The Minneapolis RNPD Initiative: Construction and Monitoring

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Disclaimer

- The views expressed here are my own and not necessarily those of others in the Federal Reserve System.

Summary

- Initiative motivated by the unique features of RNPDs for policymakers
- Construction process uses standard techniques and favors market prices over quotes
- Monitoring focused on standard movements of distributions, tail probabilities, and trading volumes
- We are making RNPD output more widely available to increase its usage by policymakers

Motivations for Initiative

- Lesson from 2007: Essential for policymakers to monitor tail risks
- RNPD output provides a full distribution view of future
- More public visibility of RNPD output = more usage by policymakers

Minneapolis Construction Process

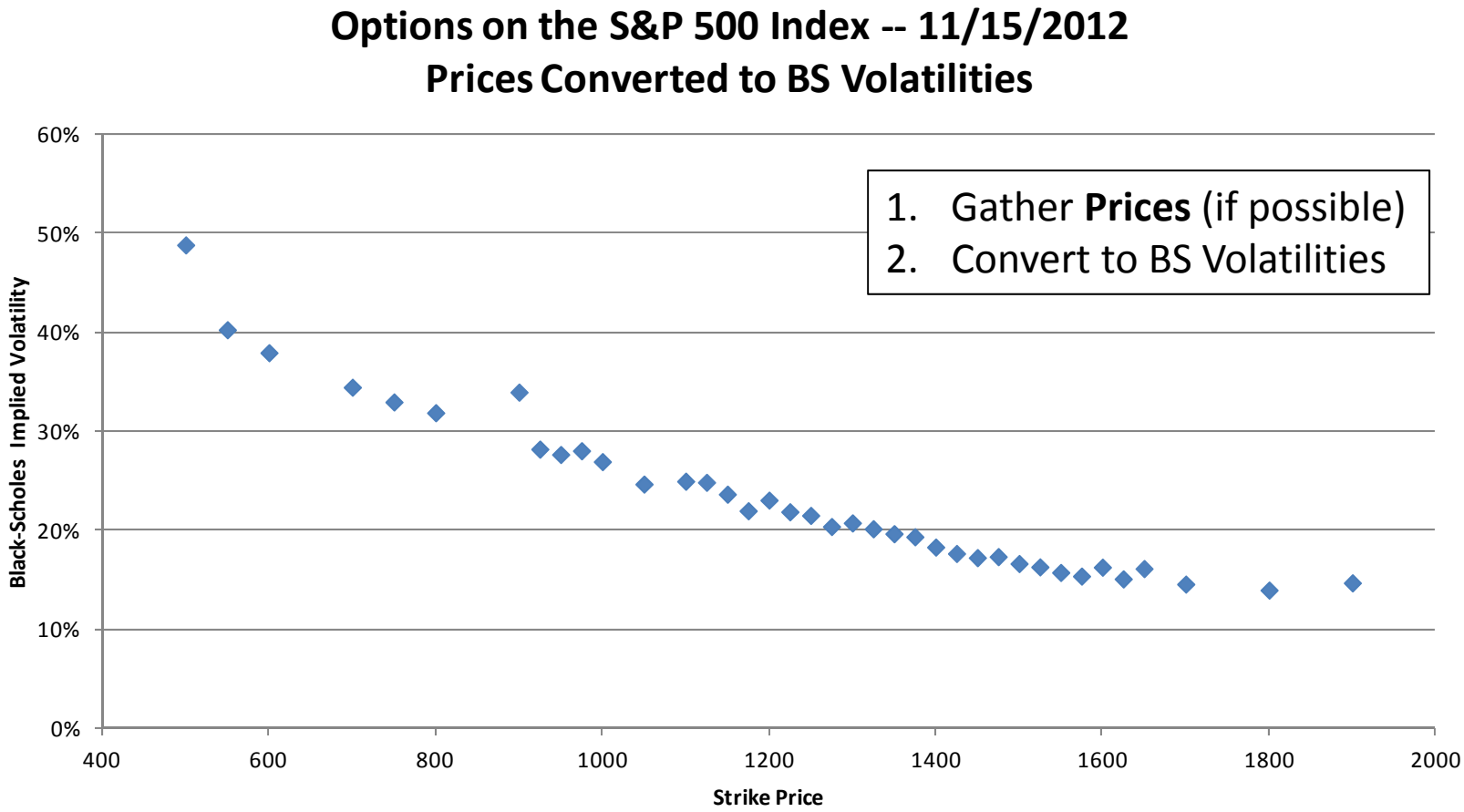
- General approach: Breeden-Litzenberger[1]
  - The risk-neutral probability density is the second derivative of call price as a function of strike price

