Movements in Yields, not the Equity Premium: Bernanke-Kuttner Redux

(Nagel and Xu, 2024, WP)

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Key Findings

- Stock price response to MPS is explained mostly by changes in yield curve, rather than equity risk premium
  - Contradicts to Bernanke and Kuttner (2005)
- In turn, yield curve change reflects both a change in expected future short rates (professional forecast) and term premium
- Even/odd week FOMC cycle in stock returns is also largely due to cycle in the yield curve rather than equity risk premium
  - Contradicts to Cieslak et al. (2019)

BK(2005):

Two Steps

1. With monthly data, estimate a VAR including stock excess returns and dividend-price ratios, among other variables
2. Regress monthly VAR innovations on FFR surprises from within-month FOMC announcement; Then, Iterate VAR to get IRFs.

Reults

- Stock price response to MPS shocks around FOMC is mainly due to the equity premium change

BK(2005):

What drives the VAR results?

- Fact 1: Stock prices fall in response to unexpected monetary tightening and hence pd ratio decrease (dividend is sticky in short run)
- Fact 2: Generally, pd ratio changes are due to changes in risk premium

Issues?

- Use monthly VAR results to infer what happens in the high-freq event

Approach 1: Dividend Futures

- Stock market index can be decomposed as

$$P_t = \sum_{n=1}^{\infty} P_{n,t} = \sum_{n=1}^{\infty} B_{n,t} G_{n,t}$$

where $G_{n,t}$ is dividend futures price and $B_{n,z}$ is zc bond price

- Decomposing the announcement returns

$$1. \quad \Delta P_{B,t} \equiv \sum_{n=1}^{\infty} \frac{G_{n,t-}}{P_{t-}} \left(B_{n,t+} - B_{n,t-} \right)$$

$$2. \quad \Delta P_{G,t} \equiv \sum_{n=1}^{\infty} \frac{B_{n,t-}}{P_{t-}} \left(G_{n,t+} - G_{n,t-} \right)$$

- **Question:** ΔP_t mainly due to $\Delta P_{B,t}$ or $\Delta P_{G,t}$?

Approach 1: Dividend Futures

Data Limitation

- Dividend futures data are up to 7 years

Assumptions made for $\Delta P_{B,t}$

- Assume forward rate do not change on FOMC days

$$f_{n,8,t+} - f_{n,8,t-} = 0, \quad \forall n > 8, \forall t$$

Then, we can compute

$$\Delta P_{B,t} = \sum_{n=1}^{7} \frac{G_{n,t-} B_{n,t-}}{P_{t-}} \left(\frac{B_{n,t+}}{B_{n,t-}} - 1 \right) + \left(1 - \sum_{n=1}^{7} \frac{G_{n,t-1} B_{n,t-}}{P_{t-}} \right) \left(\frac{B_{8,t+}}{B_{8,t-}} - 1 \right)$$

Assumptions made for $\Delta P_{G,t}$

- Simply use

$$\Delta P_{G,t} = \sum_{n=1}^{7} \frac{B_{n,t-}}{P_{t-}} \left(G_{n,t+} - G_{n,t-} \right)$$

Approach 2: Campbell-Shiller Approximation

Define the excess return as $x_{n,t+n} \equiv r_{t+n} - f_{n,t}$, then

$$p_t = \frac{\kappa}{1-\rho} + \mathbb{E}_t \sum_{n=1}^{\infty} \rho^{n-1} \left[(1-\rho) d_{t+n} - x_{n,t+n}\right] - \sum_{n=1}^{\infty} \rho^{n-1} f_{n,t}$$

Log price change around FOMC announcement

$$\begin{aligned} \Delta p_t &\equiv p_{t+} - p_{t-} \\ &= (\mathbb{E}_{t+} - \mathbb{E}_{t-}) \sum_{n=1}^{\infty} \rho^{n-1} \left[(1-\rho) d_{t+n} - x_{n,t+n}\right] + \underbrace{\sum_{n=1}^{\infty} \rho^{n-1} \left(f_{n,t-} - f_{n,t+}\right)}_{\Delta p_{F,t} = \sum_{n=1}^{30} \rho^{n-1} (f_{n,t-} - f_{n,t+})} \end{aligned}$$

Question: Δp_t mainly due to $\Delta p_{F,t}$ or not ?

