RIDING THE SWAPTION CURVE

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TopQuants Autumn event
Amsterdam – 18 November 2015

MOTIVATION

Volatility risk is priced in swaption markets

- Negative premium: realized volatility is lower than implied volatility
- Investors are willing to pay a compensation to volatility sellers
- Supported by various research methods and many authors

Term structure across the swaption maturity spectrum

- Higher volatility risk premium for low maturities
- Very little attention in the literature

LITERATURE OVERVIEW

	Volatility risk premium	Term structure VRP
Hedging Based tests	Goodman & Ho (1997) Duarte, Longstaff & Yu (2007)	**THIS STUDY**
Model free tests	Almeida & Vicente (2009) Fornari (2010) Mueller, Vedolin & Yen (2011) Merener(2012) Trolle & Schwartz (2012)	Fornari (2010)

HEDGING-BASED TEST

Straddle refresher

- Combination of call and put option
- Very sensitive to changes in volatility
- Risk exposures measured by Greeks: delta, gamma, vega

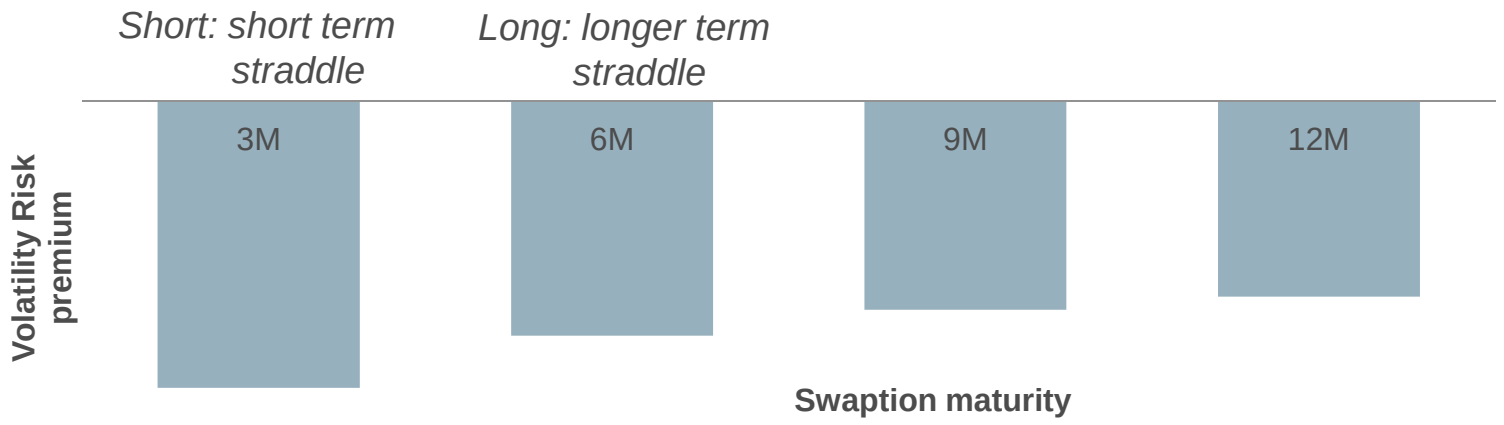
Hedging-based test

- Isolate movement in volatility and neutralize interference from directional movement in underlying instrument
- The return on buying a straddle and dynamically delta-hedging is related to the volatility risk premium (Low & Zhang, 2005)

THIS STUDY

We develop a novel hedging-based test to empirically examine the presence of a term structure of the volatility risk premium in the swaption market

- Long-short combinations of two at-the-money swaption straddles with different maturities
- Analyse the profit/loss to examine the difference in the VRP between maturities



DATA

Sample: Four largest and most liquid swap markets

- U.S., EMU, Japan, U.K.
- Daily pricing data (swap yields, ATM implied volatilities)
- April 1996 – 2011