- Specific approach to estimating the call price function: Shimko[2]

[1]**Breeden, D. T., and Litzenberger, R. H. (1978), "Prices of state-contingent claims implicit in option prices,"** ***Journal of Business*** **51 (4), pp. 621-51.**

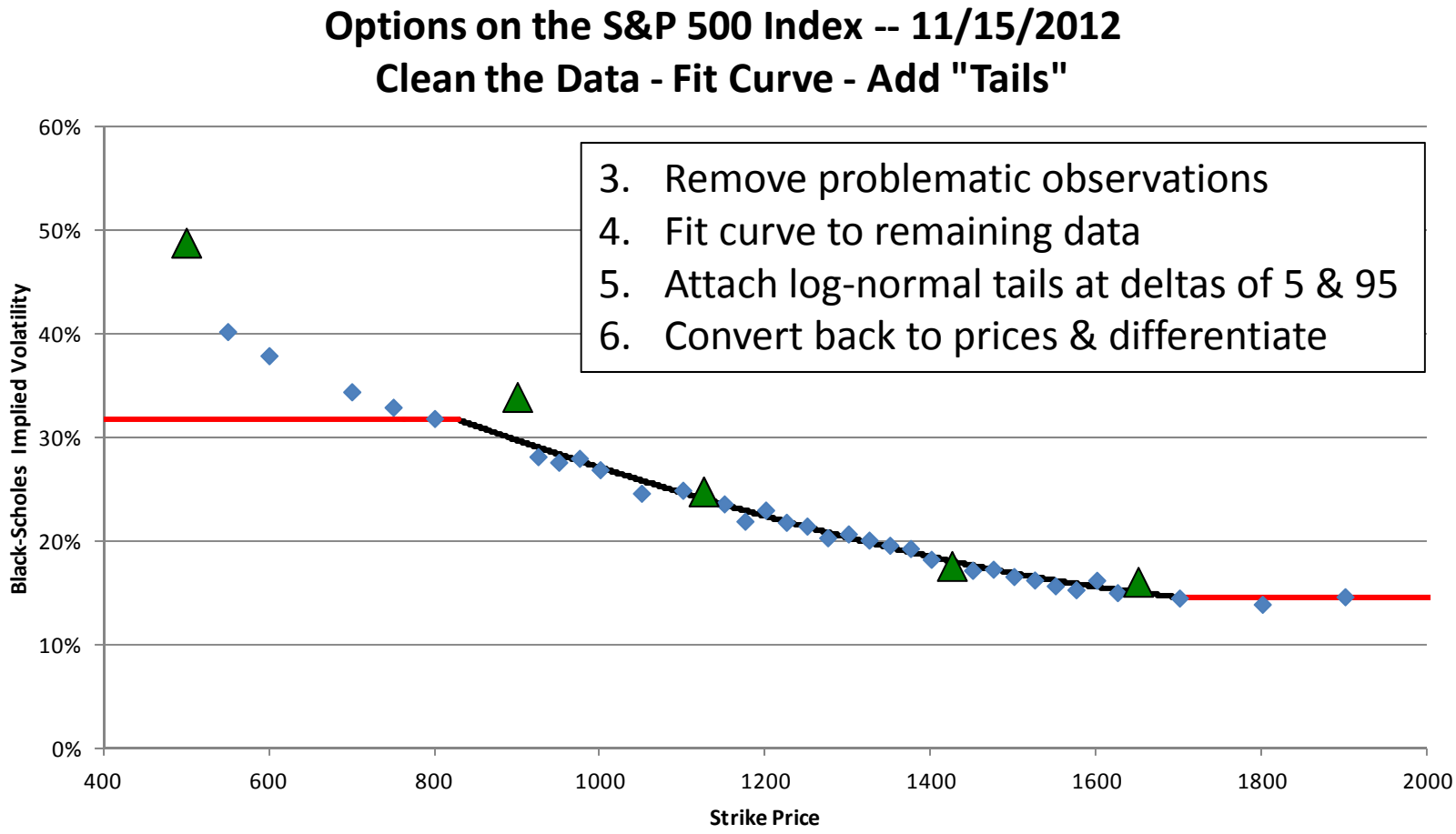
[2]**Shimko, D. C. (1993), "Bounds of Probability,"** ***Risk***, **6 (4), pp. 33-37.**

