Discussion of:

Short-term GDP forecasting with a mixed frequency dynamic factor model with stochastic volatility

by M. Marcellino, M. Porqueddu and F. Venditti

Michele Modugno
Université libre de Bruxelles, ECARES

Now-casting

This paper contribute to Now-casting.

Now-casting is optimal forecasting taking into account the characteristic of data in a real-time enviroment:

- mixed frequency
- ragged edge
- potentially more than an handful of important macro data

What have we learned about Now-casting?

- We can outperform professional and judgmental forecasters with a mechanical model in the short run

What have we learned about Now-casting?

- We can outperform professional and judgmental forecasters with a mechanical model in the short run
- Timeliness of data is important, therefore surveys are important

What have we learned about Now-casting?

- We can outperform professional and judgmental forecasters with a mechanical model in the short run
- Timeliness of data is important, therefore surveys are important
- is important to update frequently our forecast because more info we have more accurate we are

This paper

This paper uses a state of the art and coherent model *(for a survey Banbura, Giannone and Reichlin, 2011)* but extended it in two important directions:

This paper

This paper uses a state of the art and coherent model *(for a survey Banbura, Giannone and Reichlin, 2011)* but extended it in two important directions:

1. introduce stochastic volatility

This paper

This paper uses a state of the art and coherent model *(for a survey Banbura, Giannone and Reichlin, 2011)* but extended it in two important directions:

1. introduce stochastic volatility
2. evaluate how the accuracy of the density forecast improves with the flow of data

This paper

This paper uses a state of the art and coherent model *(for a survey Banbura, Giannone and Reichlin, 2011)* but extended it in two important directions:

1. introduce stochastic volatility
2. evaluate how the accuracy of the density forecast improves with the flow of data

Stochastic volatility is important for improving the accuracy of density forecasts, less for point forecasts.

This paper

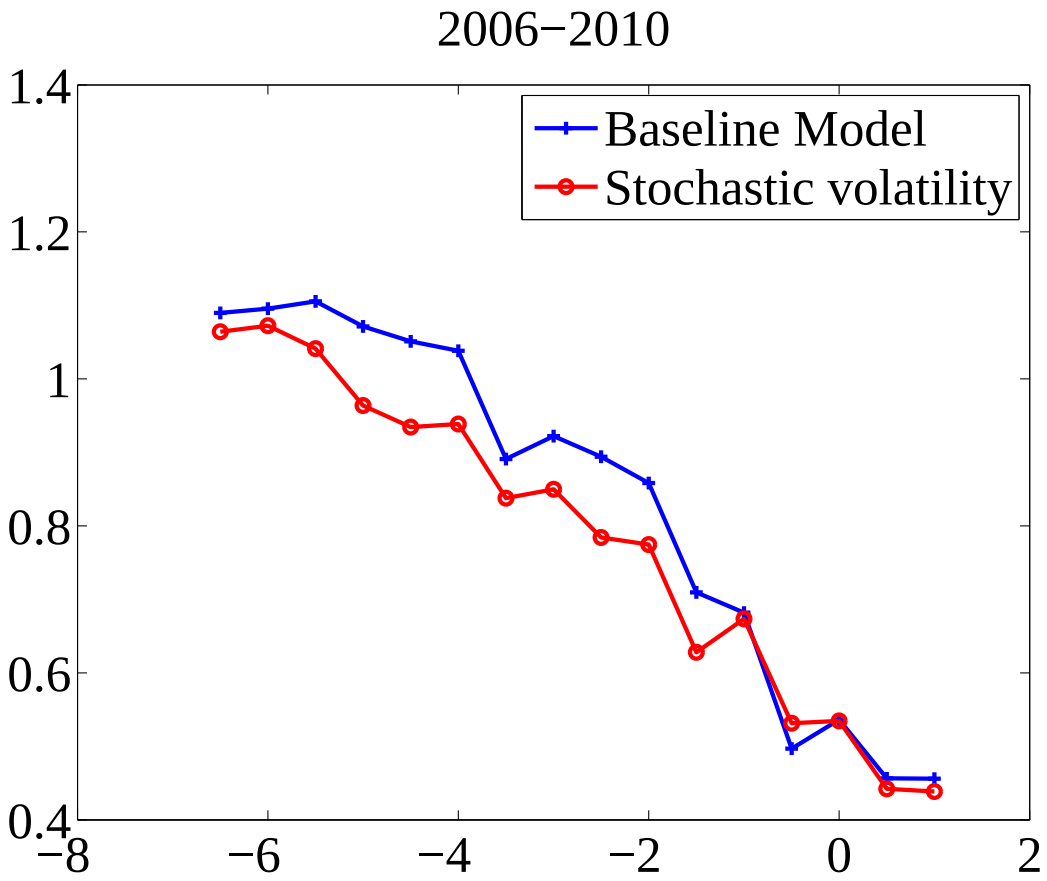
This paper uses a state of the art and coherent model *(for a survey Banbura, Giannone and Reichlin, 2011)* but extended it in two important directions:

1. introduce stochastic volatility
2. evaluate how the accuracy of the density forecast improves with the flow of data

Stochastic volatility is important for improving the accuracy of density forecasts, less for point forecasts.

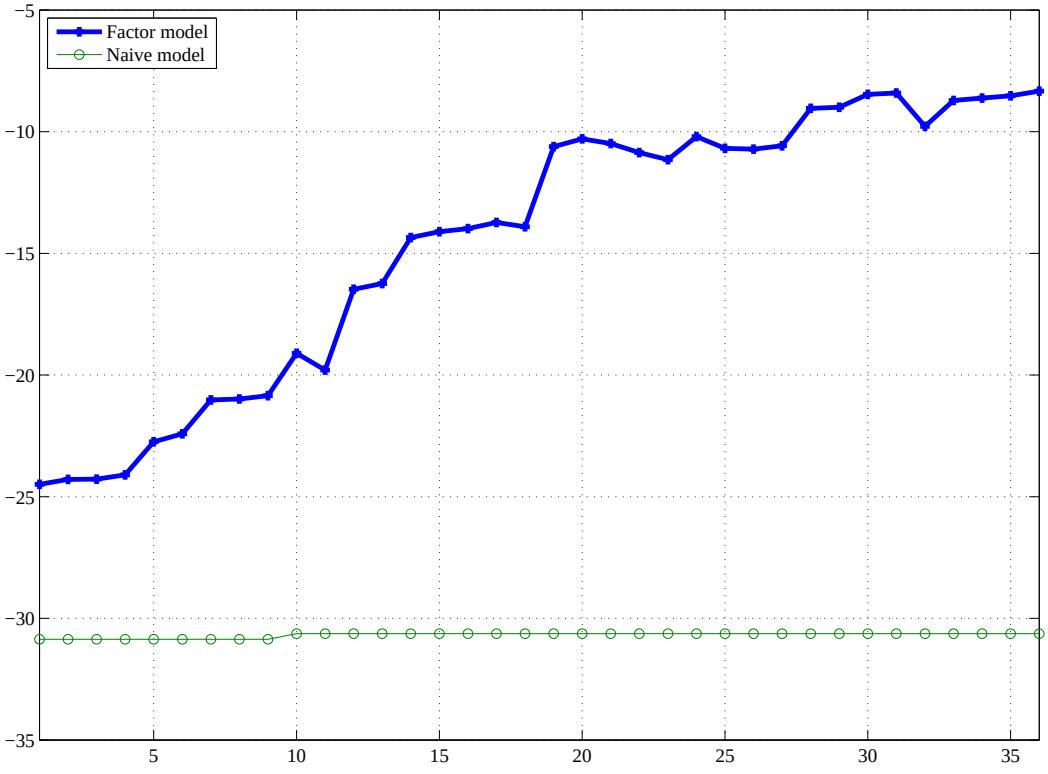
Importance of continuously update the forecast in order to improve the accuracy is confirmed with this new loss function, i.e. ***density forecast***

Figure 9: RMSE



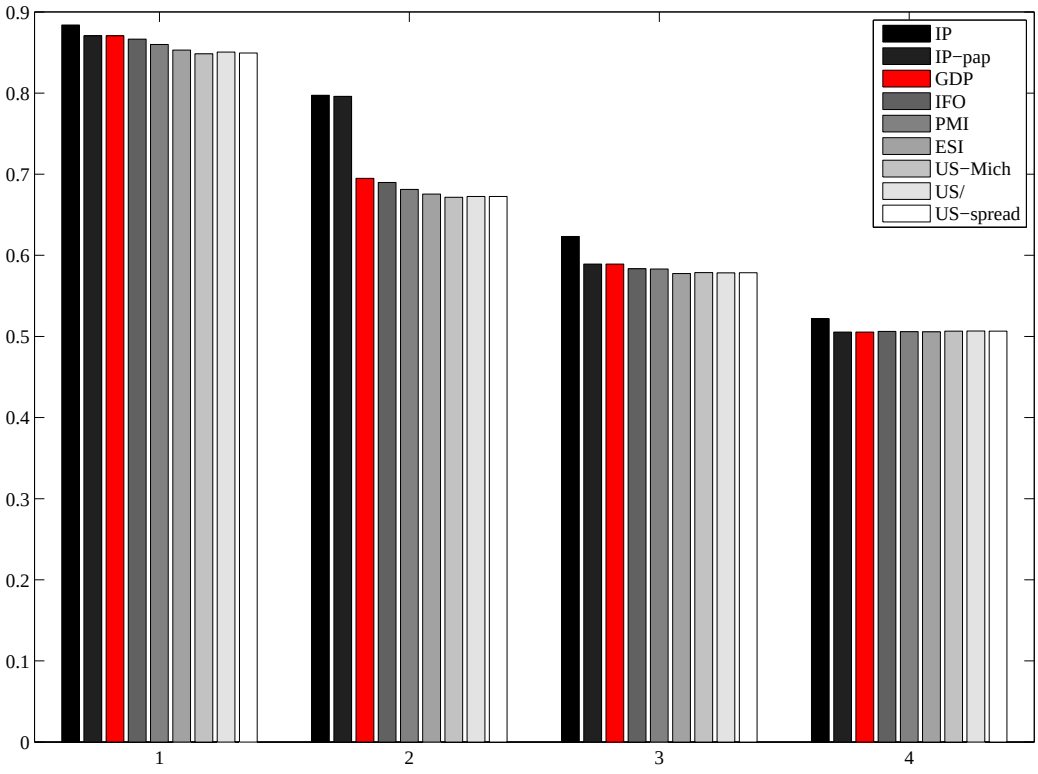
Note to Figure 9: the Figure shows the RMSFE of the factor model with stochastic volatility and of a baseline factor model without stochastic volatility between the first quarter of 2006 to the last quarter of 2010. The forecast horizon goes from six months ahead to one month after the end of the quarter of interest (backast). Therefore the first forecast is produced with the information set available in the middle of September 2005, the last one with data released at the end of January 2011.

Figure 5: Log-predictive score at different releases



Note to Figure 5: the Figure shows the log-predictive score of the factor model with stochastic volatility updated at each data release and of the naive constant growth model. Data releases follow the stylized calendar 4.

Figure 3: RMSE at different releases



Note to Figure 3: the Figure shows the ratio of the RMSE of the factor model with stochastic volatility to that of a naive constant growth model for each of the indicated data release. Data releases follow the stylized calendar 4.

News

This is different from previous results (e.g. Giannone et al., 2008) where timely data (survey) have more impact than hard data:

GDP is released $\Rightarrow$ no big news

News

This is different from previous results (e.g. Giannone et al., 2008) where timely data (survey) have more impact than hard data:

GDP is released $\Rightarrow$ no big news

what can be wrong?

