Discussion of Real-Time Measurement of Business Conditions
by Aruoba, Diebold and Scotti

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The views expressed are not necessarily those of FRBNY or FRS.

Overview of Paper

- Develops a tractable dynamic factor model at daily frequency
  - Natural complement to vast dynamic factor literature
  - Reminder of relevance of some earlier work
- Proof of concept application using 4 important variables
  - "matches" NBER chronology
  - Factor coming down from "all time high" at end of 2006

Assessment

- Paper addresses an important issue
  - For central banks understanding evolution of business conditions at high frequency
  - Using mixed frequency and type of indicators
  - real-time updating easy to implement (not discussed in paper)
- Aspects of modeling contribution are very specific, allows precise results
  - Cubic trend
  - avoids use of logarithms
  - Strict classification of variables into flow and stock
- Focus comments
  - Real-Time Updating
  - Definition of business cycle
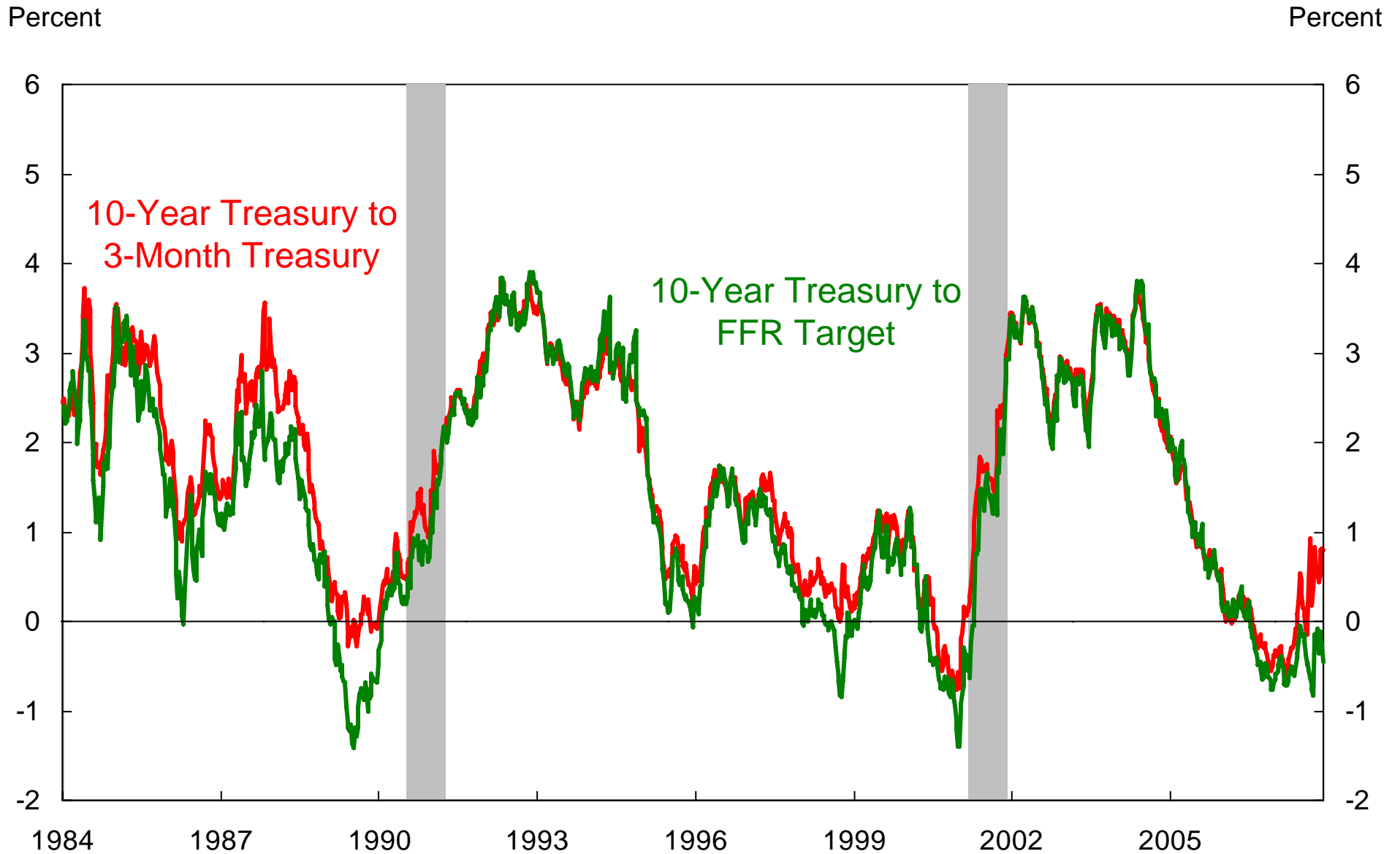 - Role for time variation