Minneapolis Construction Process



Source: FactSet Data Systems

Minneapolis Construction Process

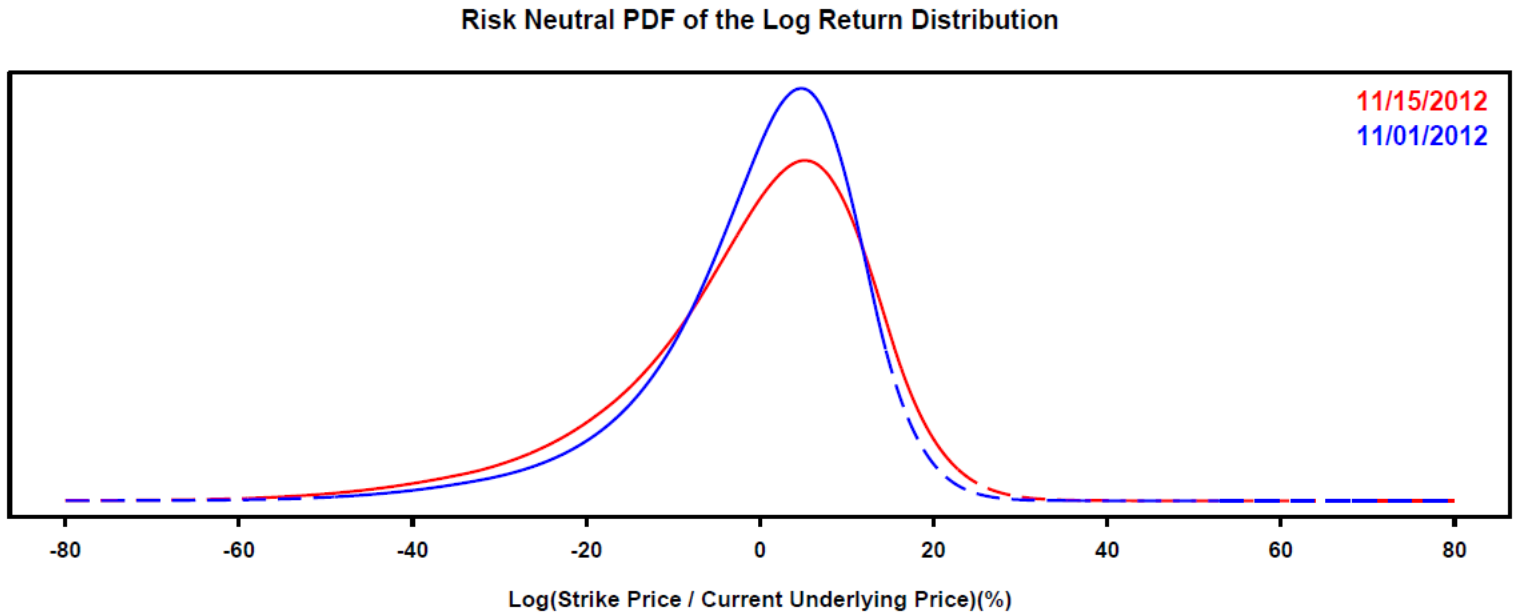


Source: FactSet Data Systems

Final Result

RISK NEUTRAL PROBABILITY DENSITY FUNCTIONS – S&P 500

Log returns are based on the risk neutral density function of the underlying asset
Derived from options that expire in approximately 6 months



