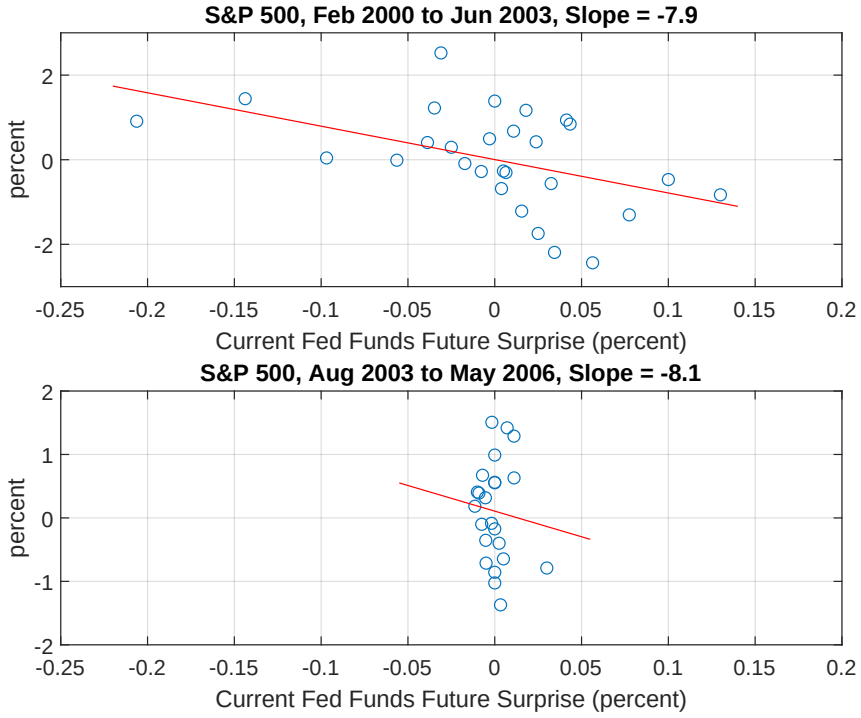
Figure J.8: Solid lines are estimates of γ from Equation (8) of the paper interpreted as cumulative IRFs to forward guidance surprises. The dependent variable is $y_{t+h} - y_t$ where y_t is 100 times the natural log of the industrial production index and h is the IRF horizon. Dotted and dashed lines are the 90 and 95 percent confidence intervals, respectively.

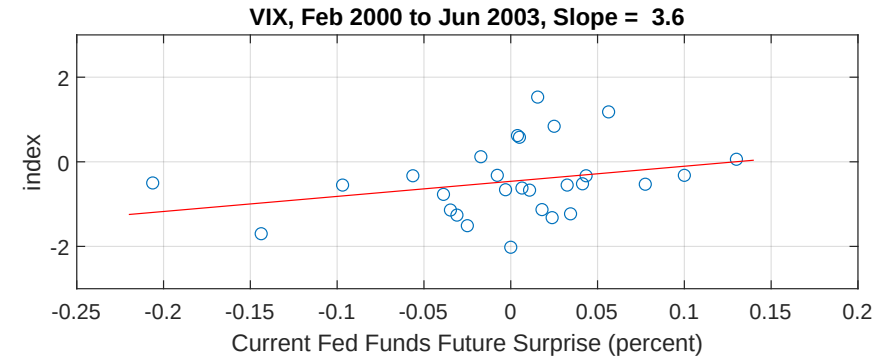
K Scatter Plots

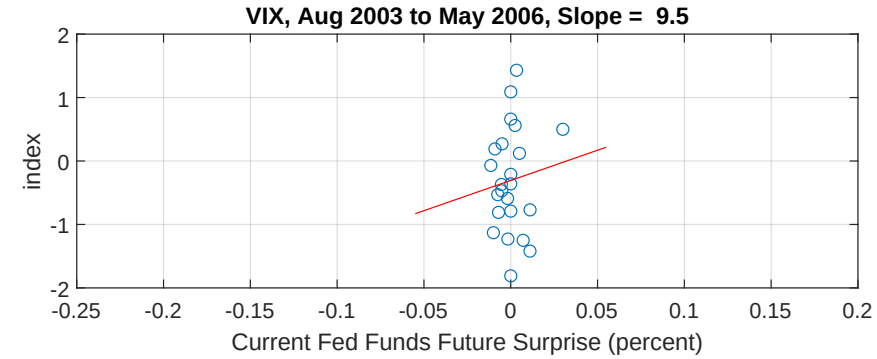
This appendix presents the scatter plots of all data used to produce the main results in Tables 1 though 5 of the paper. The scatter plots are presented as in Figures 5 and 6 of the paper with dependent variables plotted separately with current federal funds rate surprises and forward guidance surprises. Appendix K.1 has the scatter plots with the current federal funds rate surprises. Appendix K.2 has the scatter plots with the forward guidance surprises.

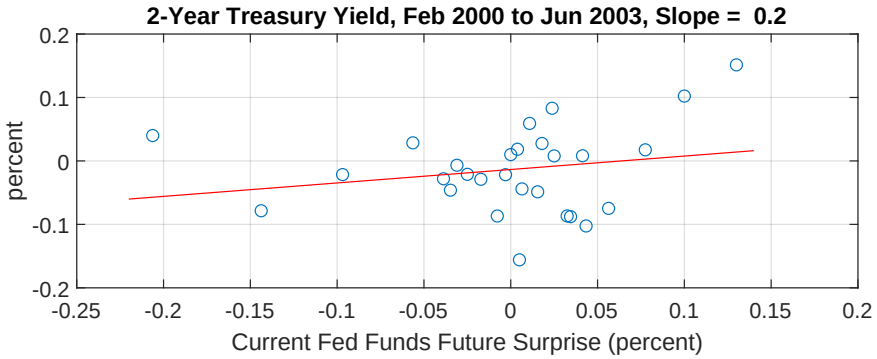
Two general patters are worth noting. First, as emphasized in the paper, there is essentially no variation the current funds rate surprises from August 2003 to May 2006, and September 2005 is influential for driving the results in this sample. Hence, caution is warranted when interpreting estimates of β_1 for the August 2003 to May 2006 sample. Second, the relationships between the dependent variables and forward guidance surprises are often visually apparent. This supports my findings that many of the regression coefficients estimated in Section 5 are statistically significant, even with my small sample sizes.

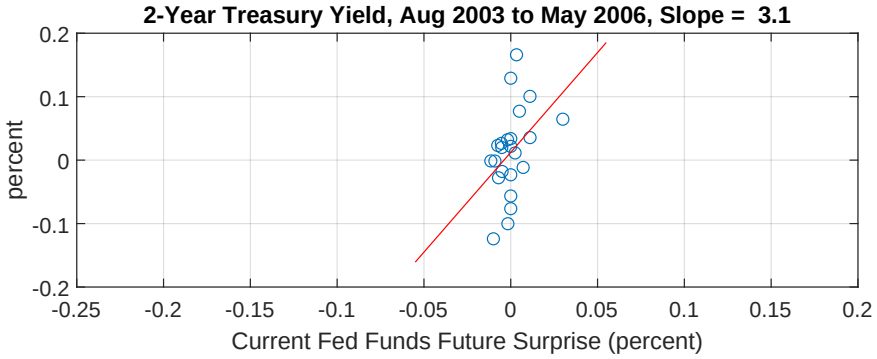
K.1 Scatter Plots on Current Fed Funds Surprises

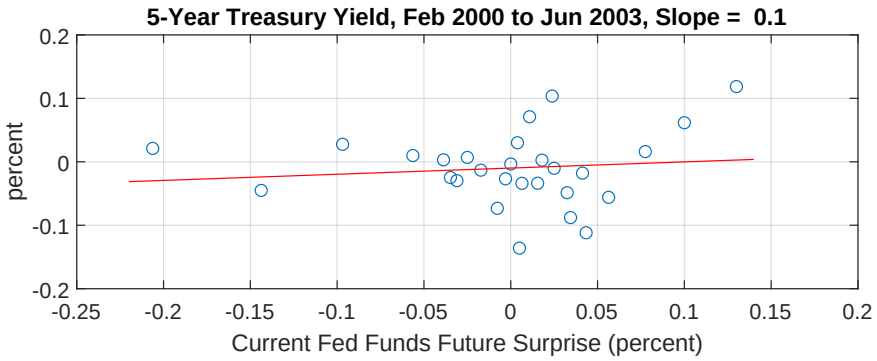


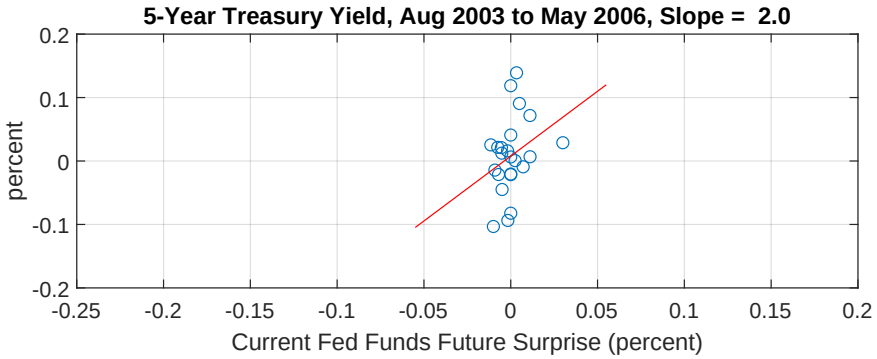

VIX, Feb 2000 to Jun 2003, Slope = 3.6
index
Current Fed Funds Future Surprise (percent)

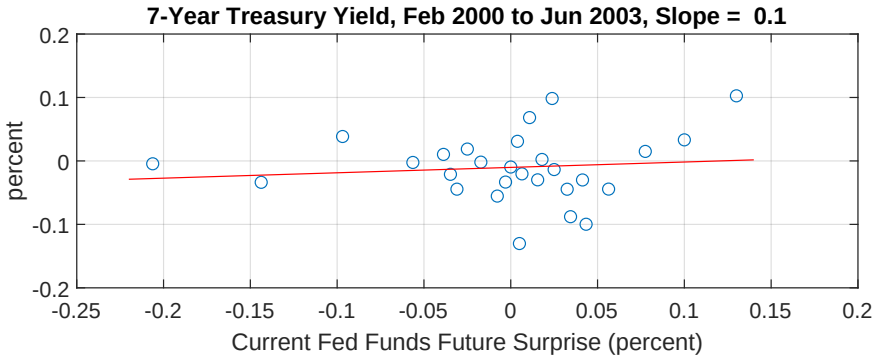

VIX, Aug 2003 to May 2006, Slope = 9.5
index
Current Fed Funds Future Surprise (percent)

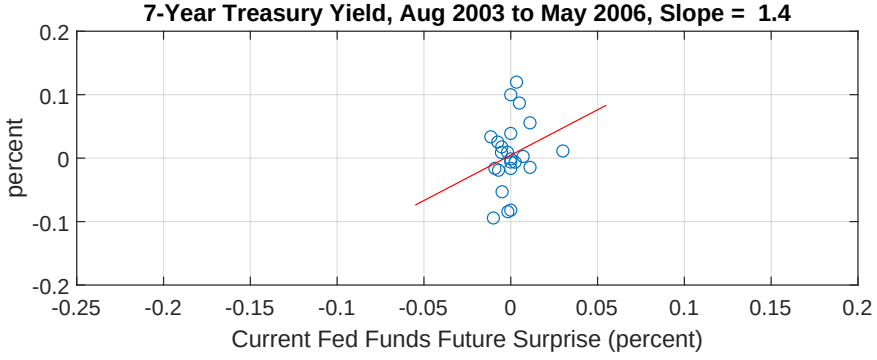

2-Year Treasury Yield, Feb 2000 to Jun 2003, Slope = 0.2
percent
Current Fed Funds Future Surprise (percent)

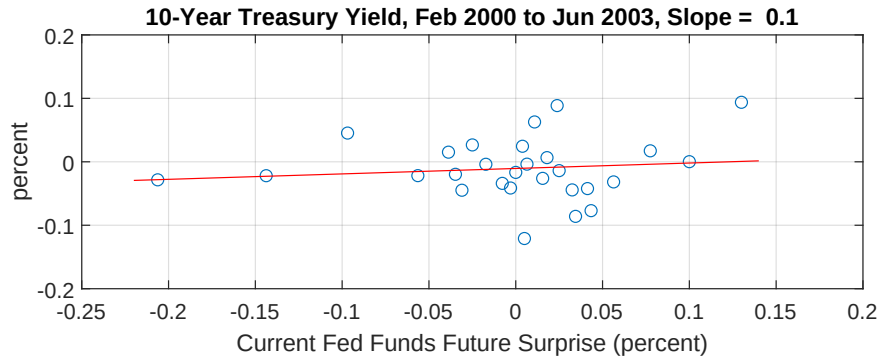

2-Year Treasury Yield, Aug 2003 to May 2006, Slope = 3.1
percent
Current Fed Funds Future Surprise (percent)

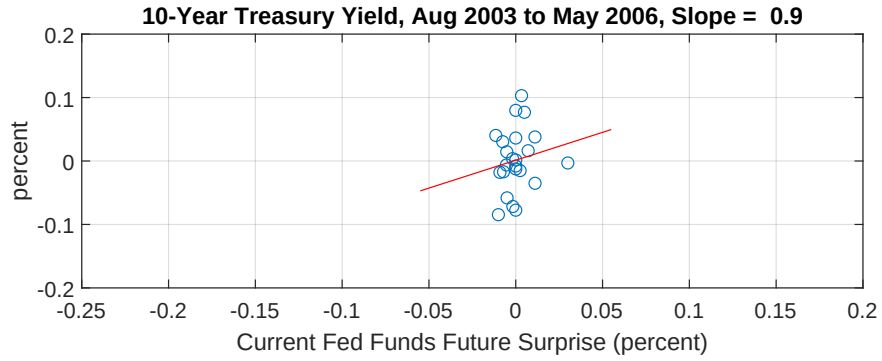

5-Year Treasury Yield, Feb 2000 to Jun 2003, Slope = 0.1
percent
Current Fed Funds Future Surprise (percent)

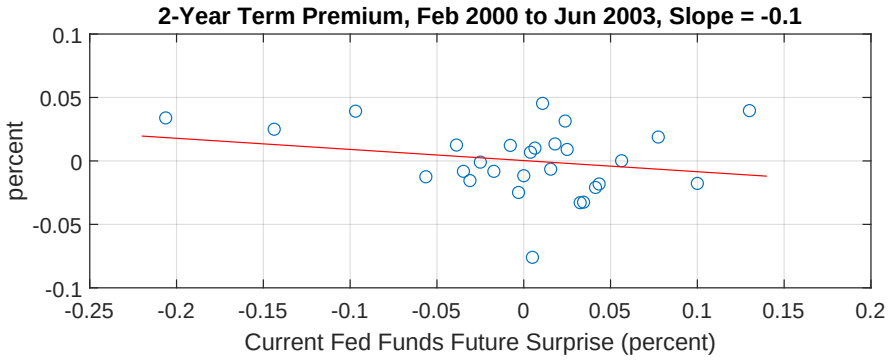

5-Year Treasury Yield, Aug 2003 to May 2006, Slope = 2.0
percent
Current Fed Funds Future Surprise (percent)

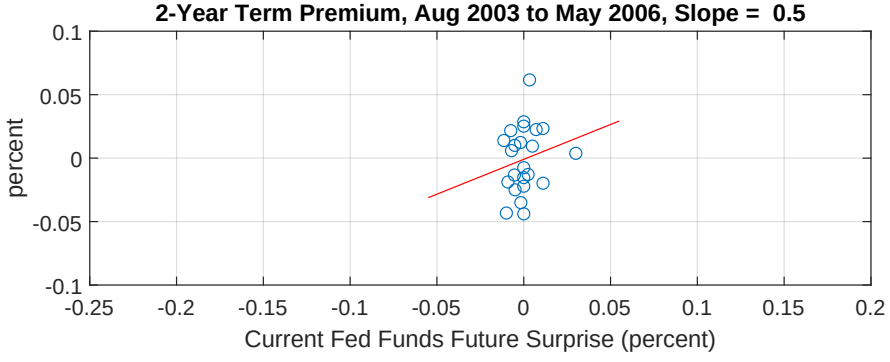

7-Year Treasury Yield, Feb 2000 to Jun 2003, Slope = 0.1
percent
Current Fed Funds Future Surprise (percent)

