Inferring Stock Durations Around FOMC Surprises: Estimates and Implications

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Abstract

Discount rates affect stock prices directly via the discount-rate channel or indirectly via the cash-flow channel because expected future cash-flow growth varies with the discount rates. The traditional Macaulay duration captures the effect from the discount-rate channel. I propose a novel duration measure, the effective equity duration, to capture the effects from both channels. I estimate it around unexpected policies in the federal funds rates. I find that the equity yield curve is hump-shaped because expected future cash flow growth increases with the discount rates. The effective equity duration captures information other than monetary policy risk.

JEL classification: E43, E52, E58, G11, G12

Keywords: FOMC announcements, effective equity duration, equity yield curve, monetary policy risk

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A. Data description

A.1. CME Federal Funds futures data

I perform the following corrections to clean up CME Federal Funds futures data. First, I remove all future prices that are below 90 (9 cases). Second, for FOMC announcement on November 6, 2001, 14:20 EST, which cut the federal funds rate from 2.5% to 2%, the first transaction after the announcement had a price of 99.79, which appears to be an irregular record. I manually correct this price as 97.79, based on other transactions around the announcement. Third, there is no CME Federal Funds futures data available during the week of January 21, 2008, so I remove the FOMC announcement on January 22, 2008. As CME data are in Central Time, to match CME data with stock price data which are in the Eastern Time, I adjust the CME transaction time to Eastern Time by adding one hour to it.

A.2. FOMC announcements

First, I collect the exact FOMC announcement days and times from various sources, including FOMC website, Bloomberg, Thomson Reuters, Wall Street Journal, Dow Jones Wire, Associated Press, CNBC, and Datastream. Next, I verify these announcement times in two steps: (1) I cross check with the times reported in Lucca and Moench (2015) and Ozdagli and Weber (2019); (2) I further verify these announcement times with the trading activities of CME Federal Funds futures. Usually CME Federal Funds futures trading becomes quiet before the scheduled FOMC announcements, so if there is a sudden trade with a significant price change, we can safely assume that the announcement was made before the transaction time of CME Federal Funds futures. These lead to several corrections of times reported in the literature. For example, based on CME Federal Funds futures transaction times, I correct 5 cases of announcement times reported in Lucca and Moench (2015).[1] I also consider the unscheduled FOMC meetings, which are excluded in Lucca and Moench (2015).

There are 195 FOMC announcements during 1995-2016. I apply several filters to select the events. First, I exclude several irregular announcements (e.g., FOMC announcements on 01/04/2001, 09/17/2001, 01/06/2003, 01/22/2008, and 11/30/2011).[2] Second, FOMC announcements must include unexpected monetary policy decisions, e.g., unexpected changes in the federal funds rate or unexpected inaction. The tick size of CME Federal Funds futures is 0.25 basis points for the nearest month contract and 0.5 basis points for all other contracts. Therefore, to minimize microstructure noise, I require FOMC announcements to contain at least 0.2 basis points of unexpected changes in the federal funds rate. After applying these filters, there are 47 FOMC announcements remain in the sample. Table A.1 reports the selected FOMC announcements.

B. Estimate Dechow, Sloan, and Soliman (2004) duration

I follow Dechow et al. (2004) to measure firm-level stock duration, which is Macaulay duration. The modified duration (D^{DSS}) for a stock i can be computed as the weighted

[1]Those FOMC announcements are on 19/12/1995, 06/25/2008, 12/16/2008, 03/16/2010, and 08/10/2010.

[2]See, e.g., Gürkaynak, Sack, and Swanson (2005) and Bernanke and Kuttner (2005) for the exclusions of FOMC announcements on 01/04/2001, 09/17/2001, 01/06/2003. FOMC announcement on 01/22/2008 is excluded because CME Federal Funds futures data are missing. There is an unscheduled FOMC meeting on 11/28/2011, discussing additional swap arrangements but not the federal funds rate. The news about this meeting is released on 11/30/2011 8:17 AM EST, so I exclude this FOMC announcement.

average time of future cash flows, as follows:

$$D_i^{DSS} = \frac{\sum_{j=1}^{\infty} j \cdot CF_{i,j}/(1+ER_i)^j}{ME_i(1+ER_i)},$$

where ME_i is the market equity of stock i at time 0, $CF_{i,j}$ is the net cash flow to equity holders at time j, and ER_i is the expected return of stock i. To simplify, Dechow et al. (2004) assume that we can forecast the stream of cash flows up to horizon J, and the remaining cash flows beyond J are to be a perpetuity. Thus,

$$\text{(B.1)} \quad D_i^{DSS} = \frac{\sum_{j=1}^{J} j \cdot CF_{i,j}/(1+ER_i)^j}{ME_i(1+ER_i)} + \left(J + \frac{1+ER_i}{ER_i}\right) \cdot \frac{\sum_{j=J+1}^{\infty} CF_{i,j}/(1+ER_i)^j}{ME_i(1+ER_i)}.$$

To estimate duration, we need to forecast cash flows for the immediate J periods. Cash flows are computed from the accounting identity $BE_{i,j} = BE_{i,j-1} + E_j - CF_{i,j}$, where $BE_{i,j}$ is the book equity at time j, and $E_{i,j}$ is the earnings during the same period. Earnings can be computed from book equity and return on equity (ROE). Dechow et al. (2004) assume that book equity grows at the rate of sales growth (SGR). They further assume that SGR and ROE follow two separate first-order autoregressive processes.