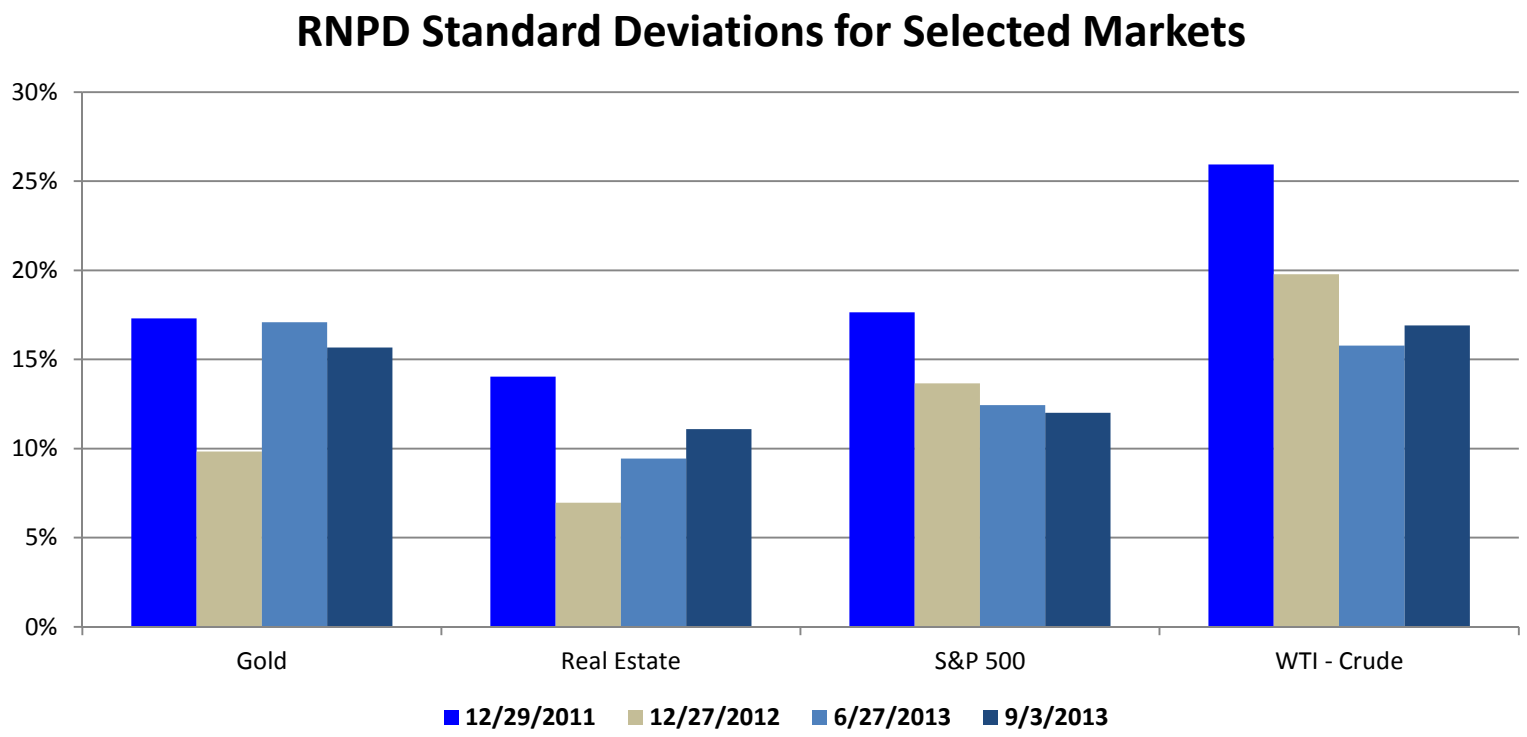
Minneapolis Construction Process

- We do NOT decompose state prices into probabilities and marginal utilities
  - Policy decisions should be based on the state prices that combine the two
  - See remarks from President Kocherlakota

