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# Interconnection of interest rate, price level, money supply and real GDP: The case of the Czech Republic

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**Abstract**

The main aim of this paper is to investigate relationships between selected macroeconomic variables – interest rate, price level, money supply and real GDP – in the Czech Republic in order to find out definite implications of its interactions and give recommendations to macroeconomic policy authorities. Implemented vector autoregression approach suggests that three pairs of Granger causality exist, in particular past price level change Granger-causes interest rate change, past real GDP Granger-causes interest rate change and finally past real GDP change Granger-causes price level change. The model allows forecasting the direction of change in case of variables interest rate and real GDP with a high success rate.



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*Keywords:* Interest rate, price level, money supply, GDP, VAR, Granger causality

## 1. Introduction

Relationships between macroeconomic variables have been always in the spotlight of macroeconomists, because they could be used to address theoretical questions of interest. One group of researchers may be interested in investigation, whether Keynesian views of the economy are supported. On the contrary, other researchers could investigate, whether monetarist theory could be applied on economy under study. Someone could be interested in an issue, whether inflation is a monetary phenomenon (Grauwe & Polan, 2005) or whether it is connected to real economy

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and economic growth (Herwartz & Reimers, 2006). A whole set of similar questions could be raised, but is beyond scope of this paper to discuss them in detail.

Author decided to investigate potential relationships between interest rate, money supply, price level and real GDP in the Czech Republic in order to find out definite implications of its interactions and give recommendations to macroeconomic policy authorities.

Mutual interconnection of these variables was investigated in an extensive number of studies, which differs in methodology, economies under study and even in results. Because of large number of studies, only some of them are stated in following paragraph.

Omay and Kan (2010) found statistically significant negative relationship between inflation and output growth with use of non-linear panel regression. Drukker et al. (2005) reached the same conclusion with use of unbalanced panel method, time varying estimates employed in Eggoh and Khan (2014) and trend cycle decomposition model employed in Macchiarelli (2013) showed also negative and nonlinear inflation-growth relationship.

Relationship between real GDP and money supply was investigated in Ravn, Psaradakis and Sola (2005). With use of VAR models with time-varying parameter, they found that the causality between money and output varies in time. International evidence as to the role of money was provided by Canova and Menz (2011). Same conclusion could be made for US and UK economy (Nelson, 2002). Detection of causality with use of VAR was content of Favara and Giordani (2009).

Investigation of potential relationship between interest rate and other macroeconomic variables is a content of Garcia and Rigobon (2004), where VAR is proposed to estimate the correlation pattern of the macro variables of the Brazilian economy and use it to implement Monte-Carlo simulations.

The fourth relationship, which attracts attention, is the one between money supply and price level. ECB research proved existence of long-run relationship between money growth and inflation in European countries, see for example Benati (2005) or Lenza (2006). Existence of this relationship was examined and proved in Thornton (2014), who concentrated on US economy. According to Nguyen (2015), money supply influence inflation also in selected Asian countries.

Investigation of connection between interest rate and inflation draws attention for example in case of Turkish economy. Gul and Ekinci (2006) examined this issue by means of Johansen co-integration technique and Granger causality test. They found a causal unidirectional relationship between nominal interest rates and inflation in Turkish economy. Close relationship was also proved, again by use of cointegrating methods, in European countries and in the US economy in Booth and Ciner (2001).

Closeness of interest rate and money supply in the euro area is shown in Cendejas et al. (2014).

## 2. Data

In our analysis we use above mentioned macroeconomic variables: interest rate, money supply, price level and real GDP. We use seasonally adjusted quarterly data on these variables for the Czech Republic from 1996Q1 to 2015Q3, which means that 79 observations for each variable were collected from this period. Table 1 contains a short description of variables and their abbreviations used in the analysis.

Table 1. Variables used in analysis.

| abbreviation of variable | variable characteristic |
|---|---|
| R | 3 month Prague InterBank Offered Rate (PRIBOR) |
| M | money supply (M2) measured in billions of CZK |
| P | price level measured by the GDP deflator (a price index with 2010 = 100) |
| Y | real GDP measured in billions of 2010 CZK |