HERDING BEHAVIOUR OF CENTRAL BANKS: FOLLOWING THE FED AND ECB

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ABSTRACT

I apply interest rate rules, especially the Taylor rule, to identify basic determinants of the central banks' decision-making process. The results confirmed herding behaviour related to the central bank financial assets and its economic power in the US and Eurozone. The conclusions are discussed in relation to the exchange rate movements and capital flows. The empirical strategy reflects different lag structure and employs autoregressive distributed lag models.

KEY WORDS

interest rates, Taylor rule, central banks, currency war

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1 INTRODUCTION

Interest rates, which are determined by the central bank, are crucial to the whole economy and important for each of us. High interest rates mean more expensive loans, people spend less, and the price level falls. Conversely, when interest rates are low, interest rates on loans are also low, people borrow more, spend more, and ultimately prices rise and unemployment falls. Also, interest rates affect the competitiveness of central banks. With the competitiveness comes the term currency war, or on other side, following of another bank.

After the financial crisis in 2008 banks began to be more active in their currency policy. The competitiveness of each state can be influenced by the interest rate in the open market. A change in the interest rate will affect the competitiveness of the country in direct proportion (Sánchez, 2005). With this is connected the term "currency war", which was made famous by Guido Mantega, former Brazilian Minister for Finance in 2010 (Darvas and Pisani-Ferry, 2010). Currency war is connected to Behavioural following. Many authors

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have been interested in the topic of currency wars – Ahamed (2009), Brown (2010), Reinhart and Rogoff (2010). Instead of wars many states can choose to follow another central bank. The question is whether to follow the ECB or the Fed. The ECB is simply slow and inefficient. This explanation would roughly run as follows: The world's financial markets were buffeted over the last years by the emergence and then the bursting of an asset price bubble. The leadership of the Fed (Mr. Greenspan in particular) is simply smarter and was quicker to spot the problems. By contrast, so the story seems to go, the ECB is a new institution that must still find its way, and its decision-making body is too large to come to quick decisions, especially given that it usually tries to forge a consensus before moving (Belke and Gros, 2002; Wypłosz, 2001; Belke and Göcke, 2003; Belke and Gros, 2003).

In this paper, I will investigate the issue of following another bank, the term currency war, which is also connected and show how much the determination of interest rates affects the interest rate of major central banks and some macroeconomic indicators.

2 METHODOLOGY AND DATA

Firstly, I will describe the original version of the Taylor rule and also describe it. I will use it to my data so I can check whether banks in the eurozone are following the Taylor rule (1a). Central banks react with delay. The original Taylor rule will also be used with Lags (1b). Secondly the Taylor rule for an open economy with the interest rate of the Fed and ECB (2a). The same rule with lags (2b). And eventually I will test the robustness analysis. In each equation, I will explain the variables and data that I am using.

The Taylor rule was first published in a work by John B. Taylor (1993). It can also be described as the interest rate rule (1). This precisely quantifies the relationship between inflation, economic growth and monetary policy of the central bank. Under the original version of the rules of the nominal interest rate it should be determined per the following formula:

$$i_t = r_t^* + a_\pi(\pi_t - \pi_t^*) + a_y(y_t - y_t^*), \qquad (1)$$

where i_t is the target short-term nominal interest rate, r_t^* equilibrium interest rate (used in long-term government securities), π_t inflation rate is measured by the GDP deflator π_t^* is the desired rate of inflation, y_t growth GDP, y_t^* potential growth, $(y_t - y_t^*)$ gap growth. Coefficients $a_p i$, a_y determine whether the central bank will focus more on inflation and economic growth (Troy and Leeper, 2007).

Using the Taylor rule has been evaluated Fed policy, also one can use this rule to tell whether a given central bank focused more on inflation and economic growth. For example, it $a_\pi = a_y = 0.5$. The Fed thus makes keeping both inflation and economic growth of the same weight. The ECB has the other side coefficients $a_\pi = 2$, $a_y = 0.8$. It concentrates therefore on a more stable price level, rather than on economic growth (Pohorský, 2011).

The Taylor rule has 4 disadvantages: (1) the Taylor rule is calculated by taking the price index (inflation) as the GDP deflator or the consumer price index. However, over the past 15 years, the Fed PCE measure of inflation (price index for personal consumption expenditures). (2) In the calculation of the rate to use variables that are not observable, but are derived from other variables. (3) The Taylor rule is a simple model with few variables. The state's economy is much more complex and sophisticated than to go to fully capture a few variables. (4) The Taylor rule does not consider risk management (Kohn, 2010).

It should be noted that central banks react with delay which is from one to two quarters. I will do regression with this delay of the data.