What We Monitor

- Moments of the Distribution
- Tail Probabilities
- Trading Activity

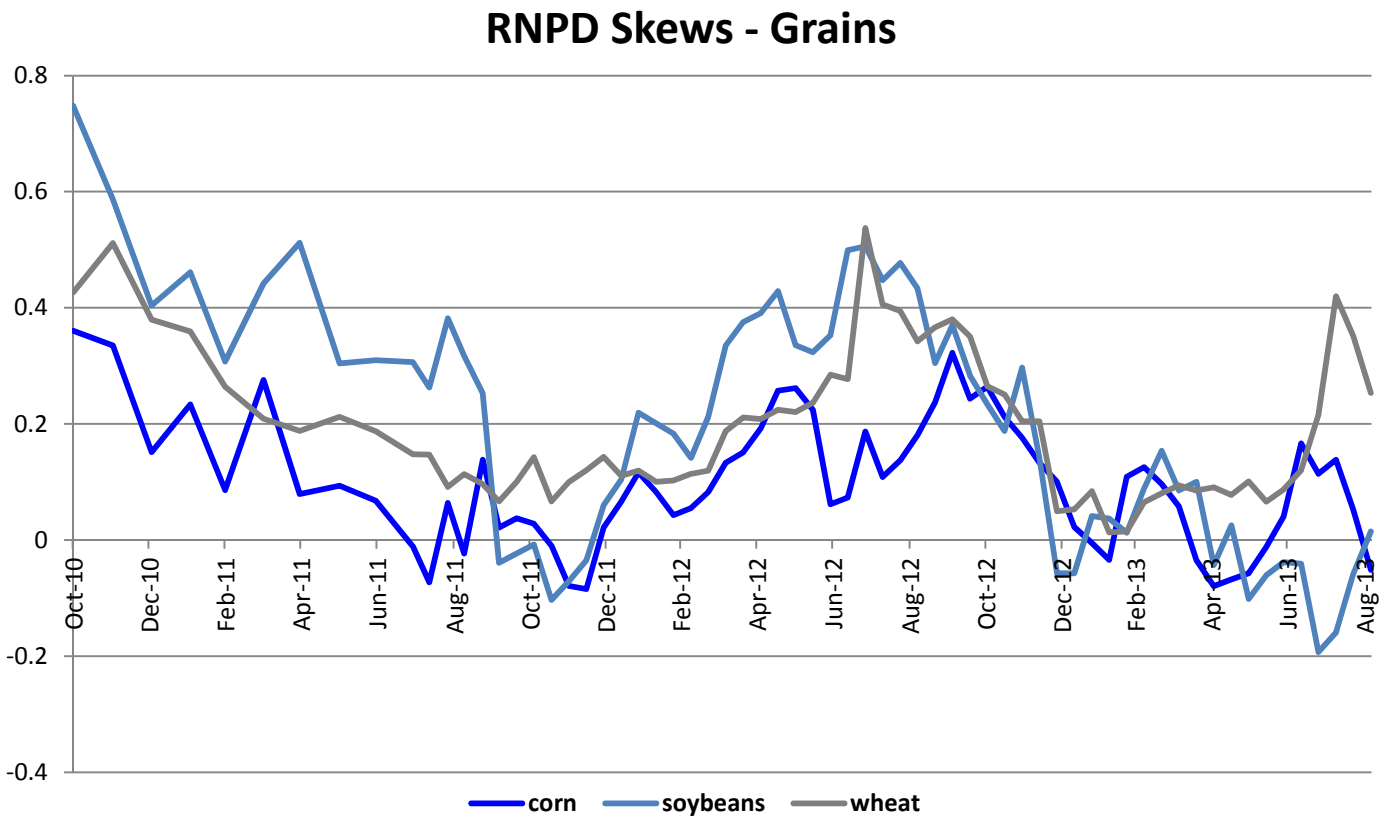
Moments – Standard Deviation



Sources: FactSet Data Systems
Bloomberg

Gold, Silver, and Oil RNPDs are derived from options on futures.
S&P 500 RNPDs are derived from options on the S&P 500 Index.
All options have approximately six months to expiration.

