

***The Diversity of Beliefs in Real Time:
Estimates of Business Cycle Dynamics from
Macroeconomic Models***

Volker Wieland

Goethe University Frankfurt

1

**The Diversity of Beliefs about
Business Cycle Dynamics**

- Theoretical research emphasizes the potential importance of belief heterogeneity for explaining asset price and business cycle dynamics.
 - ➔ Kurz & co-authors, other papers in this workshop.
- Empirical applications use **survey data** to measure belief heterogeneity.
 - ➔ Survey of Professional Forecasters, Blue-Chip economic indicators, Federal Reserve forecasts. Kurz and Motolese (2007), Kurz (2005).

2

The Diversity of Beliefs about Business Cycle Dynamics

- **But** surveys provide no insight on **why beliefs differ**. The models of the forecasters are not available.
 - Potential sources of diversity across models and over time: different modeling assumptions/paradigms, different estimation methods, different data vintage and range.
- This talk:
 - Explore the use of a new database of empirical macroeconomic models to provide examples of representative beliefs and study sources of diversity.
 - Illustrate the effect of modeling assumptions, data revisions and new data on real-time estimates of business cycle dynamics. (Example: output gaps and forecasts).

3

A New Database for Comparative Analysis of Macroeconomic Models

- Economy-wide dynamic stochastic models that may be used
 - by central banks and finance ministries for designing monetary and fiscal stabilization policies that help reduce macroeconomic fluctuations.
 - business economists to assess macroeconomic fluctuations and likely policy responses,
 - as an input for decision analysis by asset managers, banks, other large enterprises.

4

Overall Research Agenda

- ❑ All models wrong. Some may be particularly biased. But to beat a model, you need one. Competition is good.
- ❑ Create an archive of macro models and a platform for easy comparison (*Dynare/Matlab*) .
 - ➔ Comparative instead of insular approach to model development.
 - ➔ Useful for evaluating the robustness of policies. Discretionary actions as well as rules.
 - ➔ Provides a new perspective on the diversity of model-based estimates and forecasts.

5

Earlier Comparison Projects

- ❑ Brookings Institution:
 - Bryant, Currie, Frenkel, Masson, Portes, (eds.) (1989), and Bryant, Hooper, Mann (eds) (1993) (Taylor rule)

- ❑ NBER:
 - Taylor (ed.) (1999)

Note! Comparisons involved researcher teams, each working with its own model.

Instead, we build a platform that makes a large range of models usable for individual researchers and adding models easy.

6

Models in the Data Base (July 09)

- Estimated or calibrated macroeconomic models of the U.S. economy.
- Estimated or calibrated models of the euro area economy.
- Some estimated or calibrated multi-country models (G-3, G-7) .
- Some simple, calibrated textbook-style models.

7

Models of the U.S. Economy

- Taylor (1993) (G7)
- Christiano, Eichenbaum, Evans (JPE 2005), version of Altig et al (2004).
- Smets and Wouters (AER 2007)
- Federal Reserve's FRB-US: Levin, Wieland, Williams, (AER 2003)
- FRB SIGMA: Erceg et al 2008 (2 countries)
- Others: Fuhrer and Moore (1995), Orphanides and Wieland (1998), Rotemberg and Woodford (1999), McCallum and Nelson (1999), Orphanides (2003), Rudebusch and Svensson (1999), Coenen and Wieland (2003) (G3).

8

Models of the Euro Area Economy

- Smets and Wouters (JEEA 2003)
- ECB's Area-Wide Model: Fagan et al (2004)
- Coenen and Wieland (EER 2005)
- Laxton and Pesenti (JME 2003) (2 countries)
- EU-Quest: Ratto, Roeger, in't Veld, (2009)
- Adolfson, Laseen, Linde, Villani (2007).

9

Papers Using the Data Base

- „**A new comparative approach to macroeconomic modeling and policy analysis**“, Wieland, Cwik, Müller, Schmidt, Wolters, draft, May 2009.
- „**Surprising comparative properties of monetary models: Results from a new model data base**“, Taylor, Wieland, NBER WP 14849, April 2009.
- „**New Keynesian versus old Keynesian government spending multipliers**“, Cogan, Cwik, Taylor, Wieland, NBER WP 14782, March 2009.
- „**Keynesian government spending multipliers and spillovers in the euro area**“, Cwik, Wieland, CEPR DP 7389, August 2009.
- „**The illusion of precision: Estimating the business cycle in real time**“, Wolters, Wieland, work in progress.

10

Estimating the Business Cycle in Real Time

M. Wolters & V. Wieland, work in progress.

1. Consider multiple models (of beliefs) regarding the U.S. economy.
2. Match models with real-time data set: i.e. construct quarterly data vintages, 1970 till 2008, (St. Louis Fed-ALFRED & Philadelphia Fed data bases).
3. Re-estimate models on successive data vintages.
4. Compare key characteristics of the business cycle (e.g. the output gap) across models, over time and across vintages.

11

U.S: Models and Output Gaps

- Compare:
 - Simple New-Keynesian model (explains output, inflation and interest rates).
 - Medium-sized New-Keynesian DSGE model (Christiano, Eichenbaum and Evans (2005), version of Smets and Wouters (2007)).
 - Simple trend-based models of output gap for traditional Phillips curves (linear trend, HP filter, quadratic trend).
 - Expert views: Congressional Budget Office, CEA and Federal Reserve staff estimates.

12

Output Gaps and Business Cycle Dynamics

- Gaps plays key role in shaping beliefs and output and inflation forecasts based on Keynesian-style models and thinking.

$$\pi_t^V = \beta^{M,V} \pi_{t+1|t,M,V}^e + \alpha^{M,V} \left(y_t^V - z_t^{M,V} \right) + \varepsilon_t^{M,V}$$

π : inflation, y : output, z : potential/natural output

α : parameter, ε : shock

subscripts: t = time period

superscripts: e = expectations

M = estimates depend on model

V = estimates depend on data vintage 13

Medium-Sized New-Keynesian DSGE Model

Smets and Wouters (2007): largely based on Christiano, Eichenbaum and Evans (2005).

- ➔ Micro-foundations, i.e. cross-equation restrictions from optimizing behavior of representative households & firms.
- ➔ Rational expectations.
- ➔ Model labor supply and capital accumulation explicitly and allow for technology shocks.
- ➔ Price and wage rigidities due to Calvo contracts and indexation.
- ➔ Serial correlation of economic shocks.