Estimation Approach

- Authors use maximum likelihood to estimate unknown parameters
- Challenging because likelihood evaluation is time consuming with just over 16,000 observations
  - They use a multi-step approach starting from smaller system to obtain sensible point estimates
- Bayesian approach would be much easier and allow for a richer model (more variables and unknown parameters)

Daily Updating

- Updating rhythm
  - At end of every business day, new observation on term premium
  - Most Thursday's update on weekly claims from prior week+revisions to earlier week
  - First Friday (with occasional exceptions) of month update non-farm payrolls from prior month+revisions to previous two months and every October revisions to level in March of year
  - c 30 days after end of quarter start receiving information on GDP growth, 3 estimates then continuing revisions.

- At end of each day update forecast distribution for variables not observed using latest estimate of dynamic factor
  - Simple to do from Kalman filter operations under authors exact assumptions (ignoring revisions)
  - Allows measure of suprise in macro release in two ways
    - Using only prior day estimates
    - With term premium immediately after macro release (under martingale assumption for rest of day)

Variable Choice

- Many daily financial variables could be used
  - large data set approaches use more variables
- Term premium is an obvious choice
  - Monthy and quarterly averages "lead" activity
- Daily term premium is a more complex object
  - 3 month and 10 year can be hit by different flight to quality concerns
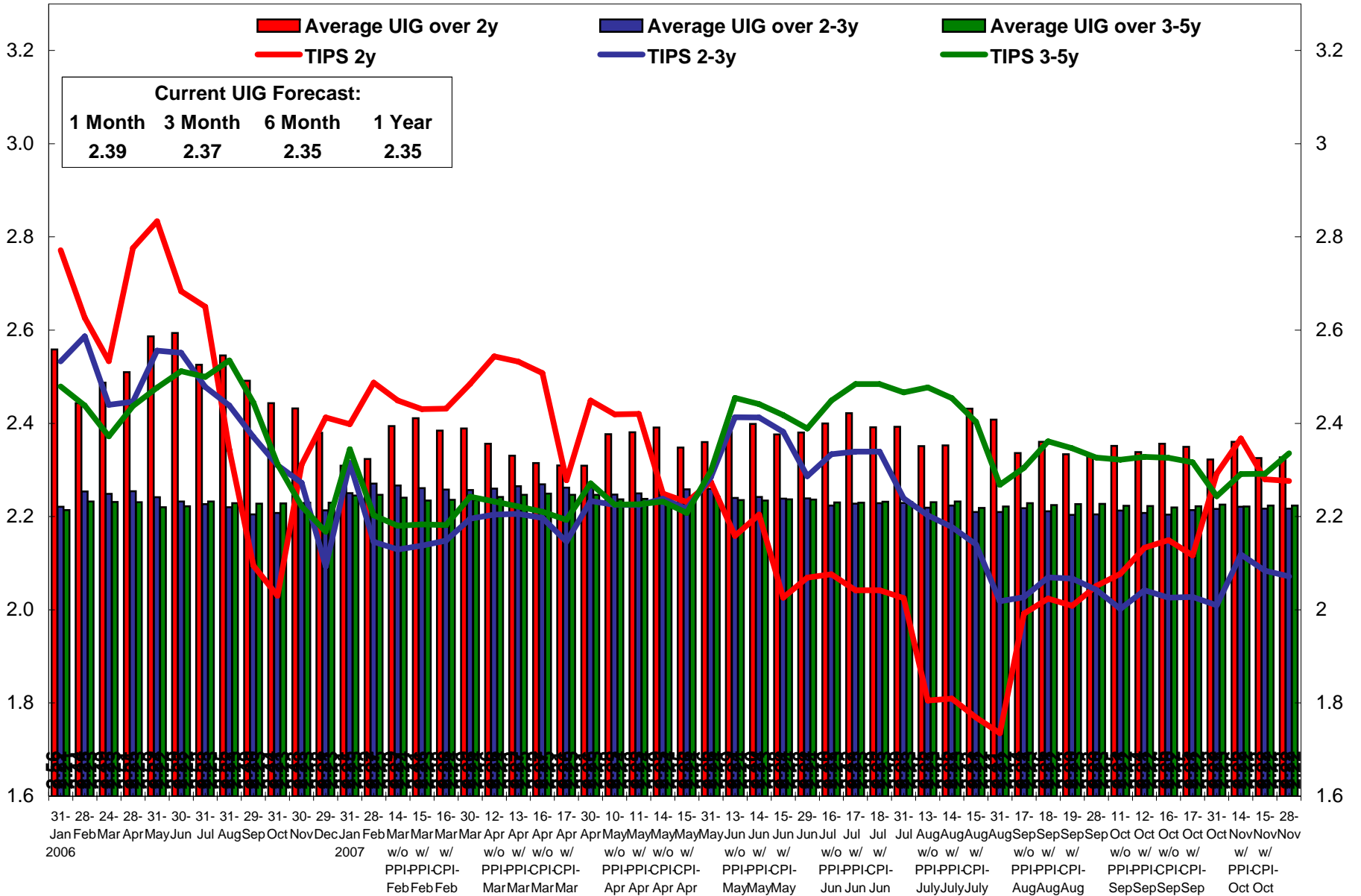 - in large data set approach can use many measures

