



# Does real interest rate parity really hold? New evidence from G7 countries



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## ABSTRACT

The purpose of this study is to understand the fulfillment of the real interest rate parity (RIRP) for G7 countries using panel data on short-term real interest rate differentials (RIRD). Two modern econometric approaches, sharp transition and smooth transition, are employed to examine the dynamic processes of RIRP in the work. More specifically, the novel approaches which specify Carrion-i-Silvestre et al.'s (2005) model and the Fourier function are adopted to re-examine the RIRD. Some major findings are summarized as follows. Firstly, the empirical results are remarkably consistent, even when using distinct numéraire countries or/and using alternative definitions of the real interest rates. Moreover, we obtain results indicating RIRP fulfillment in most cases, whether we adopt the panel or univariate stationarity tests. However, we fail to obtain the strong evidence in favor of RIRP by the Narayan and Popp (2010) unit root test.

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## 1. Introduction

Over the past decades, most countries in the world have been gradually reducing the restrictions on many economic policies and loosening regulations to pursue greater efficiency in their financial markets. This modern trend has dramatically improved international capital mobility across markets. With the increasing integration of international financial markets, the real interest rate usually plays a significant intermediary role in the transmission of macroeconomic and monetary policies. Of course, changes in the interest rates will influence investments, savings, monetary demands and other economic activities, and have further effects on outputs and prices. The monetary authority therefore usually expects to manipulate interest rates through monetary policy to influence economic performance. However, in liberalized open economies, the free movement of capital in international markets would result in the interest rate differentials disappearing across countries. In other words, there is no easy way for most monetary authorities in a global economy to adopt a purely independent monetary policy.

According to the real interest rate parity (RIRP) hypothesis, if an investor makes her/his own forecasts by using rational expectations and, at the same time, the international capital markets and the product markets are integrated well enough, then real interest rates must be equal across countries. In a theoretical sense, RIRP holds only if both

uncovered interest parity (UIP) and relative purchasing power parity (RPPP) hold. Therefore, RIRP can be understood as a more general indicator of the degree of financial and product market integration. However, the RIRP is also another fundamental assumption for various monetary models of exchange rate determination (see for example, [Mussa, 1976](#); [Frankel, 1979](#)). By contrast, if the RIRP does not hold, it implies that any monetary authority can freely implement an independent monetary policy.

Intuitively, the RIRP hypothesis would seem to be a reasonable proposition in a complete market that would allow a relationship of equality to be obtained. Unfortunately, numerous empirical studies which have tested the RIRP hypothesis have obtained mixed results. [Cumby and Obstfeld \(1984\)](#), [Mishkin \(1984\)](#) and [Chinn and Frankel \(1995\)](#), for example, offer very limited support for the short-run RIRP. These studies have accounted for empirical evidence using the transaction costs in the international financial markets (see, [Goodwin and Grennes, 1994](#)). A large number of studies have used different econometric techniques to test the equality hypothesis. With some new developments in static time series models regarding unit root and cointegration testing, there is some evidence to suggest that real interest rates are not stationary. However, the empirical results regarding the stationarity and cointegration tests of real interest rate equalizations and real interest rate differentials (RIRD) are again rather mixed (i.e., [Edison and Pauls, 1993](#); [Meese and Rogoff, 1988](#); [Wu and Fountas, 2000](#)).

In general, there are usually three major shortcomings in econometrics with these conventional empirical approaches. First, the use of the standard unit root and stationarity tests for mean reversion, such as

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the Augmented-Dickey Fuller (ADF) test and Philips–Perron (PP) test, which have low testing power when the sample size is small, can lead to misleading conclusions. Taylor et al. (2001), for example, provide a number of pieces of evidence to support this claim.

Second, the above-mentioned articles are all based on linear unit root and linear cointegration tests. Several economists, such as Kapetanios et al. (2003), assert that the key macroeconomic variables such as exchange rates and interest rates, among others, have nonlinear properties that can arise from transaction costs and other frictions in the international financial markets. Therefore, Bahmani-Oskooee et al. (2007) use the KSS (Kapetanios et al., 2003) nonlinear unit root test – which takes into account the process of an exponential smooth transition autoregression in the data-generating process (DGP) – to obtain evidence of the presence of nonlinearities in the series of real exchange rates for 23 industrialized countries. Similarly, Baharumshah et al. (2009) find powerful evidence in favor of RIRP for 17 countries by utilizing the KSS nonlinear unit root tests.

Third, when the presence of possible structural breaks in the DGP is not taken into account, conventional inferences may become misleading and seriously biased (see, Perron, 1989). Recent empirical studies have presented adequate evidence of the presence of structural breaks in real interest rates and inflation rates.<sup>1</sup> Consequently, it is essential that the presence of structural breaks in the RIRD should be considered when testing for RIRP. Recent empirical works by Lai (2004) and Camarero et al. (2010) find evidence of RIRP for industrialized countries by utilizing panel stationarity tests with structural breaks. Arghyrou et al. (2009) also find evidence of RIRP for some European Union (EU) countries via applying unit root tests with two structural breaks as advocated by Lee and Strazichic (2003).