Estimation Methods

- ❑ **SW 2007:** sample period 1966-2004. Bayesian estimation. Full set of shocks. Aims to explain all of output volatility.
- ❑ For simple and medium-sized NK model, we apply the Bayesian estimation methodology to successive data vintages.
 - ➔ Prior distributions as in Smets and Wouters (2007), Del Negro and Schorfheide (2004).
 - ➔ Posterior distributions and parameters calculated as in Schorfheide (2000).
- ❑ Simple gap models are estimated recursively by least squares and HP filter.

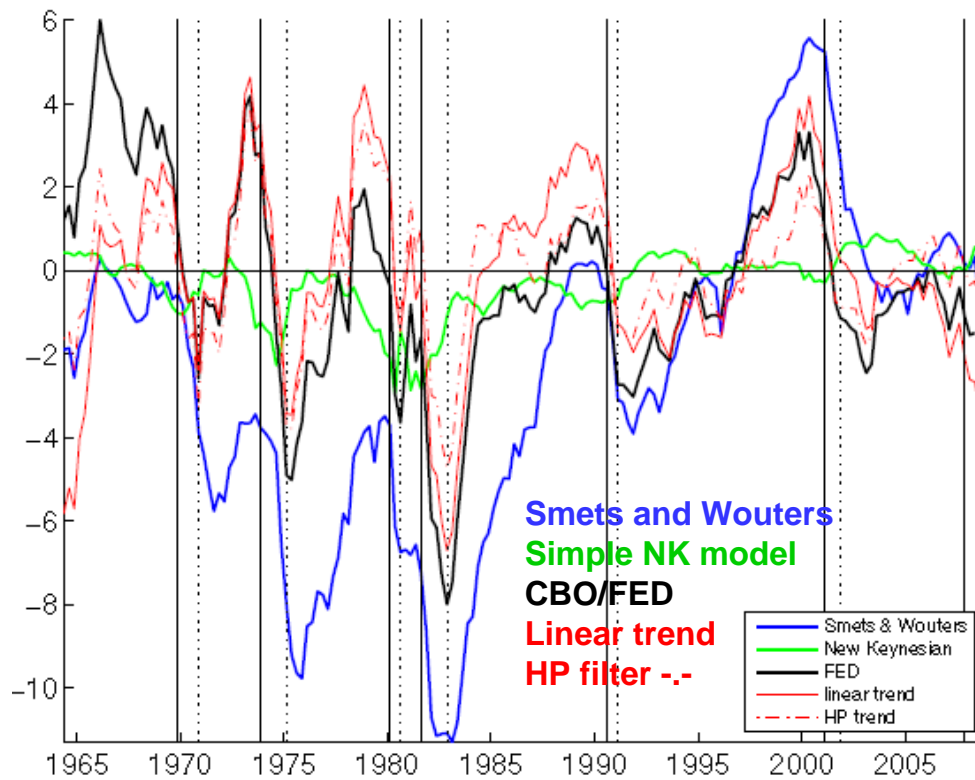
15

Data Series, Ranges and Vintages

- ❑ Up to 7 data series: real GDP/GNP, GNP/GDP deflator, personal consumption, fixed private investment, hours and employment data, wages, federal funds rates.
- ❑ We use data vintages from 1972 to 2008. The sample begins in 1964.
- ❑ End of vintage data is spliced with now-cast from the Fed staff.
 - ➔ Model-based gaps are calculated based on information that is comparable to the information underlying the Expert views (CBO, FED, CEA).