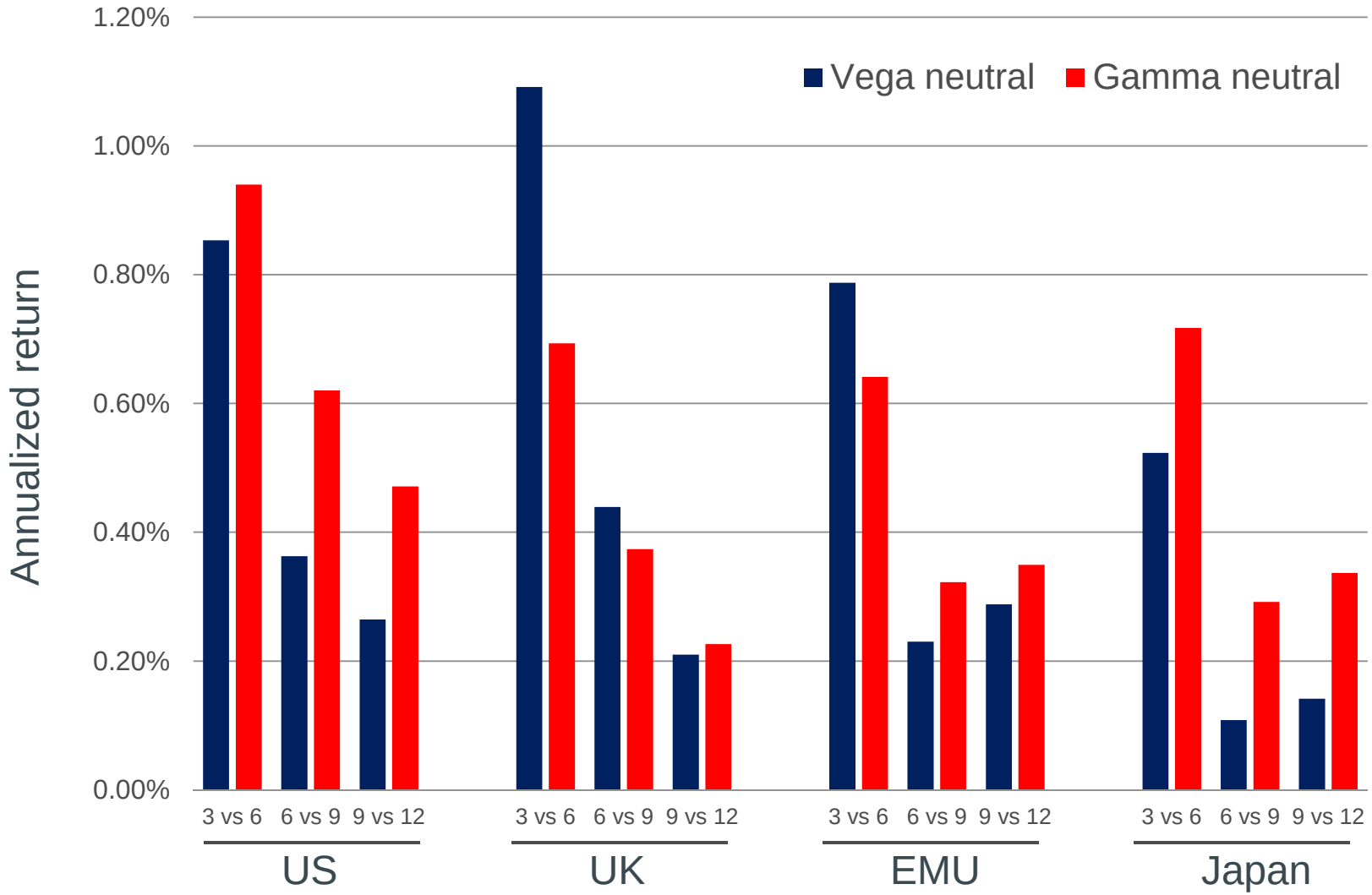
Data source: Bloomberg

- Cross-validation with anonymous broker
- Swaption maturities: 3, 6, 9, 12 months
- 10 year swap tenor

Black pricing model

- Either Gamma or Vega neutral straddle combinations

EMPIRICAL RESULTS – MAIN RESULTS



SUMMARY EMPIRICAL RESULTS

Observations

- Positive returns for all markets and maturity combinations
- Majority of returns significant
- Term structure visible

The empirical results indicate

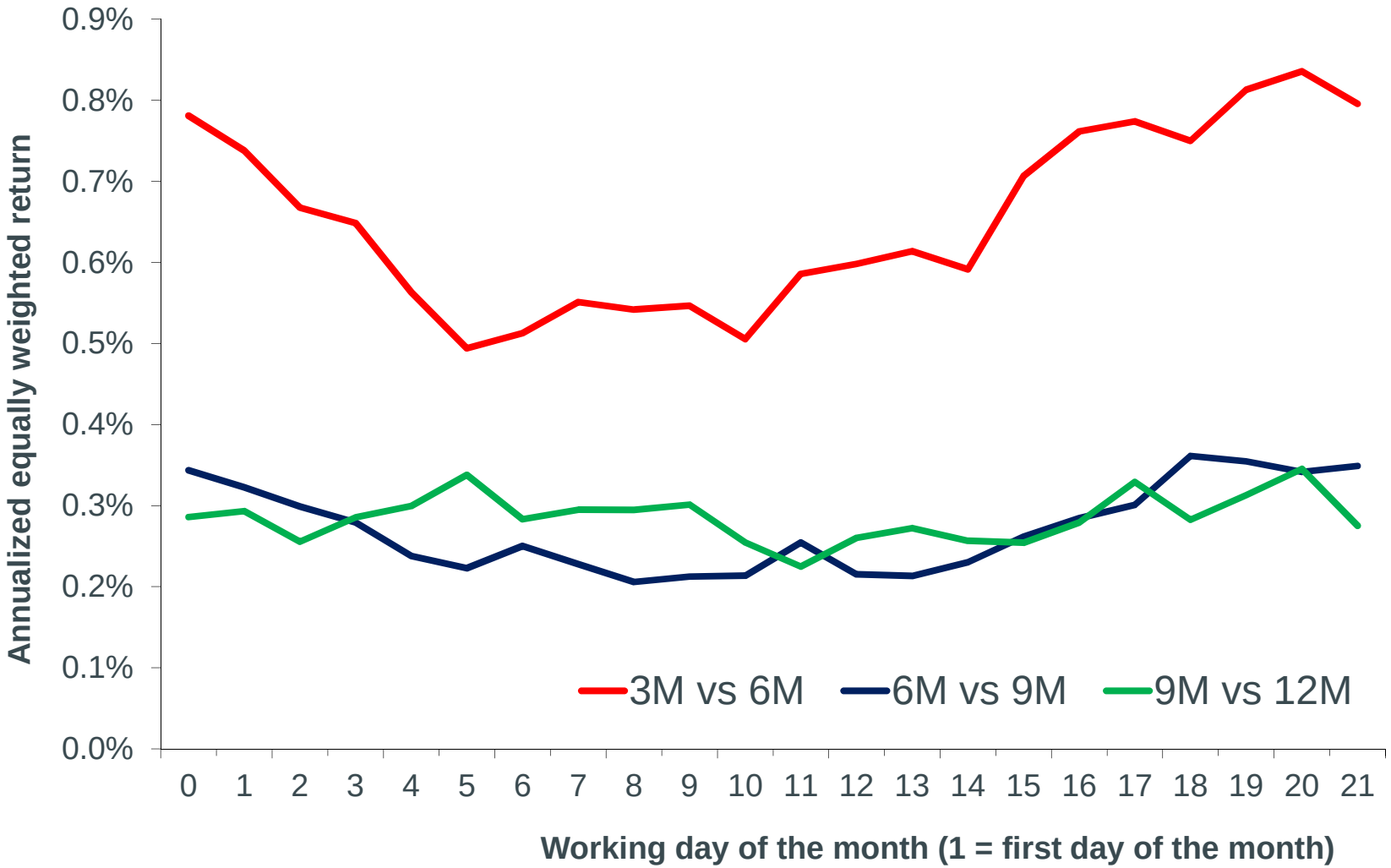
- Existence of term structure in volatility risk premium across all 4 markets
- Incrementally decreasing term structure