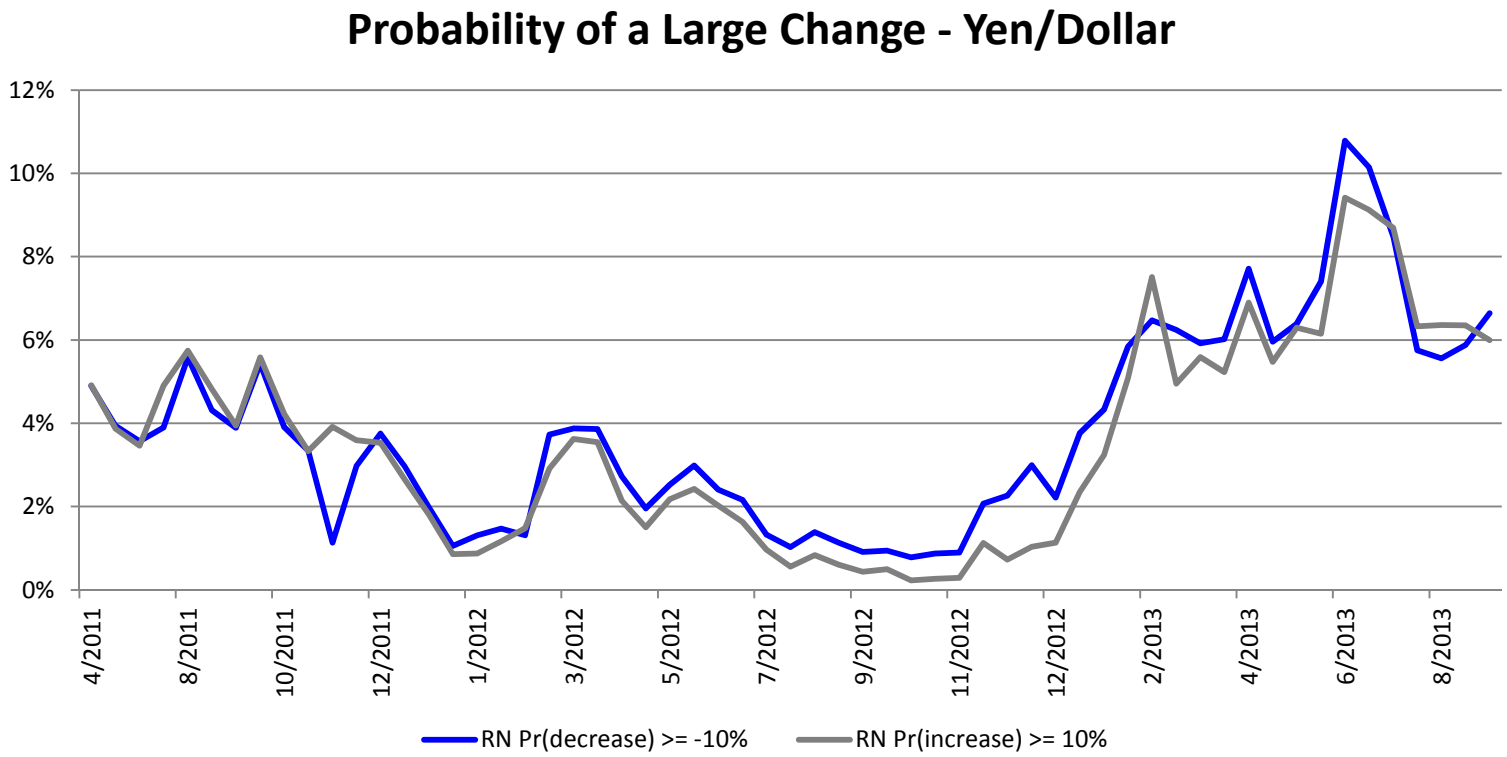
Moments – Skew



Source: Bloomberg

Corn, Soybeans, and Wheat RNPDs are derived from options on futures. All options have approximately six months to expiration.