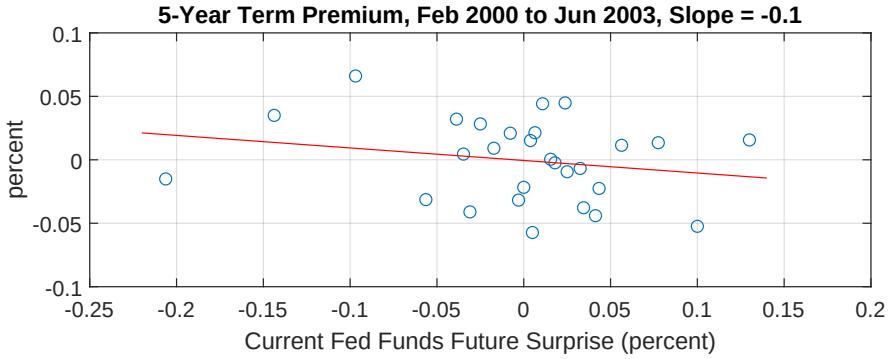

7-Year Treasury Yield, Aug 2003 to May 2006, Slope = 1.4
percent
Current Fed Funds Future Surprise (percent)

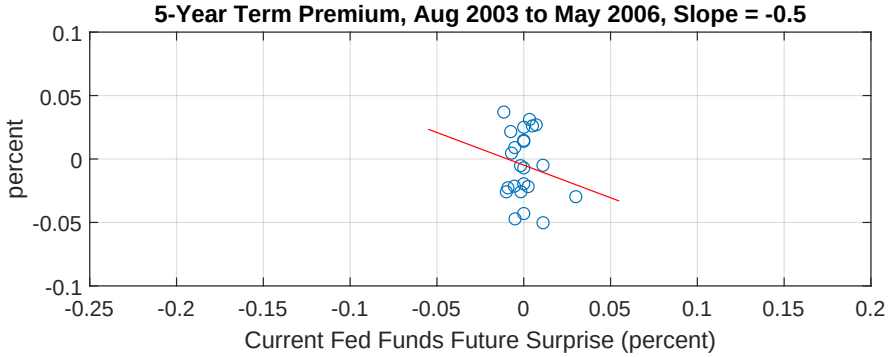

10-Year Treasury Yield, Feb 2000 to Jun 2003, Slope = 0.1
percent
Current Fed Funds Future Surprise (percent)

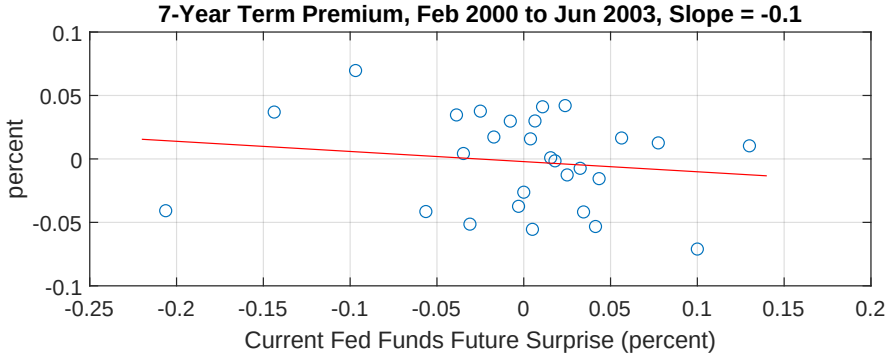

10-Year Treasury Yield, Aug 2003 to May 2006, Slope = 0.9
percent
Current Fed Funds Future Surprise (percent)

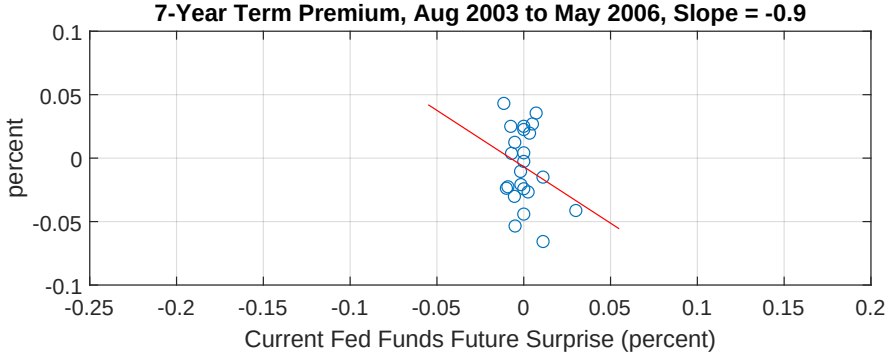

2-Year Term Premium, Feb 2000 to Jun 2003, Slope = -0.1
percent
Current Fed Funds Future Surprise (percent)

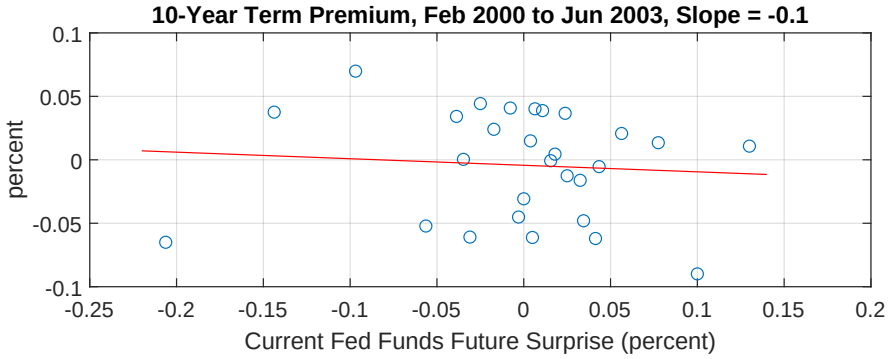

2-Year Term Premium, Aug 2003 to May 2006, Slope = 0.5
percent
Current Fed Funds Future Surprise (percent)

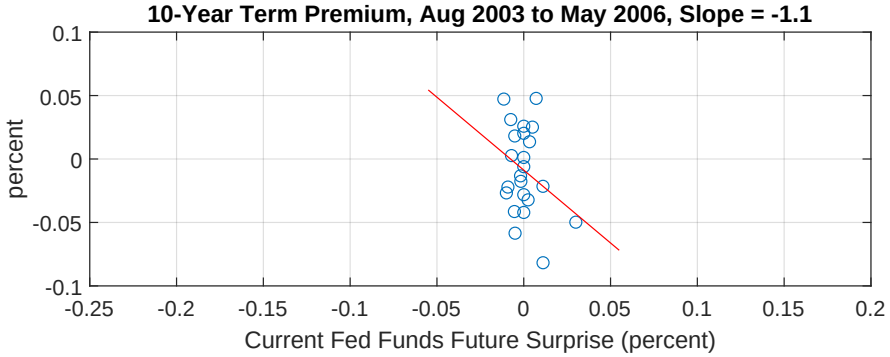

5-Year Term Premium, Feb 2000 to Jun 2003, Slope = -0.1
percent
Current Fed Funds Future Surprise (percent)

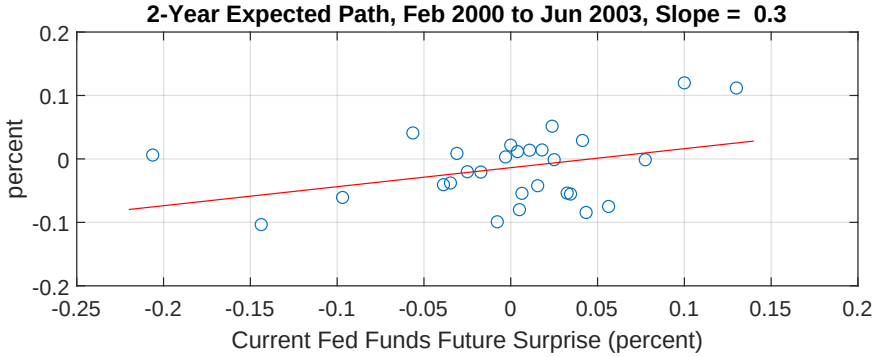

5-Year Term Premium, Aug 2003 to May 2006, Slope = -0.5
percent
Current Fed Funds Future Surprise (percent)

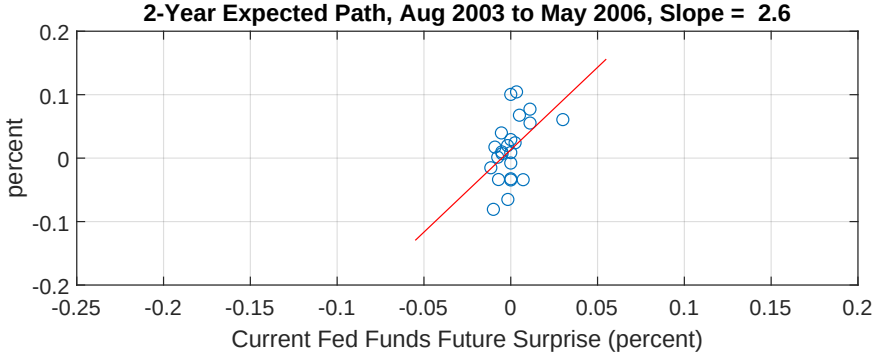

7-Year Term Premium, Feb 2000 to Jun 2003, Slope = -0.1
percent
Current Fed Funds Future Surprise (percent)

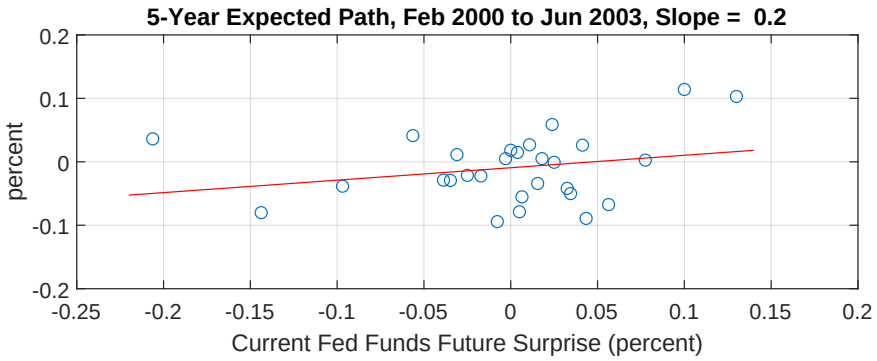

7-Year Term Premium, Aug 2003 to May 2006, Slope = -0.9
percent
Current Fed Funds Future Surprise (percent)

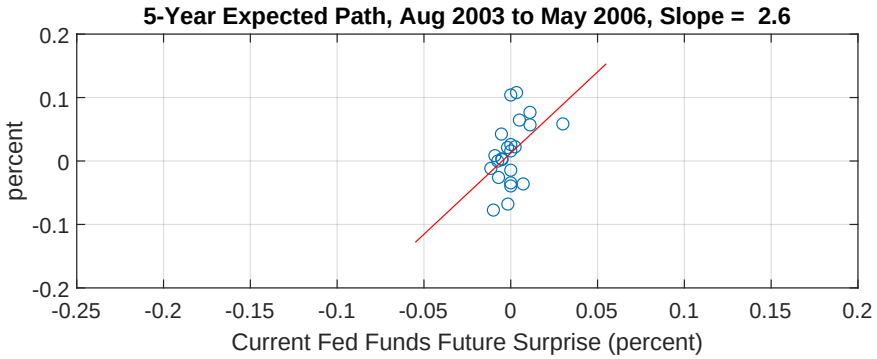

10-Year Term Premium, Feb 2000 to Jun 2003, Slope = -0.1
percent
Current Fed Funds Future Surprise (percent)

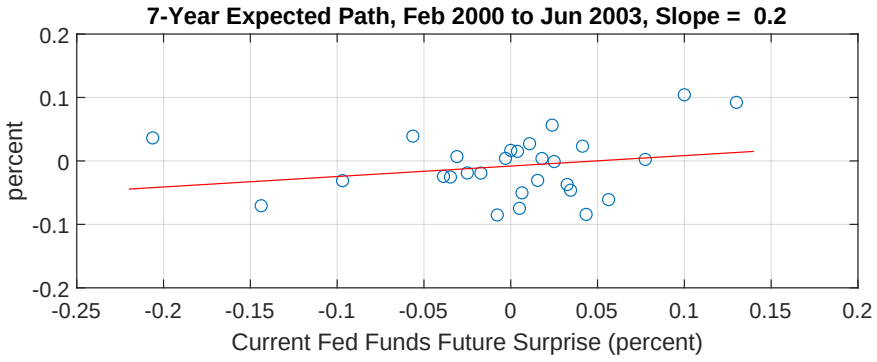

10-Year Term Premium, Aug 2003 to May 2006, Slope = -1.1
percent
Current Fed Funds Future Surprise (percent)

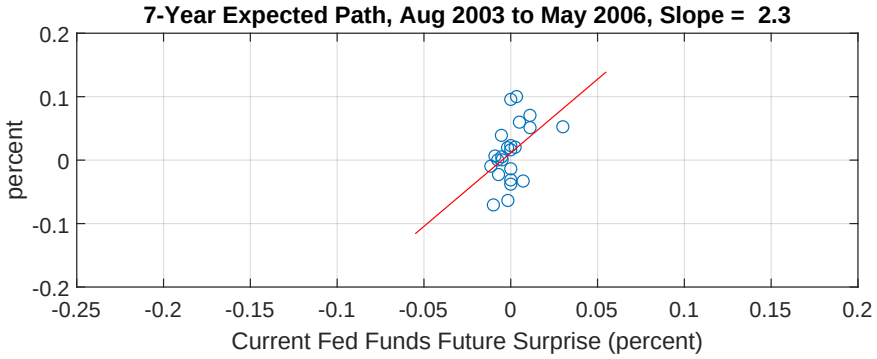

2-Year Expected Path, Feb 2000 to Jun 2003, Slope = 0.3
percent
Current Fed Funds Future Surprise (percent)

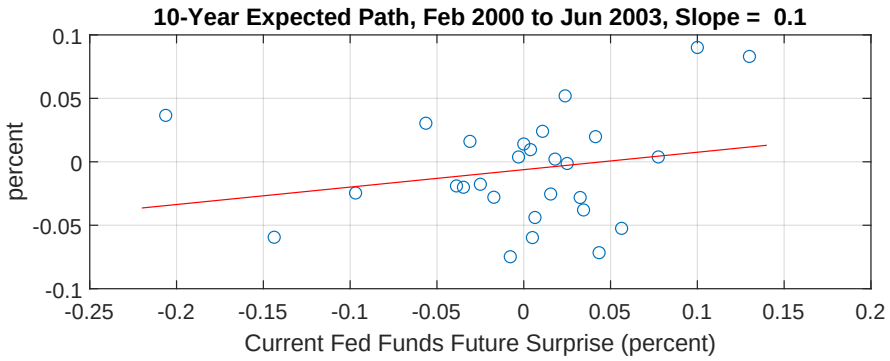

2-Year Expected Path, Aug 2003 to May 2006, Slope = 2.6
percent
Current Fed Funds Future Surprise (percent)

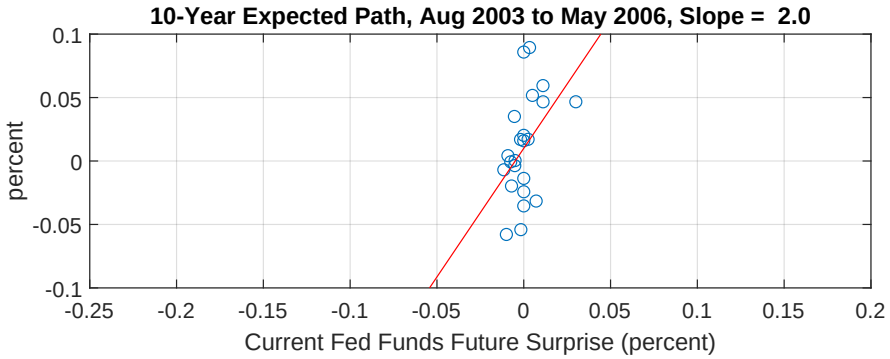

5-Year Expected Path, Feb 2000 to Jun 2003, Slope = 0.2
percent
Current Fed Funds Future Surprise (percent)