Data

High-freq Measure of Monetary Policy Shocks

1. **POLICY** (Nakamura and Steinsson, 2018): First PC of price changes of Federal funds futures expiring at the end of the month of this and next FOMC; first three quarterly Eurodollar futures
2. **FFR** (BK, 2005): Price change in Federal funds futures expiring at the end of the month after FOMC
3. **BS** (Bauer and Swanson, 2023): First PC of price changes in first four quarterly Eurodollar futures
4. **BS**$^{\perp}$ (Bauer and Swanson, 2023): Residuals from regressing BS on six macro and financial variables

Sample Period

- Dividend futures method: Nov/02 - Dec/23
- Campbell-Shiller method: Feb/95 - Dec/23

Daily Bond Market Response

Panel A: Δy_n

	1Y		2Y		5Y		10Y		20Y		30Y	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
POLICY	3.72		4.42		3.98		2.69		1.45		1.01	
	[11.04]		[9.29]		[8.27]		[5.01]		[2.92]		[1.94]	
FFR		2.17		1.82		1.56		1.09		0.61		0.54
		[5.26]		[3.21]		[2.91]		[1.97]		[1.23]		[1.02]

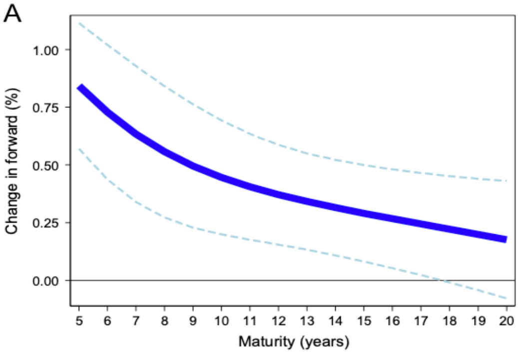
Panel B: Δf_n

	1Y		2Y		5Y		10Y		20Y		30Y	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
POLICY	3.72		5.11		2.90		1.30		0.00		0.45	
	[11.04]		[7.24]		[4.66]		[1.89]		[0.00]		[0.65]	
FFR		2.17		1.47		1.25		0.77		0.82		0.30
		[5.26]		[1.92]		[2.13]		[1.20]		[1.00]		[0.41]

- MPS have effects on long-term yields
- Nominal forward rate respond up to 5/10 years

Are Nominal Forward Rates Responses Robust?

From Hanson and Stein (2015)



- MPS is measured by changes in two-year nominal yields
- Yield data from GSW (2007, 2010); Sample period: 1999 - Feb 2012
- Nagel and Xu (2024) use Filipović et al. (2022)

Daily Stock Market Response

Panel A: Dividend Futures Method

	ΔP (1)	ΔP (2)	ΔP_B (3)	ΔP_B (4)	ΔP_G (5)	ΔP_G (6)	$\Delta P - \Delta P_B$ (7)	$\Delta P - \Delta P_B$ (8)	$\Delta P - \Delta P_G$ (9)	$\Delta P - \Delta P_G$ (10)
POLICY	-36.84		-25.47		0.52		-11.37		-37.36	
	[-2.53]		[-4.50]		[0.72]		[-0.81]		[-2.51]	
FFR		-24.33		-10.48		-0.95		-13.84		-23.37
		[-1.37]		[-1.54]		[-0.75]		[-0.77]		[-1.25]

Panel B: Campbell-Shiller PV Identity Method

	Δp (1)	Δp (2)	Δp_F (3)	Δp_F (4)	$\Delta p - \Delta p_F$ (5)	$\Delta p - \Delta p_F$ (6)
POLICY	-23.28		-26.48		3.20	
	[-2.22]		[-2.69]		[0.28]	
FFR		-20.60		-12.45		-8.15
		[-1.94]		[-1.25]		[-0.62]

- A POLICY shock that decreases 1-year yield by 25 bp increase stock market index by 156 bp
- Yield curve changes seem to be the main driver

