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The relevance of international spillovers and asymmetric effects in the Taylor rule[☆]

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ABSTRACT

Deviations of policy interest rates from the levels implied by the Taylor rule have been persistent before the financial crisis and increased especially after the turn of the century. Compared to the Taylor benchmark, policy rates were often too low. This paper provides evidence that both international spillovers, for instance international dependencies in the interest rate setting of central banks, and nonlinear reaction patterns can offer a more realistic specification of the Taylor rule in the main industrial countries. The inclusion of international spillovers and, even more, nonlinear dynamics improves the explanatory power of standard Taylor reaction functions. Deviations from Taylor rates tend to be smaller and their negative trend can be eliminated.

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1. Introduction

Since the 1980s central banks switched to policies based on rules, with strong emphasis on price stability. The Taylor rule has become popular to describe the monetary policy stance in both advanced and developing countries (Taylor, 1993). It links policy interest rates to deviations of inflation from its target and real output from its potential. According to the Taylor principle, the central bank should raise the nominal interest rate by more than one percentage point for each one percent increase in inflation. Taylor (1993) emphasized the importance of rule-like behavior on part

of central banks as a key framework to ensure time-consistency, monetary transparency, and independence.

While policy rates have been broadly in line with the Taylor rule during the Great Moderation, they have been persistently moving below it in both advanced and developing countries since the turn of the century. The monetary accommodation implied by these deviations has been blamed as a potential factor in the build-up of imbalances in the period before the financial crisis (Kahn, 2010). Therefore, their explanation is of high academic and policy relevance.

A straightforward extension of the traditional Taylor rule is based on the idea of accounting for *international spillovers*. There are several reasons why international linkages have become more important. On the one hand, declining real interest rates may have introduced an upward bias in the Taylor rule, i.e., an overestimation of nominal interest rates implied by the Taylor rate. Capital inflows from emerging markets to the industrial countries might have led to lower real interest rates, as stated by the savings glut hypothesis. In general, the savings glut was in large part a result of policies that emerging market economies put in place when the global economy started to recover from the 2000 to 2001 recession

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(Bernanke, 2005, 2007).¹ Underdeveloped financial markets in the emerging countries restricted the ability of their citizens to borrow against future income and redirected their savings to industrial countries, in particular to the US. Asset shortages triggered a reduction of the equilibrium real interest rates at a global scale (Caballero, Farhi, & Gourinchas, 2008). This development might also reflect secular demographic trends in the industrial countries, specifically strong asset demand exerted by the baby boomer generation. A further explanation refers to an increase in the perceived riskiness of capital assets in the wake of asset price booms and busts after the turn of the century. Therefore, policy interest rates fell below the Taylor rule levels in close synchronization across countries. For example, Hofmann and Bogdanova (2012) have argued that deviations from the Taylor rule can be best interpreted as a change in the global equilibrium real interest rate.²

Taylor (2013) argues that a further transmission channel for international spillovers stems from the fact that central banks no longer decide on policy rates in an independent way. While interest rates have been set according to national conditions up to the turn of the century, policy reactions have been increasingly affected by the international environment since then. Hence, the deviations might indicate a substantial shift in the monetary policy regime.

However, the statement that “central banks no longer decide on policy rates in an independent way” appears to be too strong, at least for the Federal Reserve. Central banks typically argue that they react to international developments only to the extent they affect the outlook for domestic economic performance – inflation and employment – but they do not generally take policy decisions on the basis of what other central banks are doing. They also take foreign interest rates into account if the exchange rate is one of the implicit targets. Nevertheless, monetary policy can still differ significantly across countries. The current divergence of U.S. monetary policy from that of the euro area is a prime example.

Among others, Kim (2000) demonstrates that US monetary policy shocks can affect other countries. Belke and Gros (2005) provide evidence that the ECB followed the Fed in her interest rate decisions. In fact, low US interest rates can increase risk taking in other countries, and one option to react is to lower interest rates, see Bruno and Shin (2012). In addition, central banks tend to resist large exchange rate appreciations, and adjust their interest rates according to the behavior of other central banks. Most importantly, the actions of the Federal Reserve System have been magnified due to the mimicking responses of other central banks (Gray, 2013). In particular, other central banks followed the policy path of the Fed. In this context, Gray (2013) establishes empirically how U.S. monetary policy actions impact on the actions of other major central banks, especially regarding interest rates and currency interventions. His estimation results suggest that the US Fed lowering its policy rate, either in general or in reference to a monetary policy rule, influences other central banks to decrease their own policy rates and intervene in currency markets, even when worldwide macroeconomic trends are controlled for. Overall, thus, deviations from a Taylor rule can well be amplified by international spillovers (Taylor, 2013).