Interest Rate Spreads

Percent

Percent

10-Year Treasury to
3-Month Treasury

10-Year Treasury to
FFR Target

6

5

4

3

2

1

0

-1

-2

1984   1987   1990   1993   1996   1999   2002   2005

Source: Federal Reserve Board

Note: Shading represents NBER recessions.

Underlying Inflation Gauge

Current UIG Forecast:

1 Month	3 Month	6 Month	1 Year
2.39	2.37	2.35	2.35

Legend: Average UIG over 2y, Average UIG over 2-3y, Average UIG over 3-5y, TIPS 2y, TIPS 2-3y, TIPS 3-5y

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What is the business cycle at high frequency?

- Fischer Black: "intra-day business cycle"
  - What is the business cycle like over the weekend?
  - What about seasonality?
- Burns and Mitchell: Business cycle time
  - Stock's 1980s work on time deformation closely related to ADS paper
- Daily NBER dating rather than standard approach
  - recession starts sometime in peak month, ends sometime in trough month
  - Stock and Watson some events might be hard to classify as recessions/expansions
    - Classification more difficult at daily level

Distribution of Paycheck Periods

	share
weekly	48%
bi-weekly or semi-monthly	47%
monthly	5%

Decline in the Number of Job Changers with Two Payroll Entries Not Listed as Dual Job Holders

	Share of transitional paychecks	Probability that 1st job is covered by a reference period paycheck <1>	Probability that 2nd job is covered by a reference period paycheck <1>	Effect on payroll employment (thousands)
transitions				
weekly to weekly	0.23	0.25	0.25	0
weekly to bi-weekly	0.22	0.25	0.50	-27
weekly to monthly	0.03	0.25	1.00	-6
bi-weekly to weekly	0.22	0.50	0.25	-27
bi-weekly to bi-weekly	0.22	0.50	0.50	-52
bi-weekly to monthly	0.02	0.50	1.00	-12
monthly to weekly	0.03	1.00	0.25	-6
monthly to bi-weekly	0.02	1.00	0.50	-12
monthly to monthly	0.00	1.00	1.00	-3
sum	1.00			**-145**

<1>Probability job-to-job transfer will result in 2 payroll entries without being counted as a dual-job holder in the CPS. A person who works at 2 jobs during the CPS reference week will be counted as a dual job-holder.

