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Discussion of

The Economics of Options-Implied Inflation Probability Density Functions

by Yuriy Kitsul and Jonathan H. Wright

Pavol Povala

University of Lugano
Institute of Finance

Summary

The paper:

- Use CPI inflation caps and floors to study the inflation risk-neutral densities
⇒ more comprehensive description of inflation beliefs
- Investors require substantial compensation for exposure to inflation tails, pricing kernel U-shaped in inflation
- Components:
 1. Construct **Arrow-Debreu** securities (integer support) ⇒ approximate the RN density & obtain prob. for tails
 2. Combine statistical models for inflation and derivatives ⇒ **empirical pricing kernel**

My discussion:

- Do higher moments of inflation beliefs matter? How?
- Cash instruments vs. derivatives and risk premia

Inflation and the real economy

- Can we learn more about real-nominal trade-off (Phillips curve) from inflation derivatives?
- Biggest moves in prob. of both tails ($> 1Y$) linked to **financial conditions** (QE, Eurozone) and **real activity** (payrolls, retail sales)

Probability of deflation

Table 2: Regression of Implied Probability of Deflation onto Macroeconomic Surprises

	One Year	Three Years	Five Years	Seven Years	Ten Years
CPI	-10.94*** (3.35)	-0.80 (2.83)	-0.63 (0.84)	-0.50 (0.74)	-0.49 (0.66)
Existing Home Sales	-3.65 (3.83)	-0.43 (0.32)	-0.70*** (0.25)	-0.45*** (0.17)	-0.33** (0.15)
FOMC	1.13 (0.80)	-0.06 (0.19)	-0.16 (0.19)	-0.08 (0.13)	-0.13 (0.17)
GDP (Advance)	-0.48 (1.09)	-0.11 (0.44)	-0.04 (0.31)	0.06 (0.26)	0.05 (0.25)
Housing Starts	1.41 (5.46)	2.36 (1.72)	-0.36 (1.38)	1.97 (1.75)	1.87 (1.77)
New Home Sales	-15.87 (18.35)	-9.16 (6.93)	-1.59 (1.71)	-0.27 (1.27)	0.23 (1.50)
Nonfarm Payrolls	-0.43 (0.53)	-0.20 (0.17)	-0.39* (0.21)	-0.22* (0.12)	-0.22** (0.10)
PPI	-0.71 (1.05)	-0.84* (0.50)	-0.56*** (0.19)	-0.49*** (0.17)	-0.16 (0.14)
Retail Sales	-0.53 (0.38)	-0.34 (0.26)	-0.54** (0.22)	-0.23** (0.12)	-0.22** (0.10)