ROBUSTNESS

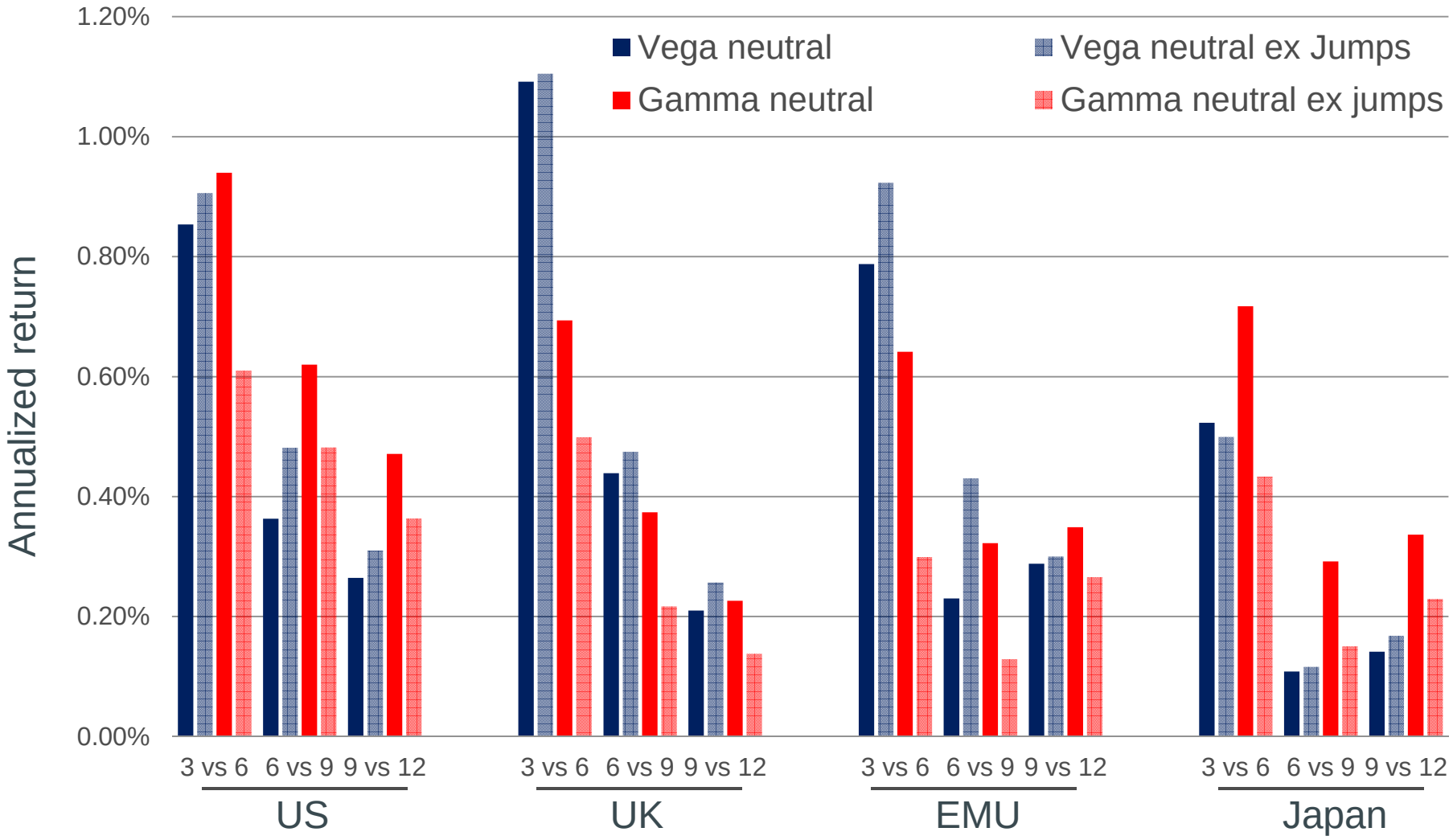
Additional analysis to improve the intuition

- Macro economic announcements (Fornari, 2010; Andersen et al ,2007)
- Jump risk (Branger & Schlag, 2008)
- Volatility risk (Cremers et al. 2015)
- Discrete trading (Branger & Schlag, 2008)