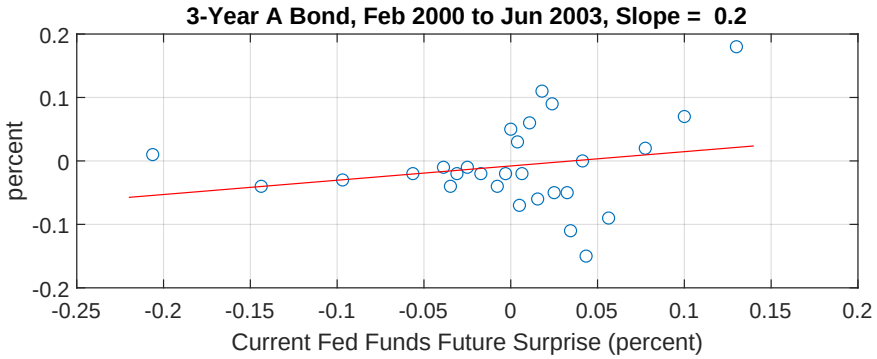

5-Year Expected Path, Aug 2003 to May 2006, Slope = 2.6
percent
Current Fed Funds Future Surprise (percent)

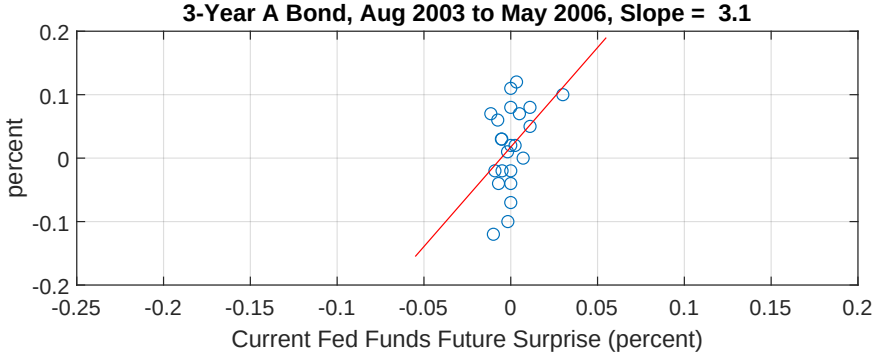

7-Year Expected Path, Feb 2000 to Jun 2003, Slope = 0.2
percent
Current Fed Funds Future Surprise (percent)

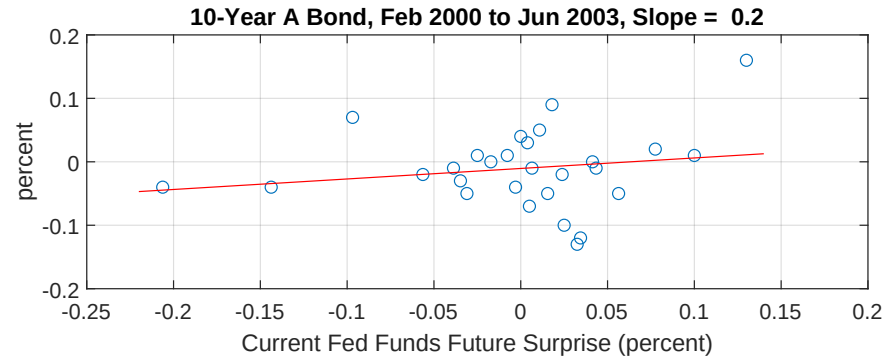

7-Year Expected Path, Aug 2003 to May 2006, Slope = 2.3
percent
Current Fed Funds Future Surprise (percent)

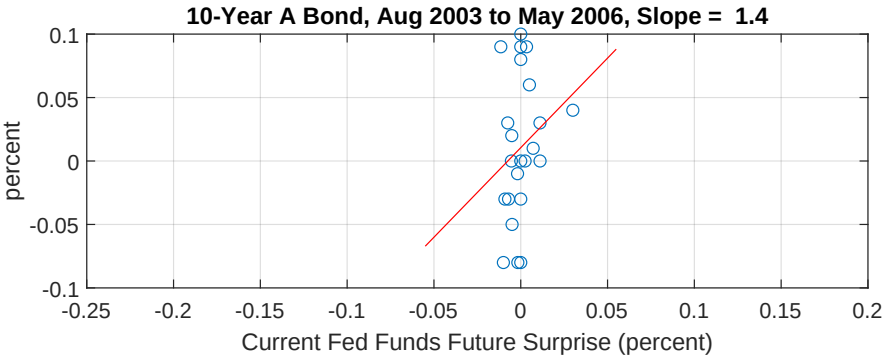

10-Year Expected Path, Feb 2000 to Jun 2003, Slope = 0.1
percent
Current Fed Funds Future Surprise (percent)

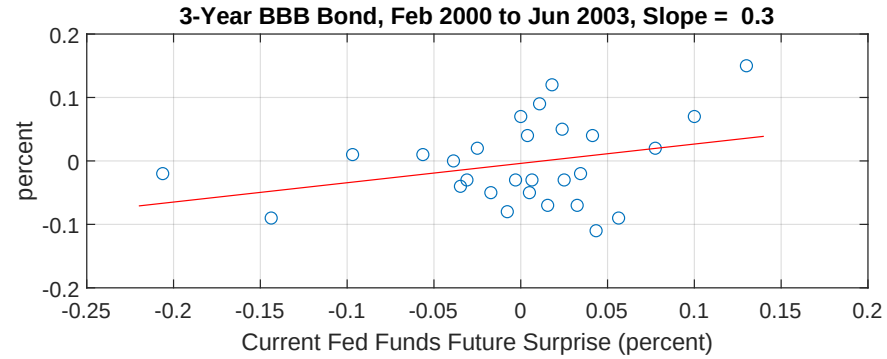

10-Year Expected Path, Aug 2003 to May 2006, Slope = 2.0
percent
Current Fed Funds Future Surprise (percent)

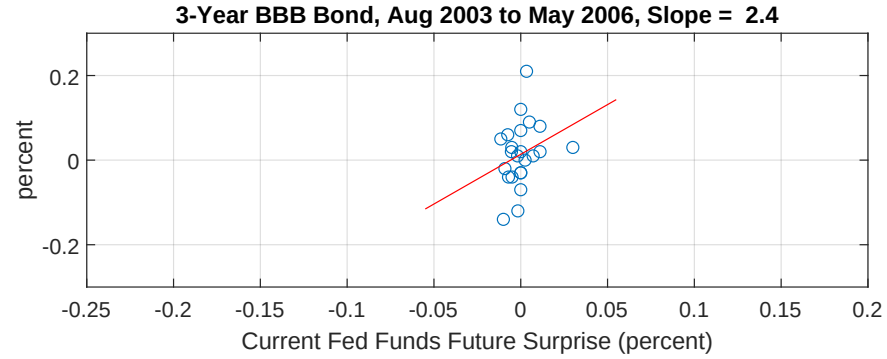

3-Year A Bond, Feb 2000 to Jun 2003, Slope = 0.2
percent
Current Fed Funds Future Surprise (percent)

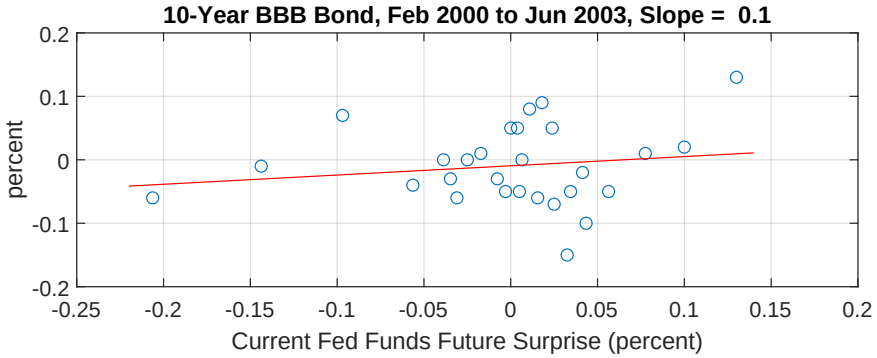

3-Year A Bond, Aug 2003 to May 2006, Slope = 3.1
percent
Current Fed Funds Future Surprise (percent)

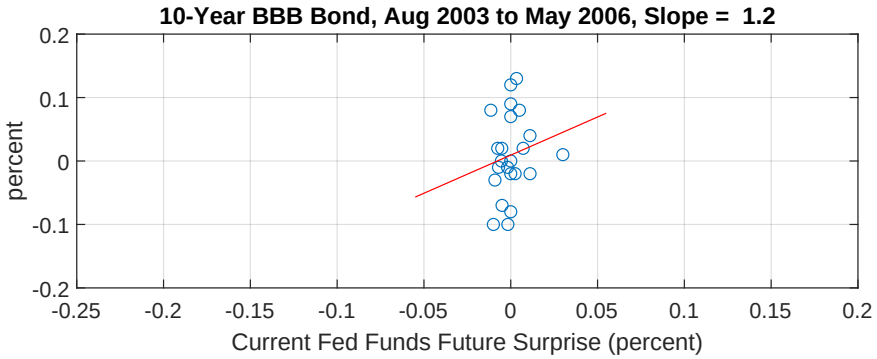

10-Year A Bond, Feb 2000 to Jun 2003, Slope = 0.2
percent
Current Fed Funds Future Surprise (percent)

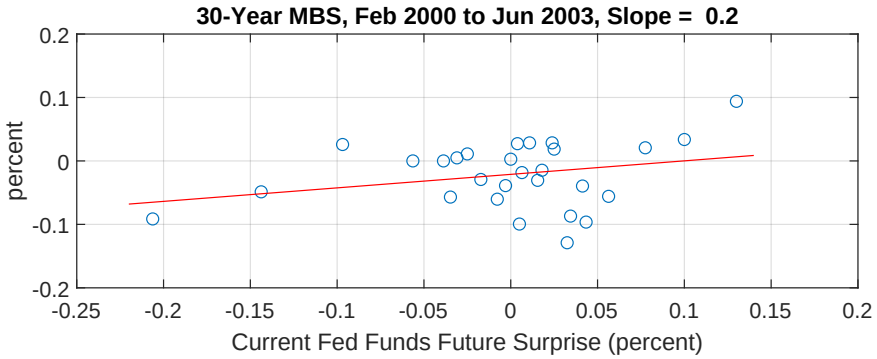

10-Year A Bond, Aug 2003 to May 2006, Slope = 1.4
percent
Current Fed Funds Future Surprise (percent)

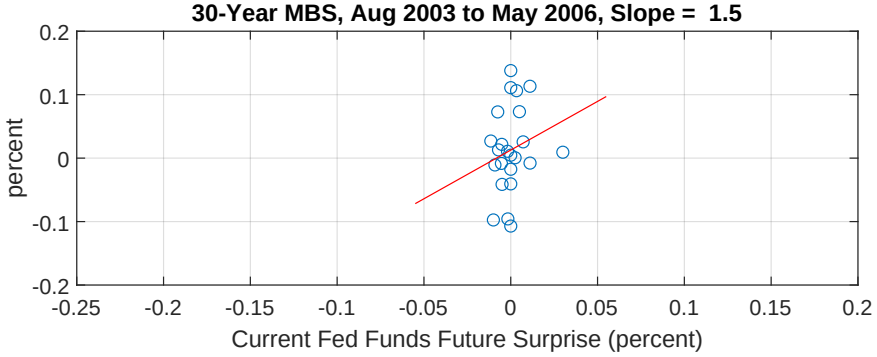

3-Year BBB Bond, Feb 2000 to Jun 2003, Slope = 0.3
percent
Current Fed Funds Future Surprise (percent)

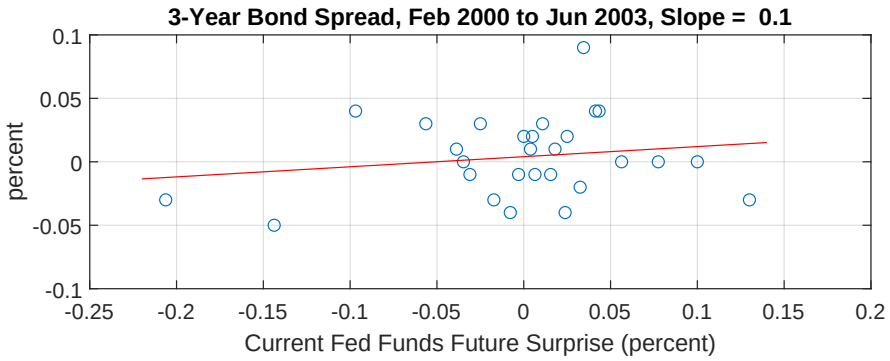

3-Year BBB Bond, Aug 2003 to May 2006, Slope = 2.4
percent
Current Fed Funds Future Surprise (percent)

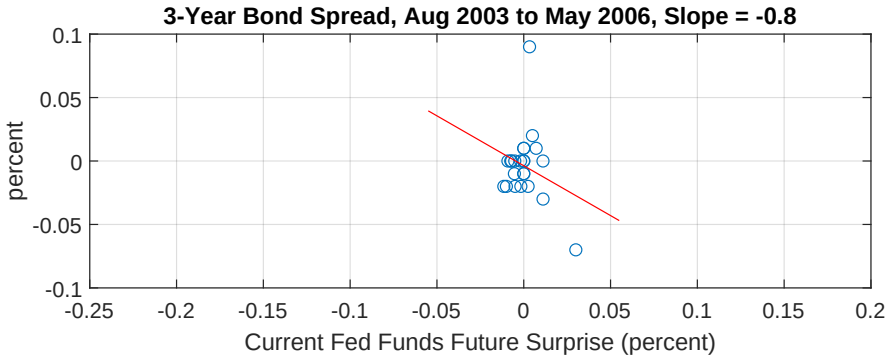

10-Year BBB Bond, Feb 2000 to Jun 2003, Slope = 0.1
percent
Current Fed Funds Future Surprise (percent)

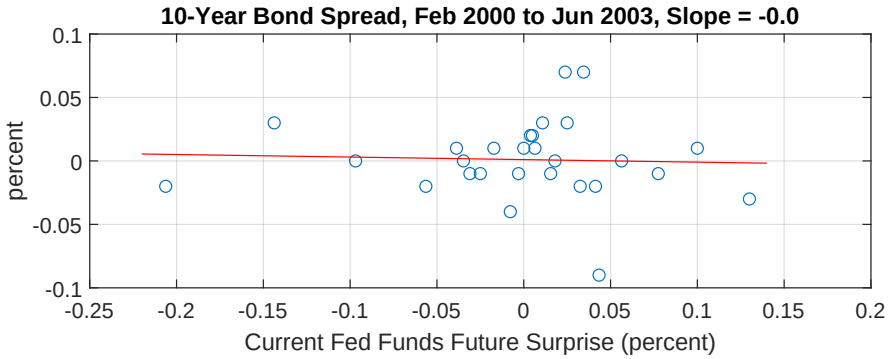

10-Year BBB Bond, Aug 2003 to May 2006, Slope = 1.2
percent
Current Fed Funds Future Surprise (percent)

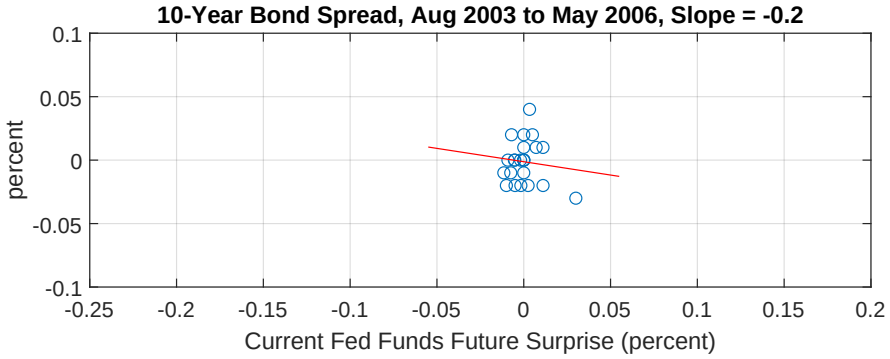

30-Year MBS, Feb 2000 to Jun 2003, Slope = 0.2
percent
Current Fed Funds Future Surprise (percent)