Probability of high inflation

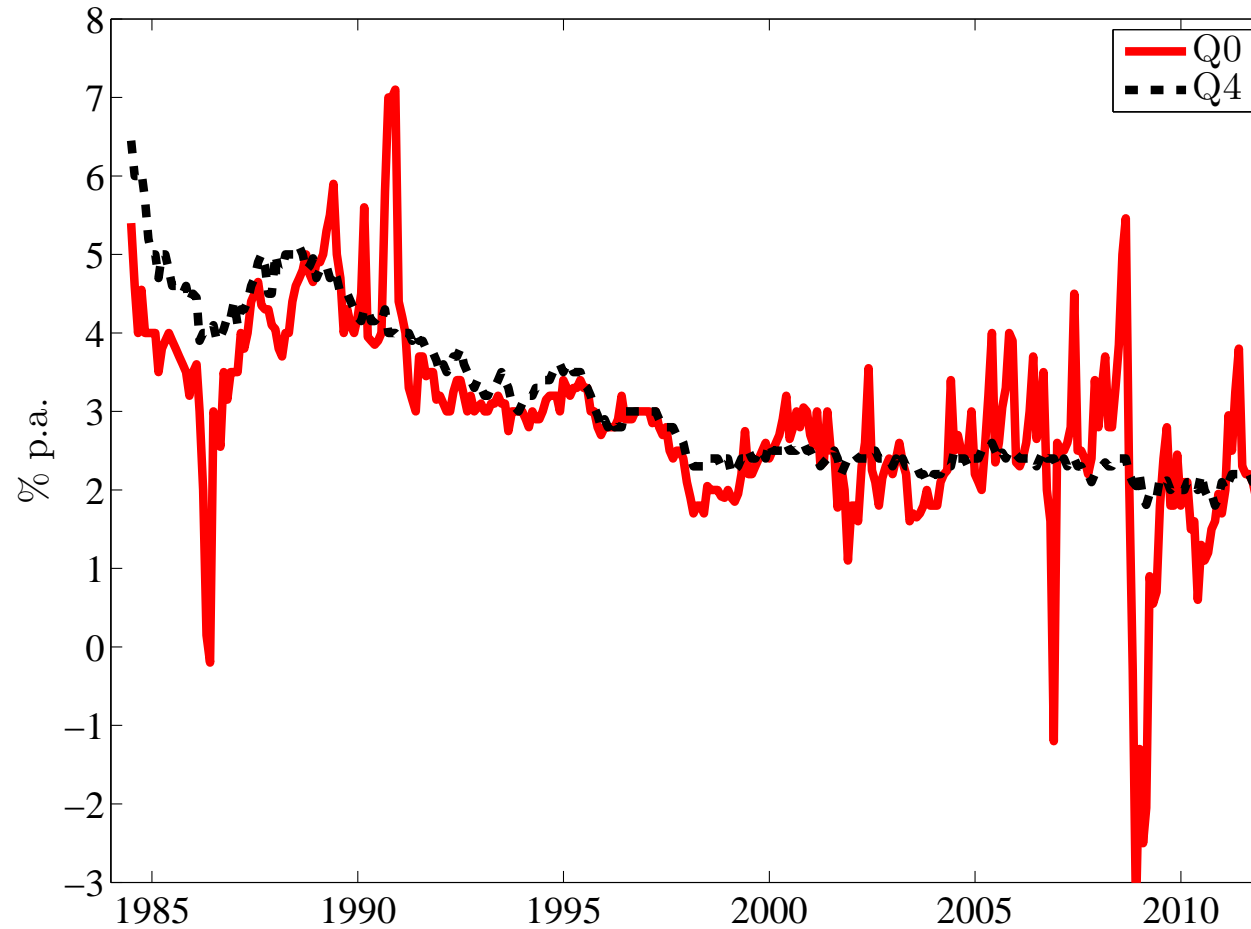
Table 3: Regression of Implied Probability of High Inflation onto Macroeconomic Surprises

	One Year	Three Years	Five Years	Seven Years	Ten Years
CPI	6.91*** (1.74)	3.50*** (1.06)	-1.42 (3.71)	-2.45 (3.94)	2.21 (2.85)
Existing Home Sales	1.01 (1.06)	0.29 (0.32)	0.80* (0.47)	0.71** (0.34)	0.68 (0.43)
FOMC	-0.34 (0.28)	0.15 (0.16)	-0.03 (0.37)	0.13 (0.26)	0.34 (0.36)
GDP (Advance)	0.31 (0.65)	0.01 (0.29)	-0.02 (0.41)	0.09 (0.38)	0.16 (0.51)
Housing Starts	-1.08 (1.66)	-0.36 (1.31)	0.42 (1.96)	-1.95 (2.17)	-2.87 (4.12)
New Home Sales	-1.49 (1.93)	-1.72 (4.37)	1.51 (2.57)	2.67 (2.45)	6.40** (2.92)
Nonfarm Payrolls	0.02 (0.28)	0.15 (0.17)	0.15 (0.09)	0.23 (0.16)	0.67** (0.27)
PPI	0.18 (0.51)	0.15 (0.38)	0.00 (0.16)	0.52 (0.33)	0.52 (0.56)
Retail Sales	-0.07 (0.18)	0.18 (0.15)	-0.14 (0.14)	0.16 (0.17)	0.61** (0.25)