High-freq Stock Market Response

Panel A: Dividend Futures Method

	ΔP^H				ΔP^H_B				$\Delta P^H - \Delta P^H_B$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
POLICY	-27.06				-30.96				3.90			
	[-4.39]				[-3.91]				[0.41]			
FFR		-12.15				-8.43				-3.72		
		[-1.23]				[-1.94]				[-0.38]		
BS			-30.36				-31.23				0.87	
			[-6.20]				[-3.28]				[0.09]	
$BS^{\perp}$				-32.64				-22.77				-9.87
				[-5.60]				[-3.66]				[-1.20]

Panel B: Campbell-Shiller PV Identity Method

	Δp^H				Δp^H_F				$\Delta p^H - \Delta p^H_F$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
POLICY	-23.36				-37.24				13.89			
	[-5.10]				[-6.31]				[1.79]			
FFR		-13.46				-7.75				-5.70		
		[-2.42]				[-2.04]				[-0.77]		
BS			-26.47				-36.28				9.81	
			[-6.51]				[-5.85]				[1.28]	
$BS^{\perp}$				-28.71				-31.56				2.85
				[-6.62]				[-6.00]				[0.38]

Short-rate expectations v.s. term premia

Short-rate expectations

- Use monthly Blue Chip survey forecasts of 3-month Treasury bill rates (only 2 year horizons available)
- Assume short rates i_t follow AR(1): $i_{t+1} - \mu = \gamma (i_t - \mu) + \eta_{t+1}$
- Then, revisions in expectations of n-period-ahead short rates follow

$$\tilde{\mathbb{E}}_{t-} i_{t+n} - \tilde{\mathbb{E}}_{t+} i_{t+n} = \gamma^{n-1} \left(\tilde{\mathbb{E}}_{t-} i_{t+1} - \tilde{\mathbb{E}}_{t+} i_{t+1} \right), \quad n \geq 1$$

- Use forecasts of 1-year-ahead 3-month rates to measure $\tilde{\mathbb{E}}_t i_{t+1}$
  - Latest forecast before FOMC: $\widetilde{\mathbb{E}}_{t-} i_{t+1}$
  - First available forecast after FOMC: $\widetilde{\mathbb{E}}_{t+} i_{t+1}$
- Use bi-annual long-range forecasts to estimate the AR(1):
  - γ and μ can have low-frequency variation at a bi-annual frequency: μ is measured as the average between 7 to 11 years
  - My Q: what if μ changes around FMOC (say, due to info on infl target)

Short-rate expectations v.s. term premia

Term Premium

- Forward rate $f_{n,t}$ can be composed into

$$f_{n,t} = \tilde{\mathbb{E}}_t i_{t+n-1} + \underbrace{\mathbb{E}_t \sum_{j=1}^{n} rx^j_{t+n-j+1}}_{n\lambda_{n,t}} - \underbrace{\mathbb{E}_t \sum_{j=1}^{n-1} rx^j_{t+n-j}}_{(n-1)\lambda_{n-1,t}}$$

  - $n\lambda_{n,t}$ is the term premium earned by an n-maturity zc bond
  - $\theta_{n,t} = n\lambda_{n,t} - (n-1)\lambda_{n-1,t}$ is the forward term premium

Short-rate expectations v.s. term premia

Dividend futures method

$$\Delta P_{B,t} = \sum_{n=1}^{\infty} \frac{G_{n,t-}}{P_{t-}} \left(B_{n,t+} - B_{n,t-}\right)$$

$$\approx \underbrace{\sum_{n=1}^{\infty} \frac{P_{n,t-}}{P_{t-}} \left(\tilde{\mathbb{E}}_{t-} \sum_{k=0}^{n-1} i_{t+k} - \tilde{\mathbb{E}}_{t+} \sum_{k=0}^{n-1} i_{t+k}\right)}_{\Delta P_{B,s,t} = i_{t-} - i_{t+} + \frac{\left(\widetilde{\mathbb{E}}_{t-} i_{t+1} - \widetilde{\mathbb{E}}_{t+} i_{t+1}\right)}{1-\gamma}\left(1 - \sum_{n=1}^{\infty} \frac{\gamma^{n-1} P_{n,t-}}{P_{t-}}\right)} + \sum_{n=1}^{\infty} \frac{nP_{n,t-}}{P_{t-}} \left(\lambda_{n,t-} - \lambda_{n,t+}\right)$$