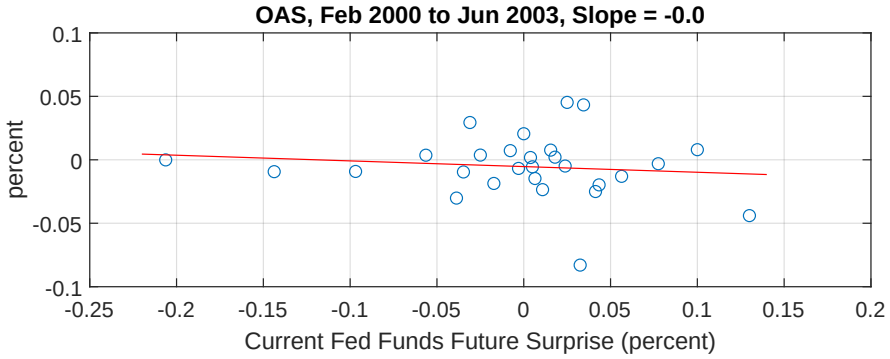

30-Year MBS, Aug 2003 to May 2006, Slope = 1.5
percent
Current Fed Funds Future Surprise (percent)

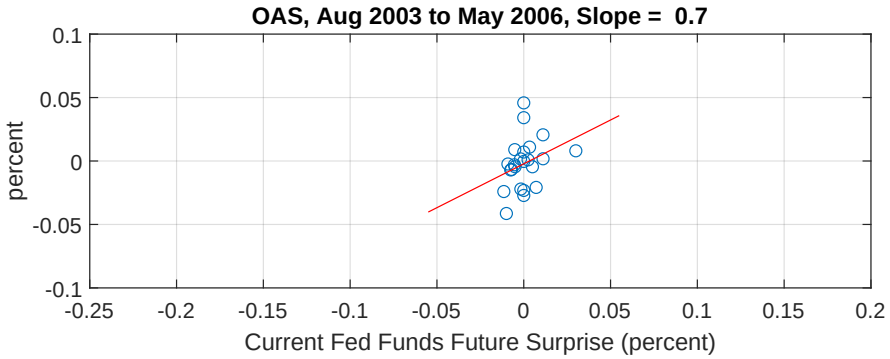

3-Year Bond Spread, Feb 2000 to Jun 2003, Slope = 0.1
percent
Current Fed Funds Future Surprise (percent)

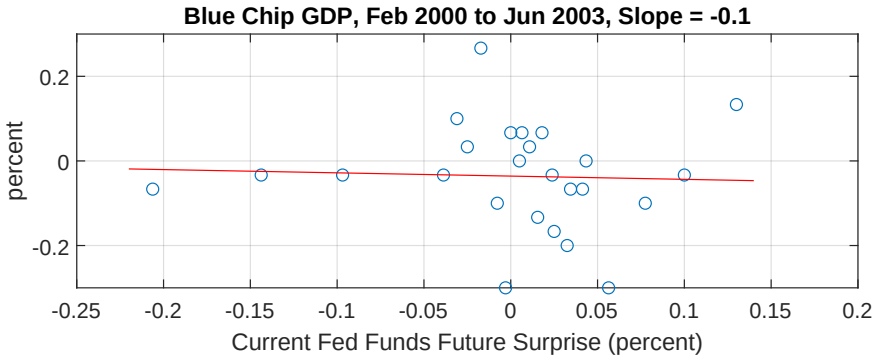

3-Year Bond Spread, Aug 2003 to May 2006, Slope = -0.8
percent
Current Fed Funds Future Surprise (percent)

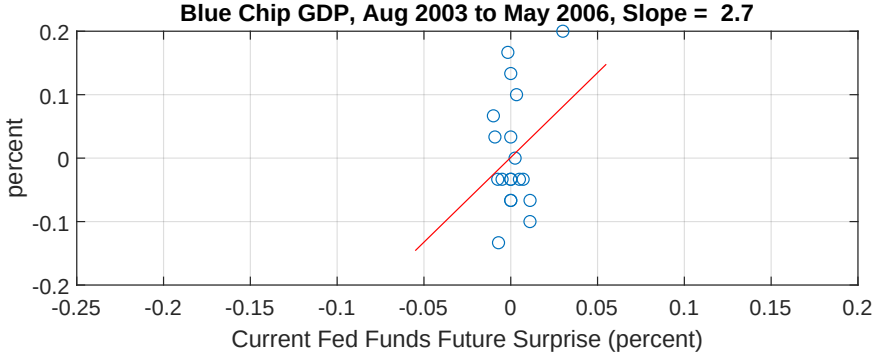

10-Year Bond Spread, Feb 2000 to Jun 2003, Slope = -0.0
percent
Current Fed Funds Future Surprise (percent)

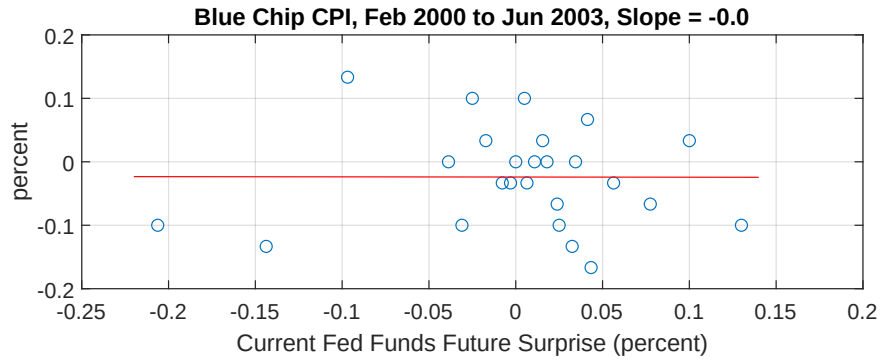

10-Year Bond Spread, Aug 2003 to May 2006, Slope = -0.2
percent
Current Fed Funds Future Surprise (percent)

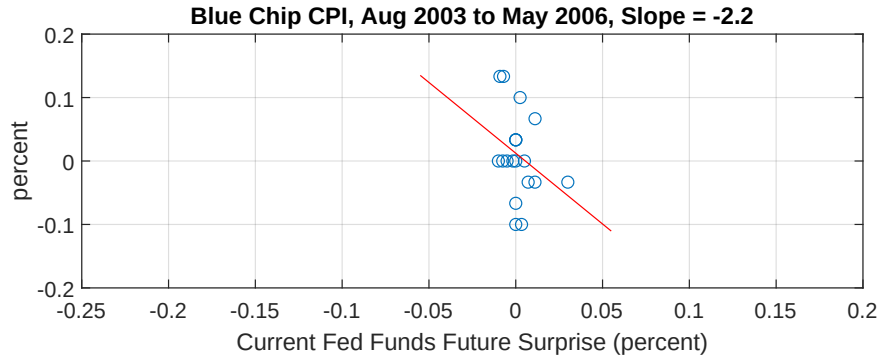

OAS, Feb 2000 to Jun 2003, Slope = -0.0
percent
Current Fed Funds Future Surprise (percent)

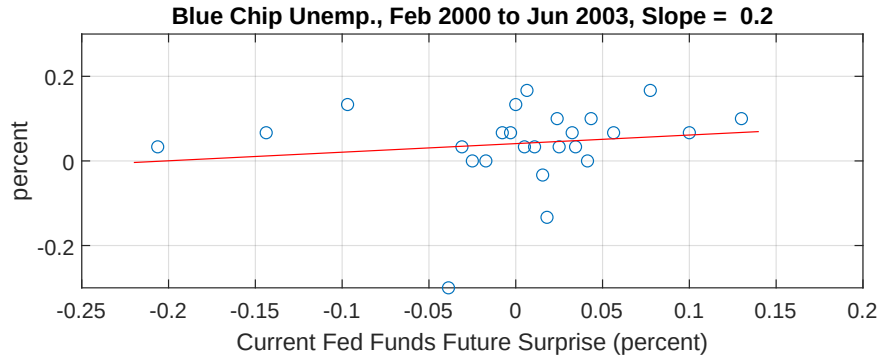

OAS, Aug 2003 to May 2006, Slope = 0.7
percent
Current Fed Funds Future Surprise (percent)

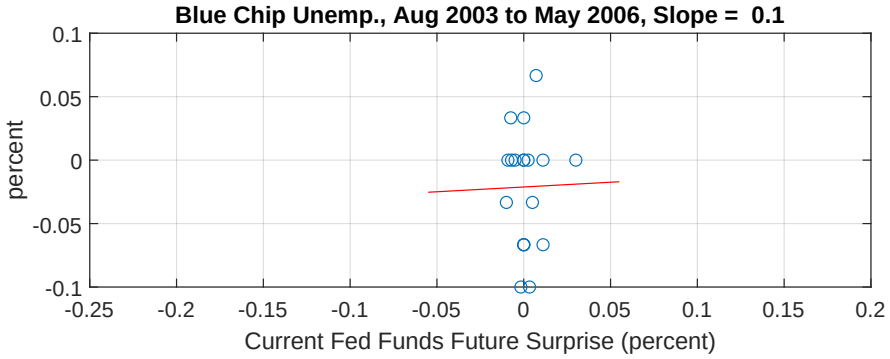

Blue Chip GDP, Feb 2000 to Jun 2003, Slope = -0.1
percent
Current Fed Funds Future Surprise (percent)

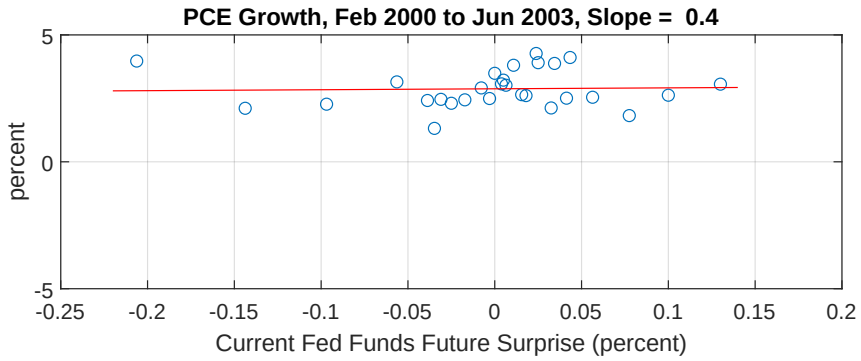

Blue Chip GDP, Aug 2003 to May 2006, Slope = 2.7
percent
Current Fed Funds Future Surprise (percent)

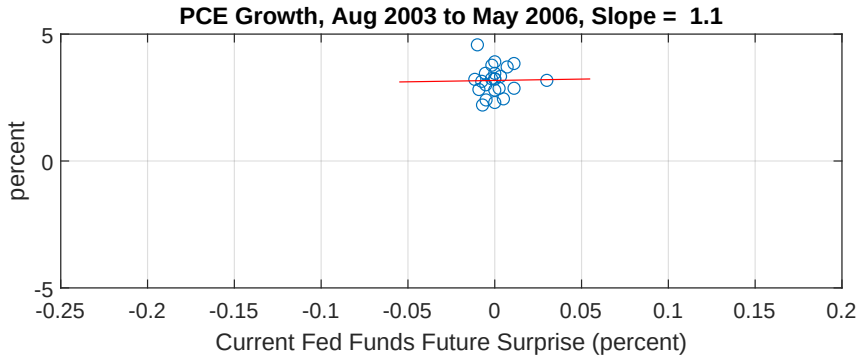

Blue Chip CPI, Feb 2000 to Jun 2003, Slope = -0.0
percent
Current Fed Funds Future Surprise (percent)

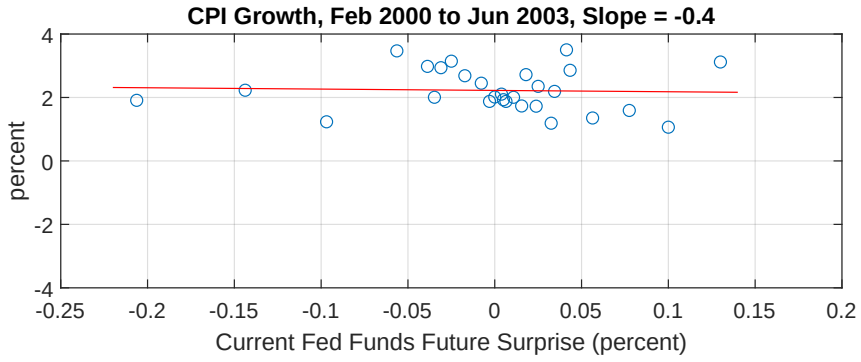

Blue Chip CPI, Aug 2003 to May 2006, Slope = -2.2
percent
Current Fed Funds Future Surprise (percent)

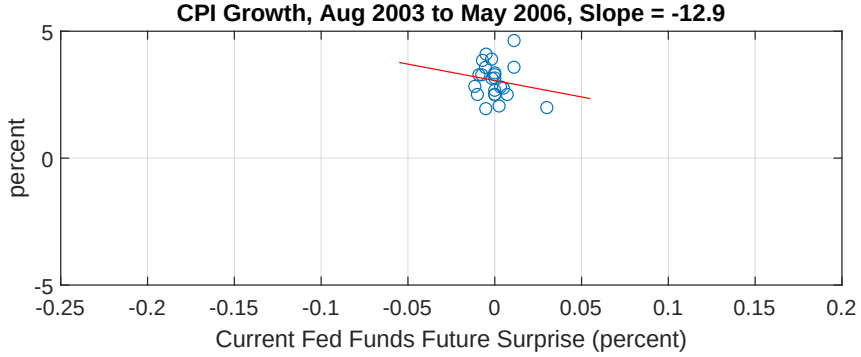

Blue Chip Unemp., Feb 2000 to Jun 2003, Slope = 0.2
percent
Current Fed Funds Future Surprise (percent)

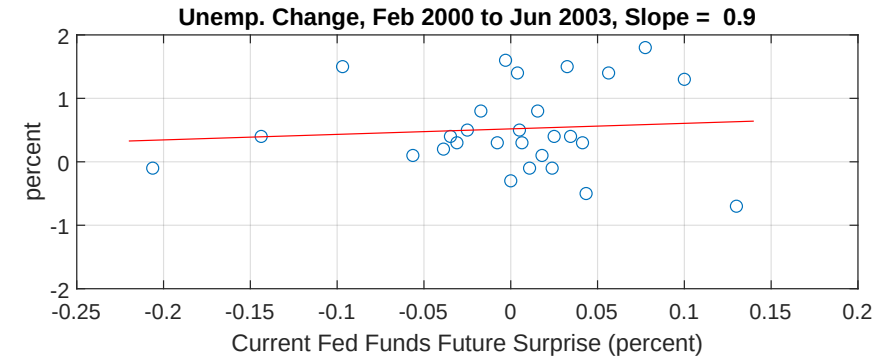

Blue Chip Unemp., Aug 2003 to May 2006, Slope = 0.1
percent
Current Fed Funds Future Surprise (percent)

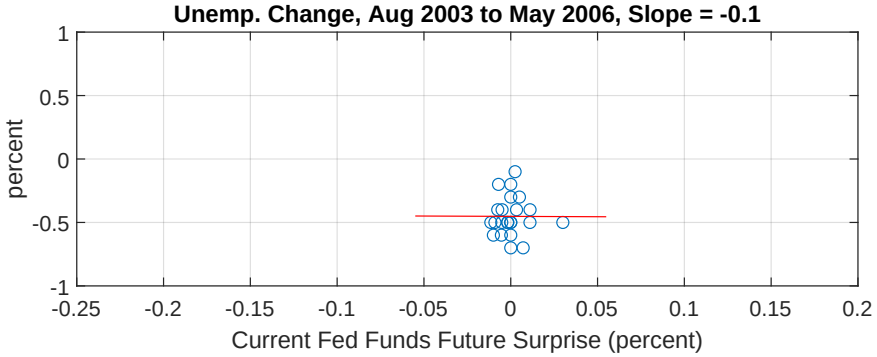

PCE Growth, Feb 2000 to Jun 2003, Slope = 0.4
percent
Current Fed Funds Future Surprise (percent)