Inflation

Inflation expectations converge fast to the local mean

CPI inflation surveys, 1984-2011

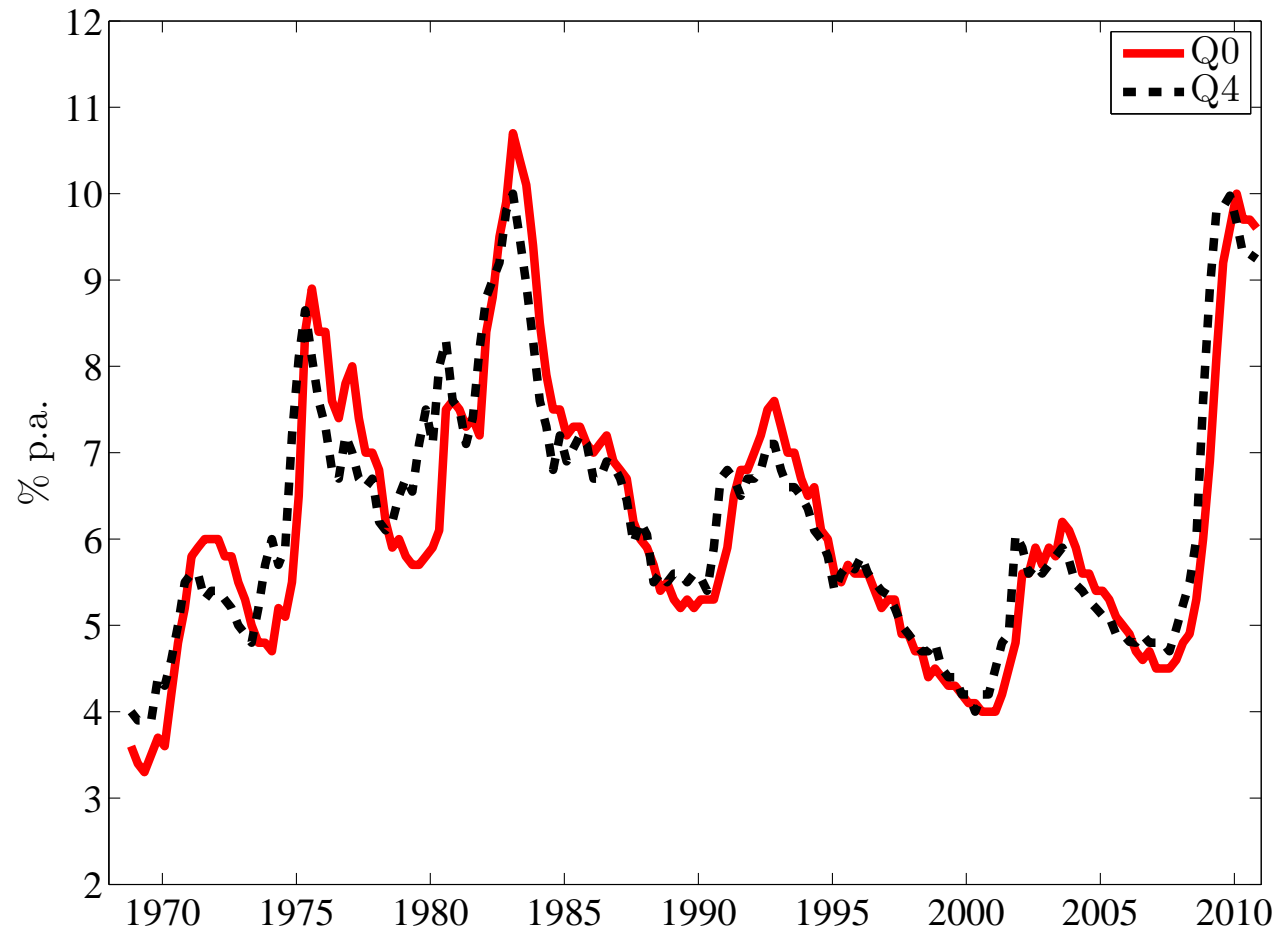


