

# Monetary Policy Communication, Policy Slope, and the Stock Market

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# Motivation

- Fed dual mandate: price stability & maximum employment
- Real consumption, investment, & GDP only respond with lag
- Asset prices respond directly & immediately
- Literature: reaction around FOMC announcements

**BUT:** monetary policy decisions happen continuously

- Literature: reaction to shocks at short end

**BUT:** also response to changes in expectations of future path

## Motivation cont.

*The FOMC will, of course, carefully deliberate about when to begin the process of removing policy accommodation. But the significance of this decision should not be overemphasized, because what matters for financial conditions and the broader economy is the entire expected path of short-term interest rates and not the precise timing of the first rate increase.*

Janet Yellen (2015)

*...policy deliberations happen on a rather continuous basis.*

Kevin Warsh (2015)

# This Paper

- Construct slope factor from change in 1M and 3M futures
- $\Delta$  1 futures: information about surprise changes in target rate
  - $\Delta$  1 futures affects all future rates: level factor
- $\Delta$  3 futures: information about future path of monetary policy
- *Slope factor*: residual of regressing  $\Delta$  3 futures on  $\Delta$  1 futures
  - *Slope* measures  $\Delta$  in speed of tightening / loosening of monetary policy

# Main Results

- Slope robustly predicts weekly excess stock returns
- Expectations of faster future tightening predicts lower returns
- Predictability corresponds to an increase of Sharpe Ratio of 20%
- Slope factor predicts forecast revisions of professionals
- Macro news do not drive predictability
- Linguistic analysis: speeches by chair explain 12% of variation in slope

## Data and Sample Period

- Weekly stock returns from CRSP:  $\text{Wednesday}_{t+1} - \text{Wednesday}_{t+2}$
- Federal funds futures from CME
- Sample period: 1994 – 2007
- Robustness: 1988 – 2014

## Federal Funds Futures

- Futures settle on average effective fed funds rate during month
- $ff_{t,1}$ : rate implied by 1 month fed funds futures on date  $t$
- Assume 1 FOMC meeting during month
- $ff_{t,1}$ : weighted average of target rate,  $r_0$ , and expectation:

$$ff_{t,1} = \frac{d_1}{m_1} r_0 + \frac{m_1 - d_1}{m_1} \mathbb{E}_t(r_1) + \mu_{t,1}$$

- $d_1$ : day of the FOMC meeting
- $m_1$ : number of days of the months
- $\mu_{t,1}$ : risk premium

## Slope Factor

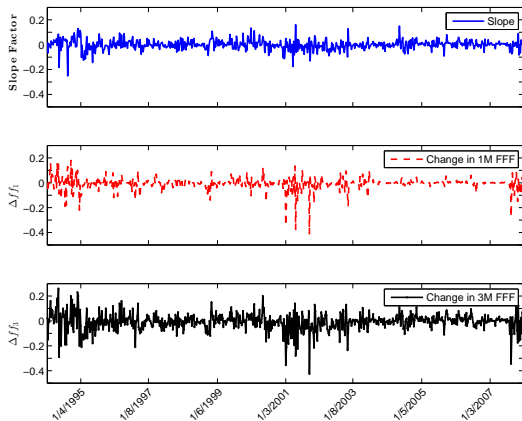
- Slope: residual of weekly  $\Delta 3M$  futures on  $\Delta 1M$  futures:

$$\Delta ff_{t,t+1,3} = \alpha + \beta \Delta ff_{t,t+1,1} + \text{slope}_{t,t+1}$$

- $\hat{\alpha}$ : -0.00,  $\hat{\beta}$ : 1.17,  $R^2$ : 67%
- 1/3 of variation in changes in 3M futures not explained