As Dechow et al. (2004), I estimate two separate first-order autoregressive processes for SGR and ROE. SGR is defined as the percentage change in net sales (SALE), while ROE is the ratio of earnings before extraordinary items (IB) over book value of common equity (CEQ).[3] These processes are assumed to converge to a long-run mean of 6% for sales growth and 12% for return on equity.[4] Thus, I estimate the AR(1) coefficients to be 0.21 and 0.56 for SGR and ROE, respectively. SGR and ROE are projected for the next $J = 10$ years to forecast cash flows. As Dechow et al. (2004), I use a discount rate ER_i of 12% per year for

[3]I also used total shareholder book equity minus deferred tax and investment tax credit, plus book value of preferred equity. The results are similar.

[4]These are the long-run average estimates of GDP growth rate and equity return from Ibbotson Associates (1999).

all stocks.

To allow for better estimates, I use the sample period from 1972 to 2016 to estimate the Dechow et al. (2004) durations. I trim the duration estimates at 1 and 300 years.

C. Equity yield curve and asset pricing models

Prominent asset pricing models based on habit formation (Campbell and Cochrane, 1999), long-run risk (Bansal and Yaron, 2004), or rare disasters (Gabaix, 2012) predict an upward-sloping or a flat equity yield curve. Emerging evidence of a downward-sloping yield curve challenges existing theories. To generate a downward-sloping yield curve, we need to constrain the cash-flow process and the pricing kernel or consider some additional frictions/risks, and several extensions have been proposed: (1) Using specifically given correlations between dividend shocks and the price of risk. For example, Lettau and Wachter (2011) assume a zero correlation between dividend shocks and shocks to the price-of-risk, while Hasler and Marfè (2016) consider the post-disaster recovery to shift dividend risks to the short run. (2) Using rigidities in financial leverage or labor. Belo, Collin-Dufresne, and Goldstein (2015) argue that leverage ratios are stationary. Thus, shareholders are forced to divest (invest) when leverage is low (high), which shifts long-horizon growth risk of earnings to short-horizon dividends. Favilukis and Lin (2016), Marfè (2016, 2017) suggests that labor rigidity induces income insurance from shareholders to workers in the short run, i.e., using dividends to smooth wage. Dividends are more volatile and procyclical. As a result, dividend (wage) risks shift to the short (long) horizon. (3) Limited information or slow learning about long-run growth shocks. Croce, Lettau, and Ludvigson (2015) assume that investors have only limited information about long-run cash-flow risk in the long-run risk framework, and dividend risk is upward-sloping in the physical measure. Ai, Croce, Diercks, and Li (2018) propose a vintage capital model with slow learning about the long-run growth shocks, together with heterogeneous exposure to aggregate productivity shocks. (4)

Gonçalves (2020) suggests equity reinvestment risk to generate the hump-shaped term structure. Gonçalves (2020) shows that market betas increase with maturities while betas relative to changes in reinvestment rates decrease. Together with the risk prices implied by ICAPM, Gonçalves (2020) finds that market risk dominates the reinvestment risk for short-duration claims (implying an upward-sloping curve) while reinvestment risk dominates the market risk for long-duration claims (implying a downward-sloping curve).

Meanwhile, some evidence shows that behavioral bias contributes to the downward-sloping yield curve. For example, Weber (2018) shows that it is related to investor sentiment and investors are too optimistic about long-duration stocks, leading to overvaluation. Jiang and Sun (2019) also find high dividend stocks (which are more sensitive to interest rate changes) are overpriced when interest rate is low.

D. Long-horizon portfolio returns

Table D.1 examines the long-term effect of the effective equity duration, using a holding period from 3 months to 36 months. To save space, only raw holding returns and alphas from the Fama-French five-factor model are reported. For easy comparisons, the holding period returns and alphas are scaled by the number of holding months. First, we see a similar hump-shaped yield curve when the holding period is short. Second, the highest return portfolio shifts from Portfolio 4 to Portfolio 2 when the holding period increases from 3 months to 36 months. Third, the $long - short$ return difference remains significant up to the 30-month holding period. For example, with a 3-month holding period, the return difference between Portfolio 10 and Portfolio 4 is significantly negative (i.e., the Fama-French five-factor model α_{FF5}= -1.19% with a t-statistic of -3.16); with a 30-month holding period, the return difference between Portfolio 10 and Portfolio 2 is still significantly negative (i.e., α_{FF5}= -0.86% with a t-statistic of -2.42), but it becomes insignificant with a 36-month holding period. This demonstrates that the effective equity duration has reasonably long-term impacts on stock returns.