Source: BCFF

Unemployment

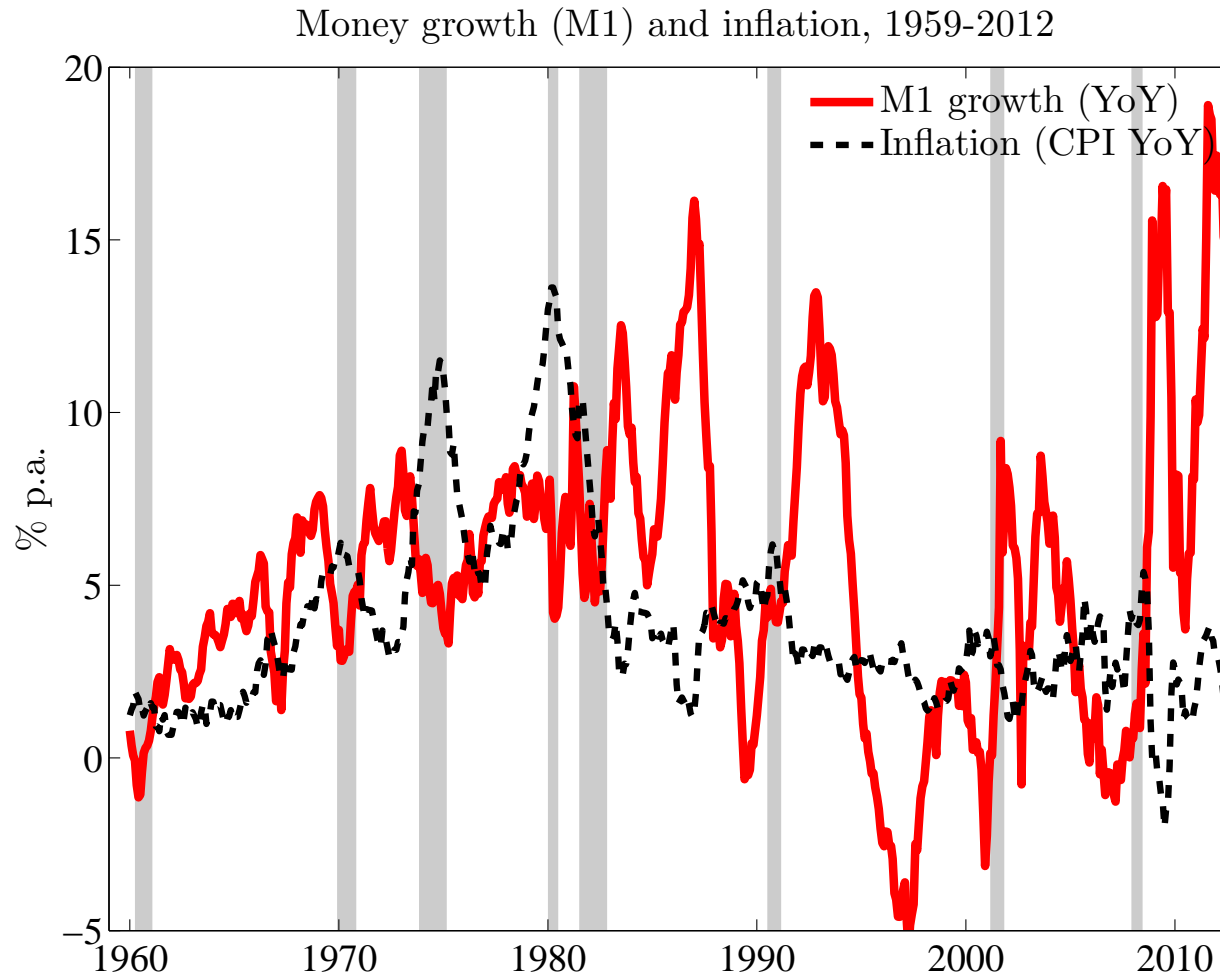
Predictions of real activity close to RW