However, most existing literature, which has applied the stationarity tests with structural breaks using dummy variables, could only capture the sharp breaks in the level and trend, but could not capture smooth transformations. Typically, structural breaks in a time series are assumed to occur instantaneously or abruptly. Nevertheless, numerous economists recognize that the effects of structural switching on the level or transition speed of a series can be gradual. For example, Leybourne et al. (1998) and Kapetanios et al. (2003) advocate a unit root test such that the deterministic component of the series is a logistic smooth transition autoregressive (LSTAR) process and an exponential smooth transition autoregressive (ESTAR) process (see also, Chang, forthcoming). However, there are some restrictions on this type of unit root test; for example, it must be assumed that there is only one gradual break with a single known break point and transition function.

In order to mitigate these problems, Becker et al. (2004), Becker et al. (2006) and Enders and Lee (2012) attempted to develop unit root and stationarity tests which allow for an unknown number of structural breaks with unknown functional forms using a flexible Fourier transformation in a time-varying intercept. Several seminal studies, such as Becker et al. (2004) and Enders and Lee (2012), illustrate that a Fourier series approximation can capture the behavior of an unknown function, even if the function itself is not periodic. Moreover, the flexible Fourier testing framework requires only the specification of the proper frequency in the estimating equations.

Because the financial and capital markets for G7 countries are well developed and prosperously matured, the price mechanism in these markets, such as interest rates, has more chances to efficiently and correctly respond to news coming than in other markets for less developed economies. In other words, the market conditions for G7 countries are much closer to the theoretical assumptions of RIRP. The real interest rates for G7 countries can therefore be good observations for testing if

RIRP holds in practice. Of importance, the national net wealth of G7 is representing more than 64% of the net global wealth, so that the testing results of RIRP for G7 countries would be a consensus viewpoint in literature.<sup>2</sup> That's why the issue of the RIRP for G7 attracts much attention in empirical economic studies (see, for example, Wu and Fountas, 2000). However, G7 countries' capital and financial markets are so closely linked that each easily suffers from the influence of political and economic events in the other, so we focus on the factor of structural breaks, but do not take the nonlinear property into account in our main approaches. As noted by Holmes and Maghrebi (2004), a very sharp transition from one interest rate to another is possible. Nevertheless Baharumshah et al. (2009) indicate that the RIRP can be characterized by a smooth transition. In this study, we adopt an integrated model which incorporates both sharp drifts and smooth breaks using dummy variables and a flexible Fourier function, respectively.<sup>3</sup> In order to capture the sharp drifts in G7 countries, we use the multiple structural breaks model proposed by Carrion-i-Silvestre et al. (2005). In order to describe the smooth transition processes, we utilize the flexible Fourier function advocated by Becker et al. (2004) and Enders and Lee (2012).

To the best of our knowledge, no study in the existing literature has yet incorporated testing for RIRP fulfillment to allow for both multiple sharp breaks and smooth transitions. In addition, we test for RIRP using both ex-ante and ex-post definitions of real interest rates. The United States and Germany both serve as numéraire countries, in order to allow us to observe if the results are sensitive to the selection of numéraire ones. We find that the results do not possess variations that are too large with respect to the definitions of the real interest rates and the selection of the numéraire country. Moreover, our empirical results present strong evidence in favor of RIRP theory. On the other hand, we adopt the novel unit root test developed by Narayan and Popp (2010), and obtain the weak evidence in favor of RIRP.

The rest of this paper is organized as follows. Section 2 provides a brief overview of the RIRP theory. Section 3 describes our econometric approaches. The empirical results are presented in Section 4. Section 5 summarizes our conclusions.

## 2. Real interest rate parity theory

The RIRP theory states that real interest rates should be equalized across countries under fully liberalized financial markets without government interventions and capital controls. The fulfillment of the RIRP is related to the UIP, RPPP and Fisher equation. The relationships between UIP and RPPP are straight-forward to obtain, because the UIP theory implies that:

$$\Delta s_{t+1}^e = i_t - i_t^* \quad (1)$$

RPPP theory implies:

$$\Delta s_t = \Delta p_t - \Delta p_t^* \quad (2)$$

where  $\Delta s_t$  denotes the changes in the nominal exchange rate between periods and the symbol \* represents the variables of the foreign country. Eq. (2) can be rewritten for period  $t + 1$  by taking expected values as follows:

$$\Delta s_{t+1}^e = \Delta p_{t+1}^e - \Delta p_{t+1}^{*e} \quad (3)$$

Consequently, substituting Eq. (1) into Eq. (3) yields  $i_t - i_t^* = \Delta p_{t+1}^e - \Delta p_{t+1}^{*e}$  and rearranging that we obtain the expression

<sup>1</sup> For example, extreme economic and political changes (i.e., Caporale and Grier, 2000; Rapach and Wohar, 2005) and supply shocks due to disturbances in the petroleum markets would engender the presence of structural breaks in the series of real interest rates and inflation rates.

<sup>2</sup> About the national net wealth, one can refer the Credit Suisse Global Wealth Report 2014.

<sup>3</sup> The incorporated model was proposed firstly by Chang and Ranjbar (2012).

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