Discussion of "The Derivative Payoff Bias" by Baltussen, Terstegge, and Whelan

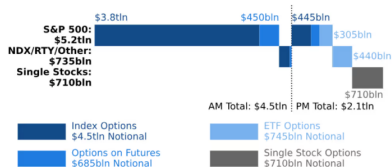Vincent Bogousslavsky

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AFA 2025

Background

S&P 500 overnight returns before 3rd Friday expiration

- S&P 500 index option expiration (monthly)
  - AM-settled at Special Opening Quotation (SOQ)
    - vs PM-settled for weekly index options
  - Trading stops on the previous Thursday after the close

Options referencing $6.6tln of equities expire on 20-Dec

Notional open interest of equity index options, ETF options, single stock options, and options on equity index futures expiring 20-Dec-2024

$3.8tln $450bln $445bln

S&P 500: $5.2tln
NDX/RTY/Other: $735bln
Single Stocks: $710bln

$305bln
$440bln
$710bln

AM Total: $4.5tln   PM Total: $2.1tln

Index Options $4.5tln Notional
ETF Options $745bln Notional
Options on Futures $685bln Notional
Single Stock Options $710bln Notional

Sources: Asym 500, ORATS, Bloomberg Finance L.P.

- S&P 500 futures expiration (quarterly): triple-witching days

The derivative payoff bias

SOQ exceeds index closing price by an average 18 bps on 3rd Fridays, which fully reverts by noon

- No such pattern for PM-settled options
  - Overnight period is special

- The bias is only observed after the rise of overnight trading
  - You can trade but it is illiquid

- Proposed explanation: price-pressure based channel
  - Option market makers' inventory risk (charm $= \frac{\partial \Delta}{\partial t}$)
  - Option market makers have to buy equity to remain delta-hedged

Intuition
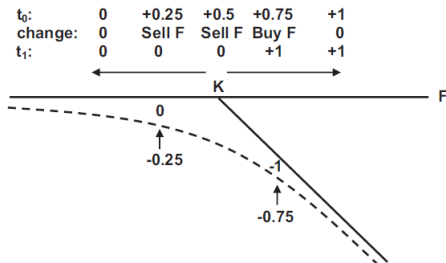
Source: Golez and Jackwerth (2012)

- Option market maker with a short call position
- At t_0, buy the stock to delta hedge
- At t_1:
  - If option is ITM, market maker has to buy (Charm> 0)
  - If option is OTM, market maker has to sell (Charm< 0)
- *Comment:* clarify the "novelty" of the hedging mechanism relative to Avellaneda and Lipkin (2003)

This discussion

- Examine SPY overnight return around 3rd Fridays
  - Huge increase in SPY's overnight volume since 2003 (if anything this is what picks up in 2003)
  - Caveat: magnitudes are likely understated since SPY open price is not equal to SOQ

- A few suggestions to test the explanation more directly and comprehensively

SPY (1993/2-2019/12)

	SPY overnight return (bps)			
	9:30am (crsp open)		10am mid	
	< 2003/2	≥ 2003/2	< 2003/2	≥ 2003/2
constant	5.84***	2.46**	4.53***	2.76***
	(4.78)	(2.52)	(3.66)	(2.71)
3rd Friday	−7.57	15.01***	−17.05***	7.99*
	(−1.50)	(2.97)	(−3.24)	(1.94)

- Robust pattern: 15bps 3rd Friday "bias" post 2003
- Already much weaker with 10am midquote: 8bps
- Negative return prior to 2003?

Year by year

Average overnight return (bps)
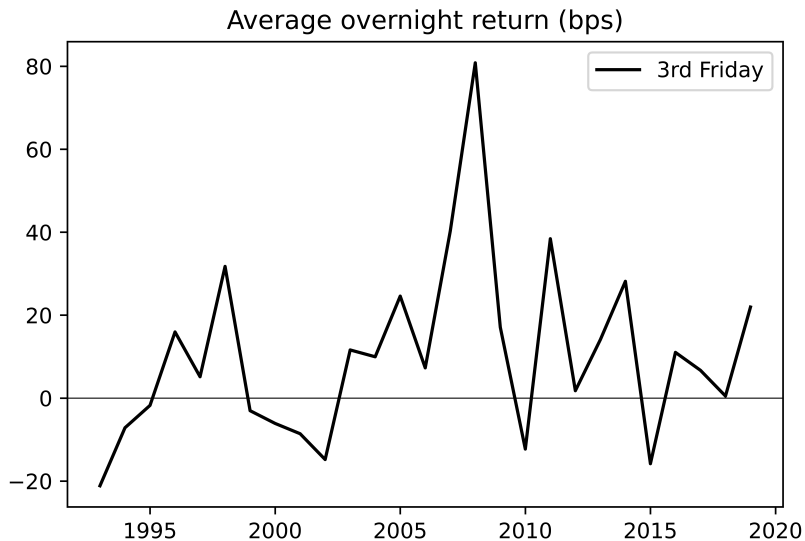
Comment 1: more direct/comprehensive tests