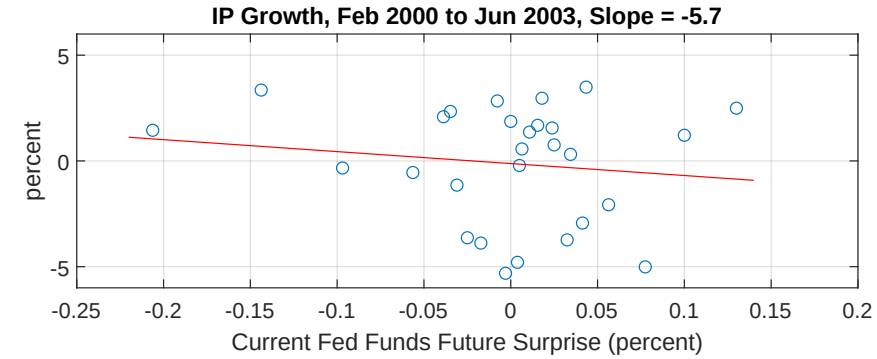

PCE Growth, Aug 2003 to May 2006, Slope = 1.1
percent
Current Fed Funds Future Surprise (percent)

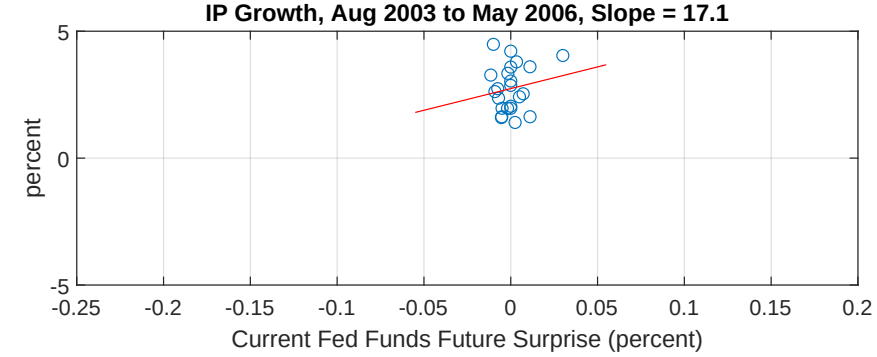

CPI Growth, Feb 2000 to Jun 2003, Slope = -0.4
percent
Current Fed Funds Future Surprise (percent)


CPI Growth, Aug 2003 to May 2006, Slope = -12.9
percent
Current Fed Funds Future Surprise (percent)

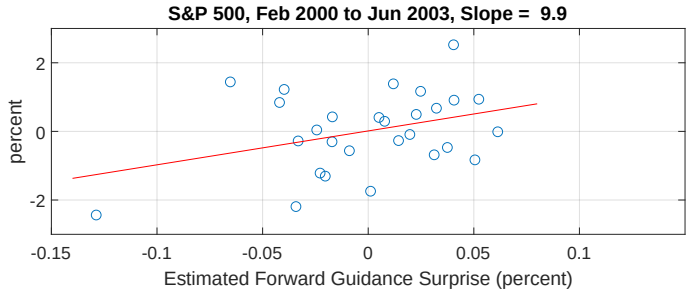

Unemp. Change, Feb 2000 to Jun 2003, Slope = 0.9
percent
Current Fed Funds Future Surprise (percent)

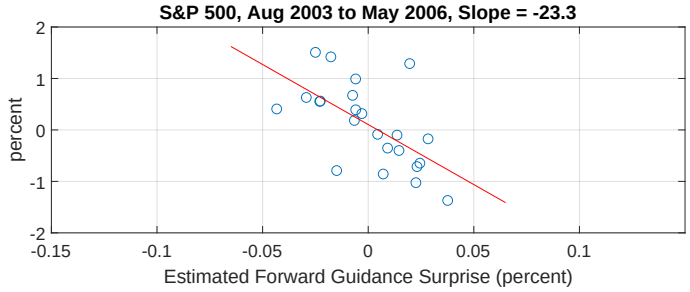

Unemp. Change, Aug 2003 to May 2006, Slope = -0.1
percent
Current Fed Funds Future Surprise (percent)

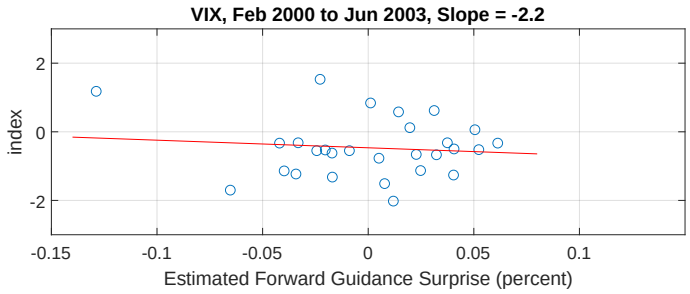

IP Growth, Feb 2000 to Jun 2003, Slope = -5.7
percent
Current Fed Funds Future Surprise (percent)

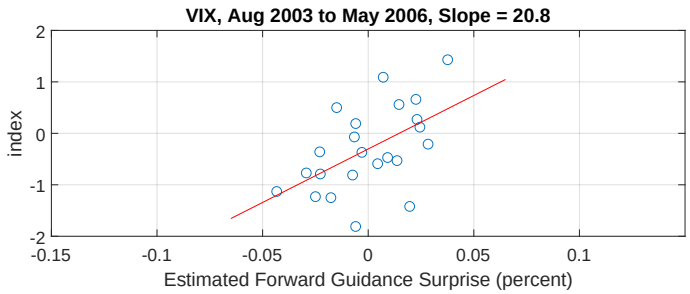

IP Growth, Aug 2003 to May 2006, Slope = 17.1
percent
Current Fed Funds Future Surprise (percent)

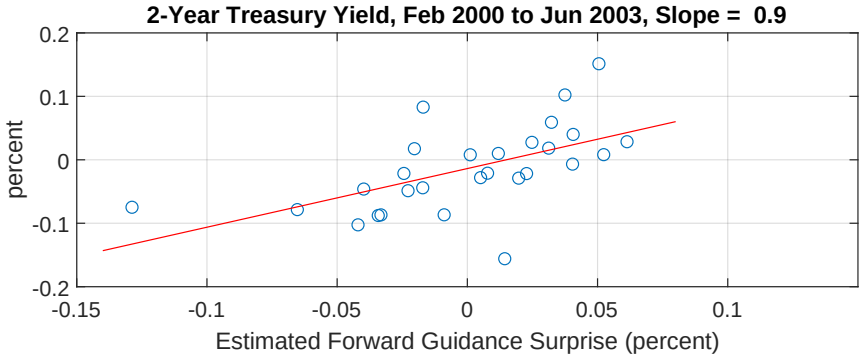
K.2 Scatter Plots on Forward Guidance Surprises

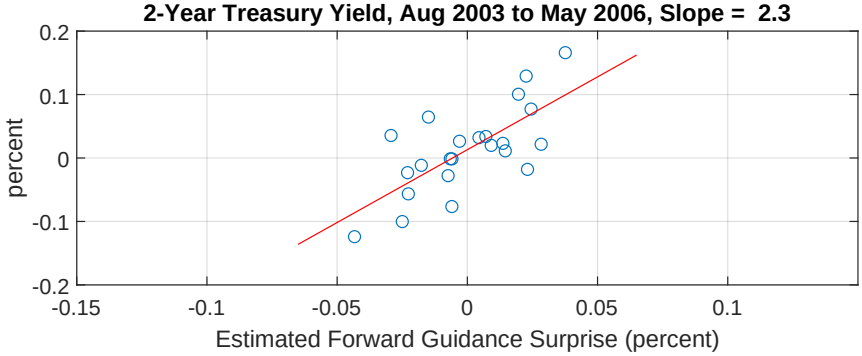


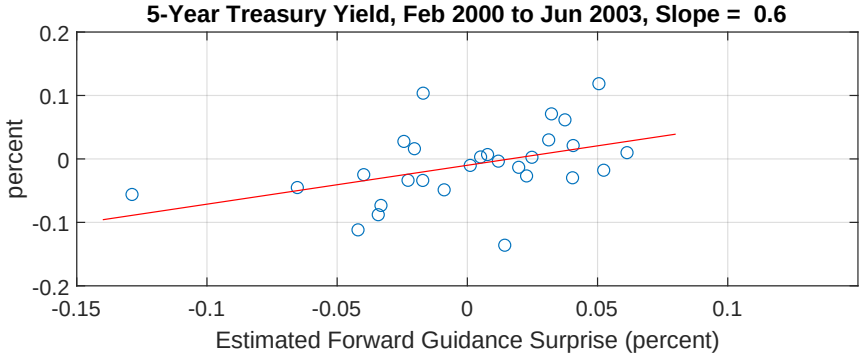


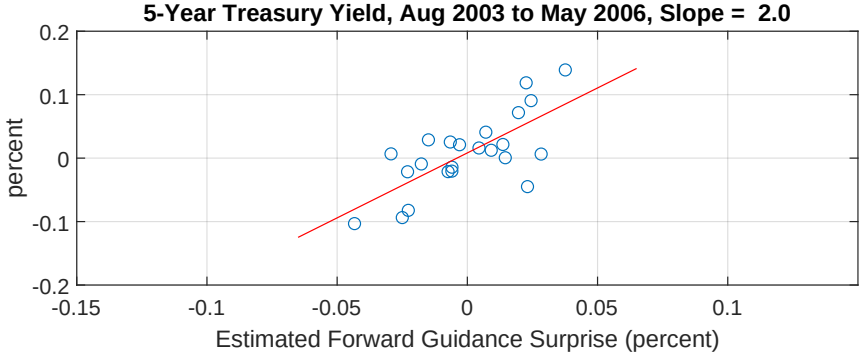


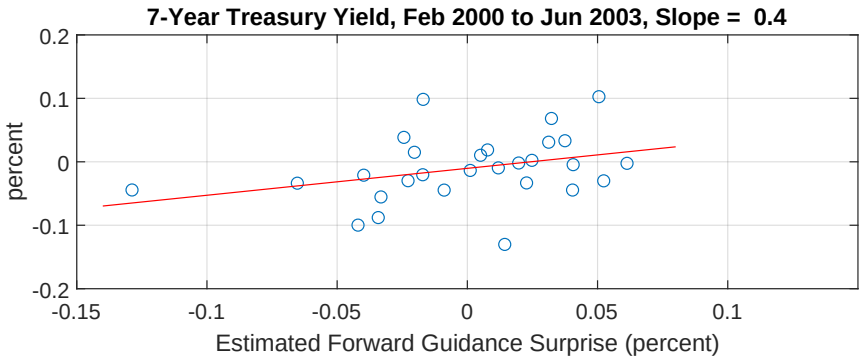


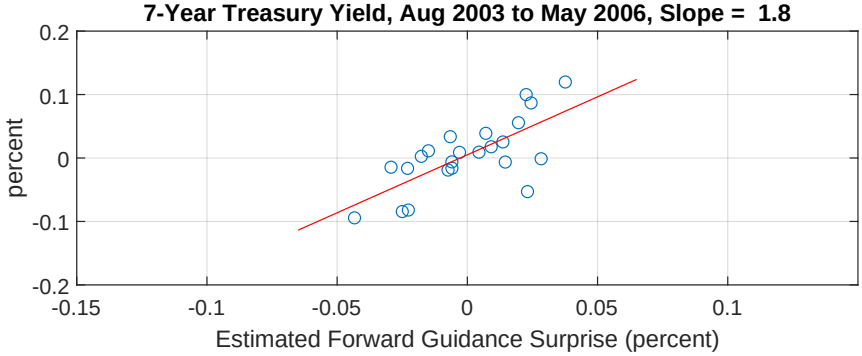

2-Year Treasury Yield, Feb 2000 to Jun 2003, Slope = 0.9
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

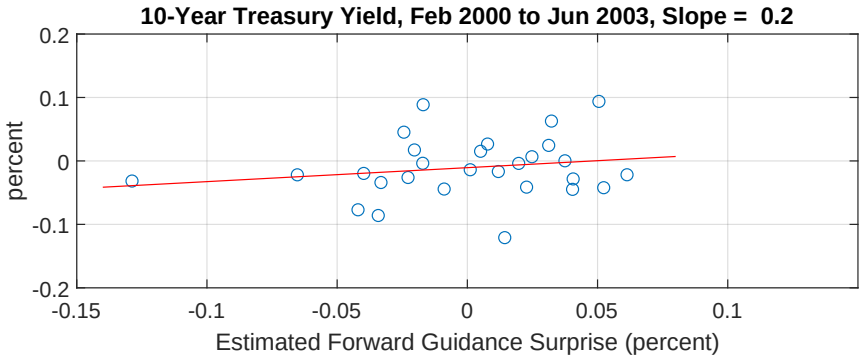

2-Year Treasury Yield, Aug 2003 to May 2006, Slope = 2.3
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

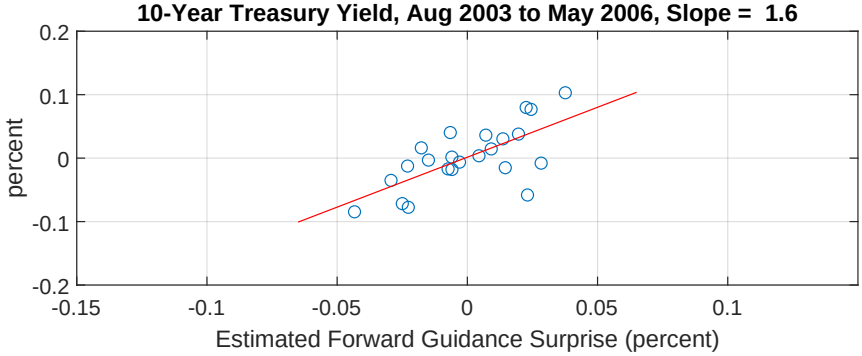

5-Year Treasury Yield, Feb 2000 to Jun 2003, Slope = 0.6
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

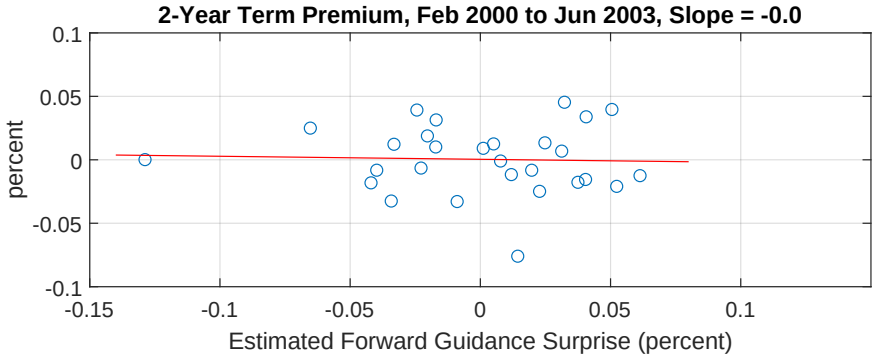

5-Year Treasury Yield, Aug 2003 to May 2006, Slope = 2.0
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

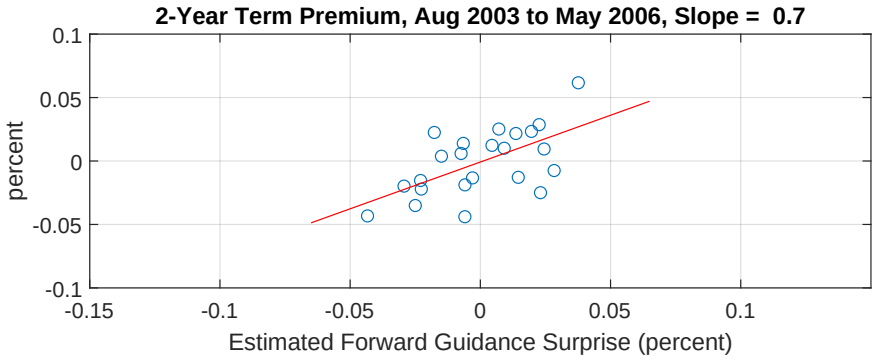

7-Year Treasury Yield, Feb 2000 to Jun 2003, Slope = 0.4
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