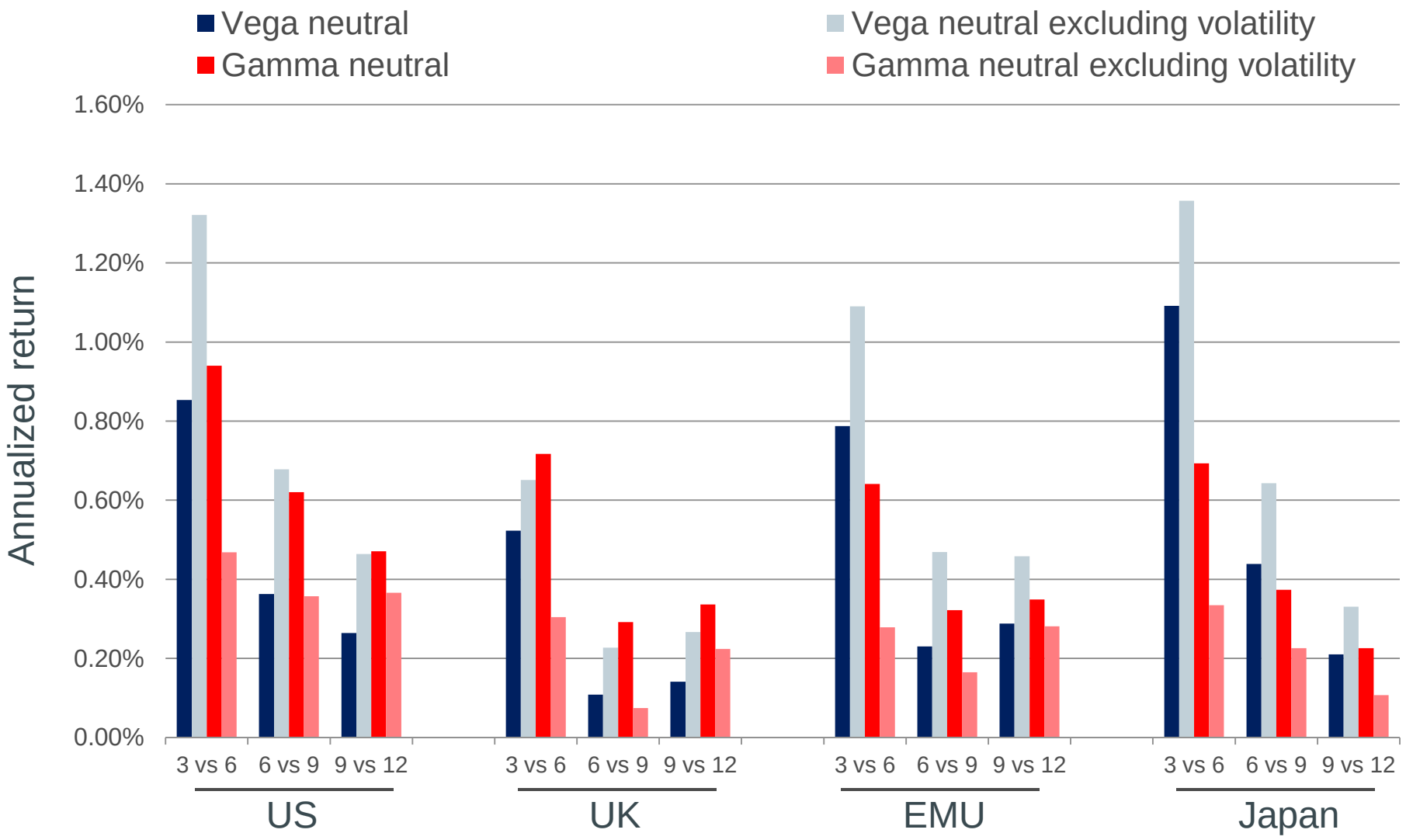
DAY-OF-THE-MONTH EFFECT



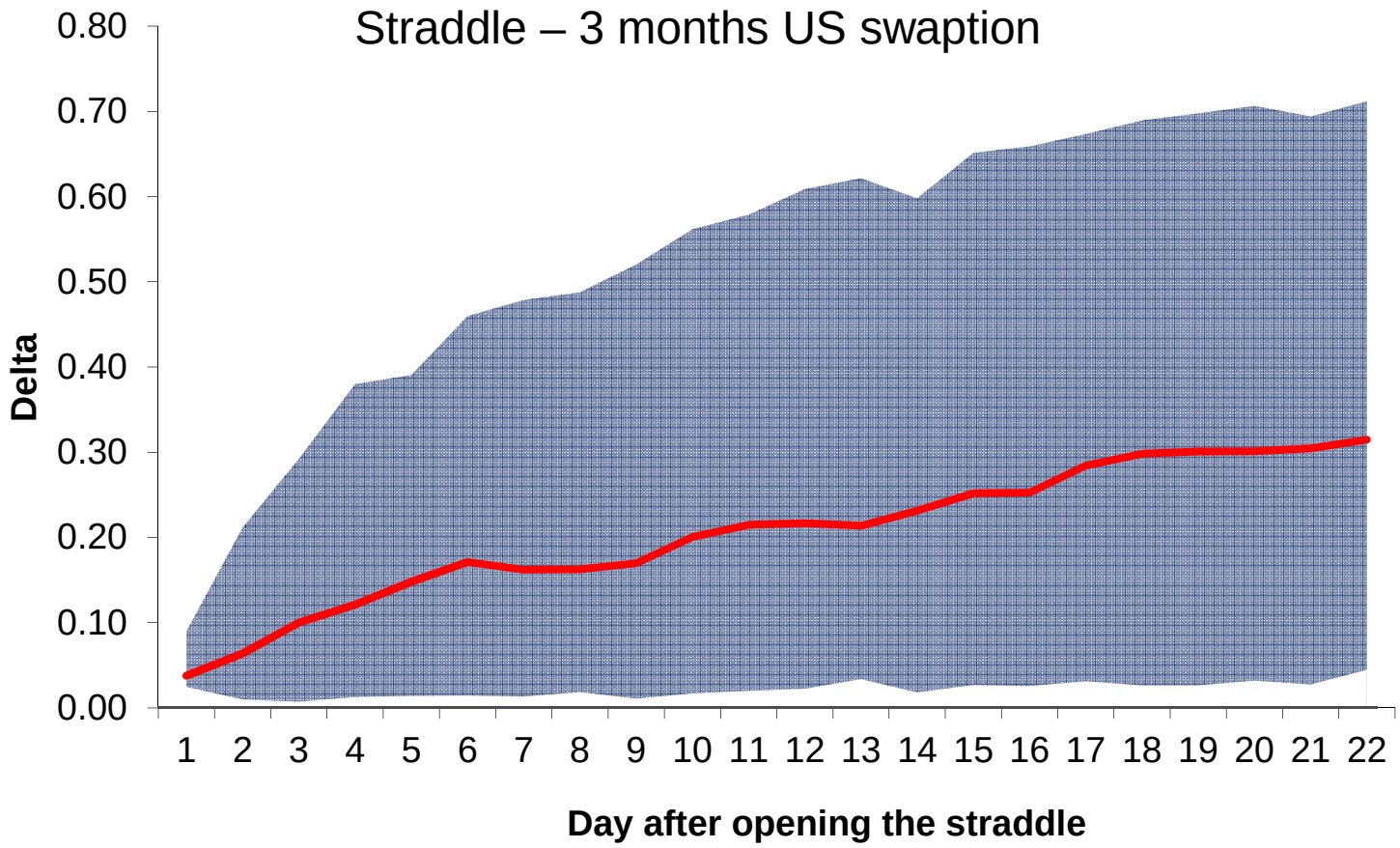
JUMP RISK


1.20%
1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
Annualized return
Vega neutral
Vega neutral ex Jumps
Gamma neutral
Gamma neutral ex jumps
3 vs 6
6 vs 9
9 vs 12
US
UK
EMU
Japan