News

This is different from previous results (e.g. Giannone et al., 2008) where timely data (survey) have more impact than hard data:

GDP is released $\Rightarrow$ no big news

what can be wrong?

- data selection

News

This is different from previous results (e.g. Giannone et al., 2008) where timely data (survey) have more impact than hard data:

GDP is released $\Rightarrow$ no big news

what can be wrong?

- data selection
- model specification (i.e. dynamic heterogeneity)

Variable Selection

The variable selected following Boivin and Ng (2003) are :

- total IP index
- Pulp and Paper sector IP index
- Germany IFO Business Climate Index (IFO)
- PMI
- European Commission Economic Sentiment Indicator (ESI)
- US yields spread
- $US\$/Euro$ exchange rate
- Michigan Consumer Sentiment

But let'me focus first on the model specification

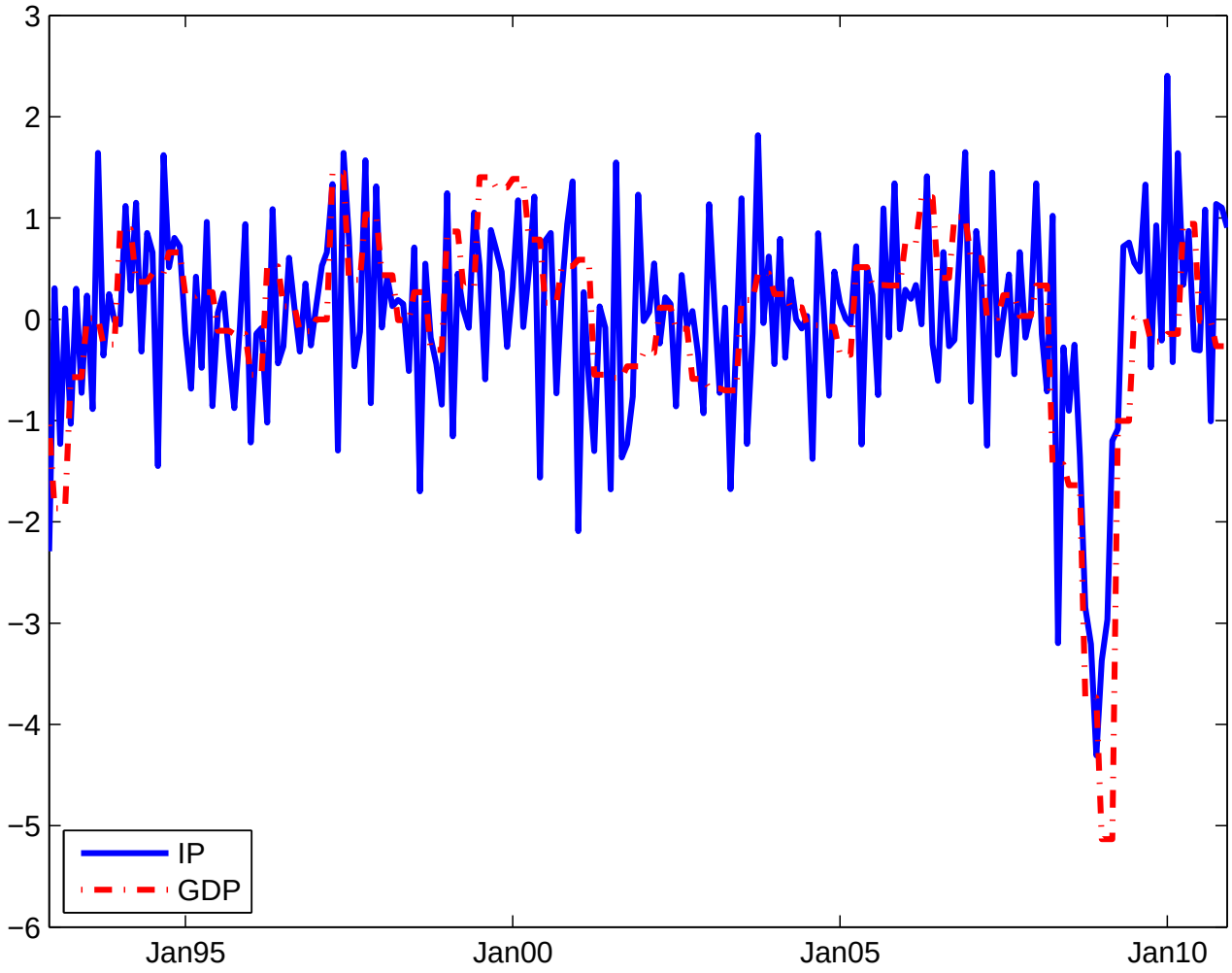
...later back on data selection.

Traditional Model

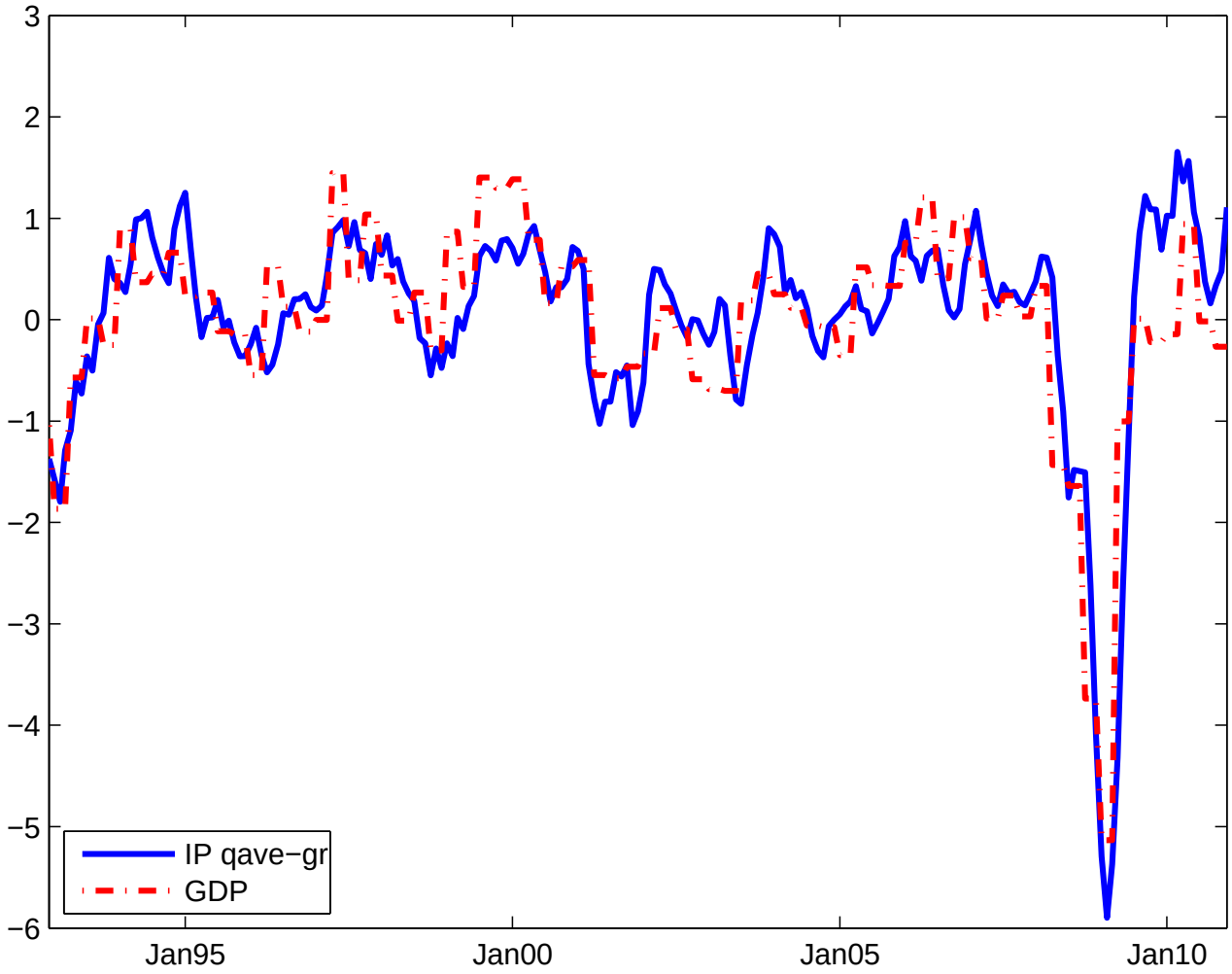
$$
\begin{aligned}
x_t &= \beta_x f_t + \epsilon_t \\
GDP_t &= \frac{1}{3}\beta_{gdp} f_t + \frac{2}{3}\beta_{gdp} f_{t-1} + \beta_{gdp} f_{t-2} + \frac{2}{3}\beta_{gdp} f_{t-3} + \frac{1}{3}\beta_{gdp} f_{t-4} + \\
&\quad + \frac{1}{3}u_t + \frac{2}{3}u_{t-1} + u_{t-2} + \frac{2}{3}u_{t-3} + \frac{1}{3}u_{t-4}
\end{aligned}
$$

Used in several institutions and for different countries: Giannone et al. (2008), Angelini et al (2008,2010), Aastveit and Trovik (2008), Bańbura and Modugno (2010), Bańbura and Rünstler (2007), D'Agostino et al (2008), Matheson (2010), Marcellino and Schumacher (2008)

Dynamic Heterogeneity



Dynamic Heterogeneity



Their Model (CPQ)

Following Camacho and Perez-Quiros (2010) the authors propose:

$$
\begin{aligned}
x_t &= \beta_x f_t + \epsilon_t \\
SU_t &= \beta_{su}\left(\sum_{i=0}^{11} f_{t-i}\right) + \nu_t \\
GDP_t &= \frac{1}{3}\beta_{gdp} f_t + \frac{2}{3}\beta_{gdp} f_{t-1} + \beta_{gdp} f_{t-2} + \frac{2}{3}\beta_{gdp} f_{t-3} + \frac{1}{3}\beta_{gdp} f_{t-4} + \\
&\quad + \frac{1}{3}u_t + \frac{2}{3}u_{t-1} + u_{t-2} + \frac{2}{3}u_{t-3} + \frac{1}{3}u_{t-4}
\end{aligned}
$$

Their Model (CPQ)

Following Camacho and Perez-Quiros (2010) the authors propose:

$$
\begin{aligned}
x_t &= \beta_x f_t + \epsilon_t \\
SU_t &= \beta_{su}\left(\sum_{i=0}^{11} f_{t-i}\right) + \nu_t \\
GDP_t &= \frac{1}{3}\beta_{gdp} f_t + \frac{2}{3}\beta_{gdp} f_{t-1} + \beta_{gdp} f_{t-2} + \frac{2}{3}\beta_{gdp} f_{t-3} + \frac{1}{3}\beta_{gdp} f_{t-4} + \\
&\quad + \frac{1}{3}u_t + \frac{2}{3}u_{t-1} + u_{t-2} + \frac{2}{3}u_{t-3} + \frac{1}{3}u_{t-4}
\end{aligned}
$$

Why do you align only on the common component? what about the idiosyncratic?

Their Model (CPQ)

Surveys are not aligned with monthly growth rate of IP but with yearly growth rate: this choice is arbitrary!

Surveys are differences between the percentage of people that is positive about the current period respect to the previous and the ones that are negative

Their Model (CPQ)

Surveys are not aligned with monthly growth rate of IP but with yearly growth rate: this choice is arbitrary!

Surveys are differences between the percentage of people that is positive about the current period respect to the previous and the ones that are negative

What is the previous period?