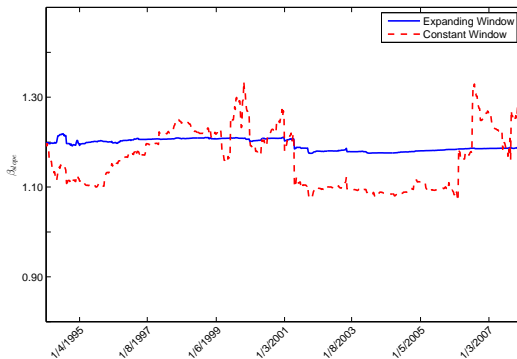


# Slope Factor: *Ingredients*



- Slope  $\perp$   $\Delta ff_1$
- $\text{corr}(\text{Slope}, \Delta ff_3) = 57\%$

# Slope Factor over time



- Little variation in regression coefficient over time

## Slope Factor cont.

- $\hat{\beta} \approx 1$
- Slope similar to “difference in differences”

$$\begin{aligned}\text{Slope}_{t,t+1} &\approx \Delta ff_3 - \Delta ff_1 \\ &= [\mathbb{E}_{t+1}(r_3) - \mathbb{E}_t(r_3)] - [\mathbb{E}_{t+1}(r_1) - \mathbb{E}_t(r_1)] \\ &= [\mathbb{E}_{t+1}(r_3) - \mathbb{E}_{t+1}(r_1)] - [\mathbb{E}_t(r_3) - \mathbb{E}_t(r_1)]\end{aligned}$$

- Change in speed of tightening / loosening of monetary policy
- No generated regressor problem
- All results identical

# Framework

- One-week predictive regressions:

$$r_{t+1,t+2,crsp} = \alpha + \beta slope_{t,t+1} + \gamma X_t + \varepsilon_t$$

- Returns  $\uparrow \Rightarrow$  expecting faster tightening (Rigobon & Sack (2003))
- Weak macro news: low returns and expectations of slower tightening
- Weekly returns autocorrelated: add lag (Campbell et al. (1997))

# Baseline Specification

$$r_{t+1,t+2,crsp} = \alpha + \beta slope_{t,t+1} + \gamma X_t + \varepsilon_t$$

	(1)	(2)	(3)
Constant	0.13* (0.09)		
$Slope_t$	-6.96*** (1.98)		
$R_t$	-0.09** (0.05)		
$dp_t$			
R <sup>2</sup>	2.61		
Additional Controls			

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- Slope 1 std ↑ returns 0.3% ↓ (1.5 × average return; 13.5% of weekly std)

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	(1)	(2)	(3)
Constant	0.13* (0.09)	-0.61* (0.41)	
$Slope_t$	-6.96*** (1.98)	-7.19*** (2.00)	
$R_t$	-0.09** (0.05)	-0.09** (0.05)	
$dp_t$		40.78** (19.72)	
$R^2$	2.61	3.20	
Additional Controls			

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$$r_{t+1,t+2,crsp} = \alpha + \beta slope_{t,t+1} + \gamma X_t + \varepsilon_t$$

	(1)	(2)	(3)
Constant	0.13* (0.09)	-0.61* (0.41)	-2.32*** (0.80)
$Slope_t$	-6.96*** (1.98)	-7.19*** (2.00)	-6.21*** (1.95)
$R_t$	-0.09** (0.05)	-0.09** (0.05)	-0.10** (0.05)
$dp_t$		40.78** (19.72)	94.24*** (27.00)
R <sup>2</sup>	2.61	3.20	7.49
Additional Controls			X

Additional controls: VIX, RV, VRP, Fed funds rate, Term spread, policy shock

- Slope 1 std ↑ returns 0.3% ↓ (1.5 × average return; 13.5% of weekly std)



## Meeting Weeks

- Monetary policy shocks strong effect on financial markets
- Large event-study literature around FOMC announcements
- “60%–80% of realized equity premium”
- Skip meeting weeks to ensure these do not drive results

## Meeting Weeks cont.

$$r_{t+1,t+2,crsp} = \alpha + \beta slope_{t,t+1} + \gamma X_t + \varepsilon_t$$

	All Weeks (1)	No Meeting Return Week (2)	No Meeting Previous Week (3)	No Meeting in either Week (4)
Constant	0.13* (0.09)	0.23*** (0.09)	0.12* (0.09)	0.24*** (0.09)
$Slope_t$	-6.96*** (1.98)	-6.87*** (2.50)	-6.58*** (2.15)	-6.10** (2.78)
$R_t$	-0.09** (0.05)	-0.08* (0.06)	-0.08* (0.06)	-0.09 (0.07)
R <sup>2</sup>	2.61	2.10	2.25	1.74
Nobs	724	606	606	490