E. Robustness checks

In this section, I perform several robustness checks of the main results from the effective equity durations, reported in Table E.1. I first consider various features of FOMC announcements that might affect market reactions. Next, I consider longer holding periods for duration-sorted portfolios, alternative event windows, and alternative VAR specifications.

E.1. Differentiating FOMC announcements

E.1.1. Unscheduled FOMC announcements

Although most FOMC announcements are scheduled in the previous June, some FOMC meetings are held unexpectedly. Unscheduled FOMC announcements may contain more surprises to the markets, given the emergency nature of these FOMC meetings. Only one of the selected FOMC announcements was not scheduled in advance, so the results remain qualitatively similar. For example, after excluding this unscheduled event, we see a similar hump-shaped yield curve in Panel A.

E.1.2. Other macro news

FOMC decisions are sometimes announced on the same day as other macro news, which might contaminate the results. I exclude four FOMC announcements that coincide with other macro news, like CPI, PPI, and employment. Still, Panel B presents a similar yield curve.

E.1.3. Changes in the monetary policy path

FOMC announcements that change the monetary policy path between expansion and contraction might be important for market reactions (Neuhierl and Weber, 2019), which could affect the duration estimates. Panel C presents the results after the four FOMC announcements associated with changes in the monetary policy path are excluded. The results are qualitatively similar to those reported before.

E.1.4. FOMC announcements during expansions/recessions

It is well known that the bond yield curve is inverted during recessions, so one would expect that the equity yield curve would also be downward-sloping during recessions. Empirically, Binsbergen, Hueskes, Koijen, and Vrugt (2013) and Bansal, Miller, Song, and Yaron (2019) find that the yield curve is downward-sloping during recessions. One might wonder if the previous results are driven by the FOMC announcements during recessions. To test this, I match the NBER recession months with the FOMC announcements and separate the FOMC announcements into two subsamples, i.e., FOMC announcements during expansion months and during recession months. Then I repeat the above analyses for these two subsamples.

Panel D presents the results over expansion times (e.g., 39 announcements), while Panel E presents the results over NBER recession months (e.g., 8 announcements). Again, we see a hump-shaped equity yield curve for FOMC announcements made during expansion months in Panel D and during recessions in Panel E. The downward-sloping pattern becomes stronger in recessions, shown in Panel E.

E.2. Alternative event windows

In the main case, to include more transactions from CME Federal Funds futures, I specify a longer event window for CME Federal Funds futures as $[s-60, s+5]$ and a shorter event window for stock price reactions as $[s-30, s+10]$, while the unit is a minute. However, choosing different event windows might raise concerns of non-synchronous issues. In this subsection, I further consider the case using the same event window for CME Federal Funds futures and stocks, $[s-30, s+10]$. Panel F presents the average portfolio returns for 10 duration-sorted portfolios. We see the average portfolio returns increase from Portfolio 1 (0.84%) to Portfolio 4 (2.22%) and then decrease to Portfolio 10 (-0.30%), forming a hump-shaped yield curve. The return difference between Portfolio 10 and Portfolio 1 (or Portfolio 4) is significant.

E.3. Alternative VAR specification

The main VAR specification includes the dividend yield, together with other predictive variables. As Campbell, Polk, and Vuolteenaho (2010) and Engsted, Pedersen, and Tanggaard (2012) suggest, this is a proper VAR system. Although the model misspecification may still present, the estimate of discount-rate news is valid because those state variables chosen can capture the expected market returns. Nevertheless, one may still concern the criticisms raised in Chen and Zhao (2009). In this subsection, I consider alternative VAR specifications, e.g., including more state variables. In addition to the 5 state variables used in the main case, I include the risk-free rate, which has been shown to predict future market return innovations (Campbell, Giglio, Polk, and Turley, 2018). Panel G presents the average portfolio returns of 10 duration-sorted portfolios. Overall, we see a similar hump-shaped equity yield curve, though it is slightly less smooth than before. We see the average portfolio returns increase from Portfolio 1 (1.50%) to Portfolio 4 (2.53%) and then decrease to Portfolio 10 (0.27%). The return difference between Portfolio 10 and Portfolio 1 (or Portfolio 4) is significant.

References

Ai, H.; M. M. Croce; A. M. Diercks; and K. Li. News Shocks and the Production-Based Term Structure of Equity Returns. *Review of Financial Studies*, 31 (2018), 2423–2467.

Bansal, R.; S. Miller; D. Song; and A. Yaron. The Term Structure of Equity Risk Premia. Working Paper, Duke University (2019).

Bansal, R., and A. Yaron. Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles. *Journal of Finance*, 59 (2004), 1481–1509.

Belo, F.; P. Collin-Dufresne; and R. S. Goldstein. Dividend Dynamics and the Term Structure of Dividend Strips. *Journal of Finance*, 70 (2015), 1115–1160.

Bernanke, B. S., and K. N. Kuttner. What Explains the Stock Market's Reaction to Federal Reserve Policy? *Journal of Finance*, 60 (2005), 1221–1257.

Binsbergen, J. H. v.; W. Hueskes; R. S. J. Koijen; and E. B. Vrugt. Equity Yields. *Journal of Financial Economics*, 110 (2013), 503–519.