- First part: changes in expectations of short-term rates (survey data)
    - Set $\gamma^{n-1} = 0$ for $n \geq 8$;
- Second part: changes in term premium, $\Delta P_{B,\lambda,t} \equiv \Delta P_{B,t} - \Delta P_{B,s,t}$

Short-rate expectations v.s. term premia

Campbell-Shiller method

$$\Delta p_{F,t} = \underbrace{\sum_{n=1}^{\infty} \rho^{n-1} \left(\mathbb{E}_{t-} i_{t+n-1} - \mathbb{E}_{t+} i_{t+n-1}\right)}_{\Delta p_{F,s,t} = i_{t-} - i_{t+} + \frac{\rho}{1-\rho\gamma}\left(\mathbb{E}_{t-} i_{t+1} - \mathbb{E}_{t+} i_{t+1}\right)} + \sum_{n=1}^{\infty} \rho^{n-1} \left(\theta_{n,t-} - \theta_{n,t+}\right)$$

- First part: changes in short-rate expectation (survey data)
- Second part: change in the forward risk premium $\Delta p_{F,\lambda,t} \equiv \Delta p_{F,t} - \Delta p_{F,s,t}$

Short-rate expectations v.s. term premia

	BCEI				BCFF			
	Short-Rate		Term Premia		Short-Rate		Term Premia	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Dividend Futures Method								
POLICY	-12.98		-10.65		-17.60		-6.03	
	[-2.82]		[-1.26]		[-3.76]		[-0.72]	
FFR		-1.00		-9.61		-4.45		-6.16
		[-0.17]		[-0.96]		[-0.68]		[-0.59]
B. Campbell-Shiller PV Identity Method								
POLICY	-10.49		-13.62		-13.13		-10.99	
	[-3.37]		[-1.17]		[-3.90]		[-0.97]	
FFR		1.73		-13.73		-2.22		-9.77
		[0.41]		[-1.17]		[-0.55]		[-0.86]

- 'POLICY' MPS: half short rates expectation, half term premium
- 'FFR' MPS: entirely term premium

FOMC Cycle

- Cieslak et al.(2019) find that average stock index returns are much higher in even weeks than odd weeks in FOMC cycle time
- Due to yield changes or equity premium?
- Cieslak et al (2019) use equity premium bound of Martin (2017) and find it is mainly due to equity premium reductions in even weeks
- Using both Dividend futures and Campbell-Shiller methods, this paper reaches a different answer: yield changes

FMOC Cycle

	Dividend Futures					Campbell-Shiller PV		
	ΔP	ΔP_B	ΔP_G	$\Delta P - \Delta P_B$	$\Delta P - \Delta P_G$	Δp	Δp_F	$\Delta p - \Delta p_F$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Even weeks								
Week 0, 2, 4	5.26	1.39	-0.34	3.87	5.60	8.16	5.79	2.37
	[1.48]	[1.06]	[-1.21]	[0.93]	[1.60]	[2.94]	[2.34]	[0.57]
B. Week by week								
Week 0	4.06	3.02	-0.43	1.04	4.49	9.30	8.97	0.33
	[0.75]	[1.50]	[-1.22]	[0.17]	[0.83]	[2.25]	[2.46]	[0.05]
Week 2	6.68	-0.41	-0.34	7.09	7.02	6.58	2.46	4.11
	[1.28]	[-0.21]	[-0.66]	[1.13]	[1.37]	[1.63]	[0.68]	[0.66]
Week 4	5.22	1.33	-0.23	3.89	5.45	8.52	5.61	2.91
	[1.13]	[0.73]	[-0.66]	[0.72]	[1.20]	[2.23]	[1.60]	[0.50]

- Average daily returns are 5.26 basis points higher in even weeks
- ΔP_B explains about a third of the effect