Their Model (CPQ)

Surveys are not aligned with monthly growth rate of IP but with yearly growth rate: this choice is arbitrary!

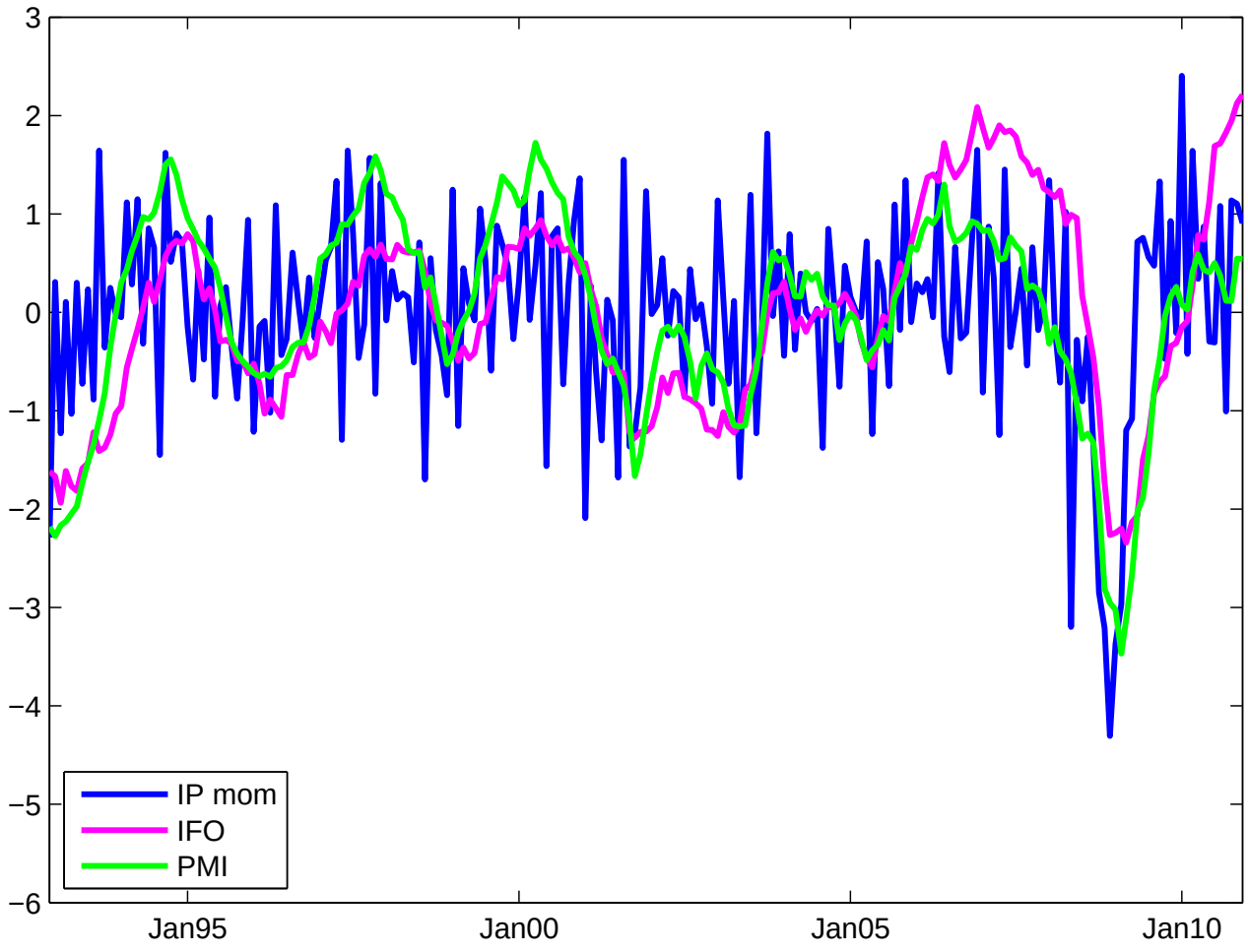
Surveys are differences between the percentage of people that is positive about the current period respect to the previous and the ones that are negative

What is the previous period?

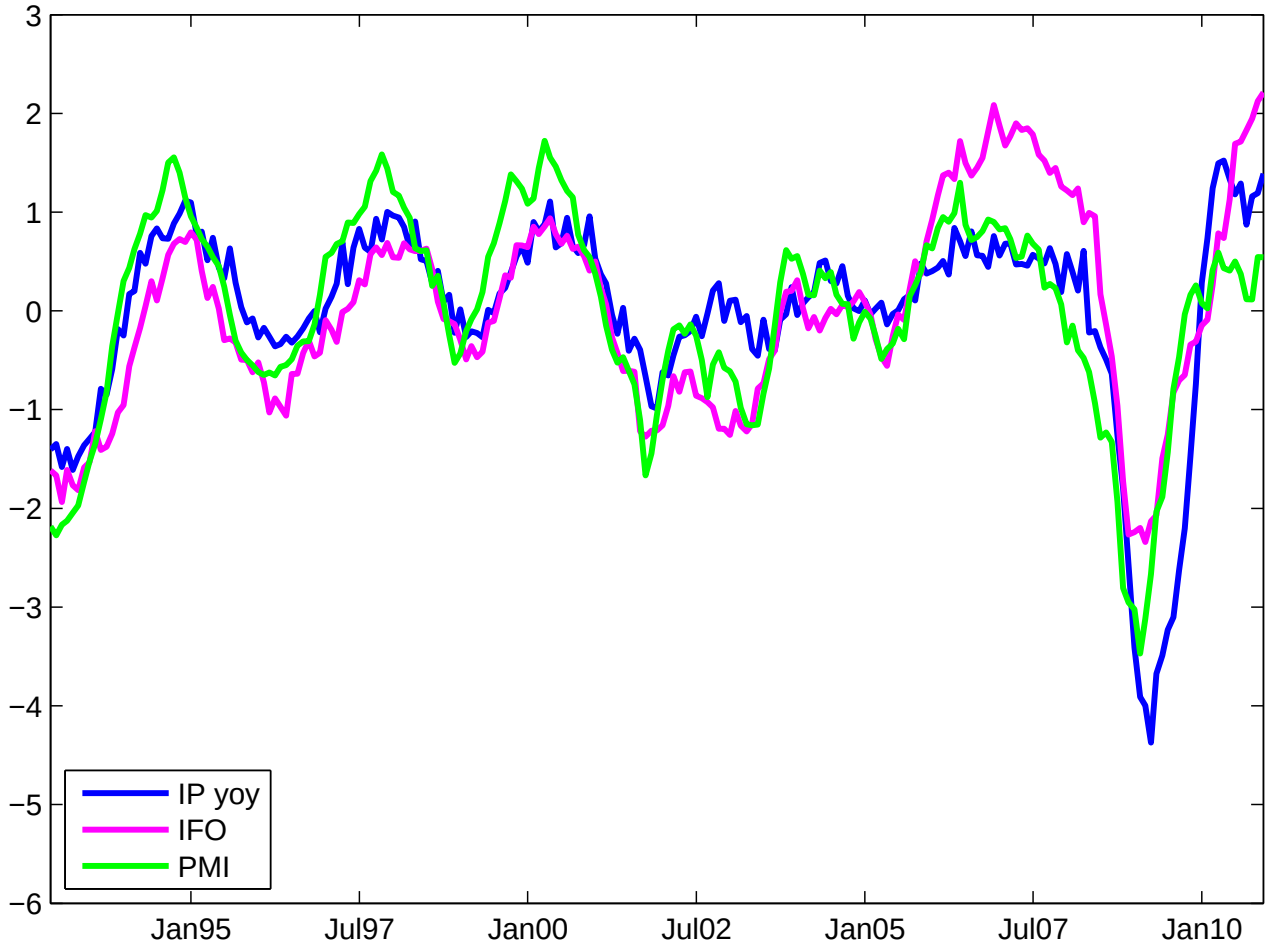
Interviewed people tend to interpret the previous period as the practice in their enterprises

sophisticated people, like *Purchasing Managers* tend to refer to a shorter horizon, *3 months*, than others (e.g. IFO), 12 months.

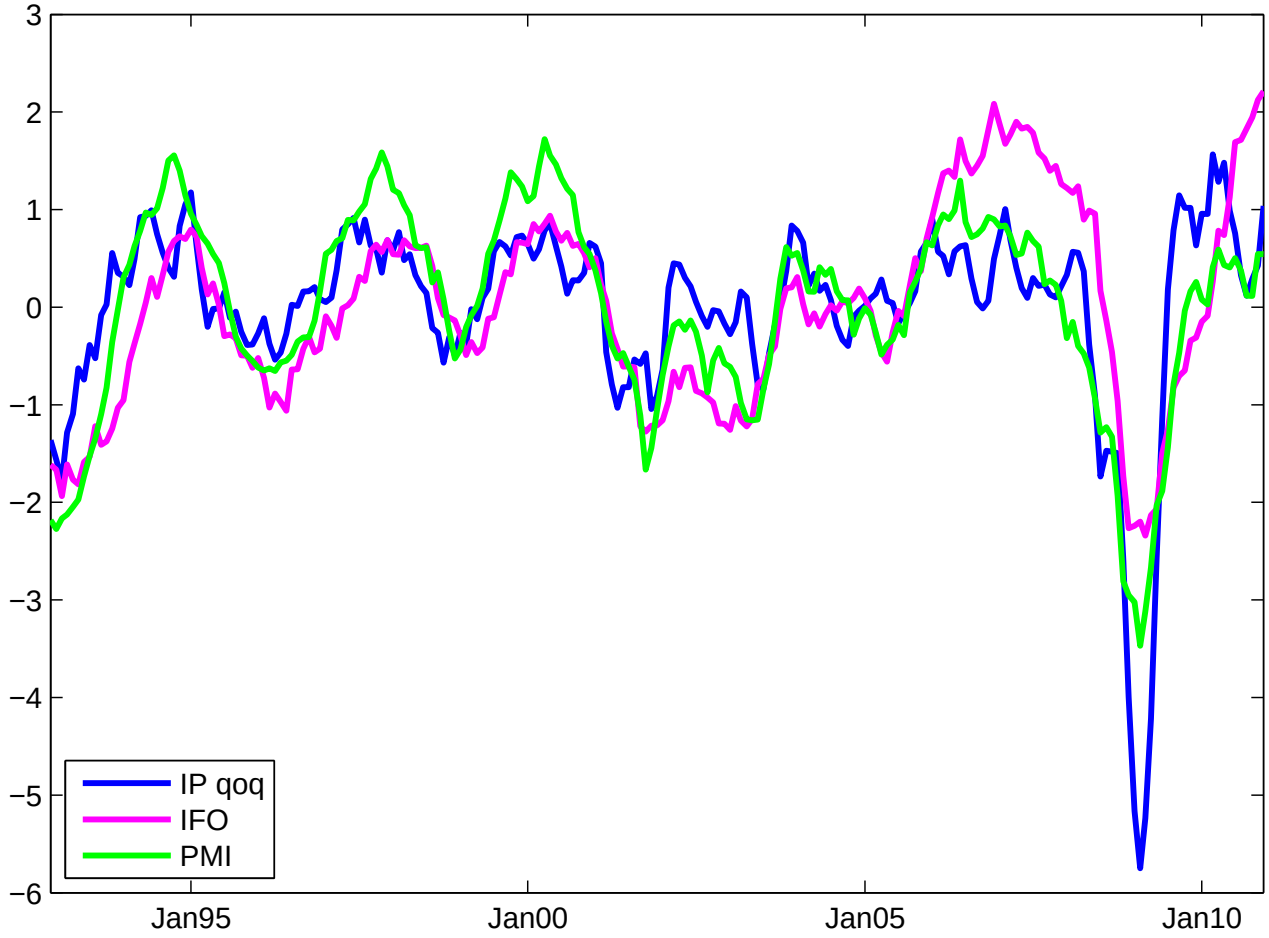
Dynamic Heterogeneity



Dynamic Heterogeneity



Dynamic Heterogeneity



Dynamic Heterogeneity

How can we overcome the problem of Dynamic Heterogeneity?