- Meeting weeks do not drive predictability
- Monetary policy affects stock returns throughout the year

## Future Changes in Federal Funds Rates

- Slope: measures tightening/ loosening of monetary policy
  - Should forecast future target rate changes
- Strong level effect
  - Orthogonalize future changes
  - Add realized changes

# Future Changes in Federal Funds Rates

$$\Delta ff_M = \alpha + \beta slope_{t,t+1} + \gamma X_t + \varepsilon_t$$

	$\Delta M1$ (1)	$\Delta M2 \perp \Delta M1$ (2)	$\Delta M3 \perp \Delta M1$ (3)
Constant	0.00 (0.01)	0.01* (0.01)	0.03*** (0.01)
$Slope_t$	0.78*** (0.23)	0.98*** (0.21)	-0.13 (0.30)
$\Delta ff_{t+1}$		0.36*** (0.05)	
$\Delta ff_{t+2}$			0.87*** (0.03)
R <sup>2</sup>	2.42	15.35	63.41

- Slope predicts future changes in federal funds target rate
- Slope loses predictive power after two months

# Forecast Revisions

- Fed communication shapes expectations
  - Market participant should update their expectations
- Monthly forecasts FFR from Blue Chip
- Survey of economists in last week of previous month
- Create one-month changes in forecasts
- Regress it on three-week cumulative slope factor

## Updating Fed Funds Forecasts: Bluechip Forecasts

$$\Delta \text{Forecasts}_{t+1,t+2} = \alpha + \beta \text{Slope}_{t,t+1} + \gamma \Delta \mathbb{E} ff + \varepsilon_t$$

	$\Delta Q1$ (1)	$\Delta Q2$ (2)	$\Delta Q3$ (3)	$\Delta Q2$ (4)	$\Delta Q3$ (5)
Constant	-0.01 (0.02)	-0.01 (0.03)	-0.02 (0.03)	-0.00 (0.01)	-0.01 (0.01)
$\text{Slope}_{t-3:t}$	0.89*** (0.17)	1.02*** (0.16)	1.00*** (0.16)	0.11 (0.08)	0.12 (0.12)
$\Delta \mathbb{E} ff_{t+1}$				1.03*** (0.04)	1.00*** (0.04)
R <sup>2</sup>	11.32	12.22	11.55	88.26	82.26

- Slope predicts forecast revisions of professional forecasters over three month horizon
- Slope unbiased predictor

## Economic Mechanism: Narrative Evidence

*“Still, in an economy that already has lost some momentum, one must remain alert to the possibility that greater caution and weakening asset values in financial markets could signal or precipitate an excessive softening in household and business spending.”*

Alan Greenspan, December 5th 2000, Community Bankers Conference.

## Economic Mechanism: Narrative Evidence cont.

- Interpreted as news about future changes beyond the next meeting
- Ed McKelvey, Goldman Sachs, in Washington Post:
  - “I don’t think it quite suggests that they are ready to cut rates...”
  - “...it seems certain that at their Dec. 19 meeting Fed [**beyond next meeting**] policymakers will shift away from their assessment that the risk of accelerating inflation is greater than the risk of an excessive slowdown.”
- Slope factor:  $-0.1063$ , next week's return 1.08%.