- Use modeling trick that innovation variance to factor varies across NBER dated business cycles
  - in-sample easy to do given NBER dates
    - If in "new" business cycle requires a modeling assumption for innovation variance
  - could use to understand the business cycle classification problem
- In current model cubic trend plus estimation in levels implies differing contribution of cycle as time progresses
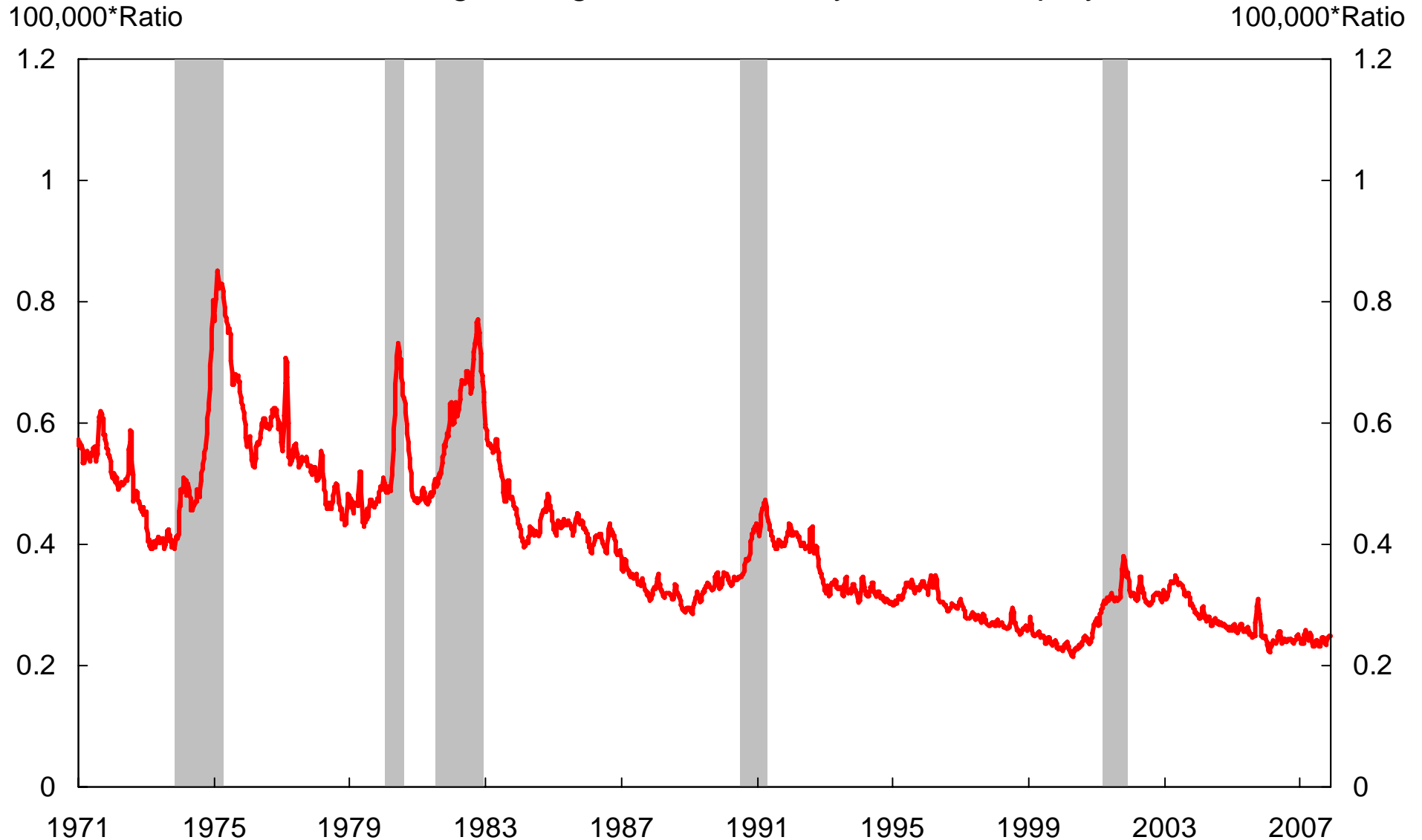
Initial Unemployment Claims