Dynamic Heterogeneity

How can we overcome the problem of Dynamic Heterogeneity?

Three solutions:

- leave them as they are (traditional model)

Dynamic Heterogeneity

How can we overcome the problem of Dynamic Heterogeneity?

Three solutions:

- leave them as they are (traditional model)
- we can account for this dynamic heterogeneity with more factors in a static framework, *lag factors equivalent to the additional factors* see Angelini et all. (2008) and Forni et all. (2006).

Dynamic Heterogeneity

How can we overcome the problem of Dynamic Heterogeneity?

Three solutions:

- leave them as they are (traditional model)
- we can account for this dynamic heterogeneity with more factors in a static framework, *lag factors equivalent to the additional factors* see Angelini et all. (2008) and Forni et all. (2006).
- Distributed lag on the factors
  (D'Agostino, Giannone, Lenza and Modugno, 2012)
  allow factors to enter without any judgmental exact restrictions.

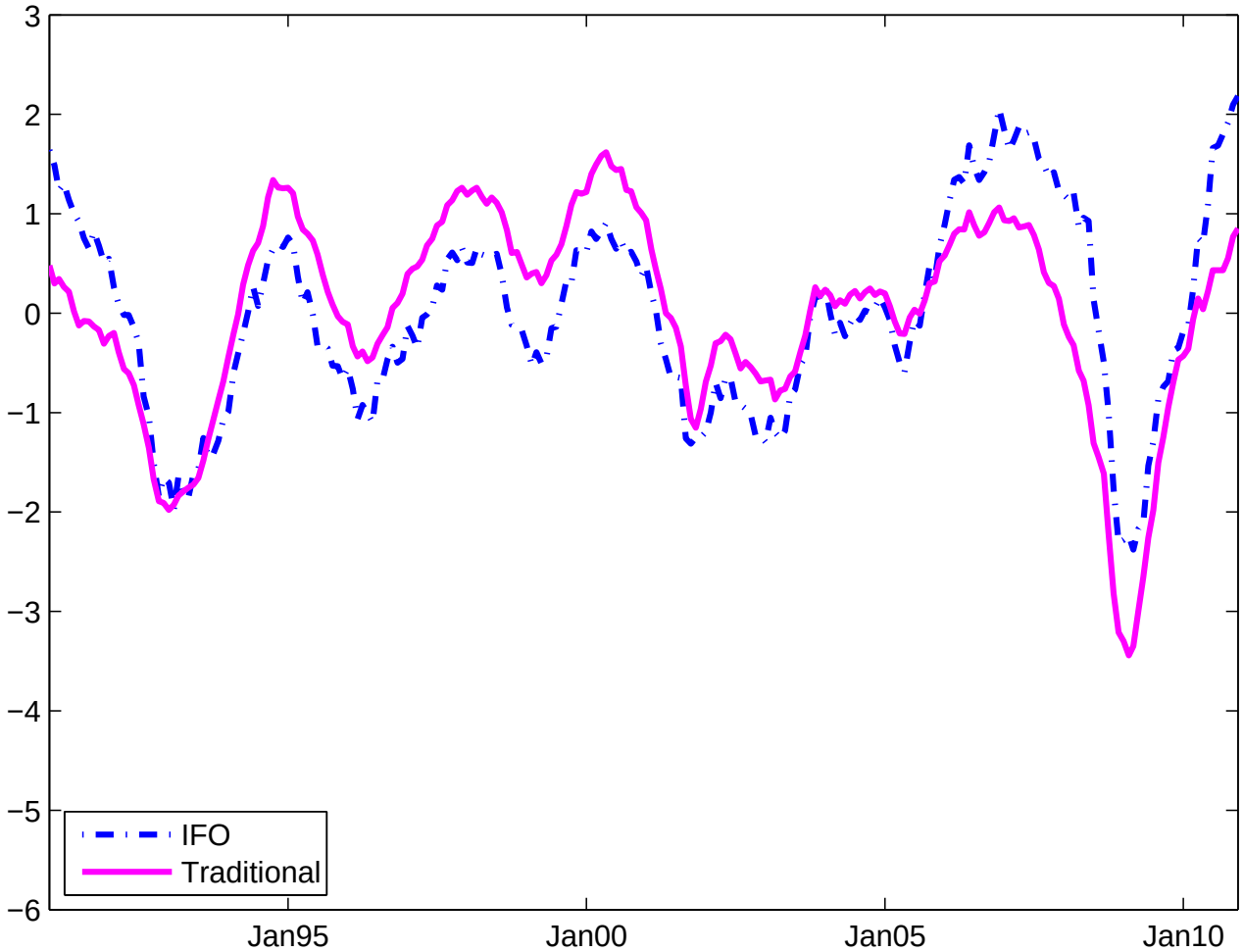
Distributed lag factors (DL-DFM)

$$
\begin{aligned}
x_t &= \sum_{i=0}^{11} \beta_i f_{t-i} + \sum_{i=0}^{11} \nu_{t-i} \\
GDP_t &= \frac{1}{3}\beta_{gdp} f_t + \frac{2}{3}\beta_{gdp} f_{t-1} + \beta_{gdp} f_{t-2} + \frac{2}{3}\beta_{gdp} f_{t-3} + \frac{1}{3}\beta_{gdp} f_{t-4} + \\
&\quad + \frac{1}{3}u_t + \frac{2}{3}u_{t-1} + u_{t-2} + \frac{2}{3}u_{t-3} + \frac{1}{3}u_{t-4}
\end{aligned}
$$

Let's now compare the fit:

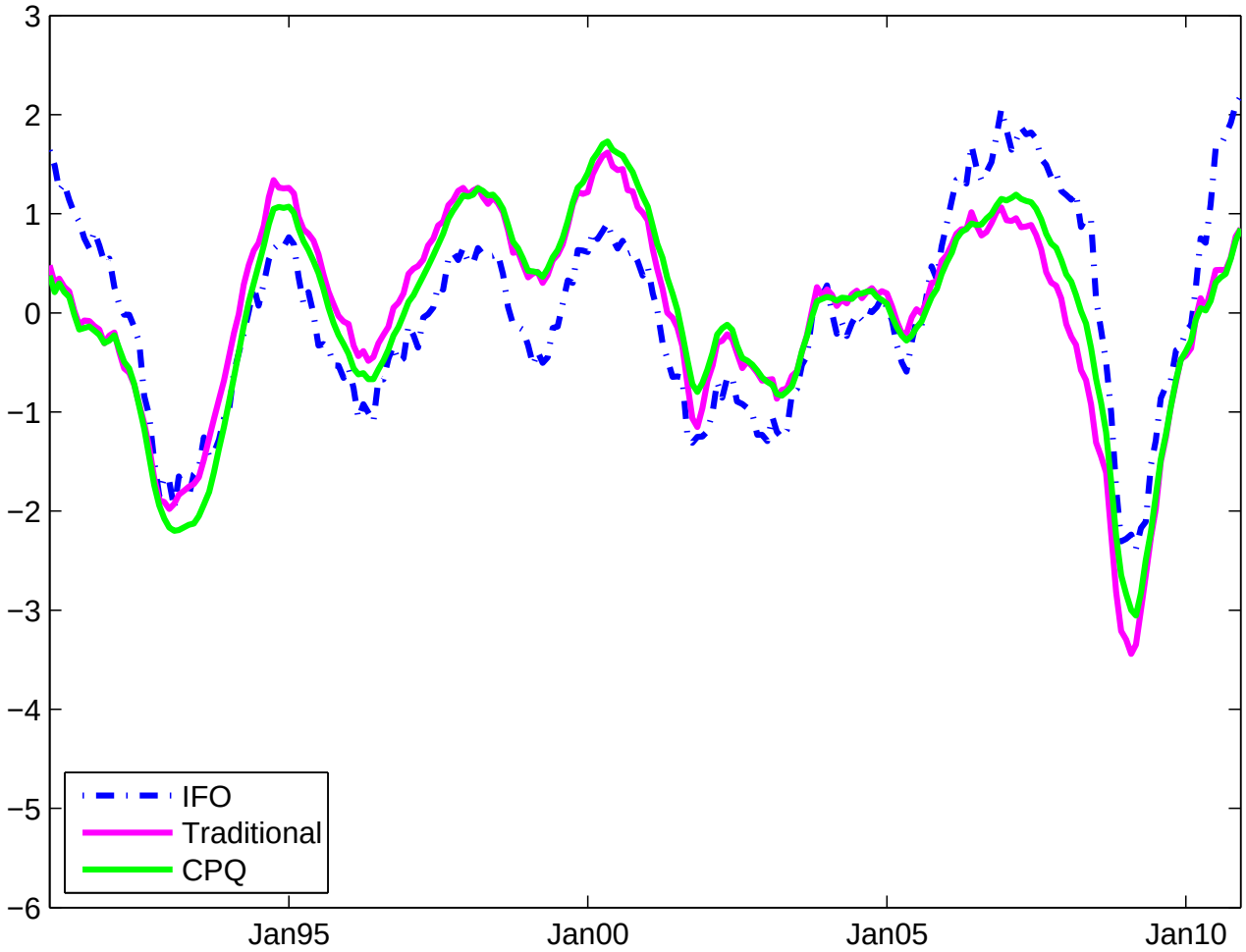
Dynamic Heterogeneity

Figure: Fit with alternative models: IFO



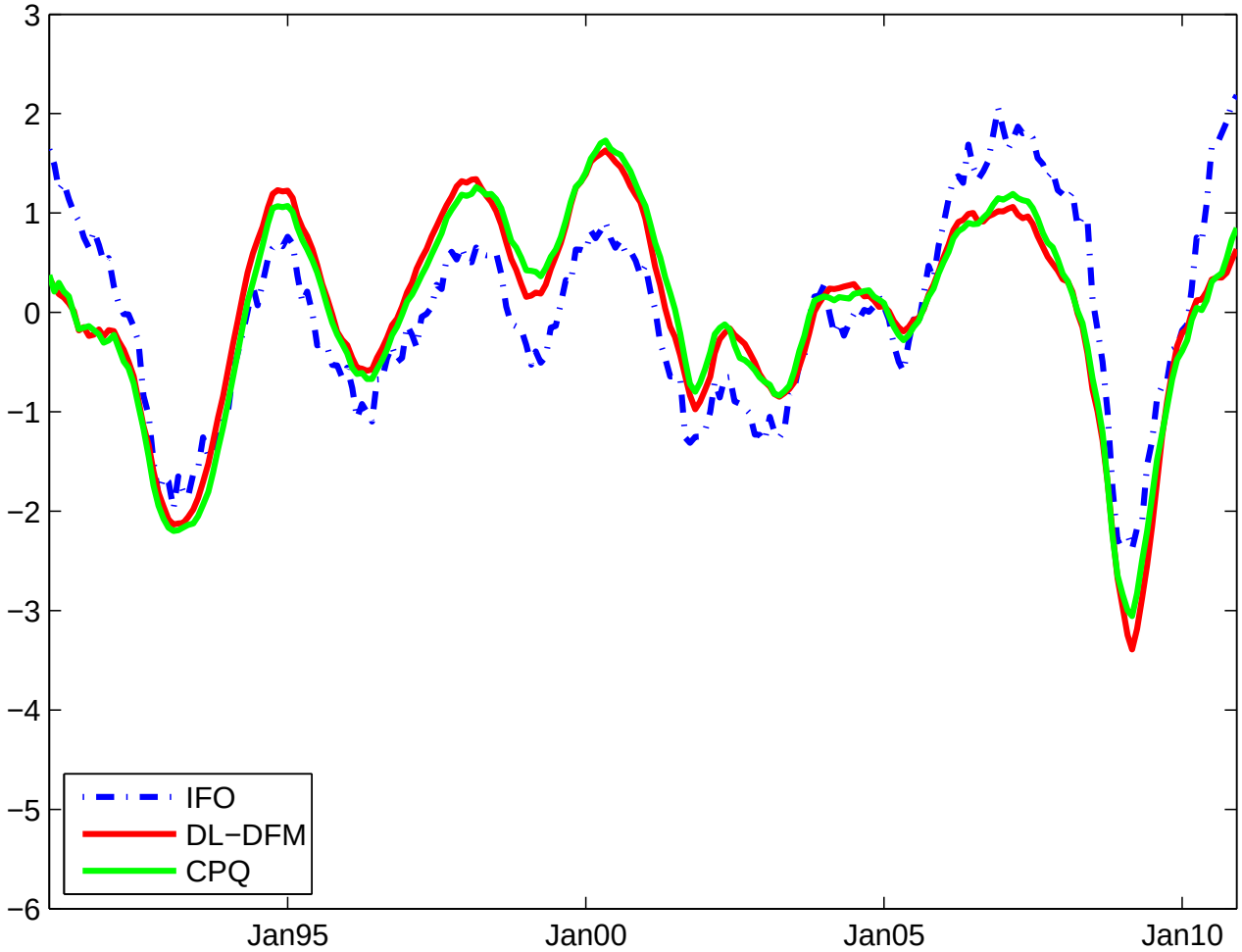
Dynamic Heterogeneity

Figure: Fit with alternative models: IFO



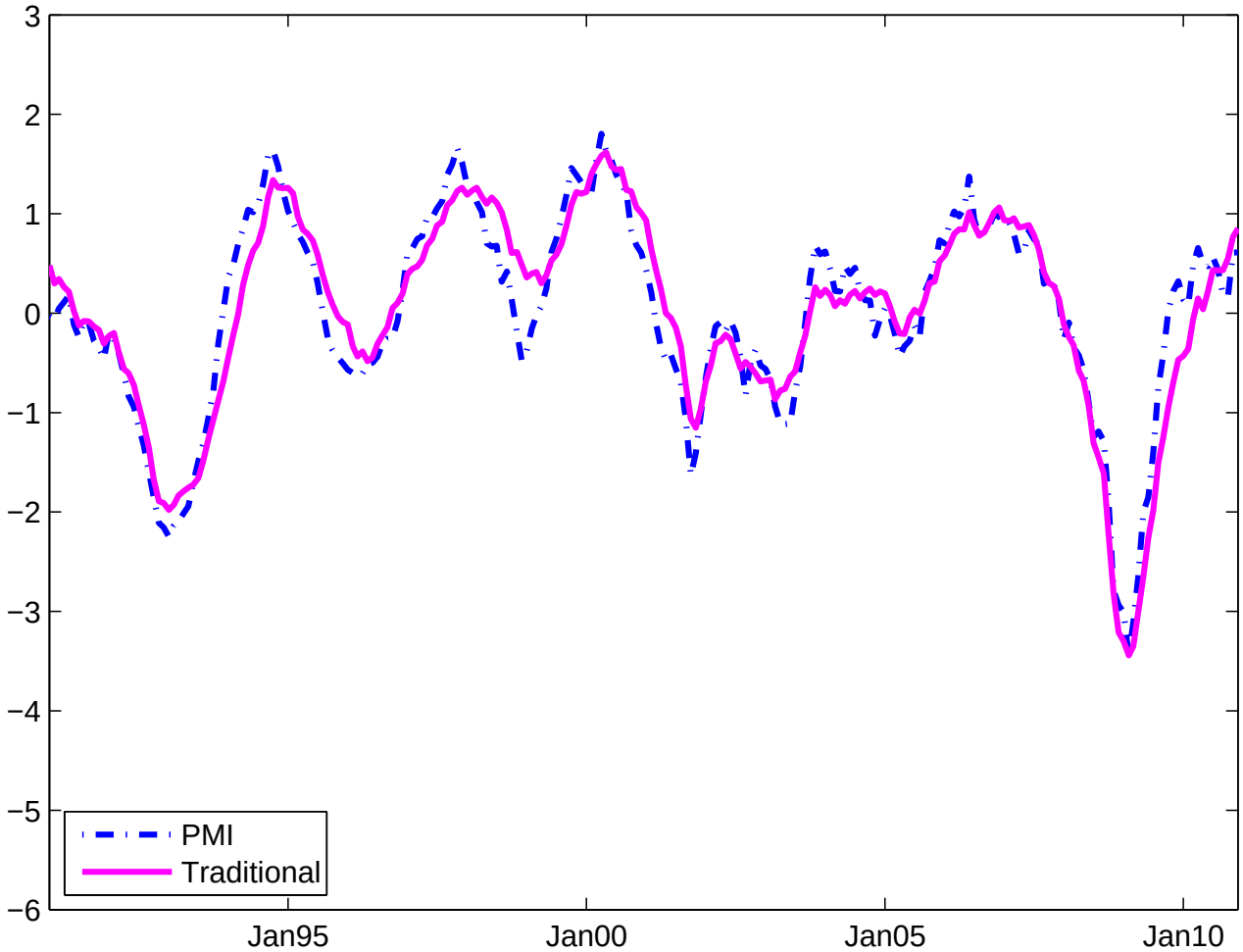
Dynamic Heterogeneity

Figure: Fit with alternative models: IFO



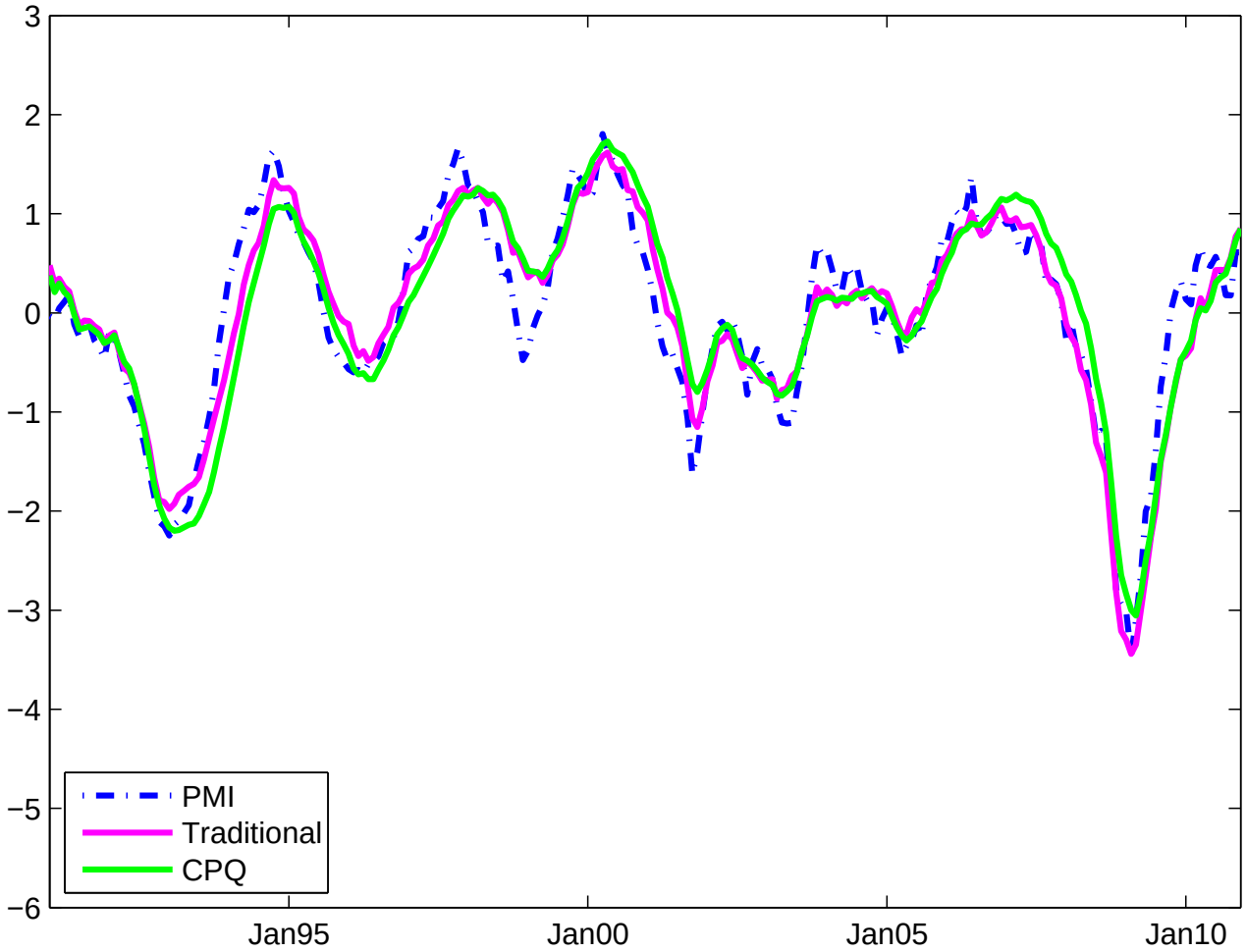
Dynamic Heterogeneity

Figure: Fit with alternative models: PMI



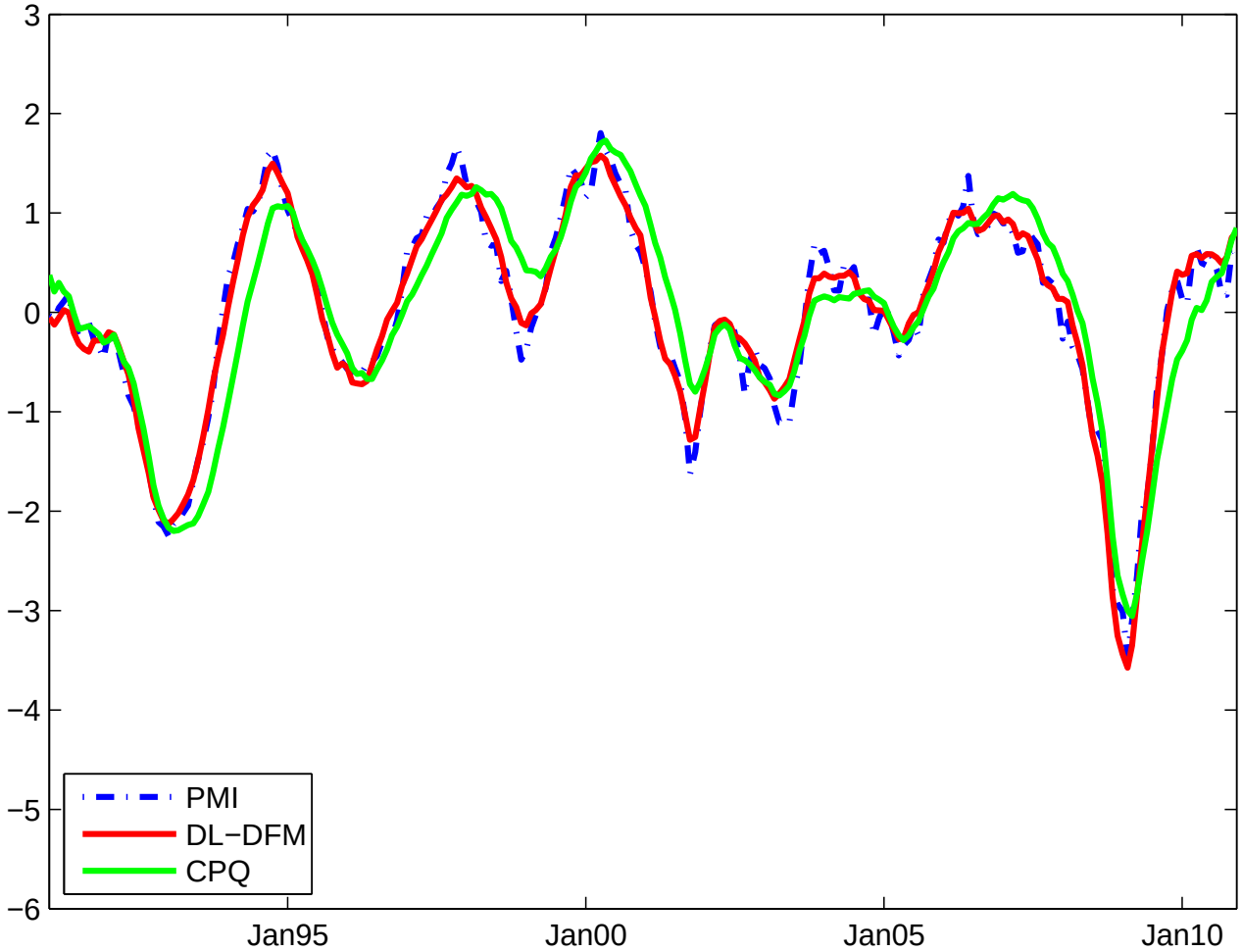
Dynamic Heterogeneity

Figure: Fit with alternative models: PMI



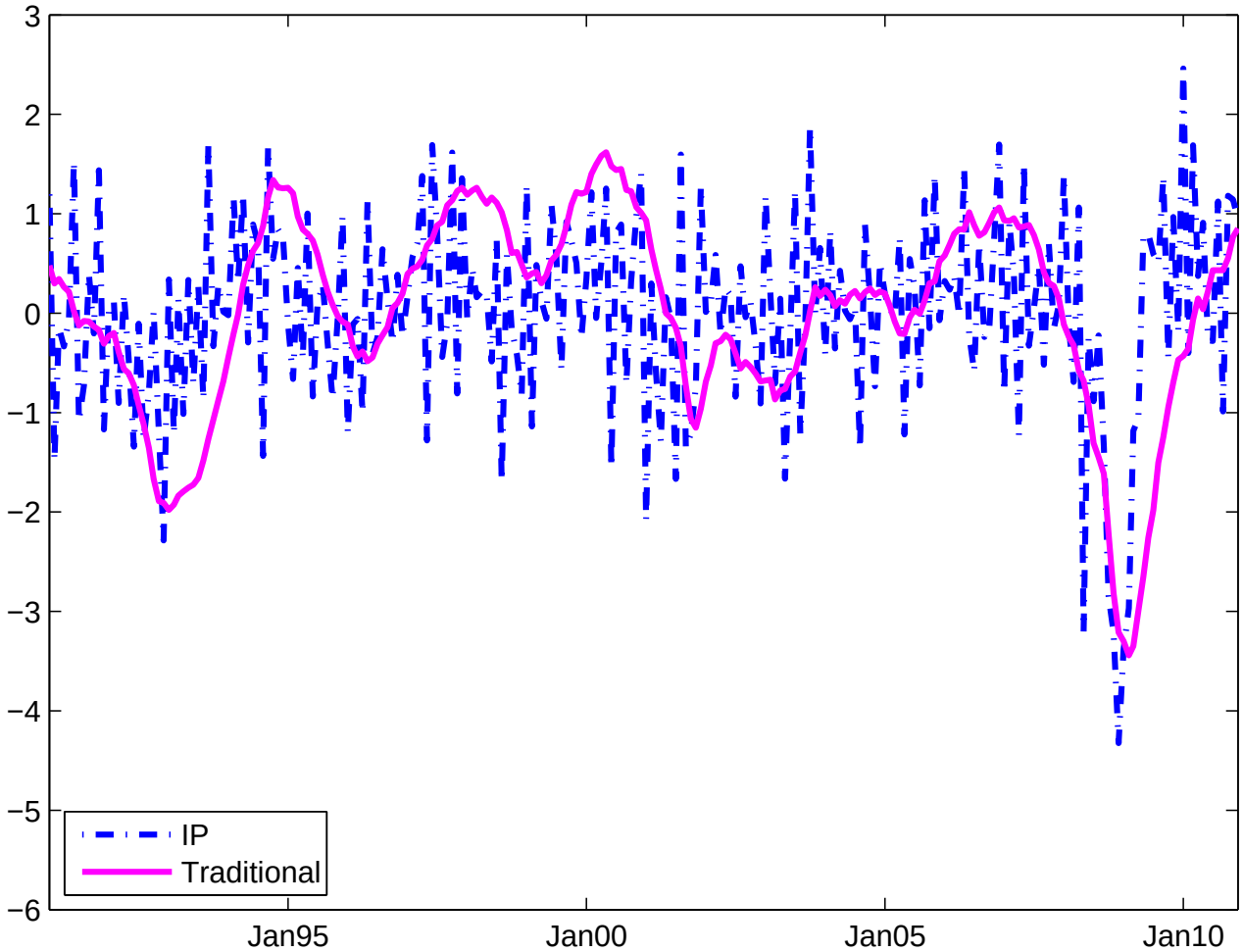
Dynamic Heterogeneity

Figure: Fit with alternative models: PMI



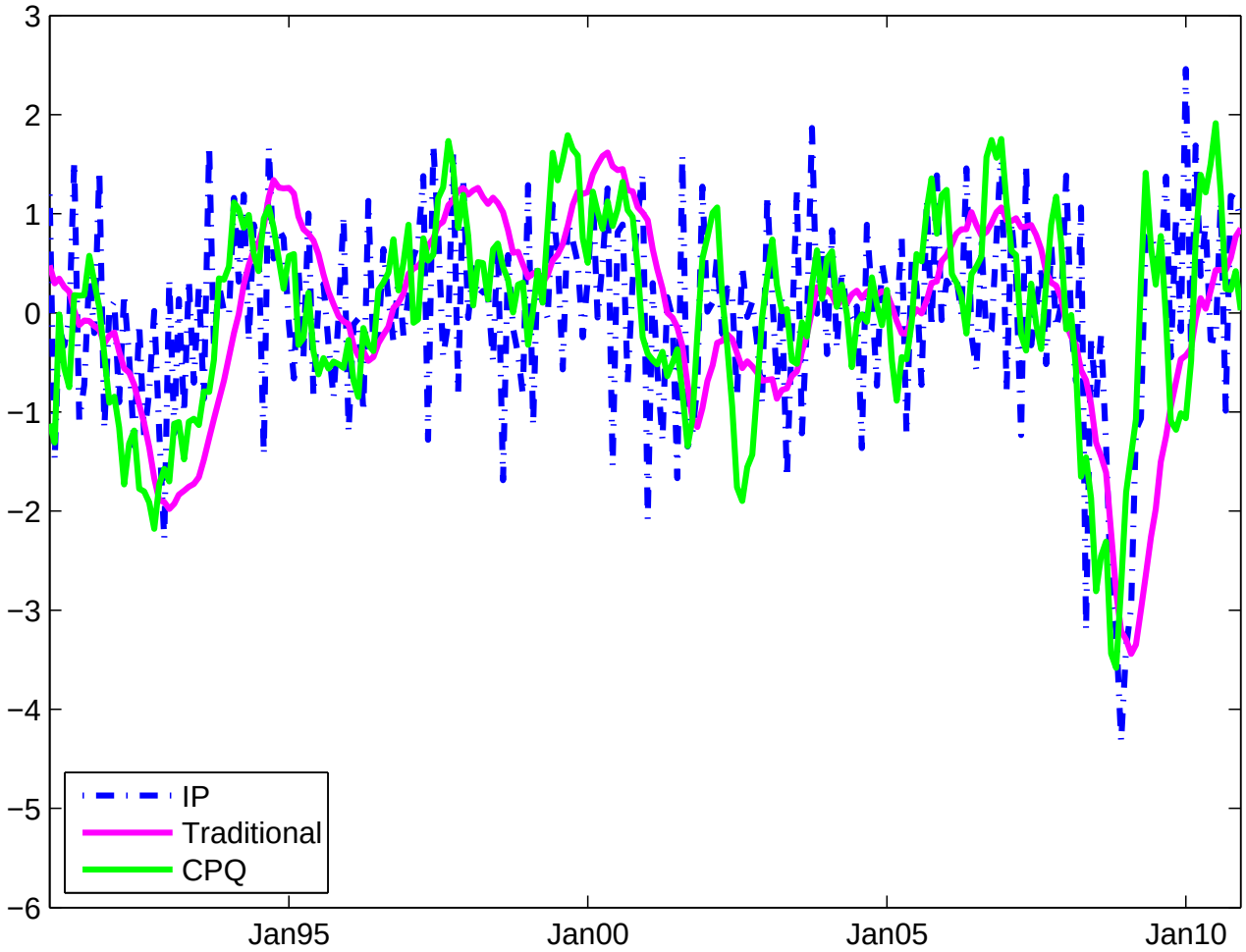
Dynamic Heterogeneity

Figure: Fit with alternative models: IP



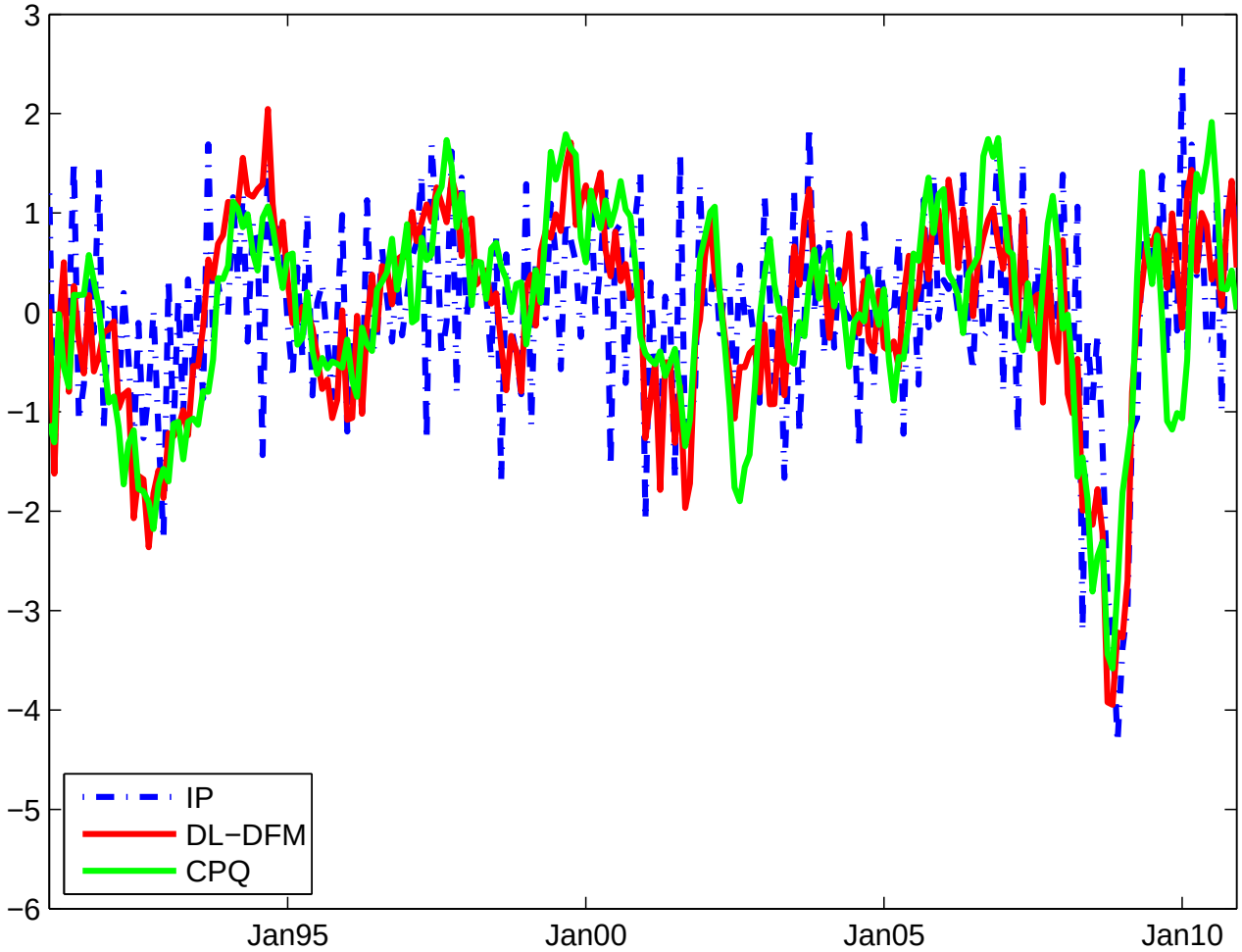
Dynamic Heterogeneity

Figure: Fit with alternative models: IP



Dynamic Heterogeneity

Figure: Fit with alternative models: IP



Dynamic Heterogeneity

Table: Input Series Now-cast Comparison

	IPTOT	IFO	PMI
Trad.	1.58	3.63	2.38
DL-DFM	**1.07**	2.67	**1.46**
CPQ	1.56	**2.32**	1.75

we predict better the IP and PMI series $\Rightarrow$ **different *News*!!**

Dynamic Heterogeneity

Table: GDP Nowcast Comparison

	Trad	DL-DFM	CPQ
month 1	0.69	**0.54**	0.84
month 2	0.49	**0.41**	0.58
month 3	0.42	**0.38**	0.57

Variable Selection

the variable selected following Boivin and Ng (2003) are :

- total IP
- Pulp and Paper sector IP index
- IFO
- PMI
- ESI
- US yields spread