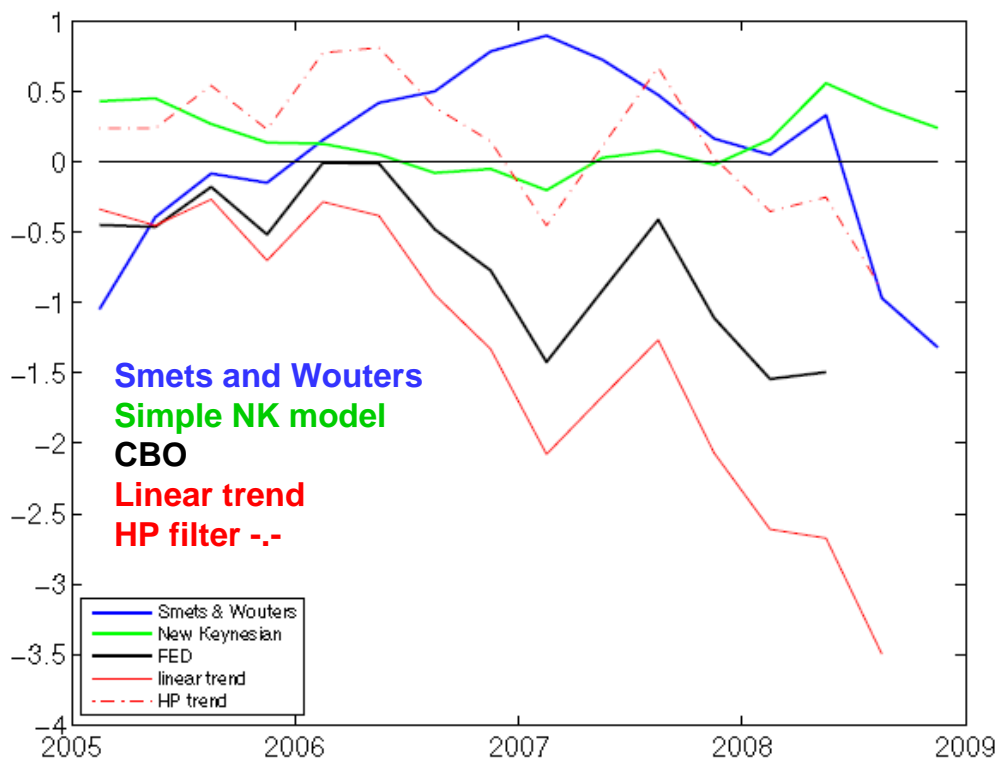
16

Diverse Output Gap Estimates: Vintage 08:4



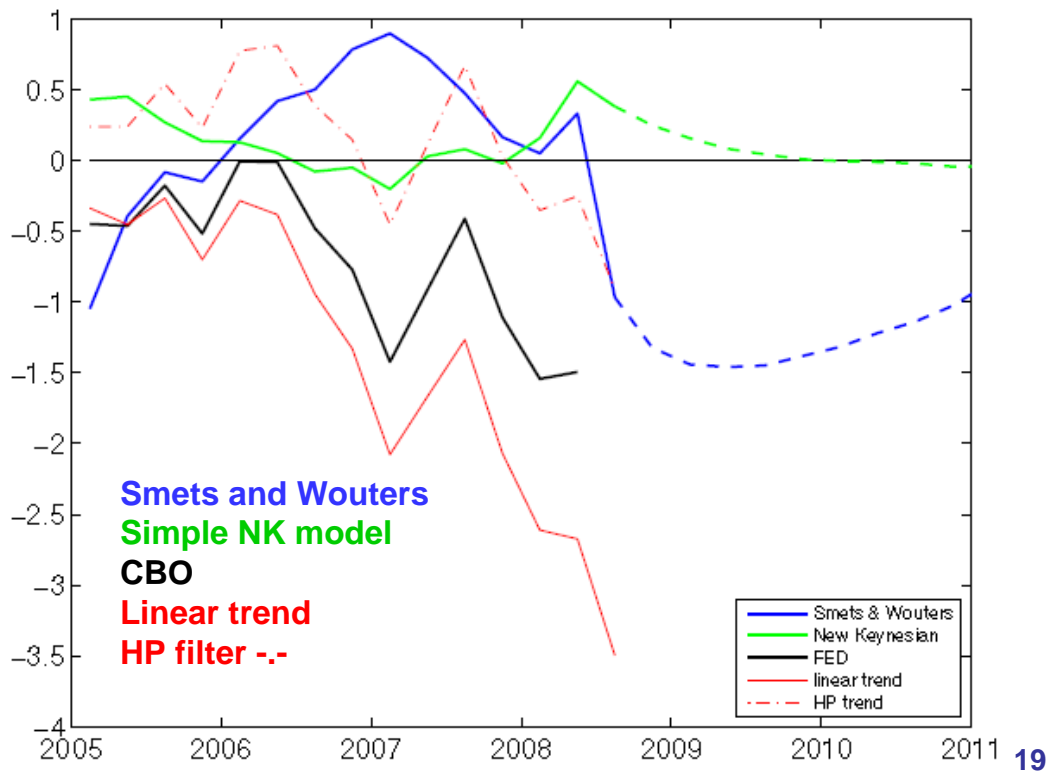
17

Output Gap Estimates: 05:1-08:4

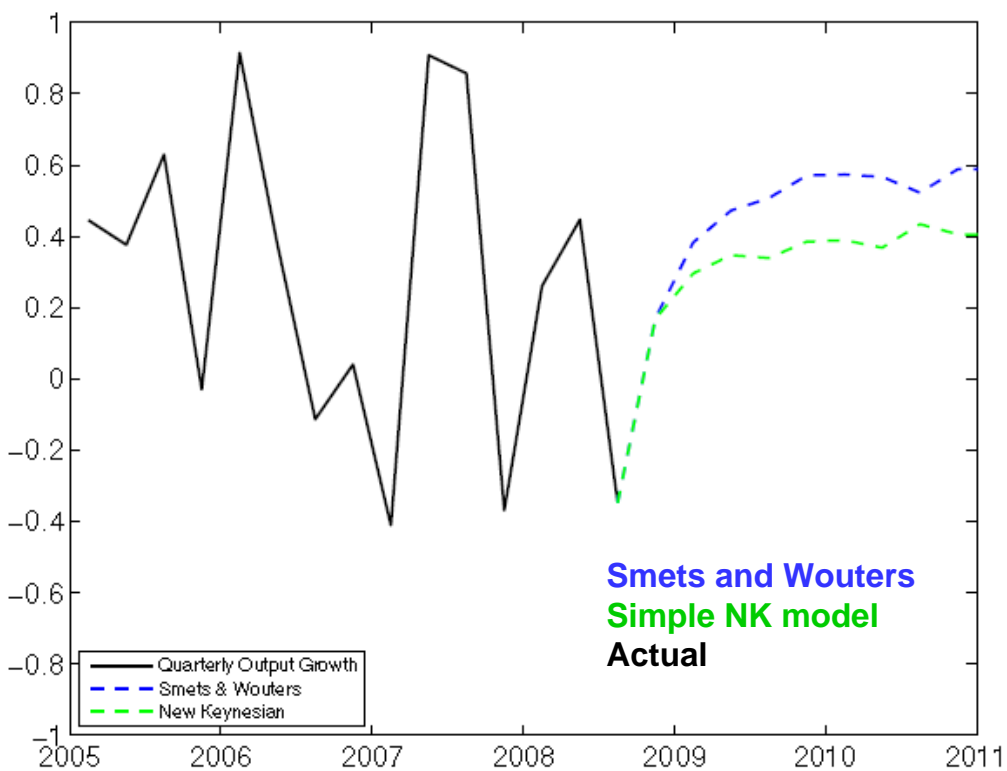


18

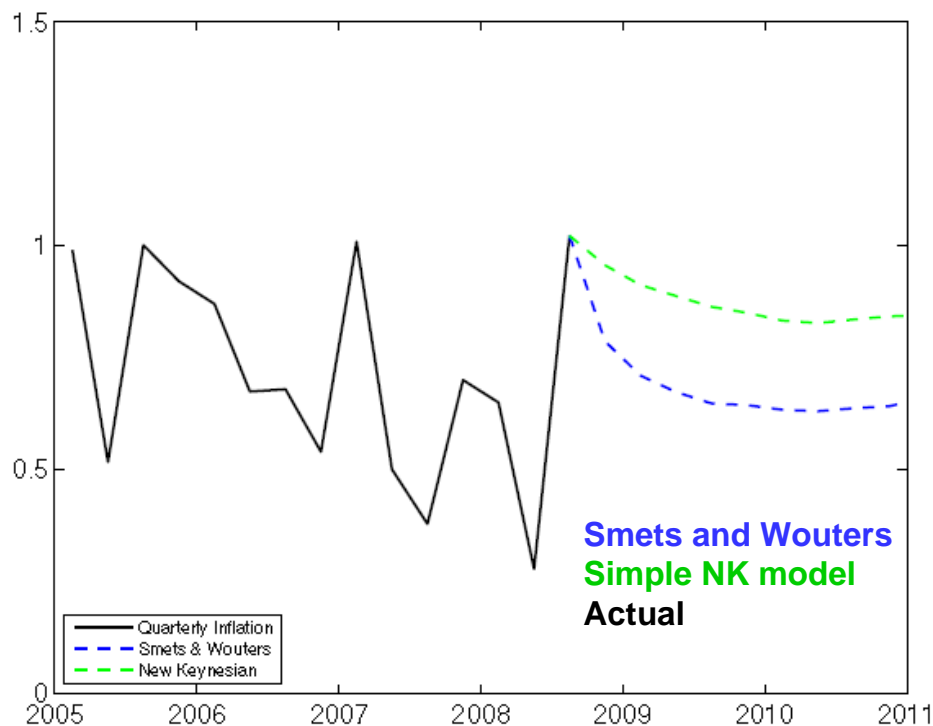
Output Gap Forecasts



Quarterly Output Growth Forecasts



Quarterly Inflation Forecasts



21

Some Historical Real-Time Analysis

- Quantify differences in output gap estimates due to choice of model, data revision, new data!
 - VINTAGE PERSPECTIVE: Focus on interesting vintages. Compare models.