UNEMPL surveys, 1968-2010

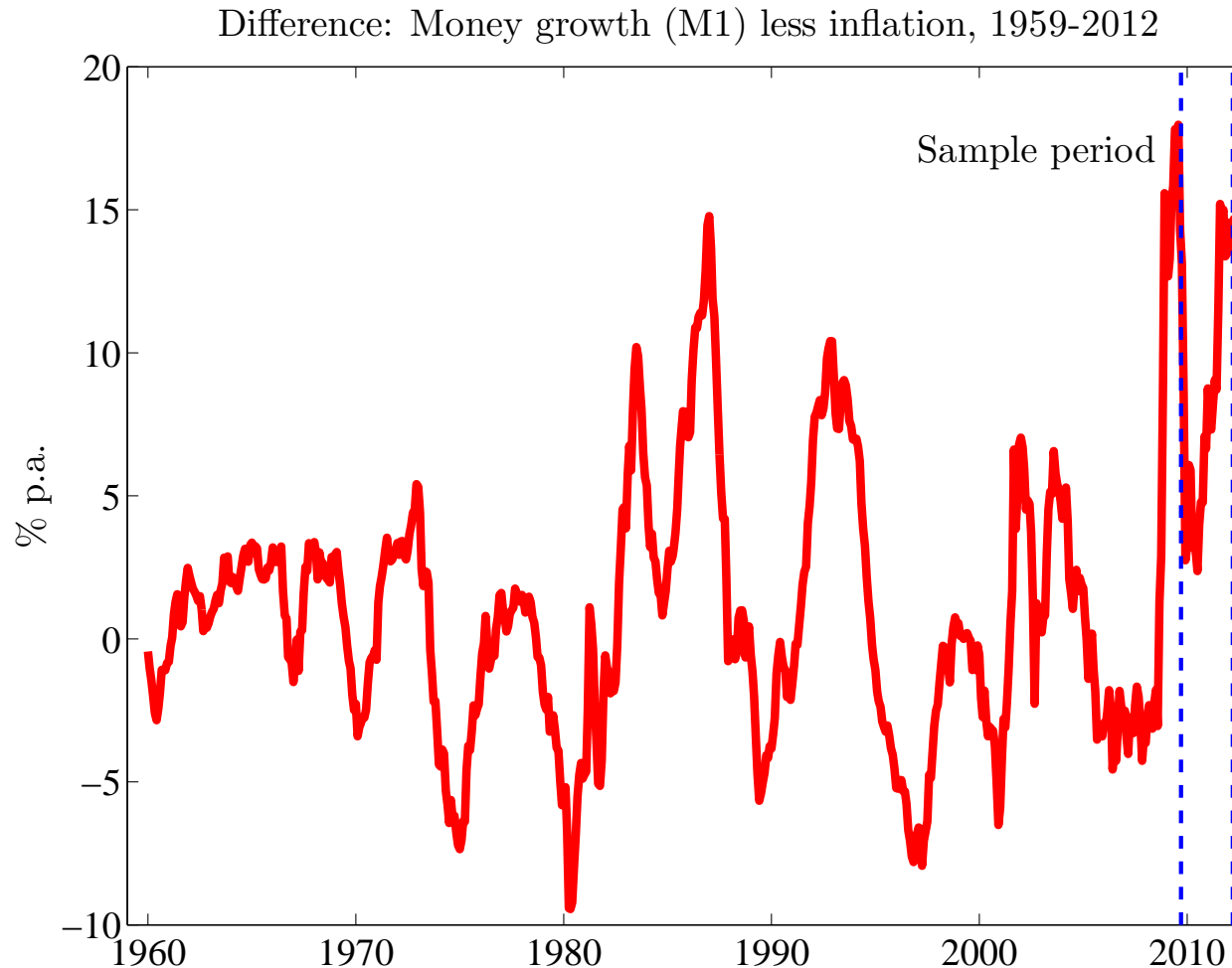


Source: SPF

Why are tails of inflation PDFs sensitive to real activity?



Why are tails of inflation PDFs sensitive to real activity? (cont'd)



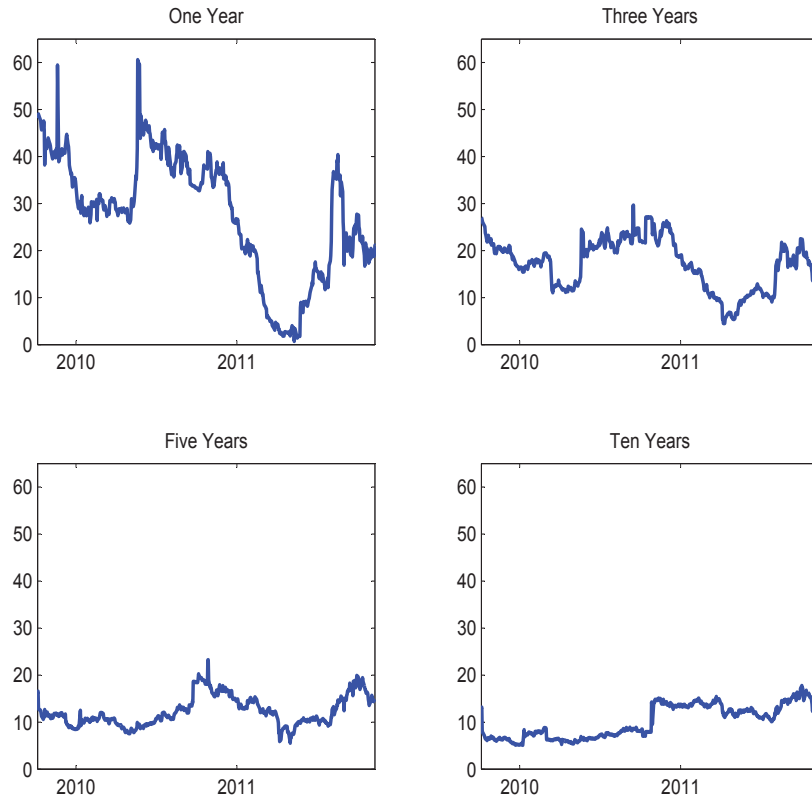
Highest discrepancy between money growth and inflation on record \implies inflation expectations sensitive to news on real activity (at some point the multiplier kicks in)