- $US\$/Euro$ exchange rate
- Michigan Consumer Sentiment

Why US yields spread and $US\$/Euro$ exchange rate, available daily, as monthly averages?

Variable Selection

the variable selected following Boivin and Ng (2003) are :

- total IP
- Pulp and Paper sector IP index
- IFO
- PMI
- ESI
- US yields spread
- $US\$/Euro$ exchange rate
- Michigan Consumer Sentiment

Why US yields spread and $US\$/Euro$ exchange rate, available daily, as monthly averages?

Nowcasting with daily data: Banbura, Giannone, Modugno and Reichlin (2012)

Variable Selection

Do we need so many US series?

Table: GDP Nowcast Comparison

	Trad.	**Trad. (w/o US)**	DL-DFM	**DL-DFM (w/o US)**	CPQ	**CPQ (w/o US)**
month 1	0.69	**0.68**	0.54	**0.50**	0.84	**0.84**
month 2	0.49	**0.48**	0.41	**0.38**	0.58	**0.60**
month 3	0.42	**0.41**	0.38	**0.35**	0.57	**0.59**

Variable Selection

Statistical methods to select variables, like Boivin and Ng (2003), do not take into account the timeliness $\Rightarrow$ crucial for Now-casting!!

Variable Selection

Statistical methods to select variables, like Boivin and Ng (2003), do not take into account the timeliness $\Rightarrow$ crucial for Now-casting!!

Instead of the Michigan Consumer Sentiment let's introduce the Philadelphia Business Outlook Survey :

available at mid-month for the current month !!

Table: GDP Nowcast Comparison

	Trad.	**Trad. (w Phil)**	DL-DFM	**12 LAG (w Phil)**	CPQ	**CPQ (w Phil)**
month 1	0.69	**0.67**	0.54	**0.50**	0.84	**0.83**