 - REVISION VS HORIZON EFFECT: Look at impact of data revision and extension of data horizon.
 - BELIEF DISPERSION: Measure time-varying dispersion of (end-point) output gap estimates.

22

Select Vintages

1972:1: first oil shock

1979:1: oil price shocks, two recessions and productivity decline

1982:3: Volcker disinflation and recession

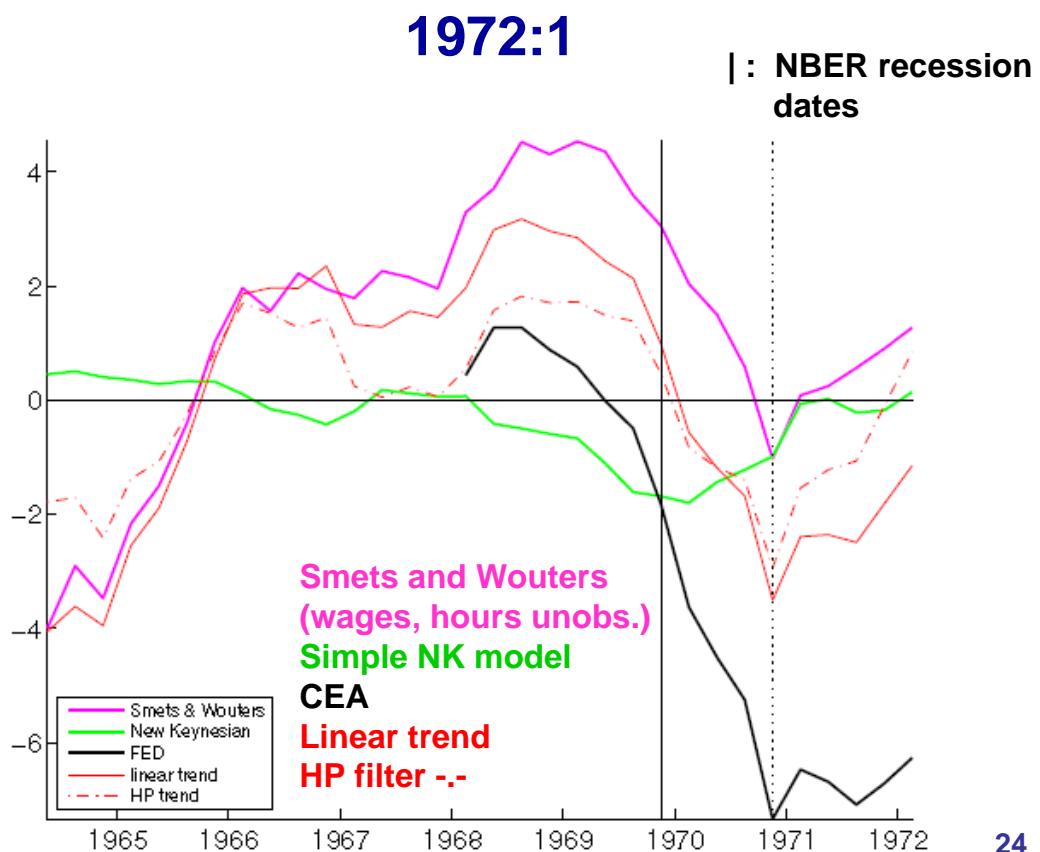
1987:3: up to stock market crash

1991:1: up to credit crunch recession

1998:1: productivity boom, Greenspan years.

2008:4: 02 recession, great moderation continued up to financial crisis.