> *"On 3rd Thursdays at market close dealers, on average, have large negative net-C, which implies they need to buy at least $280 million worth of equities overnight to maintain a Δ-neutral position into expiry. This quantity explains the abnormal overnight $306 million order imbalance that we document moved the market 18 bps upward on 3rd Fridays"*

- However,
  - I can't tell whether the imbalance actually explains the 18 bps return
  - $306 is abnormal relative to other days, but it doesn't mean that it's not anticipated

Disentangle futures from options expiration

	SPY overnight return (bps)			
	9:30am (crsp open)		10am mid	
	$< 2003/2$	$\geq 2003/2$	$< 2003/2$	$\geq 2003/2$
constant	5.84***	2.46**	4.53***	2.76***
	(4.78)	(2.52)	(3.66)	(2.71)
3rd Friday	-11.46*	7.81	-21.15***	2.58
	(-1.82)	(1.46)	(-3.36)	(0.56)
3rd Friday$\times$QuarterEnd	11.67	21.50*	12.30	16.14*
	(1.17)	(1.86)	(1.13)	(1.80)

- Table VI is important because it disentangles quarterly from non-quarterly expirations (don't include futures)
  - The paper's explanation is about option exposure
- Why magnitude half as large?
  Futures' order flow smaller, but this not a direct test
  - Compare dealer positions in SPX options (quarters vs others)

Reversal test

- $r_t = a + b r_{t-1} + e_t$
  - Paper finds that $b < 0$, but can provide more insights

	SPY 9:30am-12pm return (bps)					
	3rd Fridays		Other days		Other Fridays	
constant	-13.52***	-7.58*	0.72	0.86	-1.09	-1.42
	(-3.18)	(-1.73)	(0.80)	(0.94)	(-0.47)	(-0.64)
ov ret		-0.35***		-0.06		-0.24***
		(-3.16)		(-1.61)		(-2.81)
R^2	0.00	0.18	0.00	0.00	0.00	0.09

1. Discuss intercepts (not reported)
2. Account for day-of-week effects: Fridays look special
3. Relate SOQ-12pm return to Charm (dealer positions)
4. Compare pre 2003 to post 2003

Comment 2: what happens before/after the market close on Thursday?

- Implications for Thursday PM return are worth exploring
  - Baltussen et al. (2021): impact of gamma hedging on end-of-day returns

- What should we expect to find before 2003?
  - Negative overnight return prior to 2003?

- Why would market makers wait to adjust their hedge until midnight? Is that consistent with Charm hedging in theory?
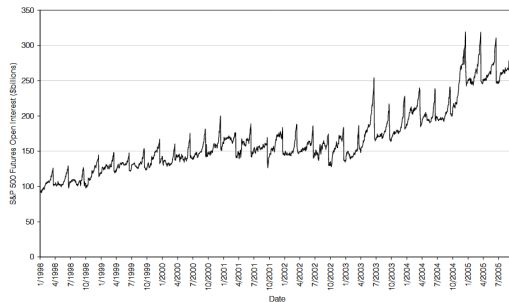
Comment 3: is it only about the increase in overnight trading?

- Substantial rise in open interest on S&P 500 Futures around 2003 (Barclay, Hendershott, and Jones (2008))

FIGURE 1

Open Interest on S&P 500 Futures

Daily open interest in billions of dollars for all S&P 500 futures contracts from January 1, 1998 to September 30, 2005.

In summary

- Nice and robust empirical finding

- Inventory risk is a plausible explanation, but the paper can do more to test Charm directly
  - Of course, a lot of other things are likely to affect overnight returns

- Good luck!