Campbell, J. Y., and J. H. Cochrane. By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior. *Journal of Political Economy*, 107 (1999), 205–251.

Campbell, J. Y.; S. Giglio; C. Polk; and R. Turley. An Intertemporal CAPM with Stochastic Volatility. *Journal of Financial Economics*, 128 (2018), 207–233.

Campbell, J. Y.; C. Polk; and T. Vuolteenaho. Growth or Glamour? Fundamentals and Systematic Risk in Stock Returns. *Review of Financial Studies*, 23 (2010), 305–344.

Chen, L., and X. Zhao. Return Decomposition. *Review of Financial Studies*, 22 (2009), 5213–5249.

Croce, M. M.; M. Lettau; and S. C. Ludvigson. Investor Information, Long-Run Risk, and the Term Structure of Equity. *Review of Financial Studies*, 28 (2015), 706–742.

Dechow, P. M.; R. G. Sloan; and M. T. Soliman. Implied Equity Duration: A New Measure of Equity Risk. *Review of Accounting Studies*, 9 (2004), 197–228.

Engsted, T.; T. Q. Pedersen; and C. Tanggaard. Pitfalls in VAR Based Return Decompositions: A Clarification. *Journal of Banking & Finance*, 36 (2012), 1255–1265.

Favilukis, J., and X. Lin. Wage Rigidity: A Quantitative Solution to Several Asset Pricing Puzzles. *Review of Financial Studies*, 29 (2016), 148–192.

Gabaix, X. Variable Rare Disasters: An Exactly Solved Framework for Ten Puzzles in Macro-Finance. *Quarterly Journal of Economics*, 127 (2012), 645–700.

Gonçalves, A. S. Reinvestment Risk and the Equity Term Structure. *Journal of Finance*, forthcoming.

Gürkaynak, R. S.; B. Sack; and E. T. Swanson. Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements. *International Journal of Central Banking*, 1 (2005), 55–93.

Hasler, M., and R. Marfè. Disaster recovery and the term structure of dividend strips. *Journal of Financial Economics*, 122 (2016), 116–134.

Ibbotson Associates. *Stock, Bonds, Bills and Inflation 1999 Yearbook*. Ibbotson Associates, Chicago, IL (1999).

Jiang, H., and Z. Sun. Reaching for dividends. *Journal of Monetary Economics*, forthcoming.

Lettau, M., and J. A. Wachter. The Term Structures of Equity and Interest Rates. *Journal of Financial Economics*, 101 (2011), 90–113.

Lucca, D. O., and E. Moench. The Pre-FOMC Announcement Drift. *Journal of Finance*, 70 (2015), 329–371.

Marfè, R. Corporate Fraction and the Equilibrium Term Structure of Equity Risk. *Review of Finance*, 20 (2016), 855–905.

Marfè, R. Income Insurance and the Equilibrium Term Structure of Equity. *Journal of Finance*, 72 (2017), 2073–2130.

Neuhierl, A., and M. Weber. Monetary Policy Communication, Policy Slope, and the Stock Market. *Journal of Monetary Economics*, 108 (2019), 140–155.

Ozdagli, A., and M. Weber. Monetary Policy Through Production Networks: Evidence from the Stock Market. Working Paper, University of Chicago (2019).

Weber, M. Cash Flow Duration and the Term Structure of Equity Returns. *Journal of*

Financial Economics, 128 (2018), 486–503.

TABLE A.1

Selected FOMC Announcements

This table reports 44 FOMC announcements selected during 1995-2016. The exact FOMC announcement times are collected from various sources, including FOMC website, Bloomberg, Thomson Reuters, Wall Street Journal, Dow Jones Wire, Associated Press, CNBC, and Datastream. These FOMC announcement times are cross checked with the times reported by Lucca and Moench (2015) and Ozdagli and Weber (2019), and the trading activities of CME Federal Funds futures. This table presents the federal funds rate target, changes form the previous federal funds rate, surprises of the federal funds rate reflected in CME Federal Funds futures, indicators of whether FOMC announcements are previously scheduled or made together with other macro news (CPI, PPI, and employment) on the same day, or change the monetary policy path between expansion and contraction, or during NBER recession periods. Rates are reported in percentages.

Date	Time	Federal funds rate target	Change of federal funds rate	Federal funds rate surprise	Unscheduled announcement	Other macro news announcement	Change of monetary policy path	NBER recession
01Feb1995	2:24:37 PM	6	0.5	0.065			0	0
26Mar1996	11:39:00 AM	5.25	0	0.005			0	0
03Jul1996	2:14:00 PM	5.25	0	-0.064137931			0	0
24Sep1996	2:15:00 PM	5.25	0	-0.125			0	0
20May1997	2:15:54 PM	5.5	0	-0.083958333			0	0
19May1998	2:13:09 PM	5.5	0	-0.017884615			0	0
17Nov1998	2:20:23 PM	4.75	-0.25	-0.091071429		CPI	0	0
30Jun1999	2:15:00 PM	5	0.25	-0.04			1	0
16Nov1999	2:16:50 PM	5.5	0.25	0.0725			0	0
02Feb2000	2:14:09 PM	5.75	0.25	-0.049196429			0	0
16May2000	2:13:59 PM	6.5	0.5	0.03875		CPI	0	0
28Jun2000	2:15:47 PM	6.5	0	-0.018333333			0	0
03Jan2001	1:18:11 PM	6	-0.5	-0.284166667	1		1	0
20Mar2001	2:13:54 PM	5	-0.5	0.045208333			0	0
15May2001	2:15:14 PM	4	-0.5	-0.091176471			0	1
27Jun2001	2:12:35 PM	3.75	-0.25	0.0825			0	1

