

UDC 336.781.5(497.7)
336.781.5(4-672EU)

BRIEF EMPIRICS OF INTEREST - RATE DIFFERENTIAL IN MACEDONIA

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Abstract

The aim of this paper is to empirically test the order of integration of the differential of the referent interest rates in Macedonia and Euro zone, in order to confirm or reject the hypothesis of interest-rate convergence in Macedonia. Namely, the strategy of exchange-rate pegging puts monetary policy on an autopilot which immediately shrinks domestic inflation at Euro zone's level, but is expected to lead to interest-rates convergence too. We utilize three less-known tests in the literature of series' integration: KPSS, Geweke and Porter-Hudak test and Robinson test and we find support for the hypothesis that interest rates are in a process of catching up, which implies that their integration level is about 0.87, hence confirming that the convergence is not yet achieved, but is underway.

Keywords: interest-rate convergence, tests for fractional integration

JEL classification: E43, E50

Introduction

The process of economic convergence is essential for any country that opts to join the European Union. Two aspects of economic convergence are important: nominal and real. The nominal convergence implies harmonization of monetary policy, in order to curb inflation and its volatility, converging interest rates, stable exchange-rate anchor and prudent fiscal policy. What follows then is the real convergence which, generally said, implies elimination of the disparities in the living standards. Whereas the real convergence is longer-term concept, the nominal convergence is usually achieved by anchoring the domestic currency. Macedonia anchored its currency to the Euro and formerly to the Deutsche mark in 1995. As an EU candidate country, it will have to fulfill the Maastricht criteria for entering the Euro zone (i.e. the criteria for nominal economic convergence), and, for this purpose, the peg needs to be the biggest contributor. An aspect of the nominal economic convergence is the convergence of nominal interest rates.

The objective of this paper is to test the level of convergence between the referent interest rate in Macedonia - the rate on the open market operations and the referent interest rate in the Euro zone - the rate on the main refinancing operations. This is implied by the basic interest-rate parity conditions, according to which, when the exchange rate is held fixed, the domestic interest rate must equal the foreign rate. Although it might be far from reality, mainly because of the risk premium implied by the country risk, still the hypothesis is empirically testable. In essence, the risk premium might be the factor that will prevent immediate equalization of both interest rates, but as monetary policy accrues the credibility of the anchor central bank, the interest rate is expected to converge. The speed of convergence depends on the central-bank's commitment towards maintaining the peg, but also on other factors out of its control, mainly in the vein of the fiscal-policy behavior and some political developments. This study opts to analyze the interest-rate differential through the prism of some newly established econometric tests.

For the purpose stated, the study is organized as follows. The next section offers a brief theoretical overview of the theory underlying our investigation. Section three describes the data and section four explicates the methodology. Section five presents the results and offers some discussion. The last section concludes.

Theoretical overview

The theoretic background of the analysis in this paper is the interest-rate parity condition, which states that the domestic interest rate equals the foreign interest rate plus the rate of depreciation of the domestic currency. When there is perfect currency substitution (Pigott, 1994) or when the domestic currency is fixed vis-a-vis the foreign currency (Obstfeld and Rogoff, 1995), the rate of depreciation equals zero and hence the domestic must equal the foreign interest rate. In other words, when authorities embark on pegged exchange rate, they completely subordinate the domestic monetary policy to the one of the anchor economy, i.e. impose the foreign inflation into the domestic monetary environment. Moreover, the interest parity condition states that not only domestic inflation will equal the foreign inflation, but the same refers to the interest rates (for additional reading, refer to any macroeconomic textbook, like Krugman and Obstfeld, 2007; Abel and Bernanke, 2008; Mishkin, 2008).