month 2	0.49	**0.45**	0.41	**0.40**	0.58	**0.56**
month 3	0.42	**0.39**	0.38	**0.35**	0.57	**0.54**

For the euro area several national indicators are more timely than the aggregated

Variable Selection

Moreover, statistical methods to select variables, like Boivin and Ng (2003), **introduce uncertainty** about the variable selection.

Variable Selection

Moreover, statistical methods to select variables, like Boivin and Ng (2003), **introduce uncertainty** about the variable selection.

How do you keep into account this uncertainty?

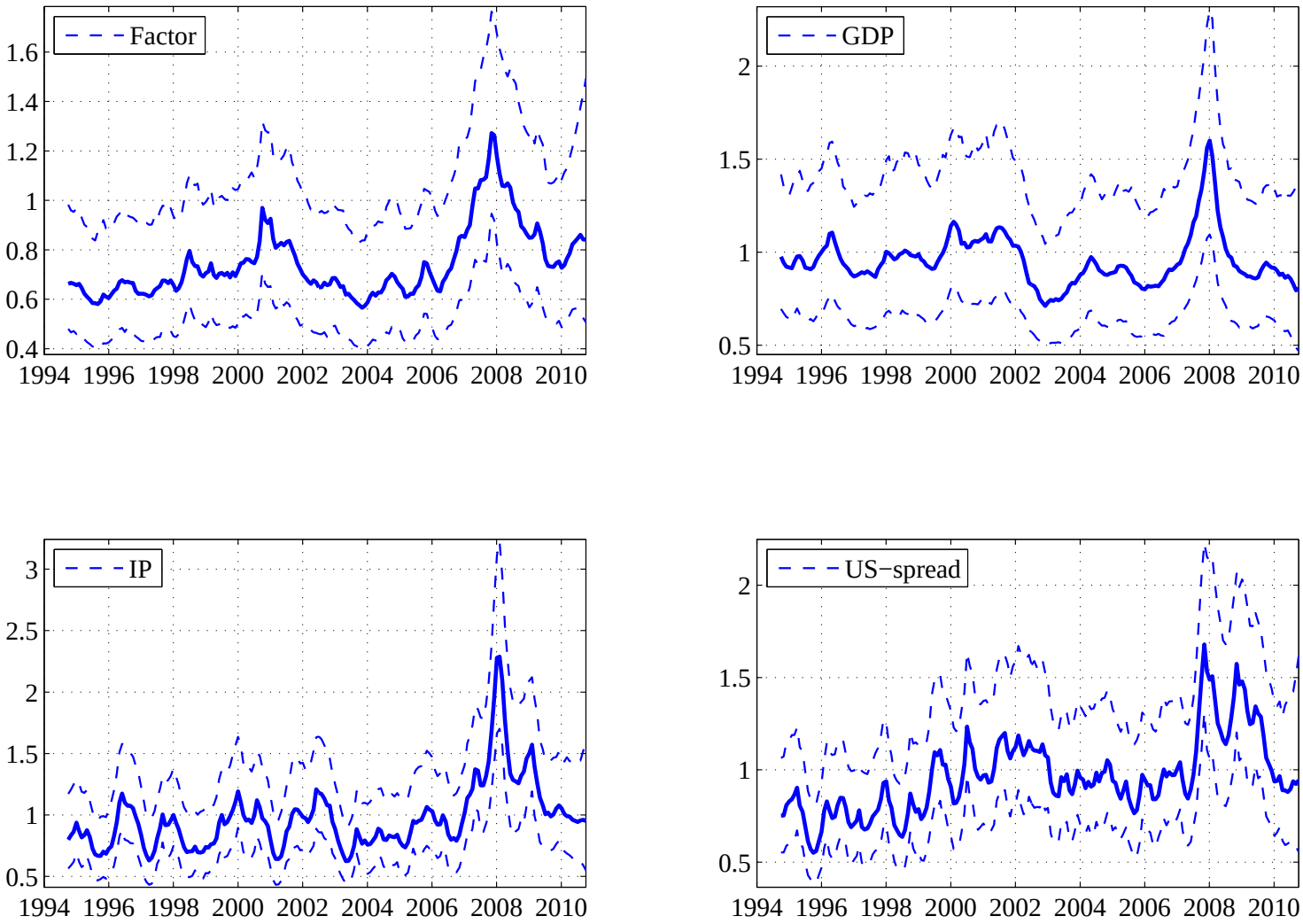
Variable Selection

Moreover, statistical methods to select variables, like Boivin and Ng (2003), **introduce uncertainty** about the variable selection.

How do you keep into account this uncertainty?

Alternative solution: let's look at the market!!
Banbura, Giannone, Modugno and Reichlin (2012)

Figure 2: Stochastic volatility for the common factor and for selected variables



What about Volatility?

The prior on the log-volatility is a random walk...
...but the estimated one it is very volatile!

What about Volatility?

The prior on the log-volatility is a random walk...
...but the estimated one it is very volatile!

Probably because the prior on the variance is not conservative!

What about Volatility?

The prior on the log-volatility is a random walk...
...but the estimated one it is very volatile!

Probably because the prior on the variance is not conservative!

