Forecasting of Polish Macroeconomic Processes in gretl

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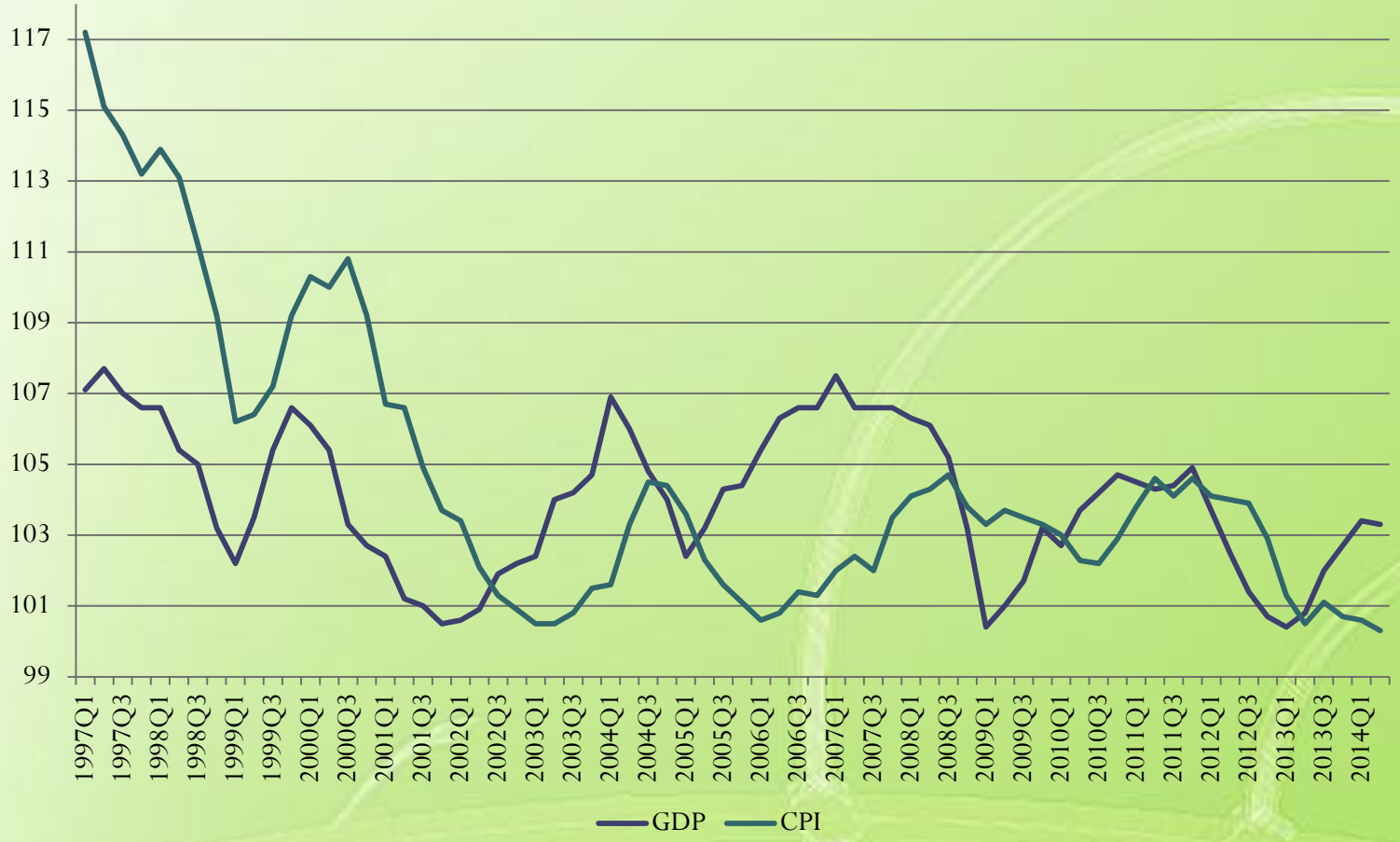
Motivation

- estimate econometric models of Gross Domestic Product (GDP) and Inflation in Poland,
- comparison of forecast accuracy
- show teaching aspects of estimation and exploitation of econometric models in gretl
- continuation of earlier works