In reality however, the equalization of the interest rates does not occur immediately. Although the pressure to converge (should) exists, still the time to converge might be substantial. Differential mainly arises because of investors' perceptions to invest their money into the economy, i.e. the differential measures the uncertainty that the economy faces and is hence known as the risk premium. In turn, uncertainty might arise because of the economic policies (high budget balance, worsening of current account, leaking of official reserves and so on) or because of political tensions (domestic and regional). The fixed exchange rate puts pressure on economic policies and hence ensures monetary and hence, interest-rate convergence. From that viewpoint, Camarero et al. (2002) defines three states: absence of convergence; long-run convergence and catching-up process.

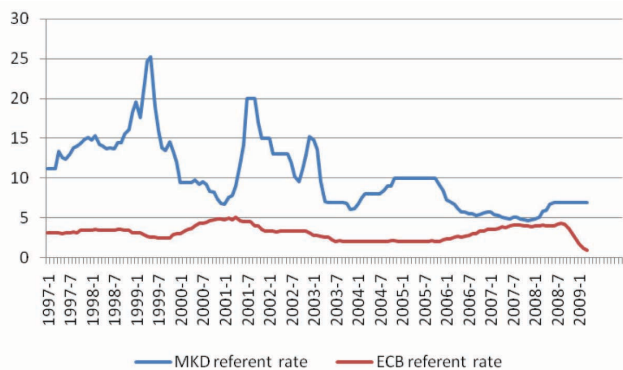
Data

We analyze monthly data over the period 1997:01-2009:03, hence obtaining 147 observations. This period is chosen because of data availability in Macedonia. For Macedonia, we use the interest rate on the open-market operations of NBRM after 2000 and the discount-window interest rate of NBRM before 2000, because those played the role of referent rates in the respective periods. For the Euro zone, we use the interest rate on the main refinancing operations of ECB after 2001 and the overnight money-market interest rate of Deutsche Bundesbank before 2001. Once specified, we econometrically analyze the interest-rate differential.

The movements of both interest rates are presented on the following graph. The movements of the Euro zone interest rate is relatively stable; the last period observes a decline of the interest rate (up to 1% in May

2009), to combat the global financial crisis and to help the real economy. However, the crisis is out of the focus of this study. Macedonian interest rate exhibits considerable volatility. At an outset, two peaks are notable: the one in the first half of 1999, because of Kosovo crisis, and the other in mid-2001, because of the domestic military crisis. Both events are of political nature and suggest that advanced modeling of interest rates must consider those shocks. In the last period, the interest rate in Macedonia, contrary to the one in the Euro zone, exhibits an increase, mainly because of the pressures on the foreign exchange market and hence, the pressures to maintain the peg. However, the trend of Macedonian interest rate is downward sloping and, in very general terms, might imply that interest rates are converging.

Figure 1.
Referent interest rate in Macedonia and the Euro zone



Methodology and tests

The empirical part of this paper uses stochastic definitions of convergence and follows the work of Bernard and Durlauf (1995), according to which, there is a long-run economic convergence between two countries i and j , if the respective long-run forecasts for the respective variable in those countries are equal at time t :

$$\lim_{k \rightarrow 0} E(r_{i,t+k} - r_{j,t+k} | I_t) = 0 \quad (1)$$

whereby I_t refers to information available at time t . This equation will stand if $r_{i,t+k} - r_{j,t+k}$ is a stationary process, i.e. both countries will converge in terms of the variable with a cointegrating vector $[1,-1]$. Moreover, if both variables are stationary in terms of their trend, the definition will result in the same time trend for each country (Camarero et al. 2002).

Bernard and Durlauf (1995) and Camarero et al. (2002) suggest differentiating two types/degrees of convergence: long-run convergence and catching-up process. The latter usually refers to the new member-states of the EU or, in general, to peripheral countries of a monetary integration, which want to converge their economy (foremost in nominal terms) with the economy of their largest trading partner. The catching-up process means that the gap between interest rates narrows as the time passes, but the ultimate, sustainable in the long run, convergence has not been achieved yet.