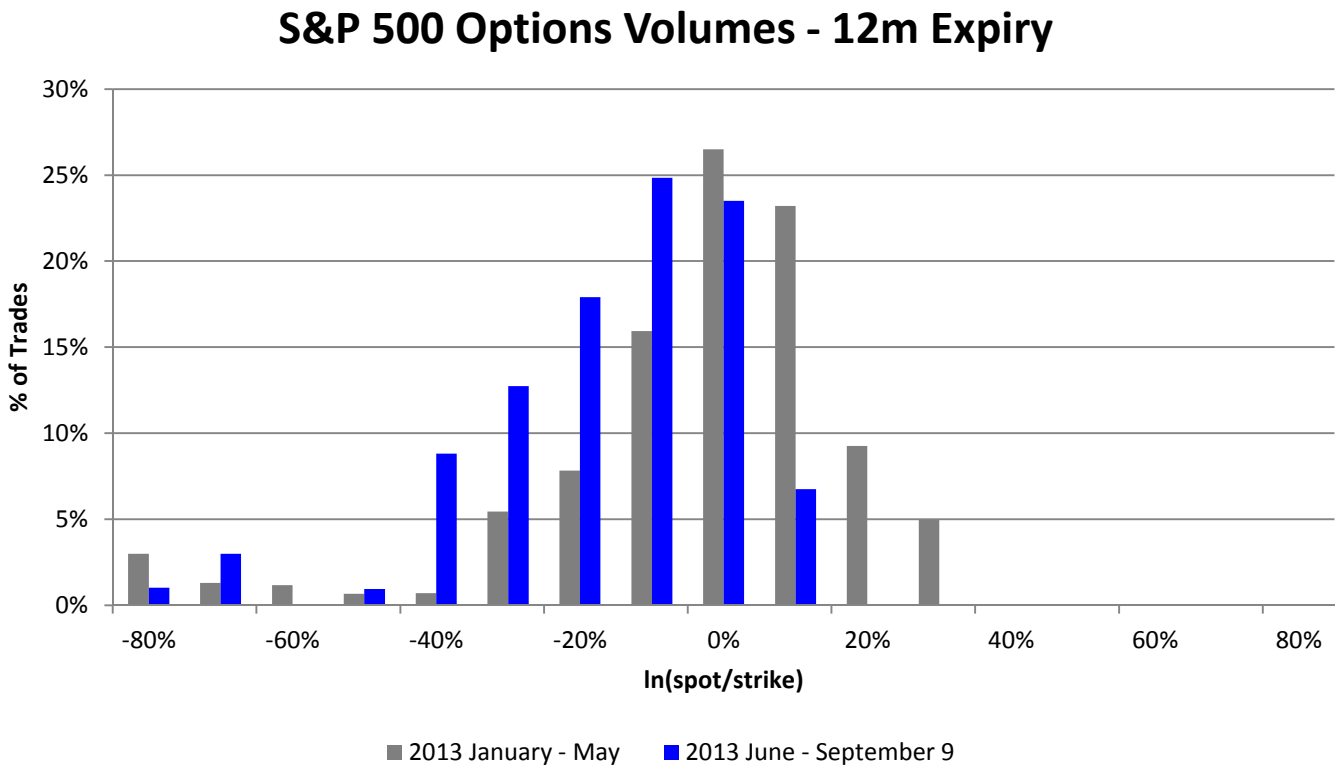
Tail Probabilities



Source: Bloomberg

Yen/Dollar RNPDs are derived from options on Yen/Dollar futures. The options have approximately three months to expiration.

Trading Activity



Sources: FactSet Data Systems

S&P 500 RNPDs are derived from options on the S&P 500 Index. The options have approximately twelve months to expiration.

Enhancing Public Visibility of RNPD Output

- We want to encourage more use of RNPD information by policymakers
  - Policymakers typically use statistical models to formulate probabilistic assessments of the future
  - Our goal is to enhance policymakers' use of RNPDs

Enhancing Public Visibility of RNPD Output

- To encourage visibility we:
  - Produce RNPD output across many asset types
  - Offer commentary
  - Avoid technical language
  - Developed an interactive website

The FRB Minneapolis Website

http://www.minneapolisfed.org/banking/rnpd/index.cfm

Enhancing Public Visibility of RNPD Output

- Communicating RNPD output has been challenging and is a work-in-progress:
  - The language of RNPDs is inherently technical, posing a barrier to policymakers and advisers
  - Lack of agreement on the benefits of combined probabilities and marginal utilities inherent in RNPD output
  - Work is needed regarding what to monitor and how to respond to changes in output