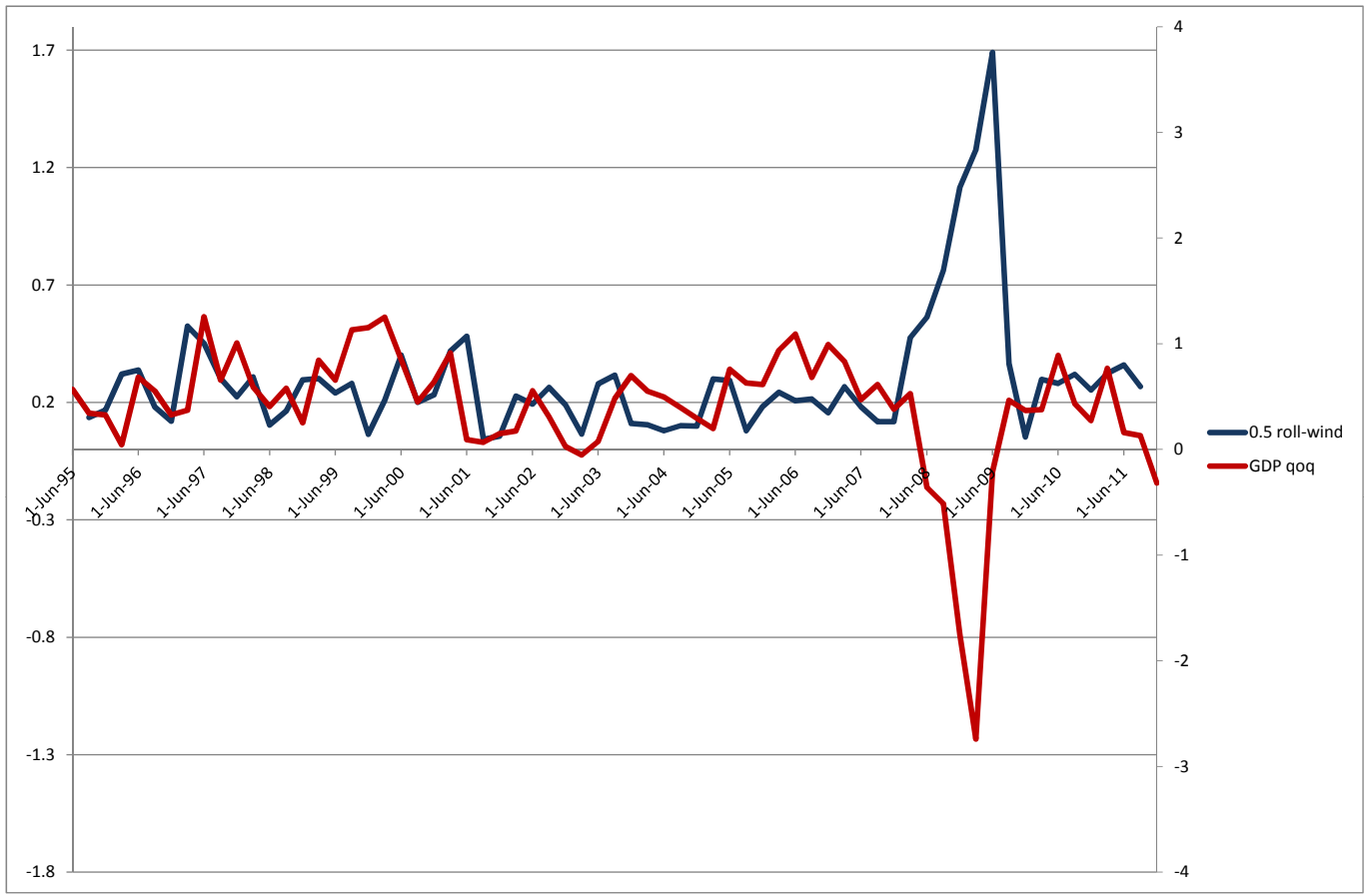
What results with a smaller prior like in Primiceri (2005)?

It’s time-varying volatility or large shocks?

Curdia, Del Negro and Greenwald (2012): *"... show that **the Great Recession** of 2008-09 does not result in significant increases in estimated time-varying volatility (i.e., it is not a reversal of the Great Moderation) but **is largely the outcome of large shocks**"*

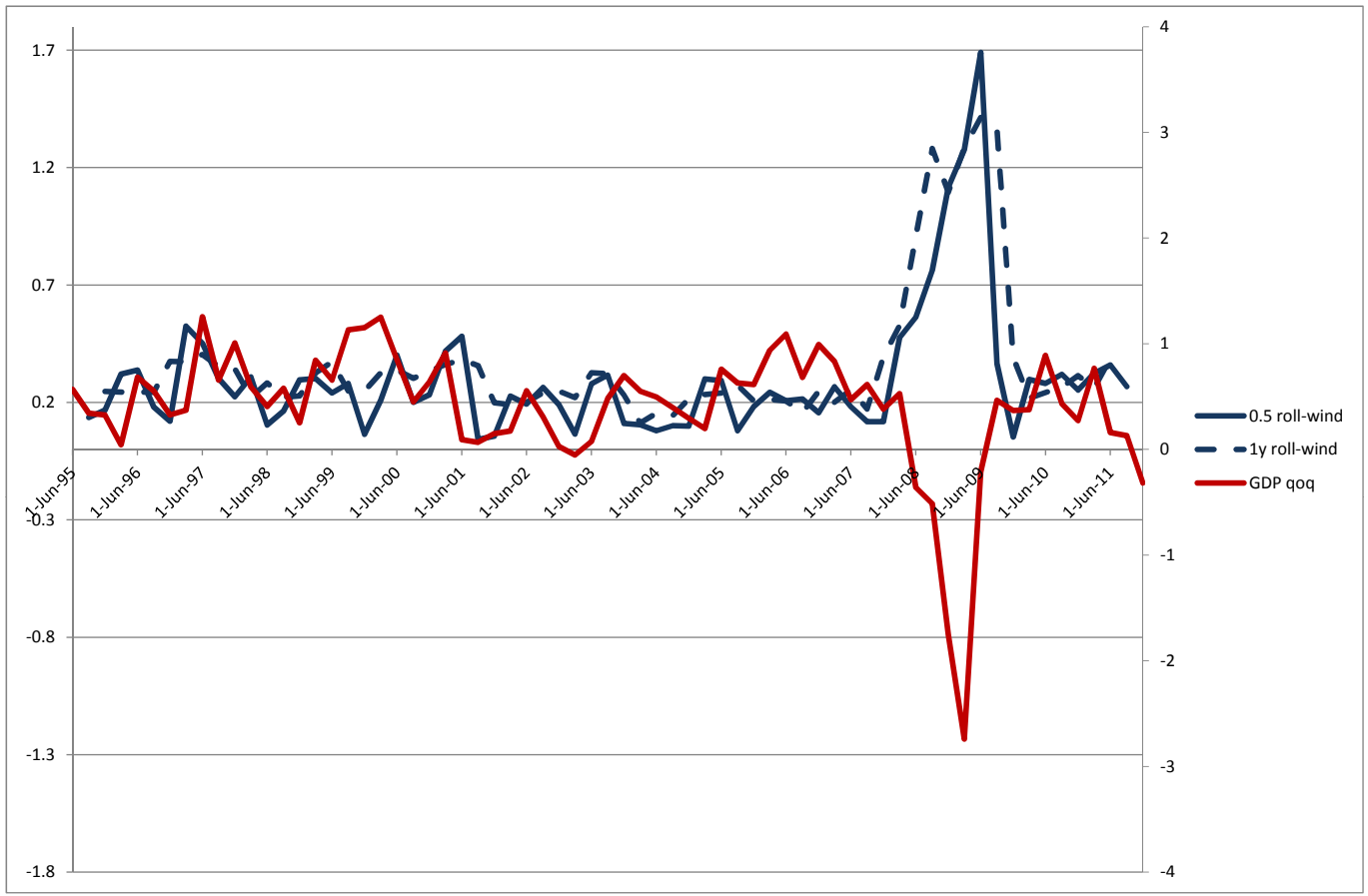
It’s time-varying volatility or large shocks?

Figure: GDP volatility



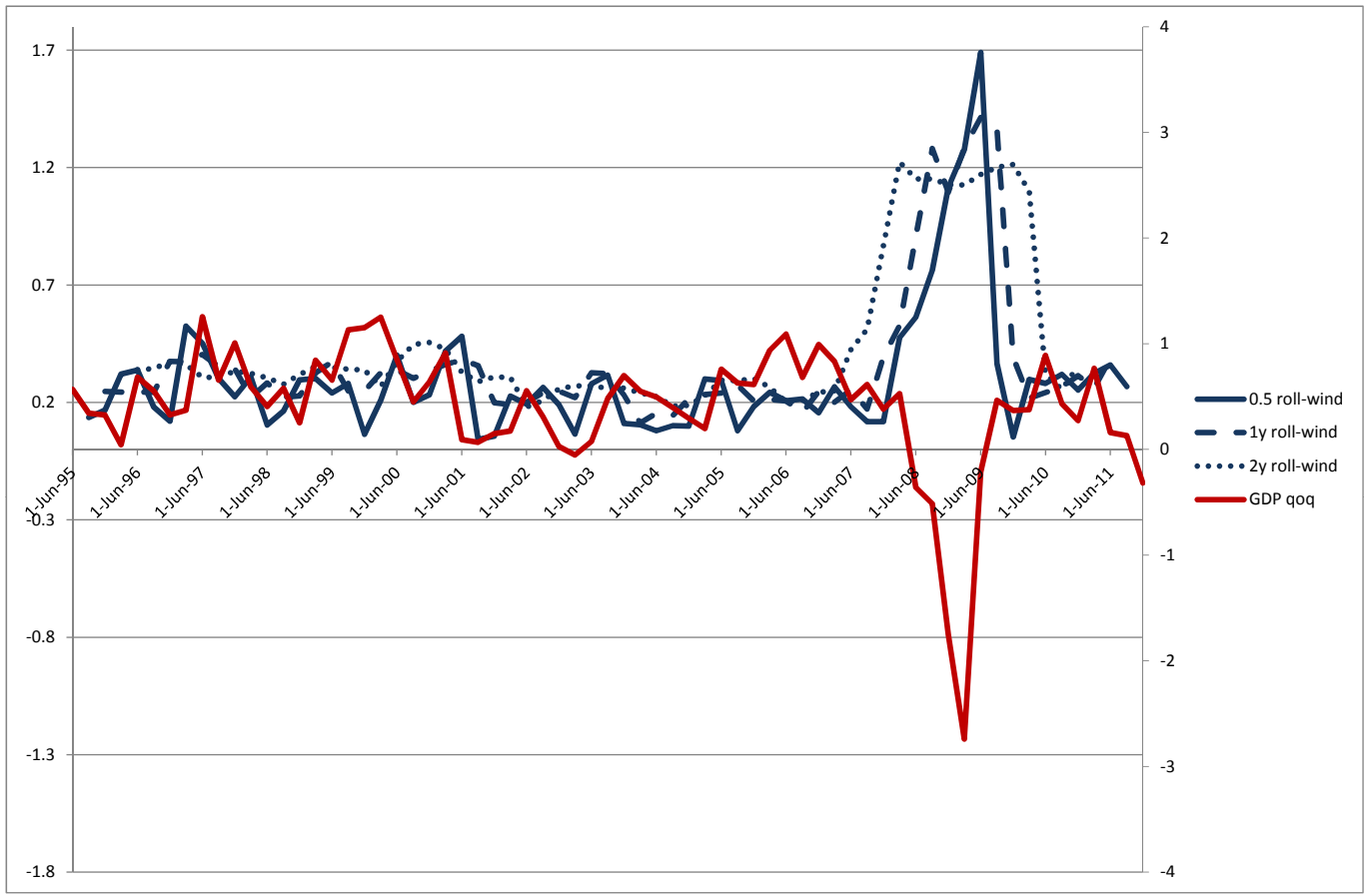
It's time-varying volatility or large shocks?

Figure: GDP volatility



It's time-varying volatility or large shocks?

Figure: GDP volatility



Conclusion

This paper uses a state of the art and coherent model but extended it in two important directions:

Conclusion

This paper uses a state of the art and coherent model but extended it in two important directions:

1. stochastic volatility

Conclusion

This paper uses a state of the art and coherent model but extended it in two important directions:

1. stochastic volatility
2. evaluate how the accuracy of the density forecast improves with the flow of data

Conclusion

This paper uses a state of the art and coherent model but extended it in two important directions:

1. stochastic volatility
2. evaluate how the accuracy of the density forecast improves with the flow of data

Stochastic volatility is important for the accuracy of density forecasts.

Conclusion

This paper uses a state of the art and coherent model but extended it in two important directions:

1. stochastic volatility
2. evaluate how the accuracy of the density forecast improves with the flow of data

Stochastic volatility is important for the accuracy of density forecasts.

Importance of continuously update the forecast in order to improve the accuracy is confirmed with this new loss function (density forecast)

Conclusions

What can be improved?

Conclusions

What can be improved?

- data selection

Conclusions

What can be improved?

- data selection
- model specification

Conclusions

What can be improved?

- data selection
- model specification
- investigate if it is time-varying volatility or large shocks

Conclusions

What can be improved?

- data selection
- model specification
- investigate if it is time-varying volatility or large shocks

Very nice paper, I strongly suggest to read it!