An easy way to test for convergence is to test the integrative characteristics of interest-rate differential, i.e. examining it for containing unit roots. Rejecting the hypothesis that a unit root exists (i.e. stochastic and deterministic trend exist) implies existence of a long-run convergence (level stationarity); if a deterministic

trend exists only, the country is in a process of nominal convergence, the so-called catching-up process (trend stationarity). At this place, using the standard unit root tests (Augmented-Dickey Fuller, Phillip-Perron) is inappropriate, because by rejecting the null of unit root, a difference cannot be suggested if stationarity is a level or a trend stationarity. Also, by not rejecting the null of non-stationarity, a significant mistake can be made to conclude no convergence, when, in essence, interest rates are in a process of catching up. Moreover, in case when series are neither $I(0)$ nor $I(1)$, but something in-between, these tests are increasingly weak. Econometric literature, however, developed appropriate solutions for situations like this. Kwiatkowski, Phillips, Schmidt, and Shin (KPSS, 1992) developed a test for stationarity of a time series. This test differs from the common tests by having a null hypothesis of stationarity. Moreover, the test may be conducted under the null of either trend stationarity or level stationarity. Inference from this test is complementary to that derived from those based on the Dickey-Fuller distribution (see, for instance, Lee and Schmidt, 1996). The estimate of the long-run variance of the time series may be calculated using either the Bartlett kernel or the quadratic spectral kernel. Andrews (1991) and Newey and West (1994) indicate that the latter kernel yields more accurate estimates of sigma-squared than other kernels in finite samples (Hobijn et al. 1998), but at this place we will present the results of both options.

In addition to KPSS, two tests were developed to test the long memory of the time series, i.e. to test the order of the fractional integration (between $I(0)$ and $I(1)$). Geweke and Porter-Hudak (1983) developed an estimate of the long memory (fractional integration) parameter, d , of a time series. Moreover, Robinson (1995) suggested a multivariate semi-parametric estimate of the long memory (fractional integration) parameters, $d(g)$, of a set of time series. If a series exhibits long memory, it is neither stationary ($I(0)$) nor it is a unit root ($I(1)$) process; it is an $I(d)$ process, with d being a real number. When applied to a set of time series, the $d(g)$ parameter for each series is estimated from a single log-periodogram regression, which allows the intercept and slope to differ for each series. The standard errors for the estimated parameters are derived from a pooled estimate of the variance in the multivariate case, so that their interval estimates differ from those of their univariate counterparts. In the next section, we apply those three tests on the interest-rate differential.

Results and discussion

At first, we look at the conventional tests of integration: Augmented Dickey Fuller (ADF), Phillip Perron (PP) and Augmented Dickey Fuller-GLS test (DFGLS).

Table 1. Conventional unit root tests

	ADF		PP		DFGLS	
	mean	trend	mean	trend	mean	trend
t-stat	-1.884	-3.336*	-2.142	-2.941	-2.361**	-2.934*

H_0 : series is non-stationary

***, ** and * indicate rejecting the null at 1%, 5% and 10%, respectively.

As expected, ADF and PP cannot reject the null hypothesis of unit root, whenever a trend is included or not. Dickey-Fuller GLS behaves somehow differently and strangely, suggesting that the null can be rejected at conventional levels, but accepting the alternative in both cases suggests that interest-rate differential is mean- and trend-stationary. Again, this difference is blurred and might further suggest test's weakness. To overcome those weaknesses, we use more advanced tests, as specified in the methodological section.