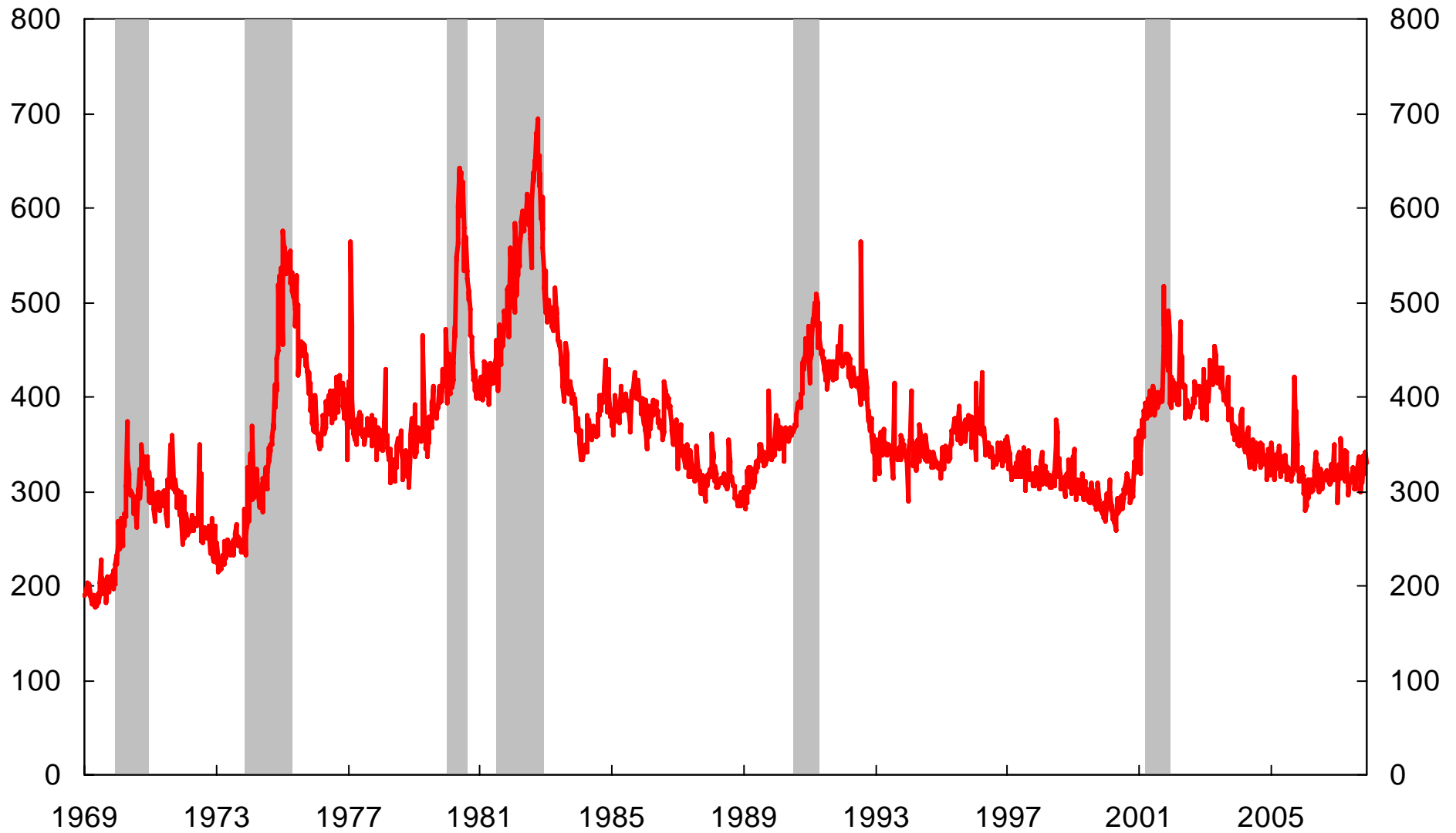
Note: Shading represents NBER recessions.

Initial Unemployment Claims

4-week moving average; normalized by insured employment

Note: Shading represents NBER recessions.

- Paper is an important addition to current factor model approaches
- Bayesian estimation algorithms would allow for real-time updating and richer model structure
- Important role for judgment on variable choice, lead/lag relationship and best transformations.