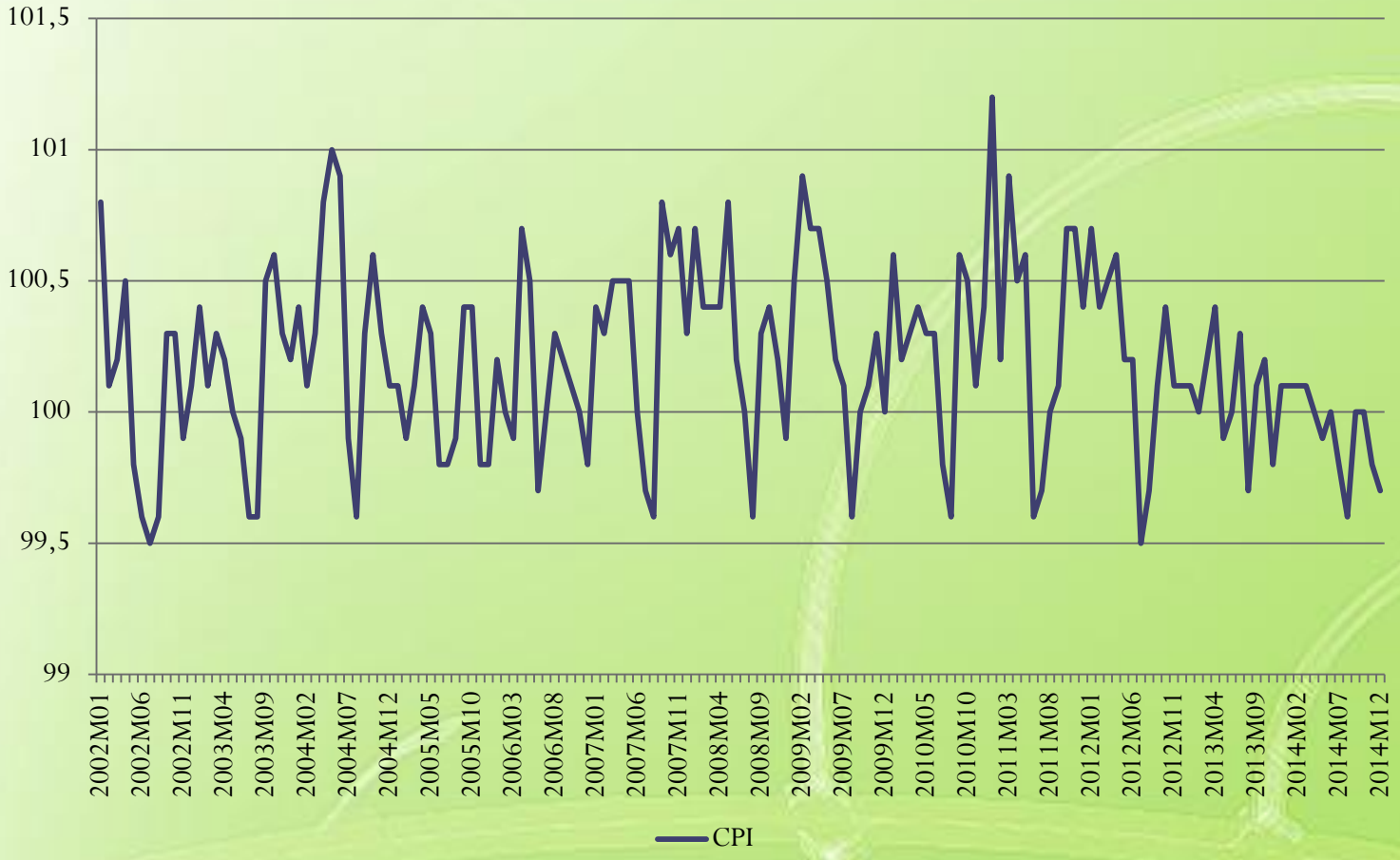
Data description

- quarterly time series from the first quarter of 1997 to the second quarter of 2014 (70 observations)
- monthly time series from January 2002 to December 2014 (156 observations)
- explained variables we used index value of Polish Gross Domestic Product and Consumer Price Index (CPI)
- Data are taken directly from Central Statistical Office of Poland Informational Portal.
- In the estimation process we used sample cut at the end of 2013.