The next two tables present the results from the KPSS test (and for its different options):

Table 2. KPSS unit root test: lags chosen by Schwert criterion

Auto-covariances weighted by Bartlett kernel				Auto-covariances weighted by Quadratic Spectral kernel			
Ho: series is level stationary		Ho: series is trend stationary		Ho: series is level stationary		Ho: series is trend stationary	
Lag order	t-stat	Lag order	t-stat	Lag order	t-stat	Lag order	t-stat
0	7***	0	0.245***	0	7***	0	0.245***
1	3.57***	1	0.128*	1	5.54***	1	0.196**
2	2.44***	2	0.0898	2	2.74***	2	0.0993
3	1.88***	3	0.0713	3	1.88***	3	0.0704
4	1.55***	4	0.0604	4	1.46***	4	0.0565
5	1.33***	5	0.0534	5	1.21***	5	0.0485
6	1.17***	6	0.0486	6	1.04***	6	0.0433
7	1.05***	7	0.0452	7	0.922***	7	0.0399
8	0.962***	8	0.0429	8	0.834***	8	0.0377
9	0.891***	9	0.0412	9	0.767***	9	0.0362
10	0.833***	10	0.0402	10	0.714**	10	0.0353
11	0.786***	11	0.0395	11	0.671**	11	0.0349
12	0.747***	12	0.0392	12	0.636**	12	0.0349
13	0.714**	13	0.0393	13	0.607**	13	0.0353

***, ** and * indicate rejecting the null at 1%, 5% and 10%, respectively.

Table 3. KPSS unit root test: automatic bandwidth selection

Ho: series is level stationary		Ho: series is trend stationary	
Lag order chosen	t-stat	Lag order chosen	t-stat
3	1.88***	3	.0704

***, ** and * indicate rejecting the null at 1%, 5% and 10%, respectively.

Both tables suggest that the interest rate differential is not level-stationary. This was confirmed by the conventional stationarity tests in table 1. Namely, columns with H0 implying level-stationarity in tables 2 and 3 suggest that the null can be rejected at 1%, for any lag selection, even when the lag-selection is automatic. On the contrary, columns with H0 implying trend-stationarity suggest that only for lag selection of 0 and 1, the null of trend stationarity can be rejected, but not for all other lags. Moreover, the automatic bandwidth selection suggests lag length of three, which does not reject the null of trend stationarity. These results suggest that indeed the interest-rate differential is not level stationary, but instead is trend stationary. They suggest that the order of integration of the interest-rate differential is fractional, i.e. is between $I(0)$ and $I(1)$. More intuitively, they suggest that interest rates in Macedonia have not converged with those of the Euro zone yet, but rather are in a process of convergence (catching up). If we have judged according to the conventional unit root tests, we wouldn't have been able to discover this catching up.

To discover the order of integration, we perform the two additional tests as specified in the methodological section. In this specifications, we exclude the period 2008:03-2009:03, as this is the time when the global financial turmoil pressed interest rates in Macedonia upwards, hence creating a structural break in the dif-

ferential. We do this, in order to obtain a value for the order of integration which will be applicable for a major part of the observed period. Results follow:

Table 4. *Geweke and Porter-Hudak and Robinson test*

Geweke and Porter-Hudak test			Robinson test		
Test's power	d	t-stat	Test's power	d	t-stat
0.5	.870449	3.5429***	0.5	.8675571	3.5525***

***, ** and * indicate rejecting the null at 1%, 5% and 10%, respectively.

Table 4 suggests that interest-rate differential is fractionally integrated, with a value of d of about 0.87, which confirms our suspicion in the conventional unit-root tests. In other words, Geweke-Porter-Hudak and Robinson tests confirm the results of the KPSS test for fractional integration and the trend stationarity (i.e. the catching-up process) of the interest-rate differential.

Conclusion

The objective of this paper was to test the level of convergence between the referent interest rate in Macedonia - the rate on the open market operations and the referent interest rate in the Euro zone - the rate on the main refinancing operations. We used more advanced unit root tests to check the order of integration of the interest-rate differential in Macedonia in order to suggest if Macedonian interest rate converges towards that of the Euro zone. The KPSS test suggested that Macedonian interest rate is in a process of catching up, while Geweke-Porter-Hudak and Robinson tests suggested a fractional integration of about 0.87 ($I(0.87)$), which confirms the results obtained by KPSS.

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