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TABLE A.1 – *Continued*

02Oct2001	2:15:29 PM	2.5	-0.5	-0.042625		0	1
06Nov2001	2:20:39 PM	2	-0.5	-0.1255		0	1
19Mar2002	2:20:07 PM	1.75	0	-0.005961538		0	0
06Nov2002	2:14:14 PM	1.25	-0.5	-0.1872		0	0
18Mar2003	2:16:44 PM	1.25	0	0.027678571		0	0
06May2003	2:13:55 PM	1.25	0	0.032788462		0	0
30Jun2004	2:18:00 PM	1.25	0.25	-0.01		1	0
10Nov2004	2:15:00 PM	2	0.25	0.003571429		0	0
02Feb2005	2:17:04 PM	2.5	0.25	-0.002592593		0	0
22Mar2005	2:17:18 PM	2.75	0.25	-0.00775		0	0
10May2006	2:17:30 PM	5	0.25	0.007045455		0	0
29Jun2006	2:16:10 PM	5.25	0.25	-0.013333333		0	0
21Mar2007	2:15:00 PM	5.25	0	0.007045455		0	0
18Sep2007	2:15:01 PM	4.75	-0.5	-0.224230769		1	0
11Dec2007	2:16:25 PM	4.25	-0.25	0.044285714		0	0
30Apr2008	2:15:56 PM	2	-0.25	-0.0525		0	1
25Jun2008	2:09:47 PM	2	0	-0.0125		0	1
05Aug2008	2:13:24 PM	2	0	-0.007175926		0	1
24Jun2009	2:18:17 PM	0-0.25	0	0.0025		0	1
16Dec2009	2:15:00 PM	0-0.25	0	-0.015742188	CPI	0	0
27Jan2010	2:17:00 PM	0-0.25	0	0.0025		0	0
21Sep2010	2:15:00 PM	0-0.25	0	-0.00375		0	0
13Mar2012	2:15:21 PM	0-0.25	0	-0.002039474		0	0
20Jun2012	12:32:00 PM	0-0.25	0	0.006818182		0	0
01Aug2012	2:13:00 PM	0-0.25	0	0.0125		0	0
29Jul2015	2:00:00 PM	0-0.25	0	-0.0025		0	0

Continued on next page

TABLE A.1 – *Continued*

16Mar2016	2:00:01 PM	0.25-0.5	0	-0.007265625	CPI	0	0
27Jul2016	2:00:00 PM	0.25-0.5	0	-0.0075		0	0
21Sep2016	2:00:00 PM	0.25-0.5	0	-0.04125		0	0
02Nov2016	2:00:00 PM	0.25-0.5	0	-0.005172414		0	0
14Dec2016	2:00:00 PM	0.50-0.75	0.25	-0.004305556		0	0

TABLE D.1

Long-Horizon Portfolio Returns

This table presents the average returns and alphas from the Fama-French five-factor model (α_{FF5}) for 10 portfolios sorted by effective equity durations, with a holding period from 3 to 36 months. Newey-West t-statistics with six lags are in parentheses. $10-4(3,2,1)$ indicates the return difference between Portfolio 10 and Portfolio 4 (3, 2, or 1). Returns and alphas are normalized by the number of holding months, reported in percentages. The sample period is 1995-2016.

