



# Purchasing power parity and real exchange rate in Central Eastern European countries☆



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## ABSTRACT

This study applies a non-linear threshold unit-root test to test the validity of purchasing power parity (PPP) to assess the non-stationary properties of the convergence of real exchange rates (RERs) based on Taylor rules for ten Central Eastern European countries. We find that the non-linear threshold unit-root test has greater power than the linear method suggested by Caner and Hansen (2001) if the true data generating process of RER convergence is a stationary non-linear process. We examine the validity of Taylor rules from the non-linear perspective and provide robust evidence that clearly indicates that PPP holds true for seven Central Eastern European countries. These results imply that the choices and effectiveness of the monetary policies in Central Eastern European economies are highly influenced by external factors that originate from the United States. Additionally, our findings highlight that these countries' RER convergence is a mean reversion towards the equilibrium values of Taylor rules in a non-linear manner. Our findings mean capital mobility, exchange rate market efficiency and monetary integration are non-linear in these Central Eastern European countries.

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## 1. Introduction

The analysis of long-run purchasing power parity (PPP) has probably been one of the most controversial topics in recent decades within international economics. The results from the validity of PPP have important implications for decision or policy makers of central banks, multinational firms and exchange rate market participants. The basic idea behind the PPP hypothesis is that because any international goods market arbitrage should be traded away over time, we should expect the real exchange rate (RER) to return to a constant equilibrium value in the long run. In particular, a non-stationary RER indicates that there is no long-run relation between the nominal exchange rate and domestic and foreign prices, thereby invalidating the PPP. A sufficient condition for a violation of PPP is that the RER is characterized by the presence of a unit root. In this case, shocks have permanent effects, and there is no tendency to return to a stable value (Perron & Vogelsang, 1992). Standard monetary models of the determination of exchange rates have long been discredited by their failure to explain exchange rate behavior, as forcefully documented by Meese (1990); Flood and Rose (1995); Su, Chang, and Chang (2011); Lee and Chou (2013), and Huang and Yang (2015). A new strand of literature identifies one of the major shortcomings of traditional exchange rate models in focusing

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minimally on the market's expectations of future values of the macroeconomic fundamentals; it also allows for the endogeneity of monetary policy by incorporating Taylor rule reaction functions into otherwise standard exchange rate models (Bacchetta & van Wincoop, 2006; Engel, Nelson, & Kenneth, 2008; Engel & West, 2004, 2005; Engel & West, 2006).

Recent literature uses Taylor rules to model the exchange rate determination (Molodtsova, Nikolsko-Rzhevskyy, & Papell, 2008; Taylor, 1995; Taylor & Peel, 2000). The Taylor rule specifies that the central bank adjusts the short-run nominal interest rate in response to changes in inflation and the output gap. By specifying Taylor rules for two countries and subtracting one from the other, an equation is derived with the interest rate differential on the left-side and the inflation and output gap differentials on the right-side. If one or both central banks also target the PPP level of the exchange rate, the RER will also appear on the right-side (Molodtsova & Papell, 2009). According to Taylor (1993), the interest rate reaction function known as the Taylor rule has become the dominant method for evaluating monetary policy. In the Taylor rule, the nominal interest rate responds to the inflation rate, the difference between inflation and its target, the output gap, the equilibrium real interest rate, the lagged interest rate and the RER. The Taylor rule incorporates the features that monetary theory has identified as associated with good monetary policy: transparency, accountability and credibility. In particular, a central bank that adheres to a Taylor rule reveals to the public that it is committed to price stability, and the bank systematically takes steps to achieve it. Therefore, the public maintains its expectations of low and stable inflation, and financial markets anticipate the central bank's next move and increase market interest rates immediately when inflation rises. The endogeneity of monetary policy can be modeled by means of a Taylor rule with the interest rate as the policy instrument. In such an environment, interest rates respond to inflation, the output gap and possibly the exchange rate. A model of the open economy with a Taylor rule displays exchange rate behavior that is very different from that in traditional exchange rate models. It is widely accepted that a well-designed monetary policy can counteract macroeconomic disturbances and dampen cyclical fluctuations in prices and employment, thereby improving overall economic stability and welfare (Orphanides & Williams, 2002). Such models display exchange rate behavior very differently than do traditional exchange rate models. For example, whereas in standard flexible-price monetary models an increase in the current inflation rate causes the exchange rate to depreciate, in Taylor rule models, the exchange rate appreciates because higher inflation induces expectations of tighter future monetary policy (Clarida & Waldman, 2008).

In particular, research was conducted in the field of measuring the impact of the international business cycle on a small open economy; refer to Smith and Summers (2005); Artis, Galvão, and Marcellino (2007); Chen and Shen (2007). The emerging evidence on the empirical performance of Taylor rule models of the open economy is very encouraging. Frömmel and Schobert (2006) explore monetary policy rules for central and eastern European countries (CEECs) by explicitly explaining changes in policy settings. The process of economic transition began in 1992 in the former Soviet Union with a liberalization of the foreign exchange markets and a provision of currency convertibility. These drastic steps resulted in initial deep undervaluations of the national currency. In this study, we analyze whether Taylor rules hold for CEECs because of their increasing importance in view of these countries joining the European Monetary Union (EMU) or the European Union (depending on the country). At the same time, price liberalization was accompanied by very high inflation rates. Therefore, the features of CEEC transition economies provide an interesting study of a Taylor rule hypothesis test. First, there was the centrally planned and rapid liberalization of prices and markets, and certain markets suffered from high inflation. Second, and most importantly, the initial conditions for CEEC transition varied extensively, and they may be an important indicator in explaining the magnitude of deviations from Taylor rules in a nonlinear view.

The central objective of this study contributes significantly to this field of research because we first examine the evidence in RER based on Taylor rules for CEECs using the threshold autoregressive model (TAR) and the test statistics suggested by Caner and Hansen (2001). The main advantage of this procedure is that it allows one to simultaneously test for nonlinearities and non-stationarity. Second, to the best of our knowledge, this study is the first of its kind to utilize the threshold unit root test for long-run RER based on Taylor rules in CEECs from a nonlinear view. This empirical result provides strong evidence that favors the validity of PPP for the seven CEECs. This information is important because it reveals how participants in financial markets assess the convergence status of the CEECs.<sup>1</sup>

The remainder of this study is organized as follows. Section 2 is a brief literature review. Section 3 describes the Taylor rules and methodology of the non-linear threshold unit root test. Section 4 presents the data used in our study and discusses the empirical findings. Finally, Section 5 reviews our conclusions.

## 2. Literature review

A non-stationary RER indicates that any long-run relation between the nominal exchange rate and domestic and foreign prices is virtually non-existent, therefore invalidating the theory of PPP. Empirical evidence of PPP on the stationarity of the RER is abundant; unfortunately, a consensus has not yet reached. For details regarding previous studies, refer to the work of Taylor (1995); Taylor and Sarno (1998); Sarno and Taylor (2002); Lothian and Taylor (2000, 2008). Cuestas (2009) finds that PPP holds in most of these countries once nonlinear deterministic trends and smooth transitions have been considered. Molodtsova and Papell (2009) provide evidence of predictability that is much stronger with Taylor rule models than with conventional interest rate, PPP, or monetary models.

<sup>1</sup> In this paper, we focus on the test of PPP and RER particularly using the nonlinear method for check. Therefore, we do not consider the Balassa–Samuelson effect.

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