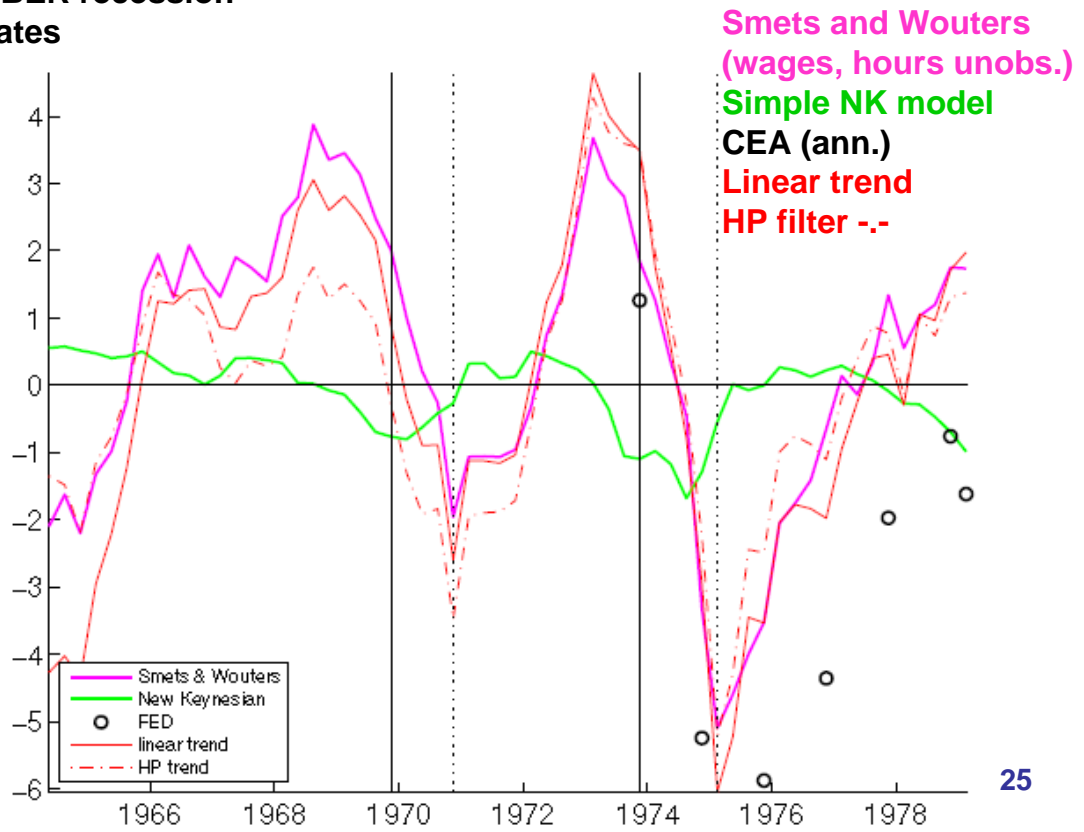
23



24

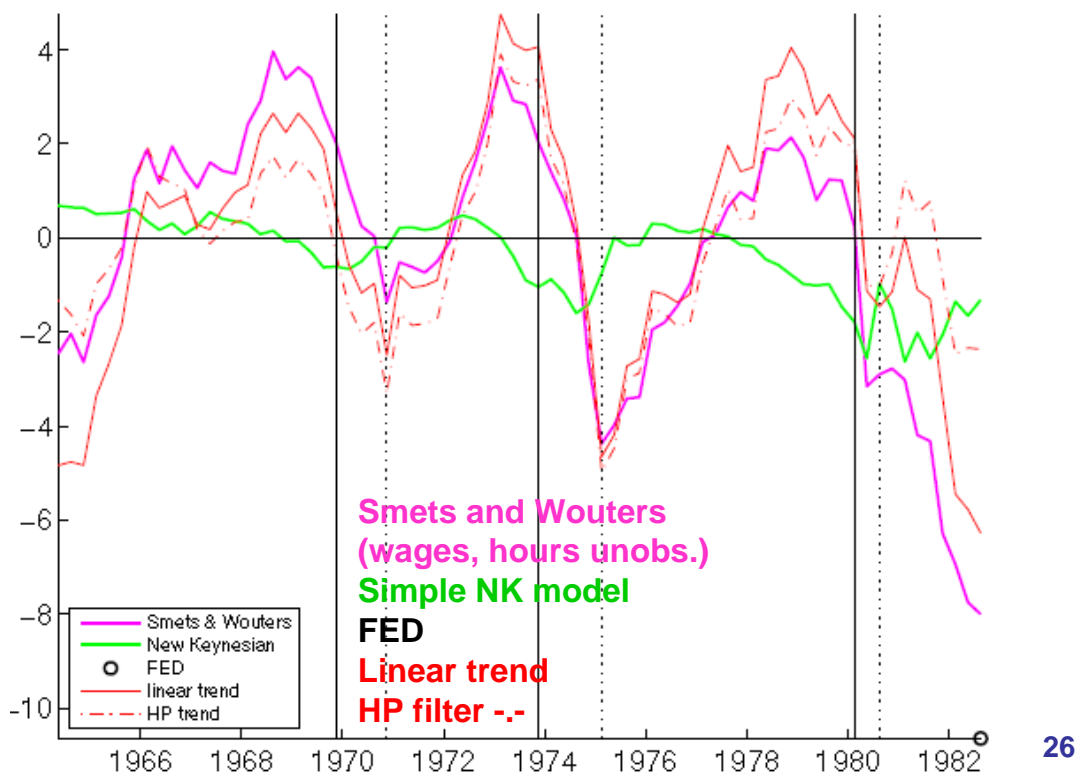
| : NBER recession dates

1979:1

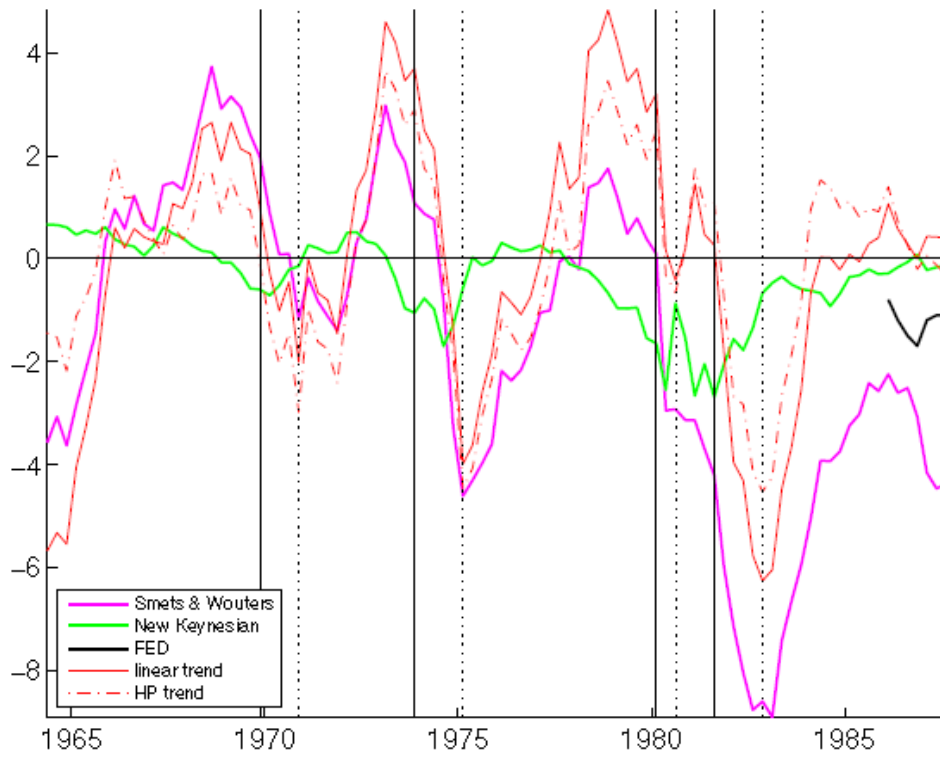


| : NBER recession dates

1982:3

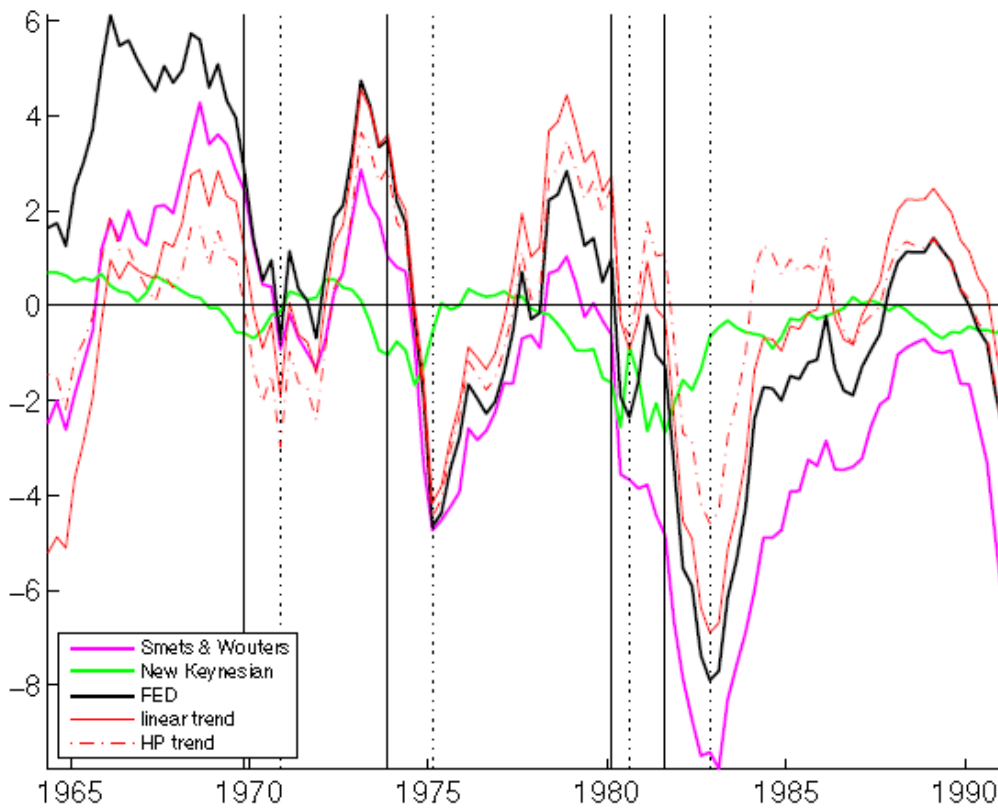


1987:3



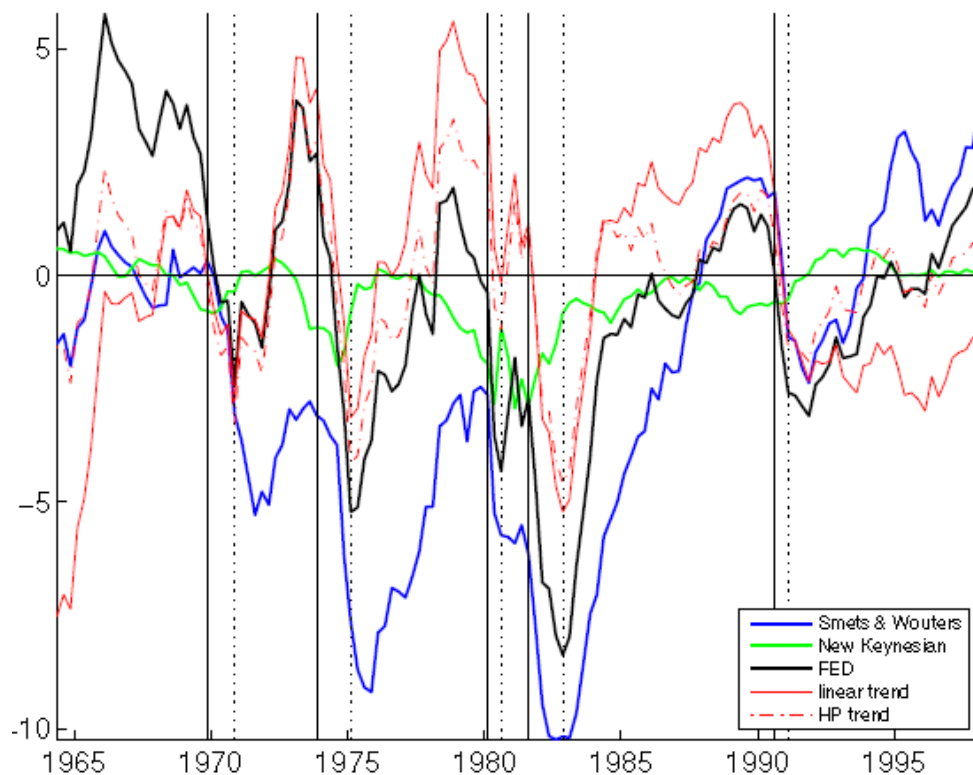
27

1991:1



28

1998:1



29

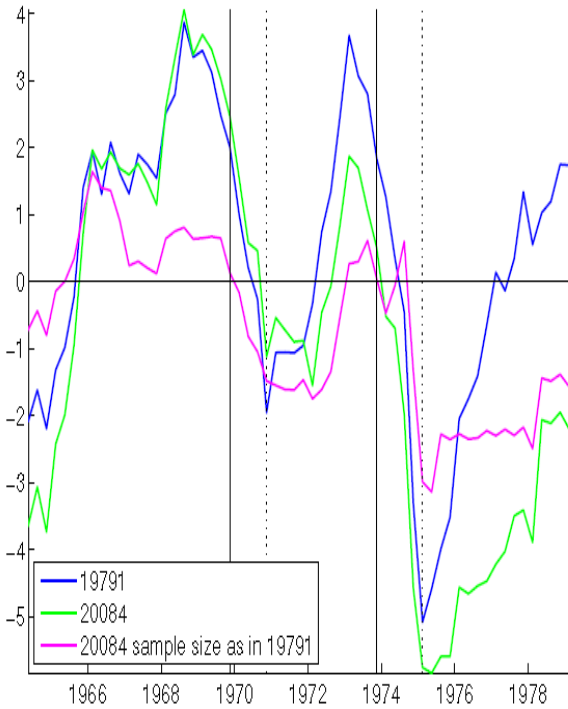
Some Findings

- 1972-82: CEA-FED expert views substantially lower than model-based estimates in recessions.
- Output gap estimates are quite diverse, particularly at the end points.
- Output gap estimates vary over time and are positively correlated.
- Output gap estimates are also strongly correlated with NBER business cycle dates.