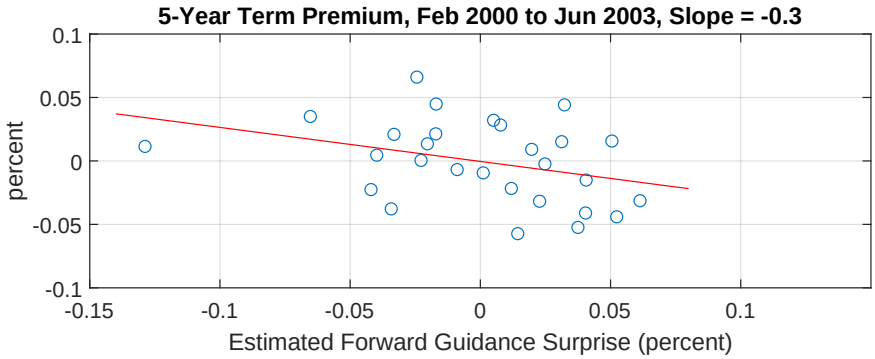

7-Year Treasury Yield, Aug 2003 to May 2006, Slope = 1.8
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

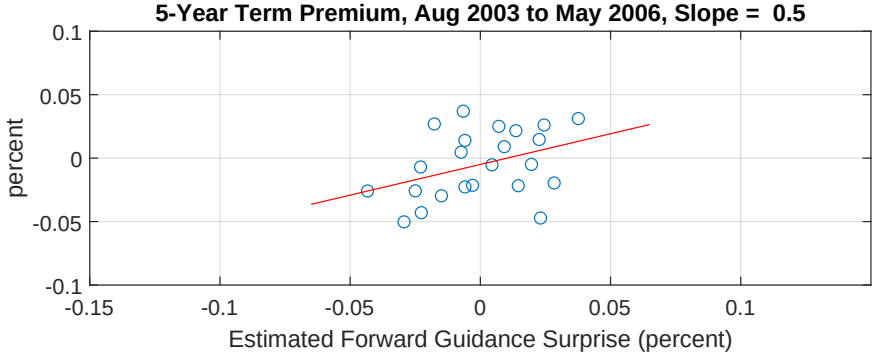

10-Year Treasury Yield, Feb 2000 to Jun 2003, Slope = 0.2
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

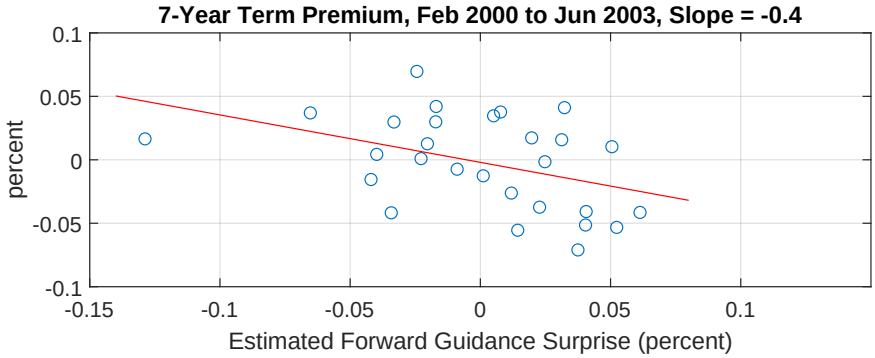

10-Year Treasury Yield, Aug 2003 to May 2006, Slope = 1.6
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

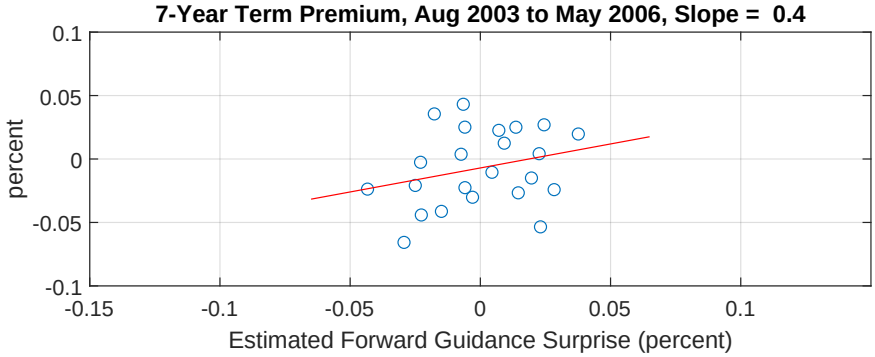

2-Year Term Premium, Feb 2000 to Jun 2003, Slope = -0.0
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

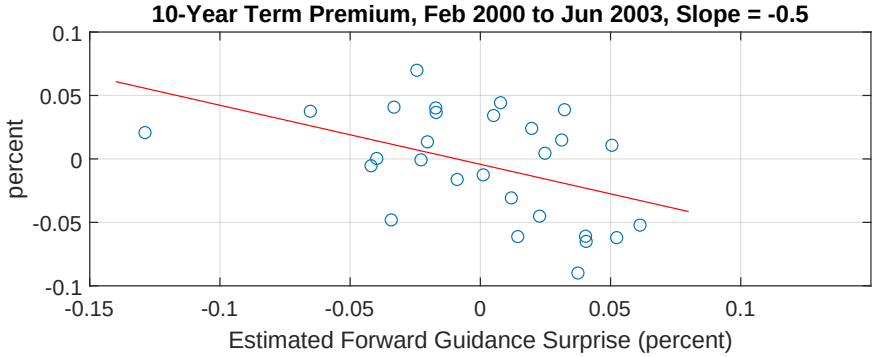

2-Year Term Premium, Aug 2003 to May 2006, Slope = 0.7
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

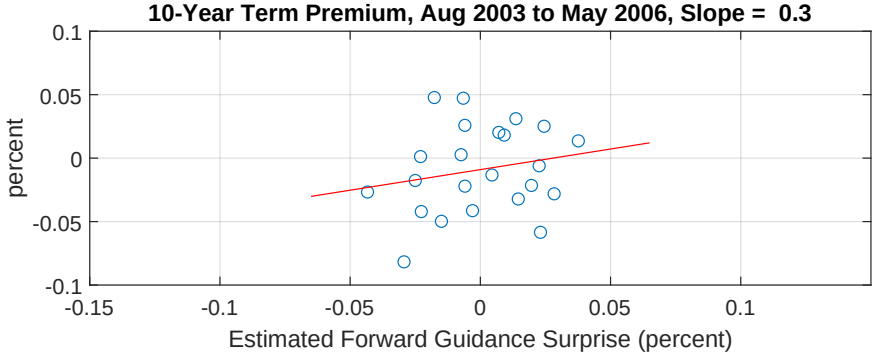

5-Year Term Premium, Feb 2000 to Jun 2003, Slope = -0.3
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

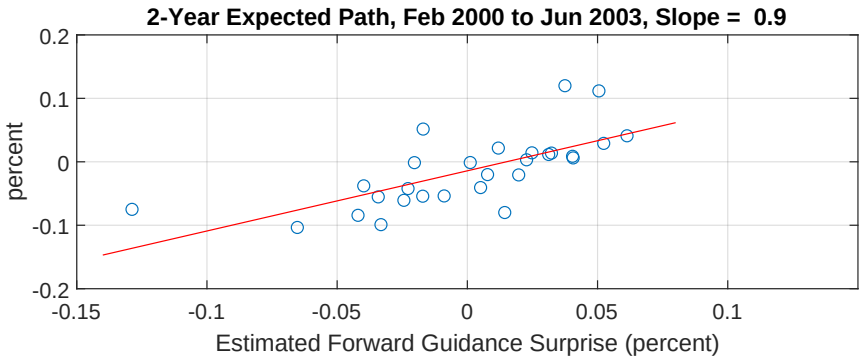

5-Year Term Premium, Aug 2003 to May 2006, Slope = 0.5
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

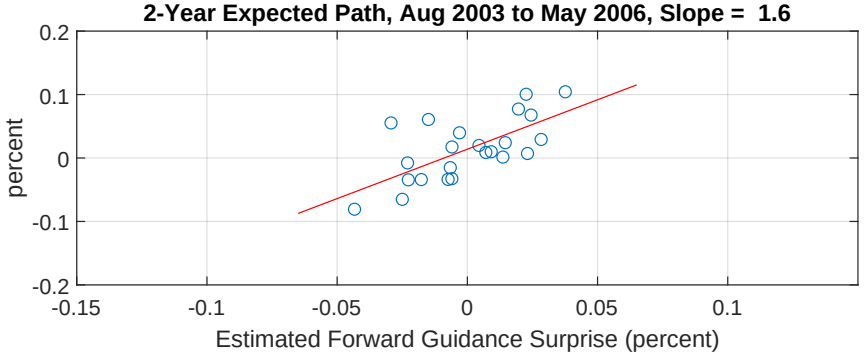

7-Year Term Premium, Feb 2000 to Jun 2003, Slope = -0.4
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

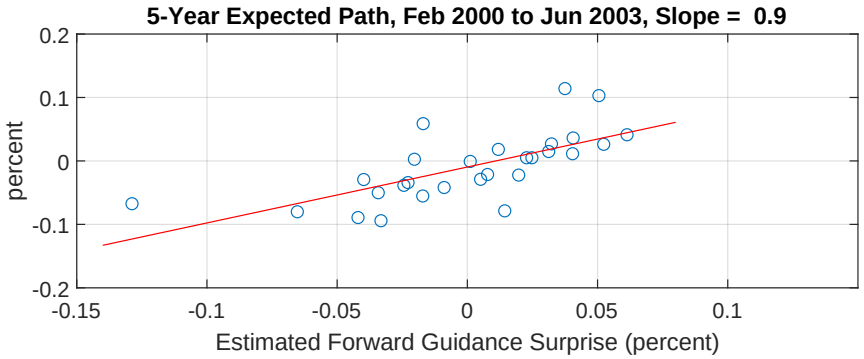

7-Year Term Premium, Aug 2003 to May 2006, Slope = 0.4
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

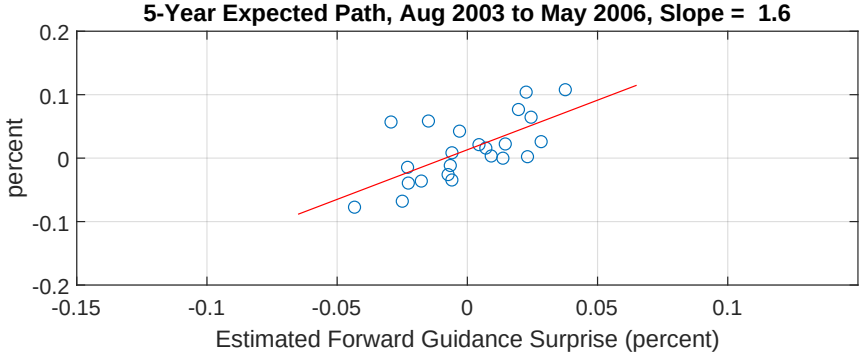

10-Year Term Premium, Feb 2000 to Jun 2003, Slope = -0.5
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

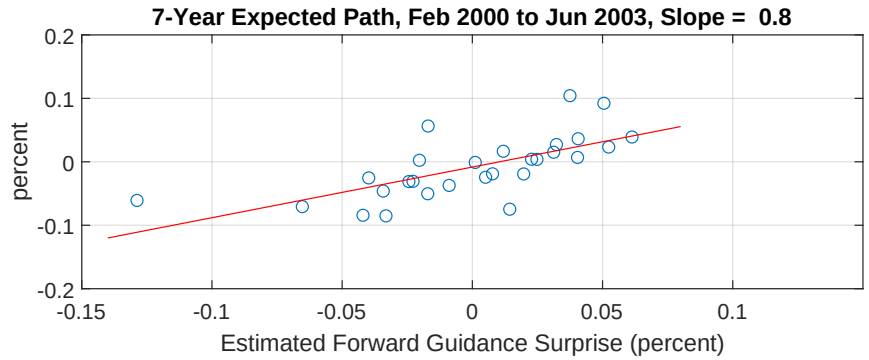

10-Year Term Premium, Aug 2003 to May 2006, Slope = 0.3
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

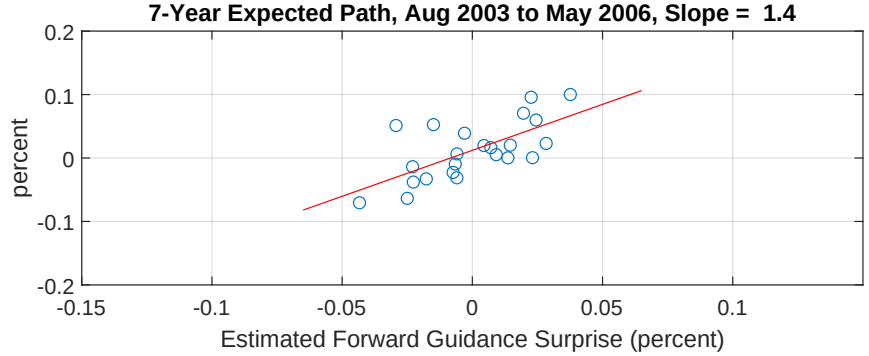

2-Year Expected Path, Feb 2000 to Jun 2003, Slope = 0.9
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

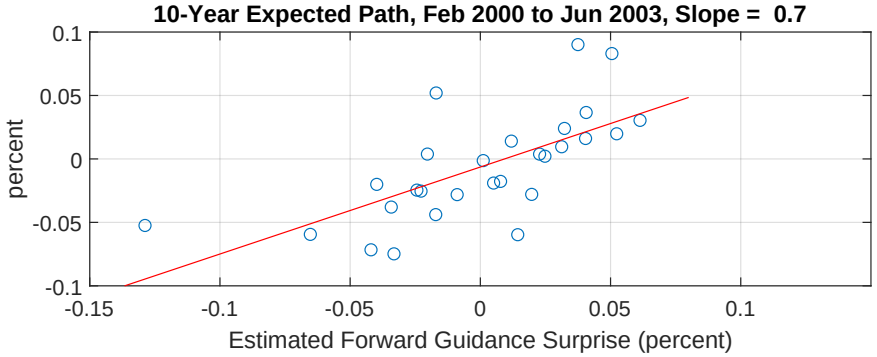

2-Year Expected Path, Aug 2003 to May 2006, Slope = 1.6
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

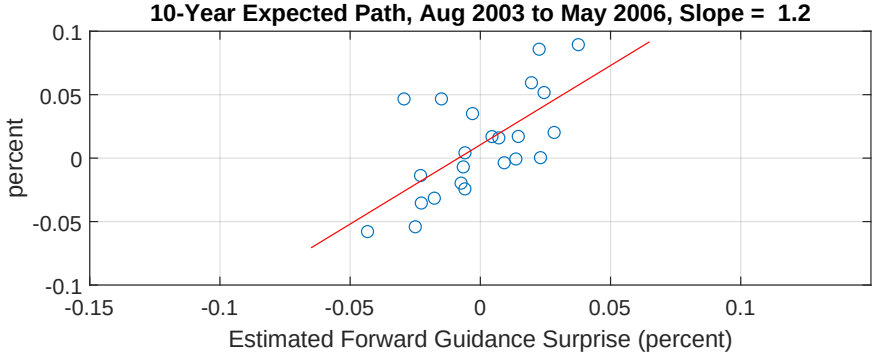

5-Year Expected Path, Feb 2000 to Jun 2003, Slope = 0.9
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

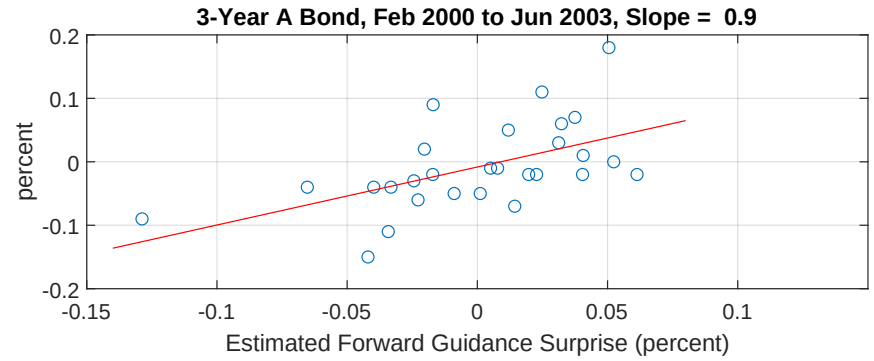

5-Year Expected Path, Aug 2003 to May 2006, Slope = 1.6
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