Inflation and asset prices

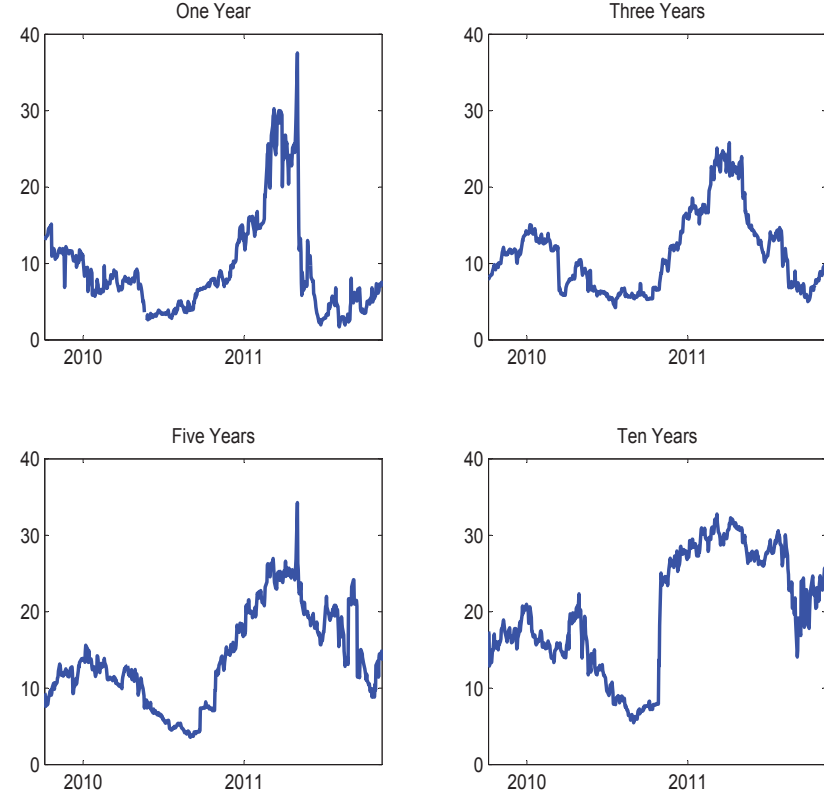
- Bond prices largely reflect the **local mean** [long term inflation expectations] of inflation, see also Ajello, Benzoni, and Chyruk (2012) \implies not much short run variation through expectations
- Inflation risk premia in nominal bonds seem **small in magnitude** and close to zero unconditionally, e.g. Grishchenko and Huang (2012)
- Taken together, nominal Treasuries provide **little information** about inflation beyond its long term expectations
- Term structure of bond volatilities is **informative** about the higher moments of inflation
- Li and Zhao (2009) find the U-shaped state-price density using LIBOR derivatives, i.e. same interpretation \implies use **LIBOR instruments** to lengthen the sample back to 2000s?