To find out whether the banks in the Euro Area follow someone and who they follow. Whether it is the Fed or the ECB I will use panel regression via this equation:

$$i_{it} = c + \beta_1 \pi_{it} + \beta_2 \text{GDP}_{it} + \beta_3 \text{ER}_{it} + + \beta_4 i_{\text{FED},t} + \beta_5 i_{\text{ECB},t} + \phi_t + + \gamma_i + \epsilon_{it}. \quad (2)$$

Variable π_{it} represents inflation bank i at time t, GDP_{it} represents the index of industrial production of the state i at time t (or GDP). ER_{it} is the real effective exchange rate. Furthermore, using the interest rate of the Fed and the ECB, ϕ_t as a dummy variable, γ_i as fixed effects and ϵ_{it} as a residue. I will also use lags for this equation:

$$i_{i,t-n} = c + \beta_1 \pi_{i,t-n} + \beta_2 \text{GDP}_{i,t-n} + + \beta_3 \text{ER}_{i,t-n} + \beta_4 i_{\text{FED},t-n} + + \beta_5 i_{\text{ECB},t-n} + \phi_{t-n} + + \gamma_i + \epsilon_{i,t-n}. \quad (3)$$

Lags will be used as $t-1$, $t-2$ and $t-3$ because central banks react with delay. The delay that they have is usually a maximum of a quarter of a year, which is why this paper uses a maximum $t-3$. We will use delay to see individual causality between lags and central banks.

All regressions and equations use monthly data. Thus we can interpret the results as accurately as possible.

3 LITERATURE REVIEW

There is a wide body of empirical literature related to the reaction function of the central banks. Jens Klose (2014) says that Determining breakpoints in central bank reaction functions is crucial to monitor the decisions of the governing councils correctly. This is especially true during the recent financial crisis. However, reaction functions do not necessarily change at the beginning of a crisis and so the specific breakpoints need to be estimated rather than being set exogenously. While central bank reaction functions typically include more than one exogenous variable it is possible that the breakpoints in the reaction coefficients change from one independent variable to the other.

Bertrand Blancheton (2016) says that the situation of public finances emerges as a key explanatory factor, and an analysis of the sequence of central banking models is proposed from the late 19th century to the present day. Central banks have, of their own volition, given up some of their de facto independence, helping governments to contain the rise in national debt. But while keeping a step ahead of pressure from governments, they have lost the control of money supply and they have to maintain their ability to compete.

Jens Klose (2016) says that The European Central Bank (ECB) and the Eurosystem consisted of 18 member countries in the end of 2014. Each of these countries had an own vote in the interest rate decisions of the governing council. Since decisions in this council are mostly reached by unanimous vote, those seem to be harder to reach when individual country variables differ than when they are rather similar. He also says that that reaction coefficients on the inflation rate and the output gap are indeed lower when dispersion in the Euro Area countries is higher while monetary policy inertia is more pronounced in times of higher dispersion of the fundamentals.

Tab. 1: Original Taylor rule (dependent variable: interest rate, 2000–2016)

	Taylor	**Taylor2**	**EA**	**EA2**	**noEA**	**noEA2**
defl	0.037	0.024	0.007	0.006	0.126**	0.088
	(0.025)	(0.024)	(0.019)	(0.021)	(0.034)	(0.041)
defl $(t-1)$	0.028*	0.020	0.010	0.010	0.112*	0.097
	(0.014)	(0.014)	(0.011)	(0.011)	(0.038)	(0.039)
defl $(t-2)$	−0.013	−0.020	−0.023	−0.024	0.020	0.007
	(0.016)	(0.016)	(0.015)	(0.015)	(0.020)	(0.025)
defl $(t-3)$	−0.002	−0.013	−0.019	−0.022	0.032	0.008
	(0.024)	(0.025)	(0.024)	(0.026)	(0.028)	(0.058)
gdp	−0.414**	−0.446**	−0.410*	−0.384*	−0.133	−3.102
	(0.200)	(0.209)	(0.217)	(0.212)	(0.558)	(1.874)
gdp $(t-1)$	−0.078	−0.146	−0.157	−0.148	0.077	−0.277
	(0.104)	(0.102)	(0.100)	(0.101)	(0.170)	(0.317)
gdp $(t-2)$	0.269*	0.171	0.152	0.139	−0.032	2.378
	(0.139)	(0.171)	(0.168)	(0.167)	(0.400)	(1.206)
gdp $(t-3)$	0.891**	0.676*	0.575	0.583	1.278*	4.270
	(0.325)	(0.328)	(0.349)	(0.349)	(0.453)	(2.390)
ER		1.063		0.954		1.260
		(0.690)		(0.675)		(0.921)
ER $(t-1)$		−0.108		−0.376		0.820
		(0.497)		(0.580)		(1.670)
ER $(t-2)$		0.114		0.120		−0.063
		(0.325)		(0.321)		(1.691)
ER $(t-3)$		−1.030		−0.840		0.861
		(0.746)		(0.891)		(2.057)
Constant	−2.323***	−2.366***	−2.582***	−2.327***	−2.176***	−2.065**
	(0.166)	(0.190)	(0.206)	(0.199)	(0.188)	(0.480)
Observations	4,576	4,358	3,812	3,796	764	562
R-squared	0.854	0.871	0.891	0.891	0.827	0.887

Note: The numbers in the parentheses indicate standard errors, * indicates a 10% significance level, ** indicates a 5% significance level, and *** indicates a 1% significance level.