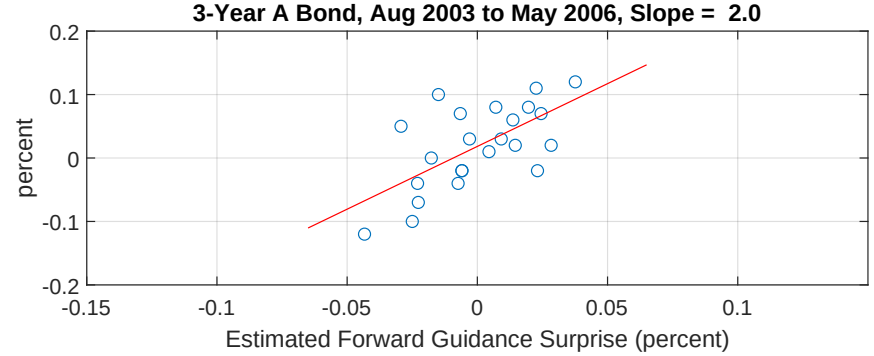

7-Year Expected Path, Feb 2000 to Jun 2003, Slope = 0.8
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

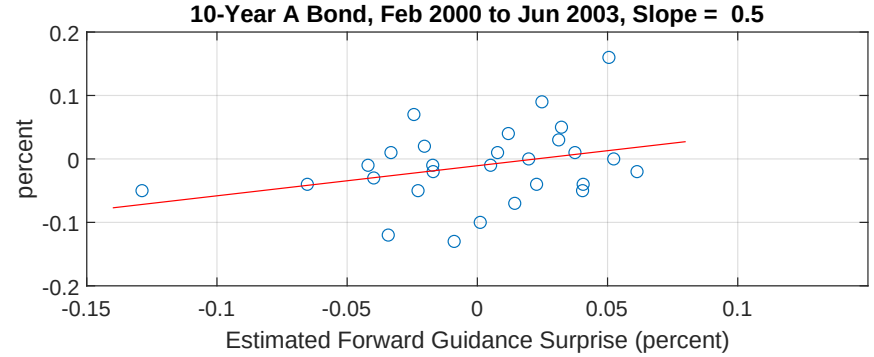

7-Year Expected Path, Aug 2003 to May 2006, Slope = 1.4
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

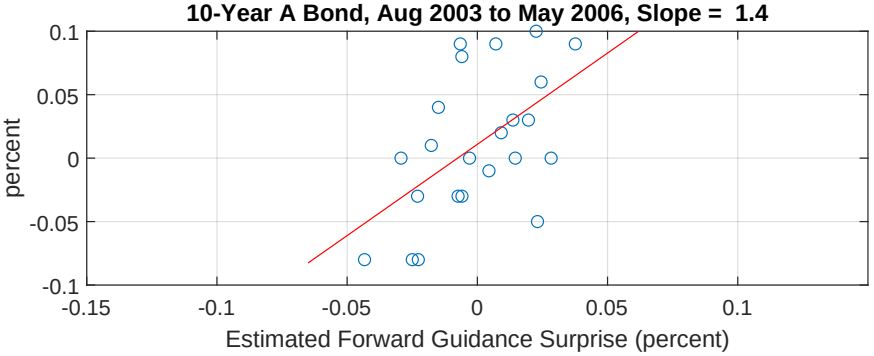

10-Year Expected Path, Feb 2000 to Jun 2003, Slope = 0.7
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

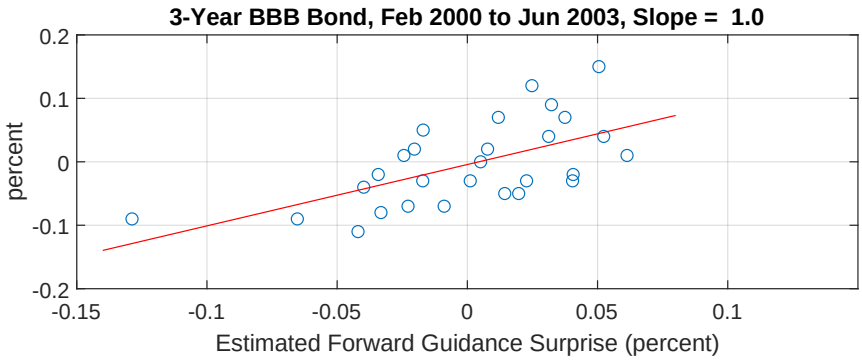

10-Year Expected Path, Aug 2003 to May 2006, Slope = 1.2
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

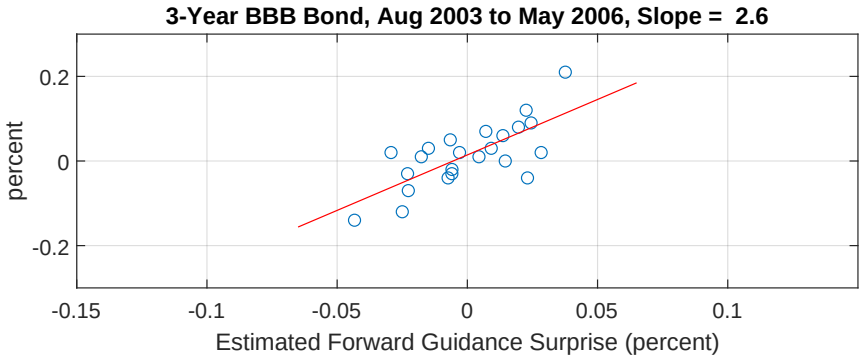

3-Year A Bond, Feb 2000 to Jun 2003, Slope = 0.9
percent
Estimated Forward Guidance Surprise (percent)

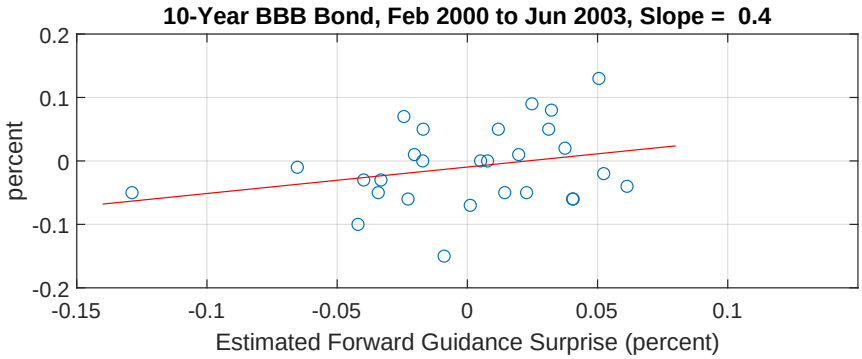

3-Year A Bond, Aug 2003 to May 2006, Slope = 2.0
percent
Estimated Forward Guidance Surprise (percent)

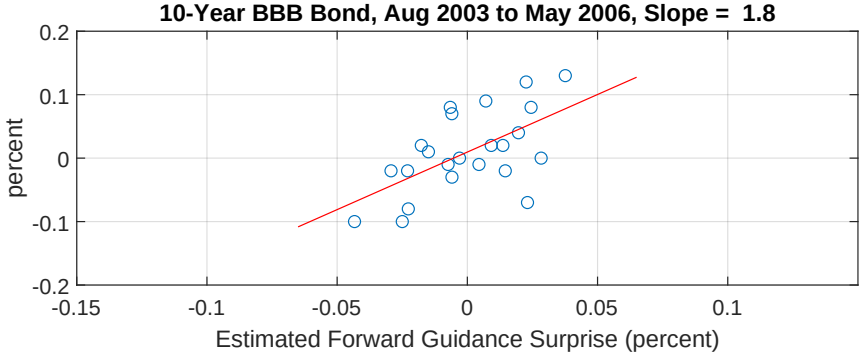

10-Year A Bond, Feb 2000 to Jun 2003, Slope = 0.5
percent
Estimated Forward Guidance Surprise (percent)

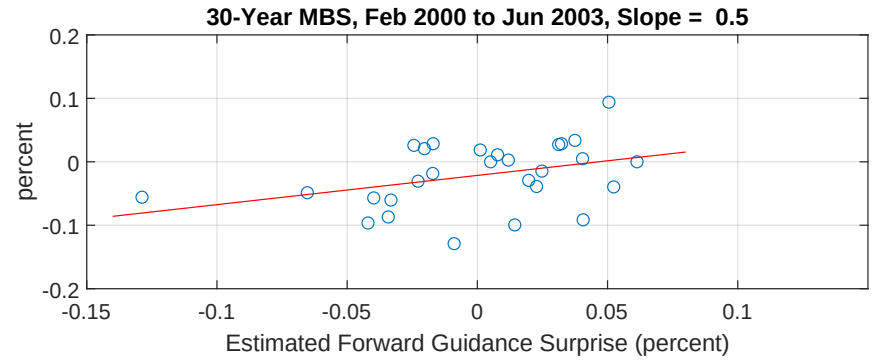

10-Year A Bond, Aug 2003 to May 2006, Slope = 1.4
percent
Estimated Forward Guidance Surprise (percent)

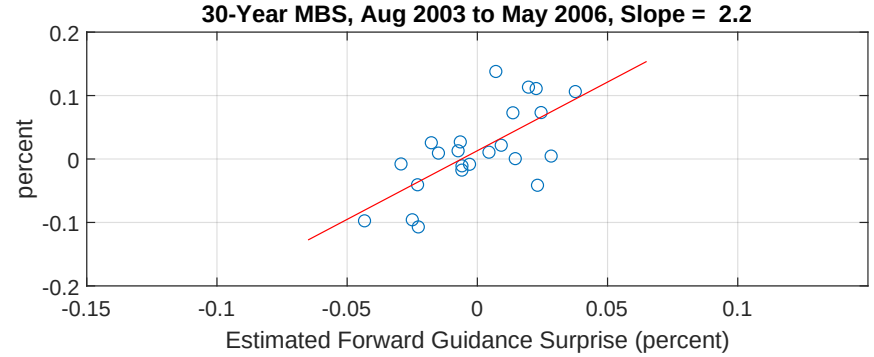

3-Year BBB Bond, Feb 2000 to Jun 2003, Slope = 1.0
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

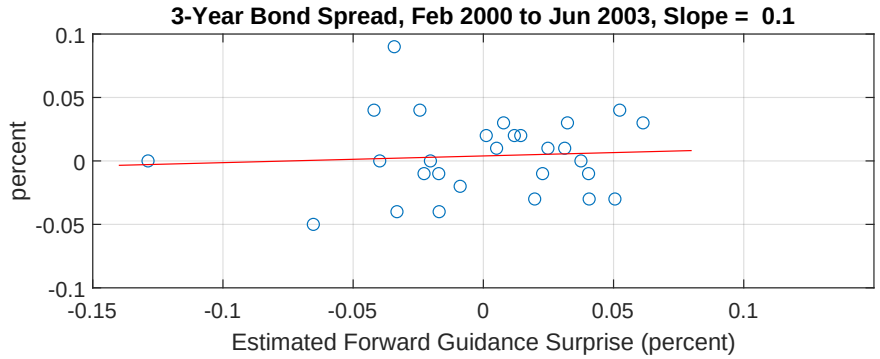

3-Year BBB Bond, Aug 2003 to May 2006, Slope = 2.6
percent
0.2
0
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

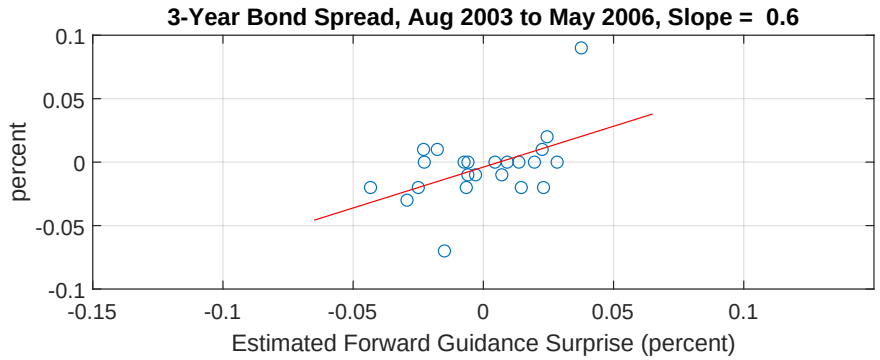

10-Year BBB Bond, Feb 2000 to Jun 2003, Slope = 0.4
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

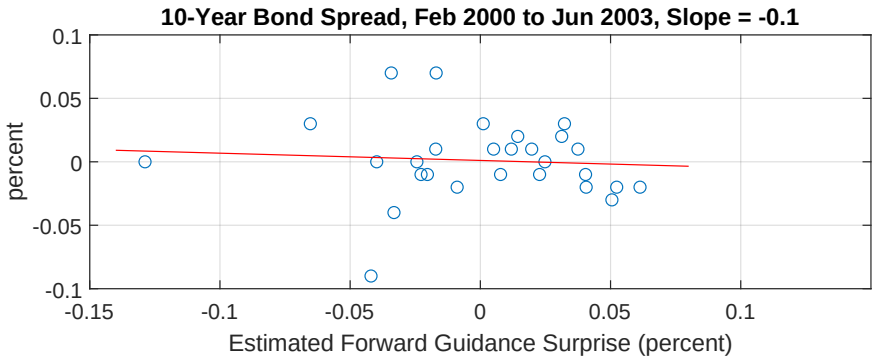

10-Year BBB Bond, Aug 2003 to May 2006, Slope = 1.8
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

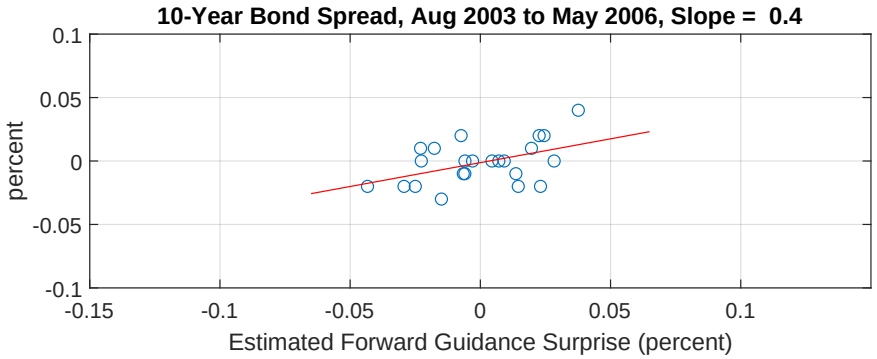

30-Year MBS, Feb 2000 to Jun 2003, Slope = 0.5
percent
Estimated Forward Guidance Surprise (percent)

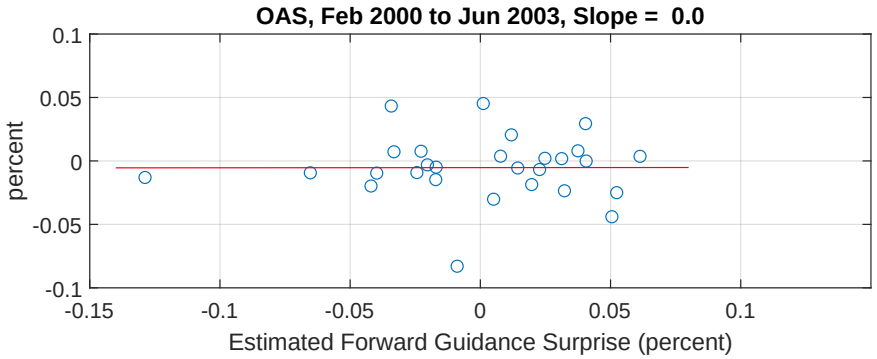

30-Year MBS, Aug 2003 to May 2006, Slope = 2.2
percent
Estimated Forward Guidance Surprise (percent)

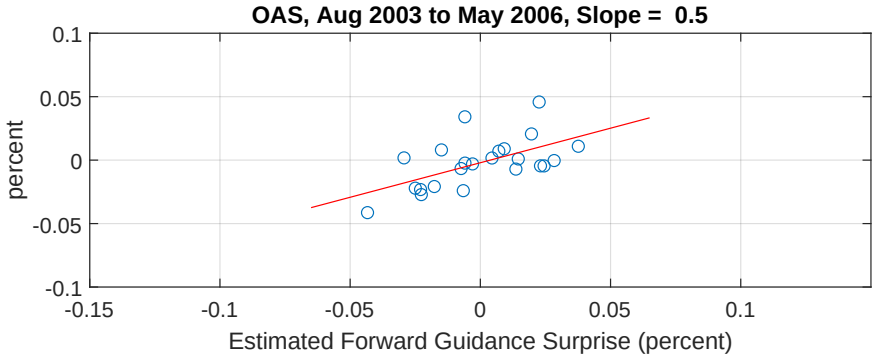

3-Year Bond Spread, Feb 2000 to Jun 2003, Slope = 0.1
percent
Estimated Forward Guidance Surprise (percent)