VOLATILITY RISK

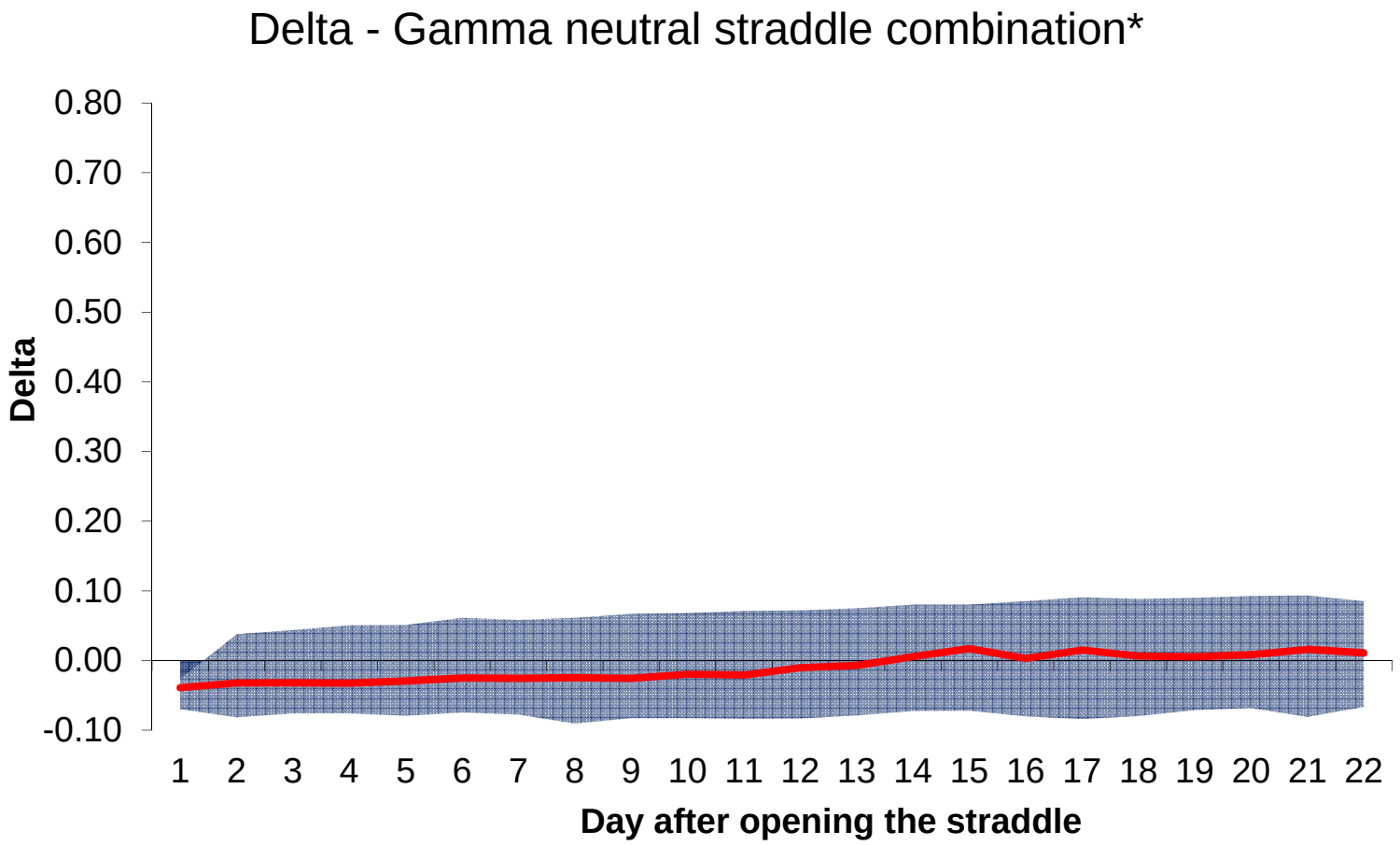


DISCRETE TRADING – DELTA EXPOSURE



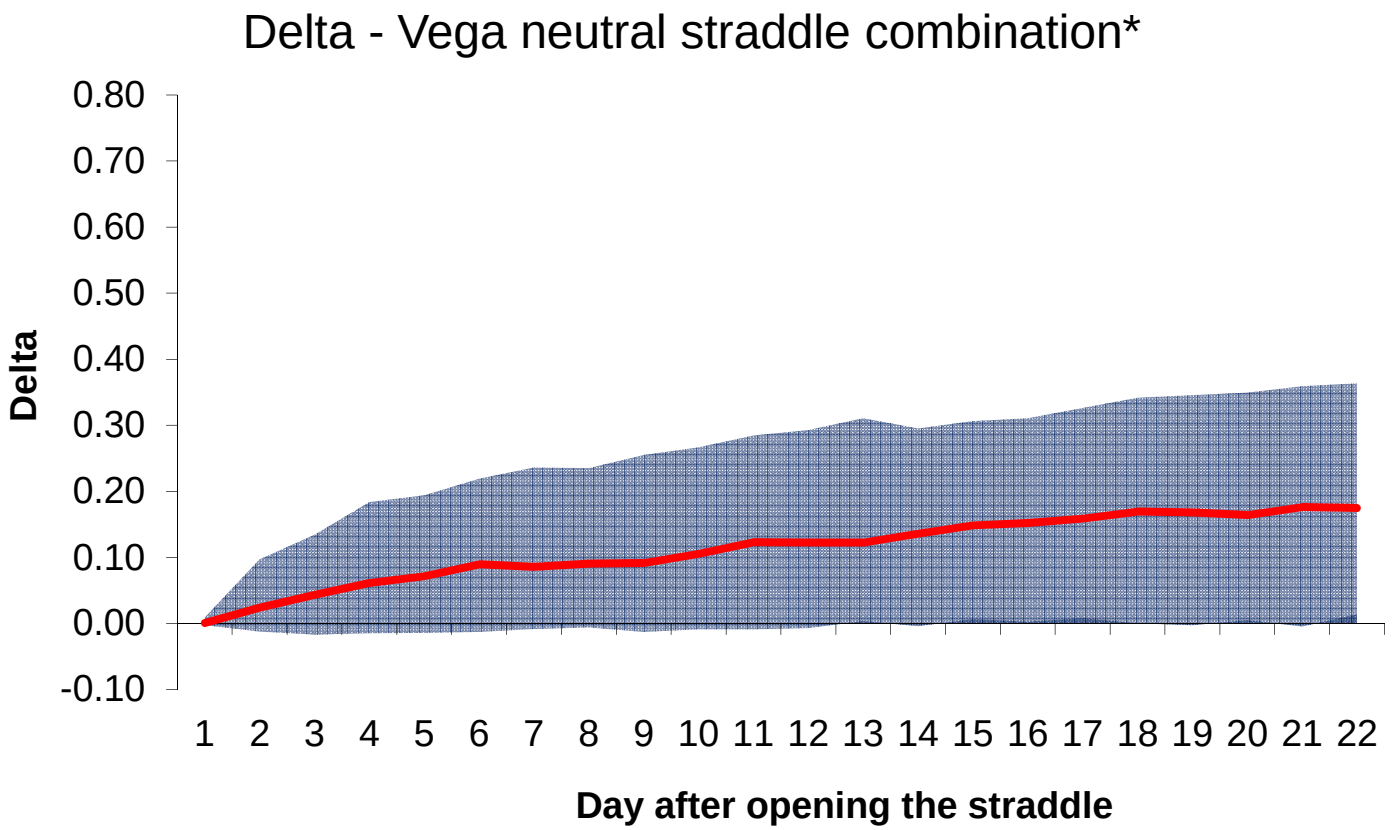
* 3 months US swaption

DISCRETE TRADING – DELTA EXPOSURE



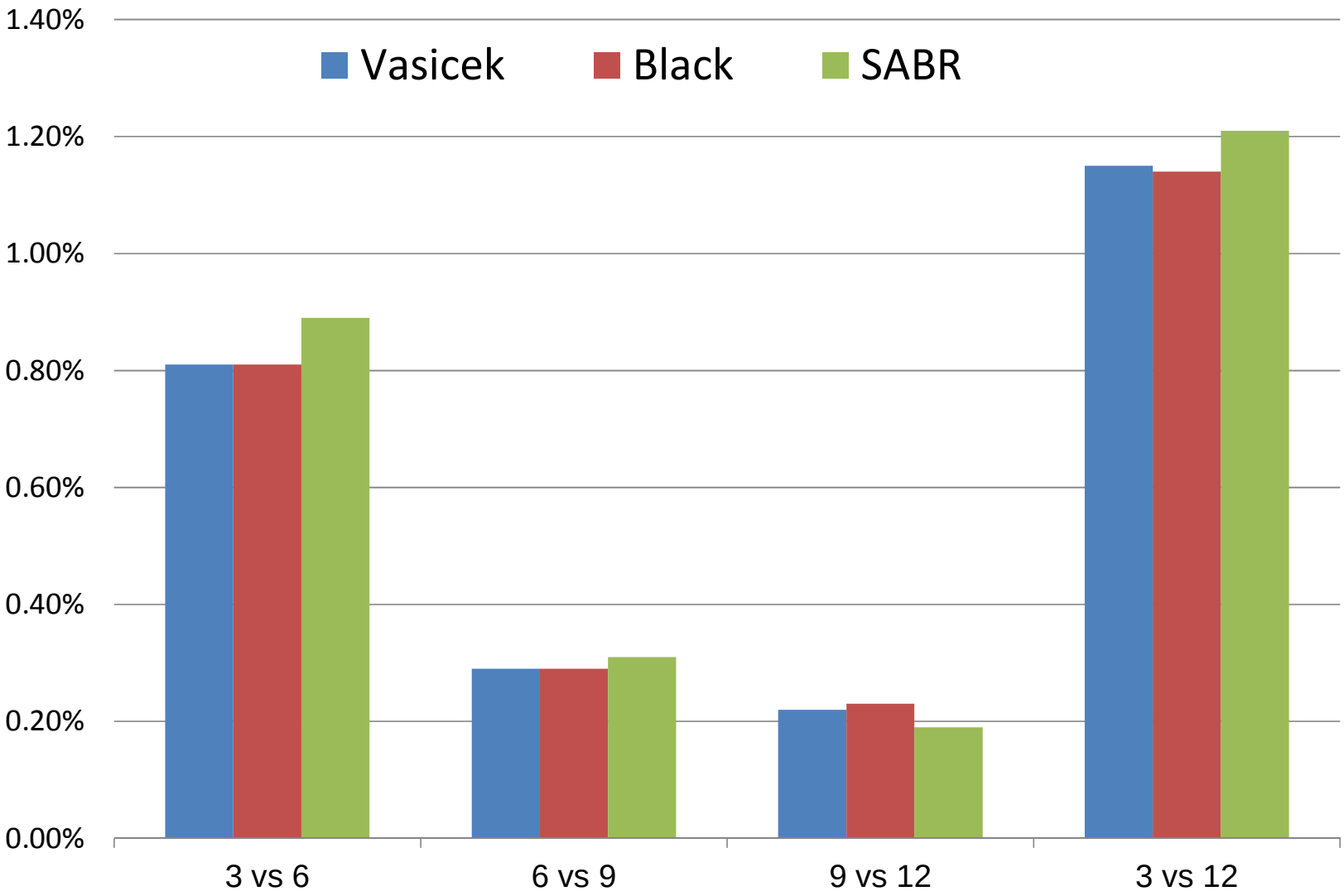
* 3 and 6 months US swaptions

DELTA RISK EXPOSURE - VEGA NEUTRAL



* 3 and 6 months US swaptions