Panel A 3-month holding returns												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-4	10-1
Raw Return	-0.10	0.27	0.74	0.74	0.54	0.39	0.36	0.52	0.49	-0.02	-0.76	0.07
	(-0.19)	(0.59)	(1.46)	(1.52)	(1.47)	(0.93)	(0.99)	(0.99)	(0.96)	(-0.04)	(-1.75)	(0.19)
α_{FF5}	-0.43	0.04	0.56	0.43	0.52	0.01	-0.25	0.20	-0.10	-0.76	-1.19	-0.32
	(-1.29)	(0.17)	(1.34)	(1.54)	(2.18)	(0.04)	(-0.75)	(0.73)	(-0.47)	(-2.48)	(-3.16)	(-0.79)
Panel B 6-month holding returns												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-4	10-1
Raw Return	0.04	0.23	0.55	0.33	0.22	0.47	0.34	0.40	0.44	0.28	-0.05	0.24
	(0.08)	(0.45)	(0.97)	(0.60)	(0.40)	(1.12)	(0.81)	(0.85)	(0.91)	(0.59)	(-0.17)	(0.76)
α_{FF5}	-0.36	-0.15	0.18	0.11	0.36	0.16	-0.15	-0.22	0.04	-0.50	-0.60	-0.13
	(-2.46)	(-0.78)	(0.77)	(1.00)	(2.30)	(1.72)	(-1.09)	(-1.25)	(0.34)	(-1.96)	(-2.04)	(-0.53)
Panel C 12-month holding returns												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-3	10-1
Raw Return	0.37	0.52	0.80	0.55	0.59	0.71	0.63	0.62	0.84	0.62	-0.18	0.26
	(0.79)	(1.24)	(1.63)	(1.21)	(1.30)	(1.77)	(1.73)	(1.63)	(2.04)	(1.96)	(-0.62)	(0.96)
α_{FF5}	-0.12	0.03	0.23	-0.02	-0.01	0.01	-0.31	-0.12	-0.10	-0.35	-0.58	-0.24
	(-0.49)	(0.22)	(1.78)	(-0.16)	(-0.07)	(0.11)	(-1.99)	(-1.40)	(-1.16)	(-1.94)	(-2.23)	(-1.26)
Panel D 24-month holding returns												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-2	10-1
Raw Return	0.53	0.75	0.72	0.65	0.58	0.61	0.68	0.72	0.81	0.64	-0.12	0.00
	(1.32)	(1.70)	(1.62)	(1.48)	(1.40)	(1.81)	(1.92)	(2.14)	(2.01)	(2.46)	(-0.53)	(0.01)
α_{FF5}	-0.01	0.58	0.00	0.11	-0.03	0.15	-0.14	-0.25	-0.22	-0.20	-0.78	-0.19
	(-0.10)	(2.23)	(0.01)	(1.07)	(-0.14)	(1.23)	(-1.76)	(-1.44)	(-1.63)	(-0.94)	(-2.91)	(-0.77)
Panel E 30-month holding returns												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-2	10-1
Raw Return	0.62	0.93	0.78	0.77	0.69	0.60	0.75	0.72	0.87	0.72	-0.20	0.00
	(1.73)	(2.08)	(1.73)	(1.76)	(1.72)	(1.83)	(2.31)	(2.37)	(2.22)	(2.89)	(-0.72)	(0.02)
α_{FF5}	0.01	0.84	-0.07	0.01	-0.21	0.04	-0.21	0.06	0.01	-0.03	-0.86	-0.04
	(0.07)	(2.24)	(-0.56)	(0.06)	(-0.80)	(0.29)	(-1.68)	(0.40)	(0.03)	(-0.13)	(-2.42)	(-0.11)
Panel F 36-month holding returns												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-2	10-1
Raw Return	0.72	0.95	0.88	0.82	0.73	0.67	0.81	0.77	0.93	0.73	-0.21	-0.07
	(2.13)	(2.34)	(1.93)	(2.02)	(1.96)	(2.18)	(2.64)	(2.78)	(2.43)	(3.48)	(-0.89)	(-0.44)
α_{FF5}	-0.10	0.66	-0.06	0.22	-0.12	0.15	-0.13	0.01	0.29	0.18	-0.48	0.28
	(-0.69)	(1.68)	(-0.33)	(1.07)	(-0.61)	(1.28)	(-0.73)	(0.08)	(1.32)	(1.12)	(-1.36)	(1.24)

TABLE E.1

The Equity Yield Curve: Robustness

This table provides robustness checks of the equity yield curve implied by effective equity durations. All stocks are sorted into 10 portfolios, based on the durations of individual stocks estimated in the previous month. I compute the value-weighted portfolio duration, monthly returns, and the alphas from CAPM (α_{CAPM}), the Fama-French three-factor model (α_{FF3}), and the Fama-French five-factor model (α_{FF5}). Panel A presents the results excluding FOMC announcements that were not scheduled previously. Panel B presents the results excluding FOMC announcements made together with other macro news (like CPI, PPI, and employment). Panel C presents the results excluding FOMC announcements associated with changes in the monetary policy path (e.g., switching between expansionary and contractionary policies). Panel D presents the results for expansion times only (excluding NBER recession months). Panel E presents the results for NBER recession months only. Panel F presents the results with an alternative event window, i.e., using CME Federal Funds futures and TAQ data 30 minutes before and 10 minutes after the FOMC announcements. Panel G presents the results with an alternative VAR specification, i.e., using six state variables in the VAR system. Newey-West t-statistics with six lags are in parentheses. $10-4$ indicates the difference between Portfolio 10 and Portfolio 4; and $10-1$ indicates the difference between Portfolio 10 and Portfolio 1. Returns and alphas are reported in percentages. The sample period is 1995-2016.