4 RESULTS

Tab. 1 presents us the original version of the Taylor rule. The column "Taylor" is the basic version of the Taylor rule. The column "Taylor2" is the basic version for the open economy means. In the formula it is added to the exchange rate. "EA" is the basic version of the rules for the Euro Area without exchange rate. "EA2" is with the exchange rate. The column "noEA" all states outside the EA and "noEA2" all states without outside the Euro Area and the formula was added exchange rate was added to the formula.

The Taylor rule says that the central bank should change the nominal interest rate in response to changes in inflation, output, or other economic conditions. From the results presented in Tab. 1.

The Taylor rule is easy to apply by looking at only the inflation rate and some output measure, it proofed to fit the actual interest rate path of many central banks quite well (Klose, 2014).

We can not see any significant dependence between none any of those variables which indicate that. We can see only little significance in GDP, but there is a − mark, which is due to economic theory nonsense. We can also see significances $p < 1$, but this significance is really small. From those results we can state that the Taylor rule written by John B. Taylor in neither Euro Area nor Asia does not apply either in the Euro Area or in Asia.

Tab. 2: Herding behavior (Taylor rule via 2a and 2b, dependent variable: interest rate, 2000–2016)

	EA −1	**noUS** −2	**noEA** −3	**noEAUS** −4
defl	0.006	0.020	0.102*	0.135***
	(0.021)	(0.024)	(0.032)	(0.000)
defl $(t-1)$	0.010	0.020	0.109*	0.151***
	(0.011)	(0.014)	(0.034)	(0.000)
defl $(t-2)$	−0.024	−0.018	−0.024	−0.005***
	(0.015)	(0.016)	(0.011)	(0.000)
defl $(t-3)$	−0.022	−0.009	0.009	0.089
	(0.026)	(0.026)	(0.073)	(.)
gdp	−0.384*	−0.415*	−2.610	−1.492
	(0.212)	(0.210)	(1.578)	(.)
gdp $(t-1)$	−0.148	−0.129	−0.094	0.174***
	(0.101)	(0.099)	(0.214)	(0.000)
gdp $(t-2)$	0.139	0.160	2.195	1.280***
	(0.167)	(0.162)	(1.048)	(0.000)
gdp $(t-3)$	0.583	0.653*	3.771	2.687***
	(0.349)	(0.332)	(2.109)	(0.000)
ER	0.954	0.580	1.936	3.873***
	(0.675)	(0.698)	(0.881)	(0.000)
ER $(t-1)$	−0.376	−0.364	0.167	−2.275***
	(0.580)	(0.495)	(1.687)	(0.000)
ER $(t-2)$	0.120	0.292	0.085	2.974***
	(0.321)	(0.299)	(1.382)	(0.000)
ER $(t-3)$	−0.840	−0.770	0.890	−2.624***
	(0.891)	(0.838)	(1.888)	(0.000)
ir_FED	−0.147	−0.141		0.352
	(0.172)	(0.180)		(0.472)
ir_FED $(t-1)$	0.721***	0.728***		−0.126**
	(0.154)	(0.168)		(0.008)
ir_FED $(t-2)$	0.000	0.000		0.000
	(0.000)	(0.000)		(0.000)
ir_FED $(t-3)$	0.090	0.113		0.138
	(0.071)	(0.087)		(0.351)
ir_ECB			0.288	0.710
			(0.451)	(0.950)
ir_ECB $(t-1)$			−0.413	
			(0.328)	
ir_ECB $(t-2)$			0.000	0.000
			(0.000)	(0.000)
ir_ECB $(t-3)$			0.735	−0.598
			(0.319)	(0.889)
Constant	−0.285	−0.423*	−0.851	−0.999**
	(0.241)	(0.216)	(0.387)	(0.052)
Observations	3,796	4,168	546	364
R-squared	0.891	0.878	0.886	0.961

Note: The numbers in the parentheses indicate standard errors, * indicates a 10% significance level, ** indicates a 5% significance level, and *** indicates a 1% significance level.