¹ The argument posits that an excess supply of savings – particularly in Emerging Asian countries – helped to generate a US current account deficit as savings had to flow somewhere. The US was the main destination and – due to its huge and non-fragmented bond market – also a capable recipient of the savings. See also Belke and Gros (2014).

² As pointed out by an anonymous referee, a distinction between declining real rates and declining equilibrium real rates is necessary in this regard. The equilibrium real rate has also fallen sharply since the onset of the financial crisis and Great Recession (Laubach & Williams, 2015; Belke & Klose, 2013, 2016). In our smooth transition specification all coefficients are allowed to vary and thus also a varying constant is allowed for.

Deviations can also occur due to asymmetric behavior by the central banks. For example, interest rate reaction functions can be different in periods of expansionary and contractionary monetary policy. This distinction may hold independently of an impact of international spillovers. Asymmetric responses lead to nonlinear Taylor rules as recently proposed by Brueggemann and Riedel (2011), among others. Such explanations might be better able to capture the evolution of policy rates. Expansionary and contractionary monetary decisions might be based on a different set of determinants. In this vein, Alcidi, Alessandro, and Fracasso (2009) show that linear Taylor rules fail to detect policy decisions driven by policymakers' judgment while smooth transition models are well-suited to improve linear Taylor reaction functions.

This paper examines the causes of the deviations from the standard Taylor rule by analyzing the importance of both international spillovers and nonlinearities for monetary policy decisions in the main industrial countries, i.e., the US, the Euro Area, the UK and Japan. A simple linear benchmark model is chosen as a point of departure and extended step by step. After incorporating international spillovers via foreign interest rates, nonlinear dynamics are examined through a smooth transition approach. Several variables steering the transition between the regimes are considered, such as lagged interest rate changes, the output gap, oil prices and lagged differentials between domestic and foreign interest rates. Our empirical results suggest that both incorporating international spillovers and, even more important, allowing for nonlinear dynamics are important to improve the empirical fit of the Taylor reaction function to explain actual monetary policy behavior. International spillovers seem to be more important in periods of increasing interest rates, with the exception of the euro area. This appears consistent with recent evidence delivered by the IMF in its spillover reports in the context of the envisaged Fed's exit from unconventional monetary policies (IMF, 2013).

The remainder of the paper is organized as follows. The next section (Section 2) reviews the Taylor rule specification. Section 3 documents the deviations from the linear model and discusses the extension of the Taylor principle by international spillovers. In Section 4 nonlinear specifications are presented. Section 5 holds the empirical results. Finally, Section 6 concludes with some policy implications.

2. Deviations from the Taylor rule

The Taylor rule establishes a linear relationship between the nominal interest rate, inflation and the output gap. In its standard form,

$$i_t = r^* + \pi^* + \alpha_1 (\pi_t - \pi^*) + \alpha_2 y_t + \varepsilon_t \quad (1)$$

i_t is the nominal policy determined interest rate, r^* is the long-run equilibrium real interest rate, π^* stands for the central bank's inflation objective assumed to be 2% in the following, π represents the actual inflation rate, and y is the output gap, i.e., the deviation of actual and potential output, expressed as a percentage of the latter. The error ε fulfills the white noise properties and the index t denotes time. The parameters describe how strong the policy interest rate should respond to deviations of inflation from its target and of output from its potential. The Taylor rule implies that central banks aim to stabilize inflation around its target and output around its potential. Positive (negative) deviations of the two variables from the respective levels would be associated with a tightening (loosening) of the monetary policy stance. An inflation reaction coefficient (α_1) above one ensures that real interest rates respond to inflationary pressures (Taylor, 1993, 1998). In that case an increase in inflation triggers a rise in the real interest rate.

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