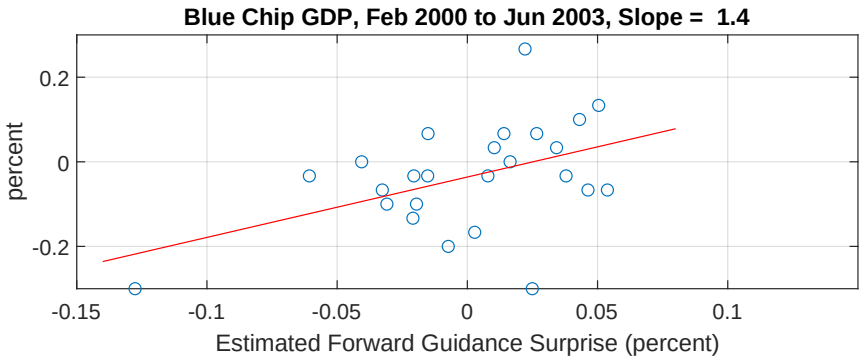

3-Year Bond Spread, Aug 2003 to May 2006, Slope = 0.6
percent
Estimated Forward Guidance Surprise (percent)

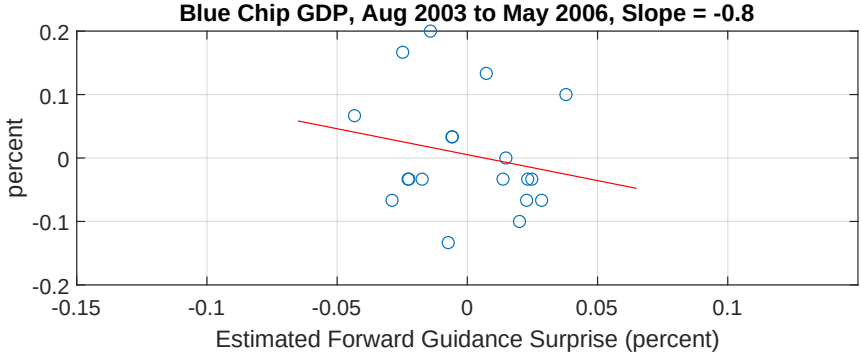

10-Year Bond Spread, Feb 2000 to Jun 2003, Slope = -0.1
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

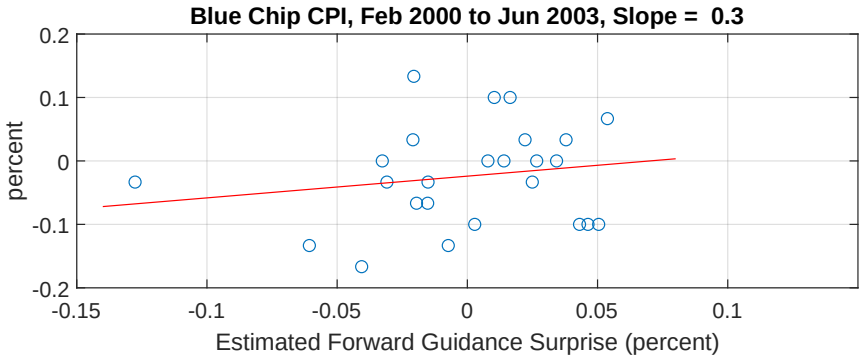

10-Year Bond Spread, Aug 2003 to May 2006, Slope = 0.4
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

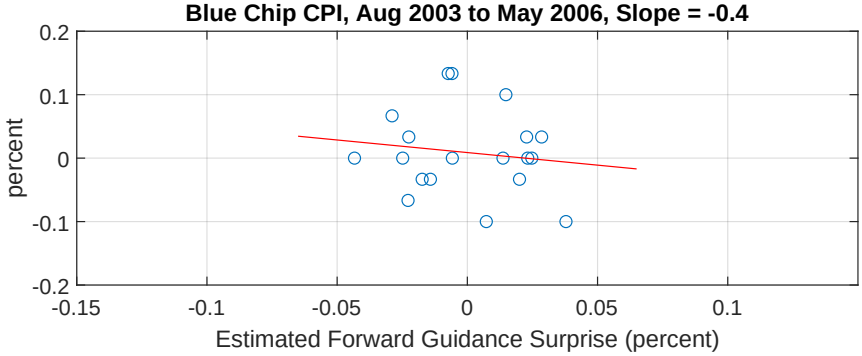

OAS, Feb 2000 to Jun 2003, Slope = 0.0
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

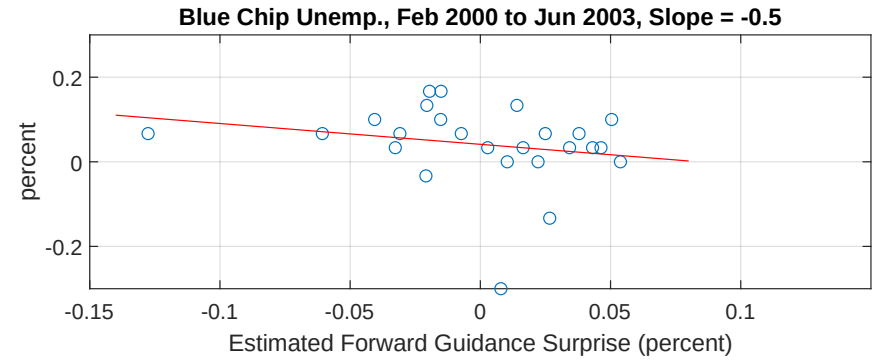

OAS, Aug 2003 to May 2006, Slope = 0.5
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

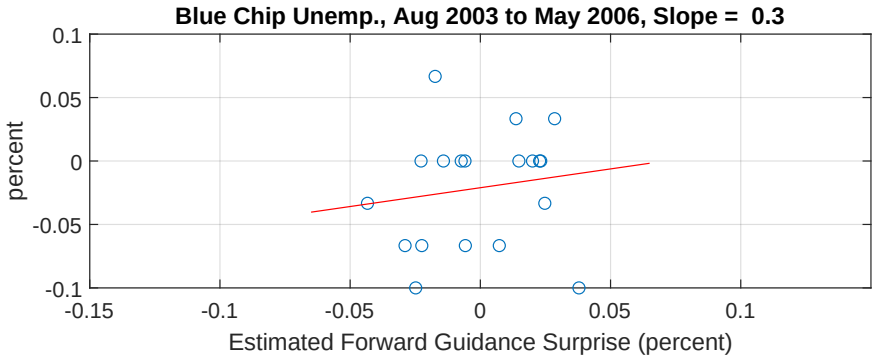

Blue Chip GDP, Feb 2000 to Jun 2003, Slope = 1.4
percent
0.2
0
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

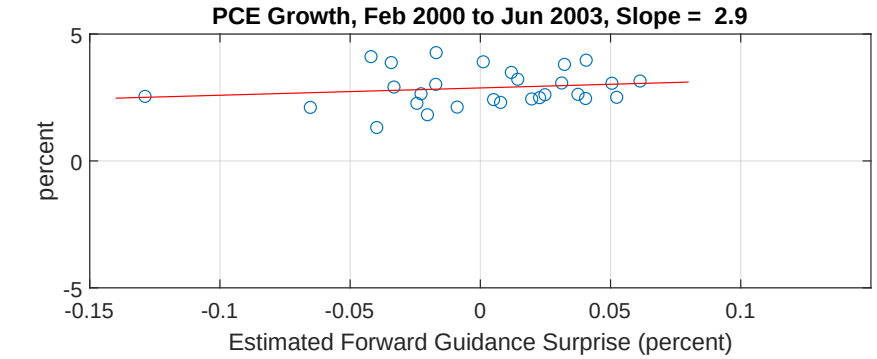

Blue Chip GDP, Aug 2003 to May 2006, Slope = -0.8
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

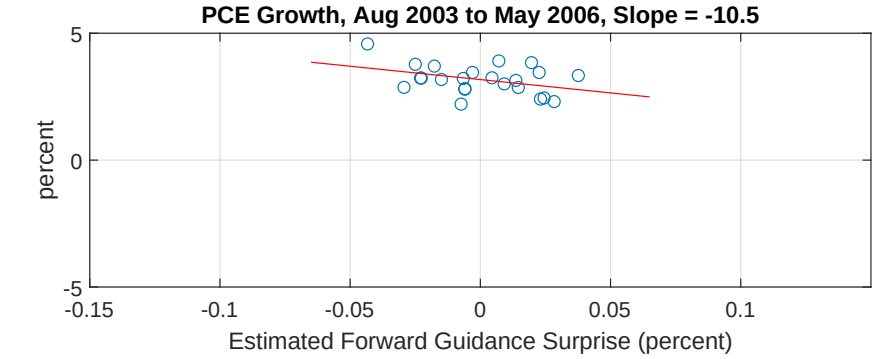

Blue Chip CPI, Feb 2000 to Jun 2003, Slope = 0.3
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

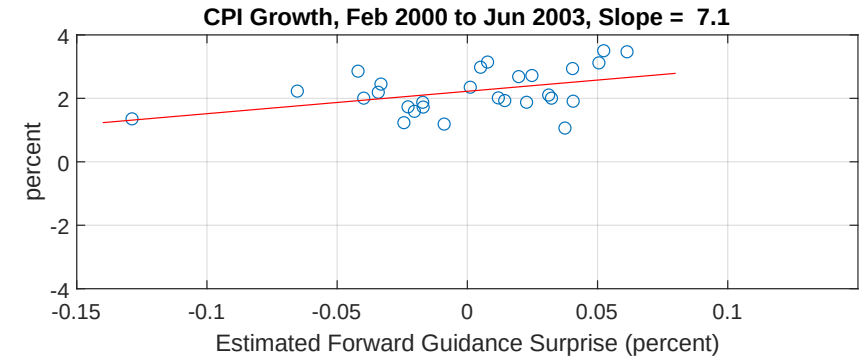

Blue Chip CPI, Aug 2003 to May 2006, Slope = -0.4
percent
0.2
0.1
0
-0.1
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

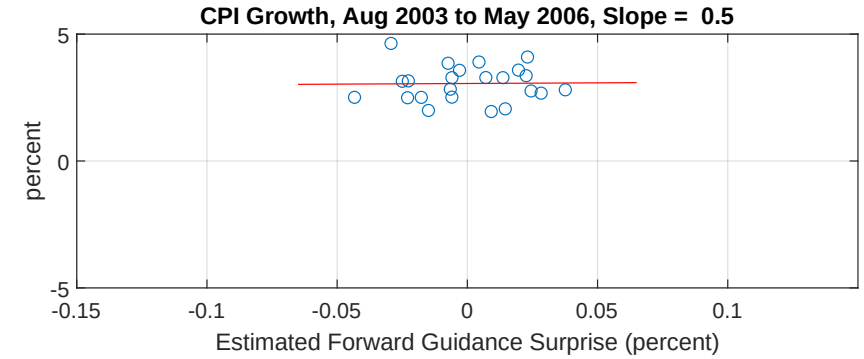

Blue Chip Unemp., Feb 2000 to Jun 2003, Slope = -0.5
percent
0.2
0
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

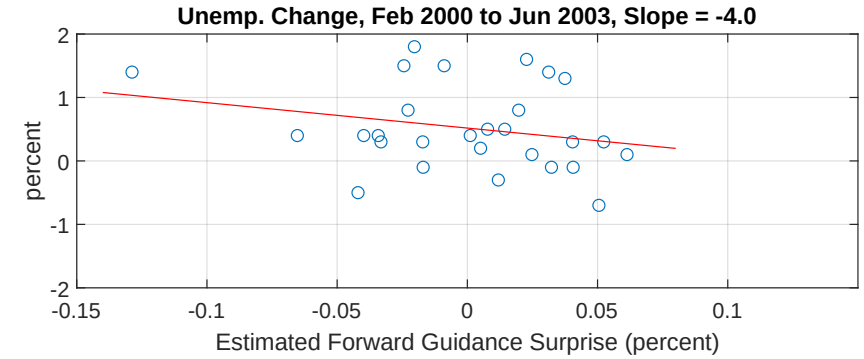

Blue Chip Unemp., Aug 2003 to May 2006, Slope = 0.3
percent
0.1
0.05
0
-0.05
-0.1
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

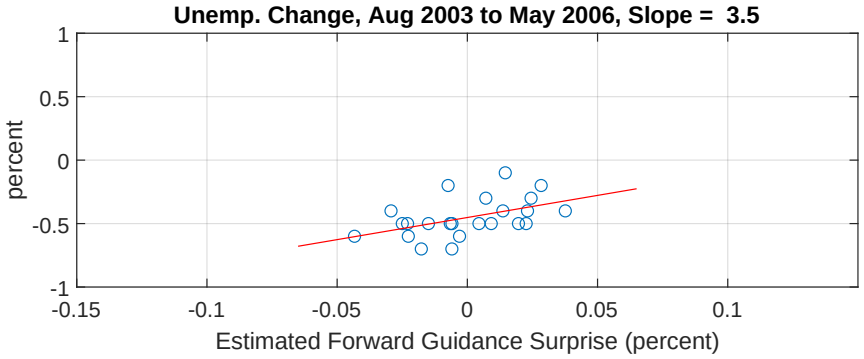

PCE Growth, Feb 2000 to Jun 2003, Slope = 2.9
percent
5
0
-5
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)

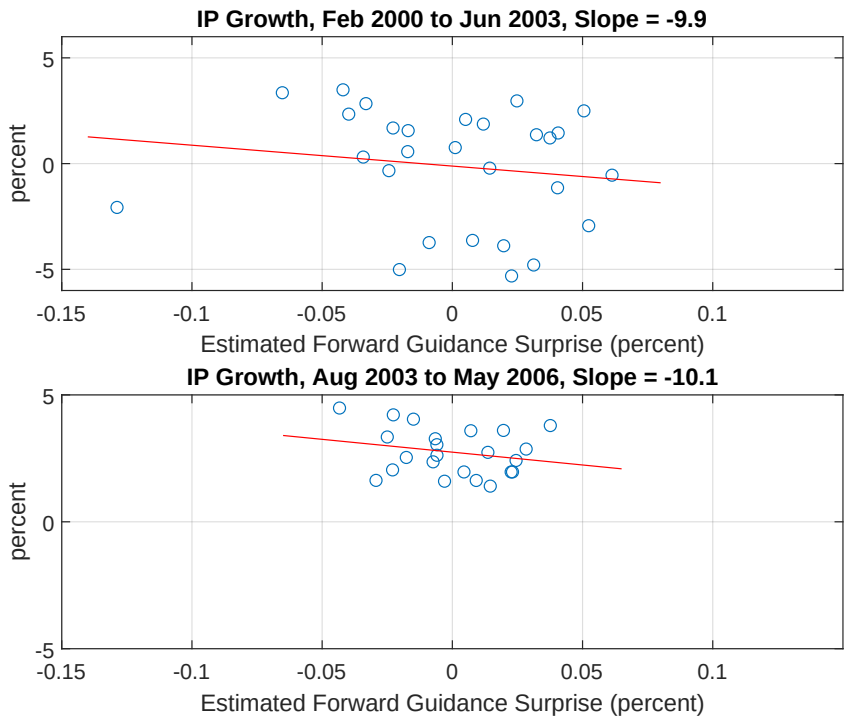

PCE Growth, Aug 2003 to May 2006, Slope = -10.5
percent
5
0
-5
-0.15
-0.1
-0.05
0
0.05
0.1
Estimated Forward Guidance Surprise (percent)


CPI Growth, Feb 2000 to Jun 2003, Slope = 7.1
percent
Estimated Forward Guidance Surprise (percent)


CPI Growth, Aug 2003 to May 2006, Slope = 0.5
percent
Estimated Forward Guidance Surprise (percent)


Unemp. Change, Feb 2000 to Jun 2003, Slope = -4.0
percent
Estimated Forward Guidance Surprise (percent)


Unemp. Change, Aug 2003 to May 2006, Slope = 3.5
percent
Estimated Forward Guidance Surprise (percent)



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