Stochastic skewness

Probability of deflation

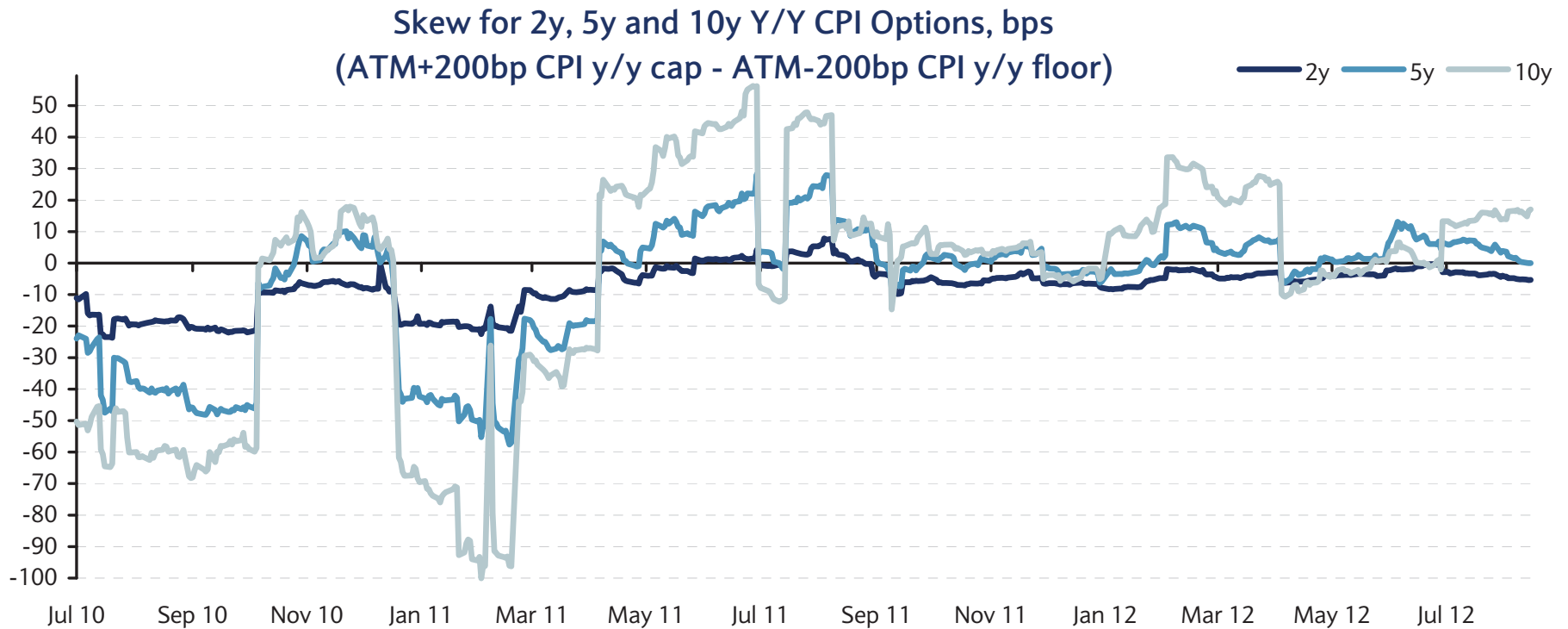


Probability of high inflation



□ Skewness likely switches sign

Stochastic skewness (cont'd)



Source: Barclays Research

- Variation in skewness has cleaner economic interpretation compared to other markets

Do inflation derivatives square with cash bonds?

- Why is the inflation risk premium not fully reflected in nominal bonds?
- Why are inflation derivatives non-redundant?
 1. Heterogenous beliefs \iff transaction costs
 2. Price discovery \iff information sensitivity
- Start of inflation derivatives market endogenous \implies similar to sovereign CDS market
- Discrepancy between sov. CDS and credit risk implied by cash bonds, i.e. basis, negative swap spreads
- Similar situation in inflation derivatives market?

Empirical exercises

- Construct the vol surface?
- How does it compare to the LIBOR vol curve?
- Continuous support for SPD?

References

AJELLO, A., L. BENZONI, AND O. CHYRUK (2012): “Core and “Crust”: Consumer Prices and the Term Structure of Interest Rates,” Working paper, Federal Reserve Bank of Chicago.

GRISHCHENKO, O., AND J. HUANG (2012): “Inflation Risk Premium: Evidence from the TIPS market,” Finance and Economics Discussion Series, Federal Reserve Board.

LI, H., AND F. ZHAO (2009): “Nonparametric Estimation of State-Price Densities Implicit in Interest Rate Cap Prices,” *Review of Financial Studies*, 22, 4335–4376.