## Economic Mechanism: Speeches by Chair

- Increased transparency of monetary policy in last decades
- Inertial and gradual approach
- FOMC tries to guide market expectations through communication
- Slope might reflect market reaction to speeches by FOMC members
- Use linguistic analysis to measure “hawkish” and “dovish” tone

# Linguistic Analysis

- Collect all speeches for members of the FOMC
- Use “search-and-count” approach to classify tone of speeches
- Pre-specified word list: “hawkish” and “dovish” word combinations
- Count # of occurrences to classify speech as hawkish or dovish
- Also calculate net-index:

$$NetIndex = \left[ \left( \frac{\#hawk}{\#hawk + \#dove} \right) - \left( \frac{\#dove}{\#hawk + \#dove} \right) \right] + 1.$$

# Hawkish and Dovish Word Combinations: Examples

Dovish	Hawkish
anchored inflation expectations	asset prices increase
boost aggregated demand	asset prices rise
cut federal funds rate	declines unemployment rate
declines crude oil	employment increased
drop house prices	higher interest rates
employment fell	house prices rise
employment stable	rapid productivity growth
raise aggregated demand	lower unemployment rate

## Economic Mechanism: Speeches by Chair cont.

$$\text{slope}_{t,t+1} = \text{Hawk}_{t,t+1} + \text{Dove}_{t,t+1} + \varepsilon_t$$

	(1)	(2)	(3)	(4)
Constant	-1.56*** (0.59)	-0.68** (0.27)	-1.99* (1.10)	-0.94 (0.90)
Hawk-Dove Index	1.06** (0.45)		1.73** (0.75)	
Hawk		0.56*** (0.21)		0.61* (0.31)
Dove		-0.30* (0.17)		-0.28* (0.17)
R <sup>2</sup>	2.98	4.60	12.38	12.35
At least 1 classification			X	X

- Higher index: more hawkish tone
- Tone of speeches shapes slope

# Monetary Policy News vs News about the Macroeconomy

- Taylor rule good description of actual monetary policy during sample
- Slope  $\uparrow$ : upward revisions about future growth?
- Construct macro shocks from Haver Analytics
- Shock := actual release as first reported - median forecast
  - GDP, inflation, capacity utilization, consumer confidence, employment costs, initial claims, manufacturing index, new home sales, non-farm payroll, PPI, retail sales, unemployment rate

# Monetary Policy News vs News about the Macroeconomy

$$r_{t+1,t+2,crsp} = \alpha + \beta \text{slope}_{t,t+1} + \gamma \text{news}_t + \varepsilon_t$$

	(1)	(2)	(3)	(4)	Slope
Constant	0.13* (0.09)	0.13* (0.09)	0.12* (0.09)	0.09 (0.09)	-0.00 (0.00)
<i>Slope<sub>t</sub></i>	-6.84*** (1.98)	-6.86*** (1.99)	-6.74*** (1.99)	-6.71*** (2.04)	
<i>R<sub>t</sub></i>	-0.09** (0.05)	-0.09** (0.05)	-0.09** (0.05)	-0.08* (0.05)	
<i>shock_gdp</i>	0.59* (0.37)		0.58* (0.37)	0.55* (0.37)	-0.00 (0.01)
<i>shock_cpi</i>		-1.99 (1.58)	-1.98 (1.58)	-1.43 (1.57)	0.02 (0.04)
Additional News				X	X
R <sup>2</sup>	2.97	2.76	3.12	5.17	9.23

- Macro news orthogonal to predictive power of **slope**
- Macro news explain **9%** of variation in slope

## Economic Significance

- How much can investor gain trading on slope?
- Follow Campbell & Thompson (2008) and Cochrane (2009)
  - Re-estimate slope and baseline regression from 1988 to 1994
  - Create out-of-sample slope through 2007
- $S^* = \sqrt{\frac{S^2 + R_{OOS}^2}{1 - R_{OOS}^2}}$ 
  - $S$ : Sharpe ratio of buy-and-hold investor
  - $S^*$ : Sharpe ratio of investor conditioning on slope
- Increase in Sharpe Ratio by 20%

## Additional Results

- Slope stronger predictive power for monetary policy easing
- No predictive power beyond 1 week
- Slope predicts longer term yields
- Slope explains variation orthogonal to *target* and *path* factors



# Conclusion

- Construct a slope factor from changes in federal funds futures
- Slope predict increases in fed funds rates and drop in returns
- “Monetary policy is 98 percent talk and only two percent action”
- Speeches by the chair and vice chair change the slope factor
- Policy affects markets continuously rather than only on meetings