Panel A Portfolio returns: Excluding unscheduled announcements												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-4	10-1
Raw Return	1.23	1.73	1.74	2.49	1.10	0.55	0.67	0.58	0.87	0.14	-2.35	-1.09
	(1.63)	(1.94)	(1.39)	(1.83)	(1.74)	(0.71)	(0.74)	(0.70)	(1.21)	(0.18)	(-2.01)	(-1.75)
α_{CAPM}	0.1	0.46	0.27	1.04	-0.14	-0.56	-0.54	-0.65	-0.13	-0.89	-1.93	-0.98
	(0.26)	(1.27)	(0.62)	(1.52)	(-0.30)	(-1.81)	(-1.23)	(-1.55)	(-0.41)	(-1.47)	(-1.99)	(-1.60)
α_{FF3}	0.2	0.84	0.8	1.49	-0.1	-0.33	-0.08	-0.28	-0.34	-0.74	-2.23	-0.94
	(0.49)	(2.19)	(1.19)	(1.76)	(-0.21)	(-0.97)	(-0.20)	(-0.74)	(-1.08)	(-1.47)	(-2.02)	(-1.63)
α_{FF5}	-0.03	1	0.39	1.35	-0.03	-0.46	-0.21	-0.25	-0.35	-0.72	-2.07	-0.69
	(-0.09)	(2.70)	(0.67)	(1.86)	(-0.06)	(-1.28)	(-0.49)	(-0.57)	(-0.97)	(-1.31)	(-2.15)	(-1.60)
Panel B Portfolio returns: Excluding announcements together with other macro news												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-4	10-1
Raw Return	0.97	1.29	1.60	2.31	0.75	0.24	0.25	0.25	0.50	0.00	-2.32	-0.97
	(2.03)	(1.87)	(1.64)	(2.02)	(1.68)	(0.39)	(0.32)	(0.35)	(0.80)	(-0.00)	(-2.21)	(-1.89)
α_{CAPM}	0.24	0.5	0.72	1.39	-0.1	-0.45	-0.53	-0.58	-0.22	-0.69	-2.08	-0.92
	(0.77)	(1.18)	(1.08)	(1.59)	(-0.19)	(-1.15)	(-1.02)	(-1.46)	(-0.69)	(-1.17)	(-2.11)	(-1.68)
α_{FF3}	0.31	0.96	0.91	2.14	0.32	-0.39	0.02	0.07	-0.32	-0.55	-2.69	-0.86
	(1.10)	(1.69)	(1.13)	(1.78)	(0.52)	(-0.95)	(0.03)	(0.19)	(-1.05)	(-1.12)	(-1.93)	(-1.69)
α_{FF5}	0.01	1.16	0.54	1.96	0.46	-0.6	-0.22	-0.02	-0.34	-0.62	-2.59	-0.64
	(0.05)	(2.13)	(0.70)	(1.87)	(0.81)	(-1.39)	(-0.41)	(-0.05)	(-0.88)	(-0.96)	(-2.09)	(-1.24)
Panel C Portfolio returns: Excluding announcements that change monetary policy path												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-4	10-1
Raw Return	1.41	1.99	2.12	2.77	1.27	0.71	0.84	0.79	1.02	0.19	-2.58	-1.22
	(1.64)	(2.02)	(1.50)	(1.87)	(1.81)	(0.86)	(0.79)	(0.82)	(1.20)	(0.22)	(-2.18)	(-1.97)
α_{CAPM}	0.06	0.5	0.38	1.04	-0.17	-0.6	-0.57	-0.69	-0.16	-1.04	-2.08	-1.11
	(0.17)	(1.53)	(0.89)	(1.59)	(-0.35)	(-1.95)	(-1.41)	(-1.60)	(-0.46)	(-1.63)	(-2.13)	(-1.78)