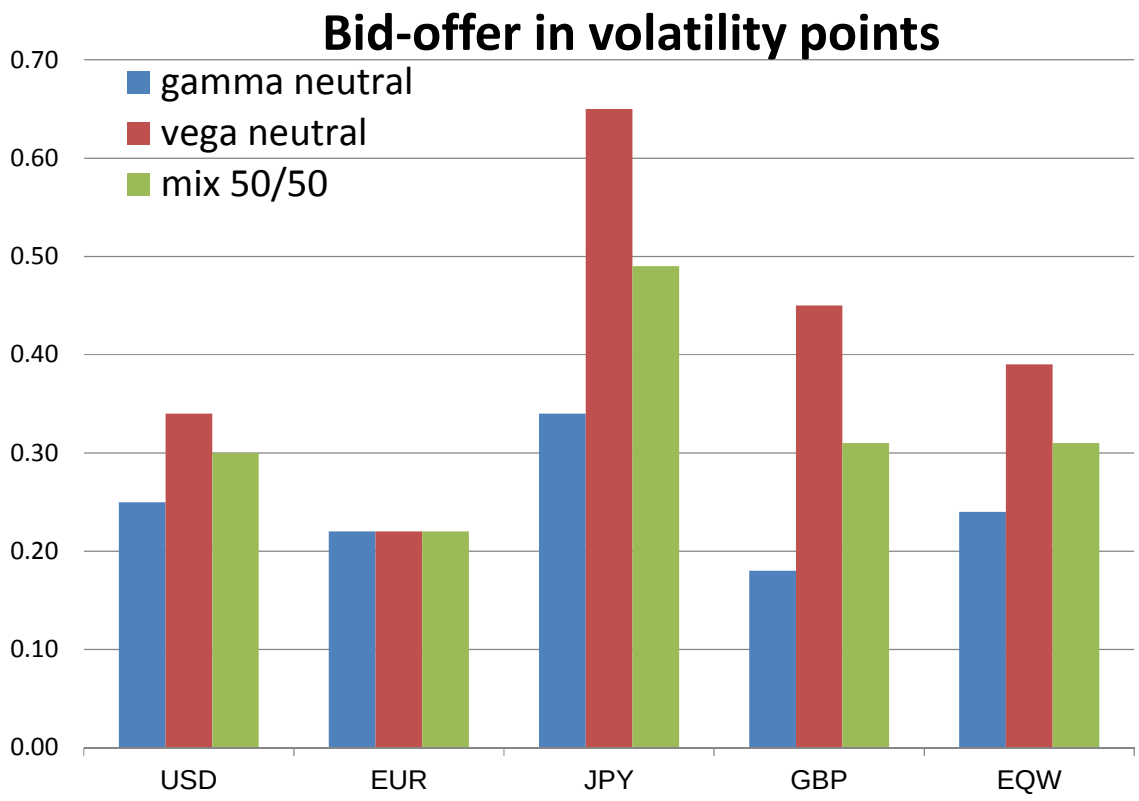
STOCHASTIC MODELS



ECONOMIC IMPORTANCE

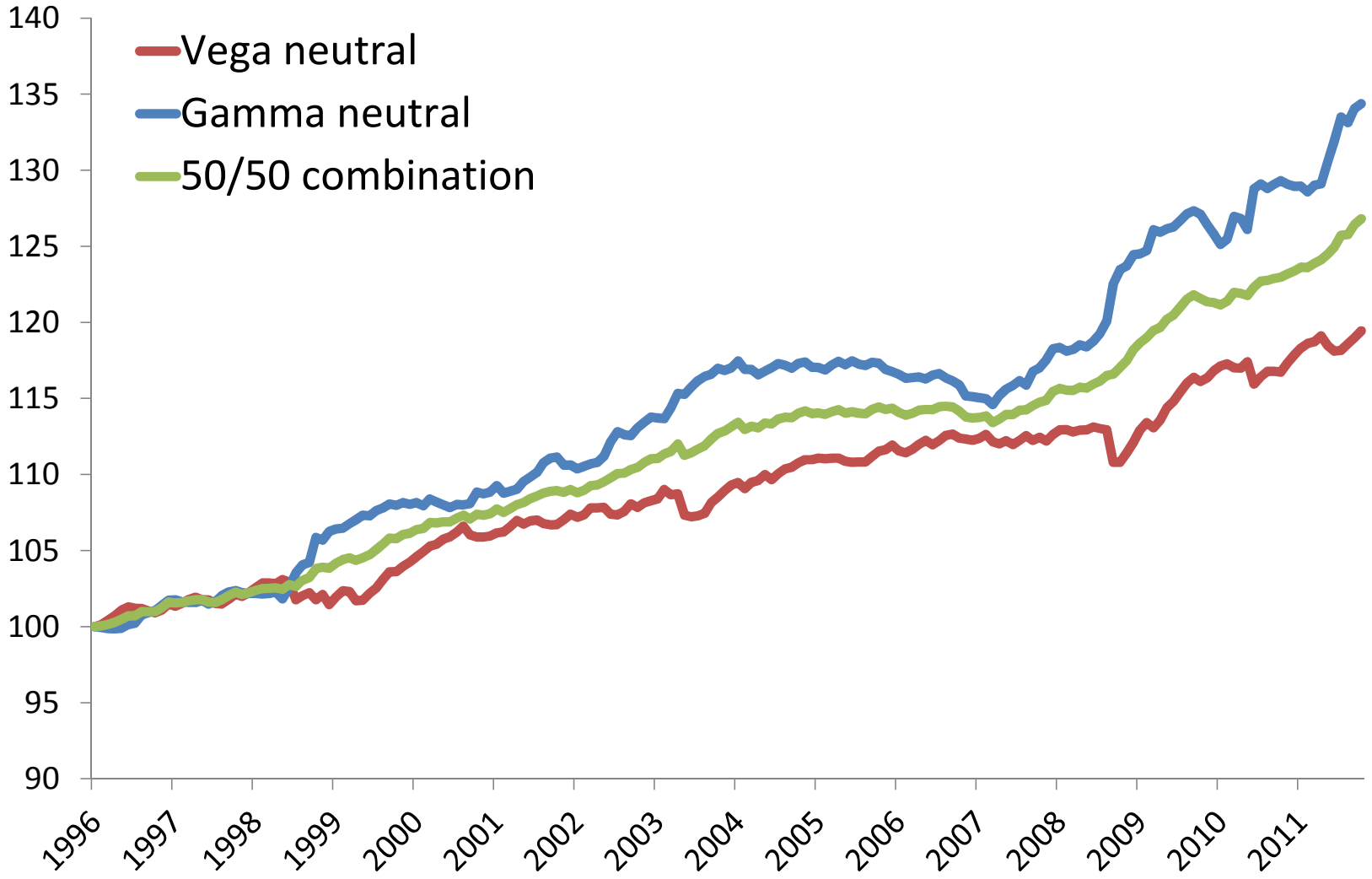
- Transaction costs are typically not included in related literature
- Our framework enables analyzing the economic importance

Break-even bid-ask spreads (3 vs 12)



ECONOMIC IMPORTANCE

- Strong diversification vega neutral and gamma neutral strategies



SUMMARY AND CONCLUSION

- First paper to provide an hedging-based framework for testing the existence of a term structure in the volatility risk premium

- Our empirical results for the swaption market
  - indicate a term structure in the volatility risk premium in all 4 major swaption markets
  - suggest that the term structure is affected by both jump risk and volatility risk corroborating the equity market findings of Cremers et al. (2015)
  - are robust for Jump Risk, Macro Economic Announcements and discrete trading biases

- Journal of Banking and Finance, Volume 59, October 2015, Pages 57–75
  http://www.sciencedirect.com/science/article/pii/S0378426615001545