Quarterly data



Monthly data



VAR system of quarterly GDP and CPI

	coefficient	std. error	t-ratio	p-value
Equation 1: CPI				
const	−2,235	7,113	−0,314	0,754
CPI_1	1,085	0,123	8,854	0,000
CPI_2	−0,242	0,115	−2,107	0,039
GDP_1	0,355	0,110	3,233	0,002
GDP_2	−0,167	0,119	−1,402	0,166
time	−0,060	0,043	−1,385	0,171
sq_time	0,001	0,001	1,402	0,166
	R-squared	0,96	**rho**	0,004
Equation 2: GDP				
Const	33,972	7,893	4,304	0,000
CPI_1	−0,112	0,136	−0,823	0,414
CPI_2	−0,086	0,128	−0,674	0,503
GDP_1	1,127	0,122	9,253	0,000
GDP_2	−0,238	0,132	−1,796	0,078
time	−0,098	0,048	−2,027	0,047
sq_time	0,001	0,001	1,768	0,082
	R-squared	0,852	**rho**	-0,002

AR quarterly CPI and GDP models

	coefficient	std. error	t-ratio	p-value
CPI AR model				
const	9,616	2,908	3,307	0,002
CPI_1	0,906	0,028	32,670	0,000
	R-squared	0,943	**rho**	0,416
GDP AR model				
const	19,094	5,412	3,528	0,001
GDP_1	1,280	0,110	11,610	0,000
GDP_2	−0,464	0,109	−4,251	0,000
	R-squared	0,83	**rho**	-0,044

Causal quarterly CPI and GDP models

	coefficient	std. error	t-ratio	p-value
CPI causal model				
const	112,552	4,014	28,040	0,000
IPS	0,066	0,037	1,770	0,082
UN	−0,456	0,083	−5,491	0,000
time	−0,439	0,050	−8,746	0,000
sq_time	0,004	0,001	5,904	0,000
	R-squared	0,831	rho	0,803
GDP causal model				
const	73,529	2,263	32,490	0,000
IPS	0,318	0,022	14,740	0,000
UN	−0,225	0,041	−5,537	0,000
	R-squared	0,778	rho	0,788

AR and Causal monthly CPI models

	coefficient	std. error	t-ratio	p-value
CPI AR model				
const	5,096	2,294	2,222	0,028
CPI_1	1,300	0,080	16,350	0,000
CPI_2	−0,349	0,080	−4,367	0,000
	R-squared	0,933	**rho**	-0,016
CPI causal model				
const	106,690	0,881	121,000	0,000
time	−0,006	0,004	−1,730	0,086
UN	−0,248	0,045	−5,538	0,000
	R-squared	0,238	**rho**	0,952

Forecast accuracy

- Mean Absolute Error (MAE)
- Mean Absolute Percentage Error (MAPE)
- Random Mean Square Error (RMSE)
- Theil ratio

Quarterly forecast errors - I

	MAE	MAPE	RMSE
	CPI		
VAR	0,594	0,591	0,594
AR	**0,240**	**0,238**	**0,240**
Causal	2,778	2,761	2,778
	GDP		
VAR	0,203	0,196	0,203
AR	**0,179**	**0,173**	**0,179**
Causal	0,460	0,445	0,460

Quarterly forecast errors - II

	MAE	MAPE	RMSE	Theil
	CPI			
VAR	0,824	0,821	0,856	3,514
AR	**0,345**	**0,343**	**0,360**	**1,498**
Causal	3,308	3,294	3,351	12,797
	GDP			
VAR	0,608	0,588	0,731	10,134
AR	**0,336**	**0,325**	**0,370**	**4,925**
Causal	0,487	0,472	0,488	5,149

Monthly forecast errors

	MAE	MAPE	RMSE	Theil
		3m		
AR	**0,095**	**0,095**	**0,097**	**0**
Causal	1,698	1,688	1,7	11,683
		6m		
AR	**0,133**	**0,133**	**0,145**	**1,911**
Causal	2,034	2,025	2,063	10,096
		9m		
AR	**0,181**	**0,181**	**0,229**	**1,294**
Causal	2,386	2,383	2,454	10,338
		12m		
AR	**0,252**	**0,252**	**0,328**	**1,28**
Causal	2,69	2,695	2,788	11,135

Diebold – Mariano test

	p - value
6m	0,000017
9m	0,000003
12m	0,017087

Conclusions for teaching

- example is very good to use in teaching
- shows three different ways of modelling
- it is based on empirical data
- it shows that simplier models can be better
- speed and easiness
- clarity and transparency
- it is easy to repeat all the process

Summary

- The best model for forecasting Polish macroeconomic processes: Gross Domestic Product and Inflation are autoregressive models.
- Differences between monthly frequency forecasts are significant.
- GDP and CPI data can be good examples in teaching.
- This paper can be used as a basis for further GDP and CPI analysis.

Thank you for your attention

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