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TABLE E.1 – *Continued*

α_{FF3}	0.19	0.95	1.03	1.59	-0.2	-0.36	-0.07	-0.24	-0.42	-0.91	-2.5	-1.1
	(0.47)	(2.35)	(1.49)	(1.98)	(-0.42)	(-0.99)	(-0.18)	(-0.67)	(-1.19)	(-1.56)	(-2.16)	(-1.77)
α_{FF5}	-0.06	1.04	0.49	1.41	-0.23	-0.46	-0.11	-0.06	-0.29	-0.72	-2.13	-0.66
	(-0.18)	(2.85)	(0.96)	(2.13)	(-0.53)	(-1.19)	(-0.31)	(-0.16)	(-0.74)	(-1.34)	(-2.32)	(-1.41)
Panel D Portfolio returns: Expansion times												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-4	10-1
Raw Return	0.83	1.49	1.40	2.24	0.21	0.43	0.80	0.58	0.83	0.55	-1.69	-0.27
	(1.24)	(1.59)	(1.09)	(1.62)	(0.35)	(0.53)	(0.87)	(0.77)	(1.09)	(0.91)	(-1.32)	(-0.57)
α_{CAPM}	-0.04	0.52	0.3	1.07	-0.88	-0.45	-0.22	-0.42	-0.05	-0.17	-1.23	-0.13
	(-0.14)	(1.26)	(0.51)	(1.15)	(-2.08)	(-1.23)	(-0.60)	(-1.30)	(-0.17)	(-0.61)	(-1.13)	(-0.30)
α_{FF3}	0	0.83	0.6	1.27	-0.6	-0.35	0.04	-0.25	-0.3	-0.33	-1.6	-0.33
	(-0.00)	(1.89)	(0.78)	(1.39)	(-1.34)	(-1.03)	(0.11)	(-0.66)	(-1.01)	(-1.01)	(-1.48)	(-0.62)
α_{FF5}	-0.06	1	0.32	1.26	-0.47	-0.49	-0.07	-0.17	-0.36	-0.3	-1.56	-0.24
	(-0.17)	(2.15)	(0.48)	(1.49)	(-0.93)	(-1.36)	(-0.17)	(-0.45)	(-1.05)	(-0.90)	(-1.62)	(-0.58)
Panel E Portfolio returns: Recession times												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-4	10-1
Raw Return	2.17	1.91	2.70	2.48	3.34	0.57	-1.25	-0.97	-0.81	-2.64	-5.12	-4.81
	(1.23)	(2.02)	(1.91)	(1.73)	(4.14)	(0.66)	(-0.86)	(-0.59)	(-1.15)	(-1.49)	(-5.45)	(-5.41)
α_{CAPM}	1.33	1.05	1.78	1.72	2.63	-0.08	-1.87	-1.79	-1.49	-3.56	-5.28	-4.89
	(0.81)	(1.92)	(1.78)	(1.48)	(7.06)	(-0.10)	(-1.40)	(-1.28)	(-6.72)	(-2.12)	(-5.04)	(-5.42)
α_{FF3}	3.82	1.82	5.33	5.58	4.12	-0.84	-4.88	4.4	-0.73	0.43	-5.14	-3.39
	(1.85)	(1.93)	(3.99)	(6.35)	(12.04)	(-0.38)	(-1.51)	(2.28)	(-0.89)	(0.14)	(-2.03)	(-1.45)
α_{FF5}	-0.01	5.27	2.71	3.98	3.83	-4.78	-0.59	1.15	-0.63	-5.43	-9.41	-5.42
	(-0.00)	(3.63)	(1.70)	(1.88)	(11.17)	(-2.04)	(-0.40)	(1.98)	(-0.81)	(-5.87)	(-5.71)	(-4.34)
Panel F Portfolio returns: Alternative event window												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-4	10-1
Raw Return	0.84	1.66	1.22	2.22	0.87	-0.03	0.07	0.16	0.18	-0.30	-2.51	-1.14
	(1.06)	(1.54)	(0.95)	(1.47)	(1.37)	(-0.04)	(0.07)	(0.18)	(0.24)	(-0.37)	(-2.13)	(-2.19)
α_{CAPM}	0.18	0.93	0.45	1.37	0.11	-0.66	-0.63	-0.58	-0.47	-0.9	-2.27	-1.08
	(0.46)	(1.63)	(0.60)	(1.64)	(0.18)	(-1.73)	(-1.18)	(-1.37)	(-1.46)	(-1.59)	(-2.29)	(-2.06)
α_{FF3}	0.23	1.13	0.74	1.71	0.14	-0.66	-0.18	-0.14	-0.42	-0.85	-2.56	-1.08
	(0.61)	(2.36)	(0.96)	(2.67)	(0.23)	(-1.79)	(-0.40)	(-0.38)	(-1.48)	(-1.84)	(-3.22)	(-3.46)
α_{FF5}	0.07	1.16	0.34	1.64	0.17	-0.56	0.05	-0.01	-0.36	-0.78	-2.43	-0.86
	(0.19)	(2.34)	(0.53)	(2.55)	(0.31)	(-1.26)	(0.11)	(-0.02)	(-0.91)	(-1.48)	(-2.82)	(-2.05)
Panel G Portfolio returns: Alternative VAR specifications												
Portfolio	1	2	3	4	5	6	7	8	9	10	10-4	10-1
Raw Return	1.50	1.42	1.40	2.53	0.98	0.18	0.39	0.52	0.09	0.27	-2.26	-1.23
	(2.12)	(1.76)	(1.41)	(2.03)	(1.82)	(0.29)	(0.49)	(0.63)	(0.18)	(0.40)	(-2.16)	(-2.09)
α_{CAPM}	0.62	0.45	0.38	1.43	-0.05	-0.61	-0.54	-0.48	-0.68	-0.51	-1.93	-1.13
	(1.34)	(1.05)	(0.62)	(1.86)	(-0.13)	(-1.57)	(-1.48)	(-1.38)	(-1.88)	(-1.17)	(-2.15)	(-1.97)
α_{FF3}	0.77	0.49	0.54	1.73	0.28	-0.66	-0.19	0.04	-0.93	-0.47	-2.2	-1.24
	(1.65)	(1.13)	(0.81)	(1.97)	(0.53)	(-1.66)	(-0.40)	(0.13)	(-2.09)	(-1.19)	(-2.01)	(-1.88)
α_{FF5}	0.52	0.55	0.16	1.62	0.32	-0.74	-0.28	-0.05	-0.79	-0.68	-2.3	-1.2

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TABLE E.1 – *Continued*

	(1.50)	(1.14)	(0.32)	(2.03)	(0.68)	(-1.87)	(-0.63)	(-0.14)	(-1.79)	(-1.62)	(-2.27)	(-2.45)