Tab. 3: Taylor rule before 2007 (dependent variable: interest rate, 2000–2016)

	EA −1	**noUS** −2	**noEA** −3	**noEAUS** −4
defl	0.000	0.023	0.184	0.273***
	(0.035)	(0.040)	(0.067)	(0.000)
gdp	0.148	0.216	3.068	2.828
	(0.454)	(0.412)	(1.336)	(.)
ER	−0.057	−0.214	3.145***	2.233***
	(0.917)	(0.894)	(0.152)	(0.000)
ir_FED	0.689***	0.645***		0.283
	(0.061)	(0.070)		(0.274)
ir_ECB			0.522	0.411
			(0.211)	(0.516)
Constant	−0.488***	−0.478***	−0.391	−0.513
	(0.141)	(0.148)	(0.433)	(0.228)
Observations	4,026	4,234	555	370
R-squared	0.889	0.877	0.879	0.948

Note: The numbers in the parentheses indicate standard errors, * indicates a 10% significance level, ** indicates a 5% significance level, and *** indicates a 1% significance level.

Tab. 2 shows regression via equation 2a, 2b. In the tables we have four regressions: Regression for the Euro Area (1), States outside the US (2), States outside the Euro Area (3) and states outside the Euro Area and US (4).

In his empirical work Klose (2016) tried to evaluate whether country preferences are present in the interest rate decisions of the ECB council. He found out that yes, it is. If there were no country preferences in the interest rate decisions, dispersion indicates of fundamental variables should be neglected by the decision markers.

Considers changes in monetary policy to be a major reason for improved economic performance (measured by variability of output and inflation). Since 2003 policy has become much more discretionary with interventions into particular markets, the expansion of the FED's balance sheet and the commitment to hold the interest rate at zero. Discretionary practices were driven by the Fed in response to the new context particularly after the subprime crisis: it anticipates government constraints and aspirations. According to Taylor the loss of de facto independence more recently was driven by the Fed itself (Taylor, 2013, p. 15).

From the results presented in Tab. 2 we can see that states outside the US and EA have an interaction between inflation and interest rates in time t and $t-1$. Interactions between GDP and interest rates are in time $t-1$, $t-2$ and $t-3$ because central banks react with a sort of delay. Interactions between the exchange rate and interest rates are valid only in time t and $t-2$, because the mark $-$ in time $t-1$ and $t-3$ does not correspond with economic theory. The main findings that we see from this table is that the Euro Area and states outside America follow the interest rate of the Fed in time $t-1$, because central banks react with a delay. We cannot see the results between the ECB, because there were no significances.

5 ROBUSTNESS ANALYSIS

I check the sensitivity of my analysis in relation to the interest rate before year 2007 (Tab. 3) and after year 2007 (Tab. 4). The results presented in the both of the tables are similar. Thus, we can believe in the robustness of our previous results in both before and after year 2007.

Tab. 4: Taylor rule after 2007 (dependent variable: interest rate, 2000–2016)

	EA −1	**noUS** −2	**noEA** −3	**noEAUS** −4
defl	0.018	0.023	0.184	0.273***
	(0.037)	(0.040)	(0.067)	(0.000)
gdp	0.191	0.216	3.068	2.828
	(0.453)	(0.412)	(1.336)	(.)
ER	−0.163	−0.214	3.145***	2.233***
	(0.899)	(0.894)	(0.152)	(0.000)
ir_FED	0.672***	0.645***		0.283
	(0.059)	(0.070)		(0.274)
ir_ECB			0.522	0.411
			(0.211)	(0.516)
Constant	−0.463***	−0.478***	−0.391	−0.513
	(0.153)	(0.148)	(0.433)	(0.228)
Observations	4,064	4,234	555	370
R-squared	0.882	0.877	0.879	0.948

Note: The numbers in the parentheses indicate standard errors, * indicates a 10% significance level, ** indicates a 5% significance level, and *** indicates a 1% significance level.

6 DISCUSSION AND CONCLUSIONS

This paper was looking for interlinkages between the interest rate of central banks and the interest rate of the ECB or Fed as per the Taylor rule. With the results which we presented, we can say that Taylor's rule for an open economy in the Euro Area does not simply apply. In today's economy central banks may use the Taylor rule, because the Taylor rule uses inflation, which in today's economies is zero or even negative. Another finding of this paper was that the interest rate of banks outside the Euro Area and America is determined by all variables. By GDP in time t, $t-1$, $t-2$ and $t-3$ as well. By Defl in time t and $t-1$. By Exchange rate in time t and $t-2$. The main finding was that states in the Euro Area and outside America tend to follow the interest rate of the Fed and none of those areas tend to follow the interest rate of the ECB. This is probably as mentioned by Belke and Gros (2002) and Wypłosz (2001) in their paper. The ECB is simply new, slow and inefficient. Following the bank that is the strongest leader is simply the best idea.

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