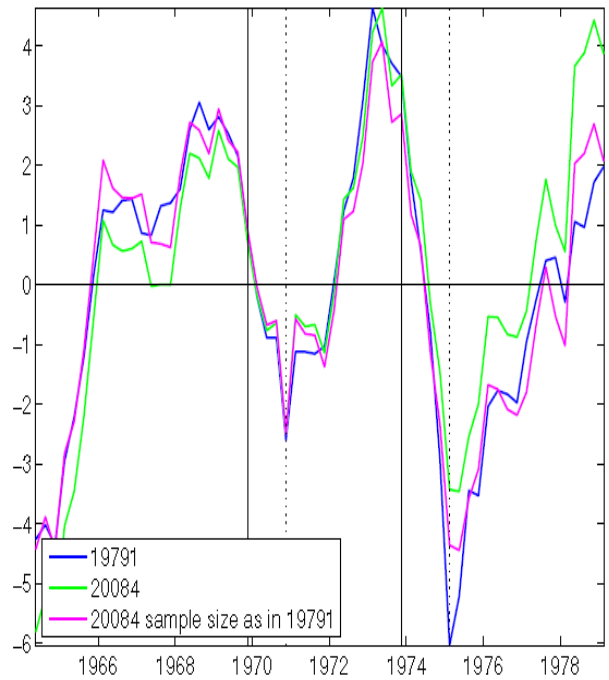
30

Data Revision vs Horizon Effect: 79:1

Smets and Wouters



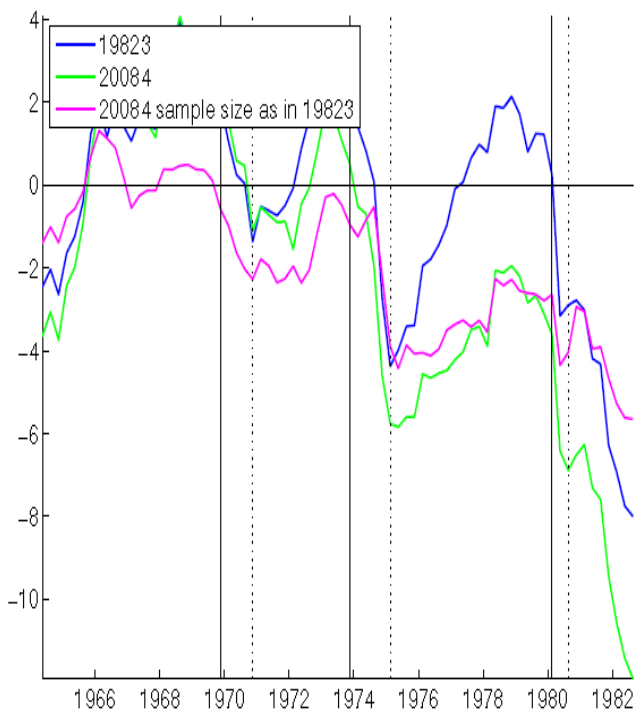
Linear Trend Gap



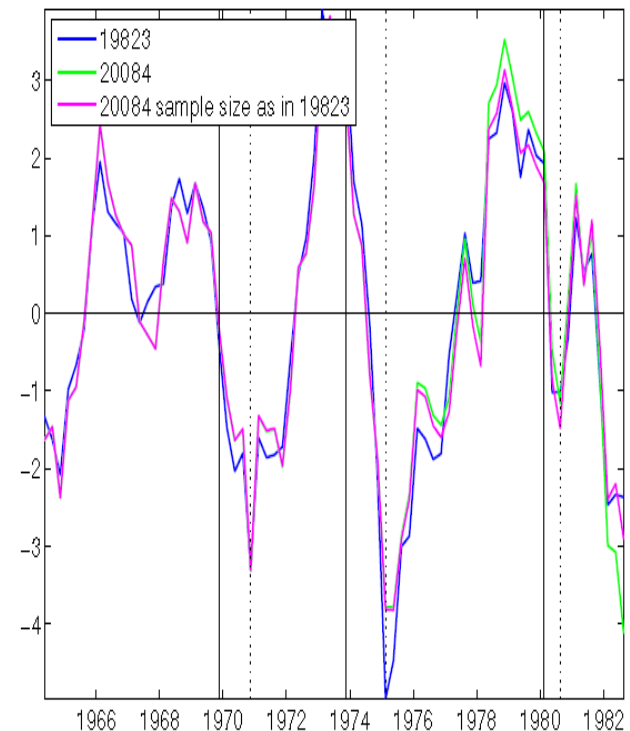
31

Data Revision and Horizon Effect: 82:3

Smets and Wouters

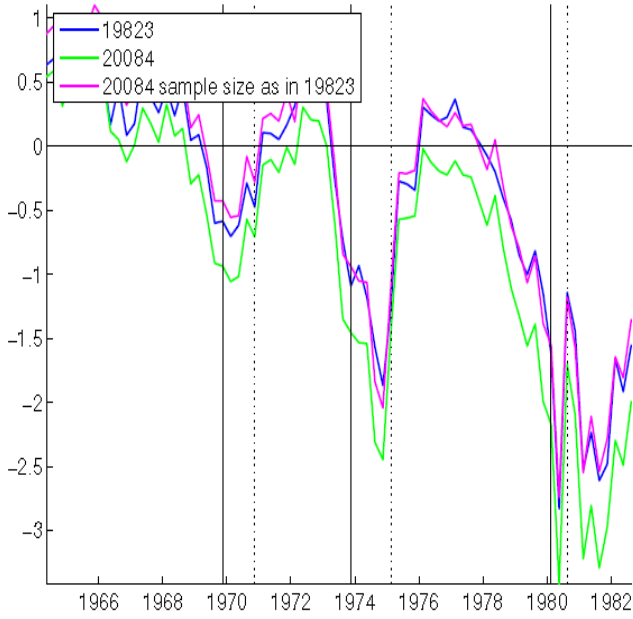


HP Filter Gap

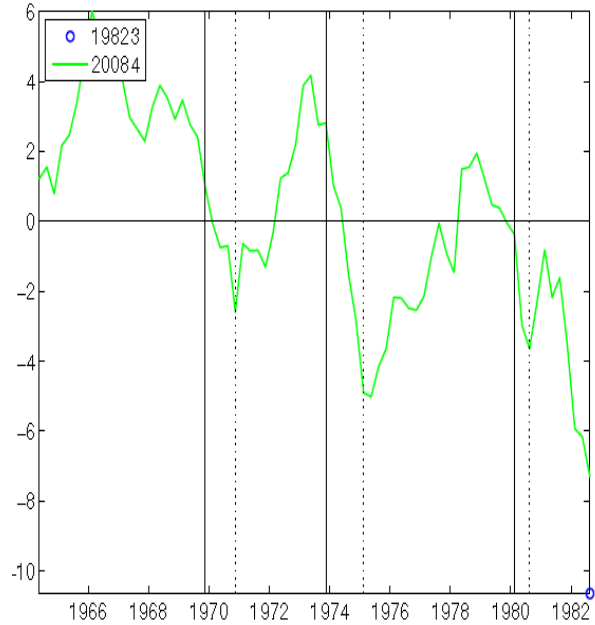


Data Revision and Horizon Effect: 82:3

Simple NK Model

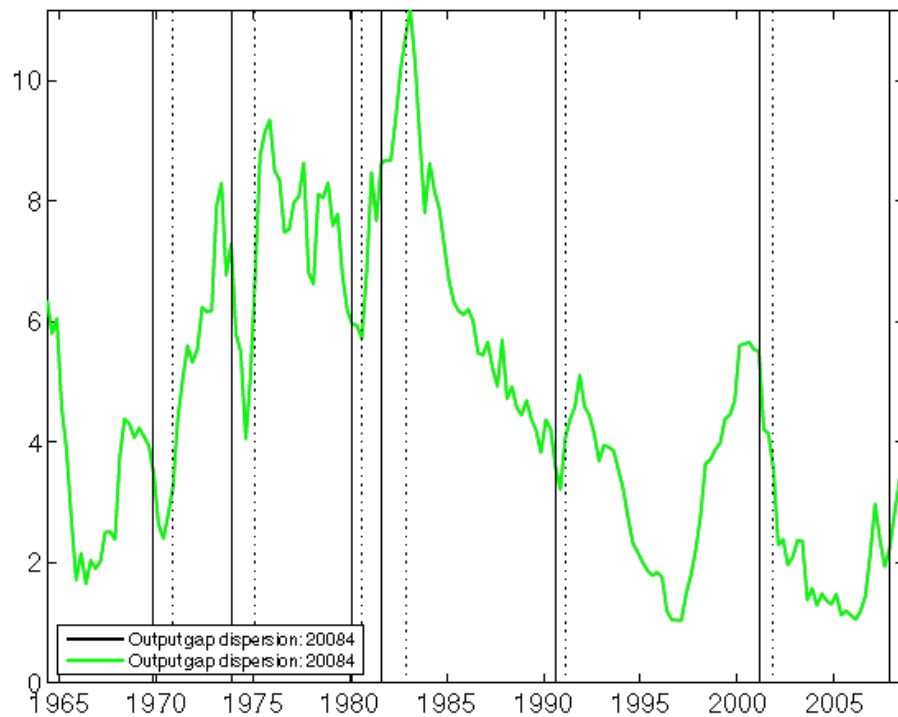


Expert View



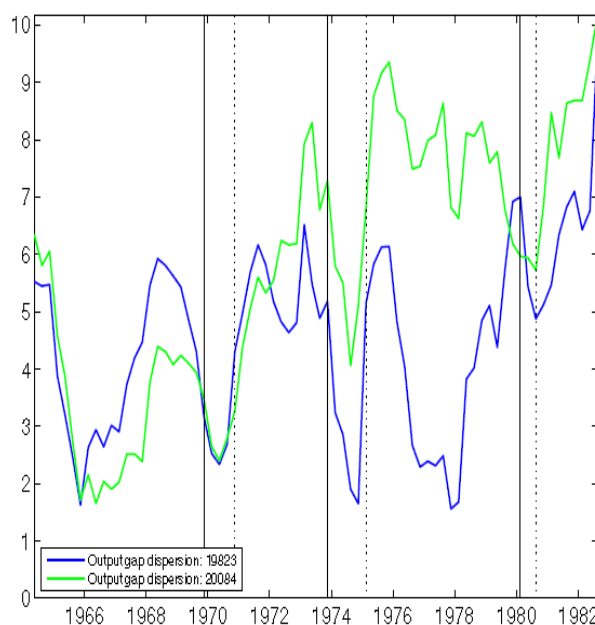
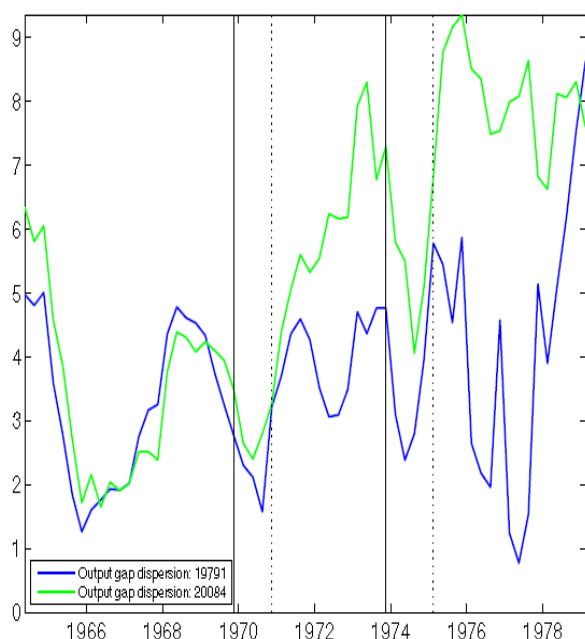
33

Output Gap Dispersion 2008



4

Output Gap Dispersion Vintages 79:1 and 82:3



35

Conclusions

- ❑ Model database offers perspective on diversity of beliefs regarding output gaps (or other unobservable characteristics of business cycle and policy) due to modelling assumptions.
- ❑ Matching with real-time data base allows to study the effect of data revisions, re-definitions, and data range on the time-varying beliefs.
- ❑ Economically significant diversity of output gap estimates, gap estimates are correlated, also with NBER dates.
- ❑ Data revisions and data range effects are economically significant.

36

Plan for Model Data Base

- Publish modelbase along with paper and applications.
- Make platform widely available via website for download.
- Create self-sustaining protocol for inclusion of new models by model authors.