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Revisiting inflation in the euro area allowing for long memory☆

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HIGHLIGHTS

- We analyse inflation and inflation differentials in the euro area allowing for long memory.
- Evidence based on the short memory assumption and standard normal asymptotics may be spurious.
- Inflation differentials between "core" and "peripheral" countries are strongly persistent.
- "Core" economies have less persistent differentials and may be more integrated.
- "Peripheral" countries with high inflation may find themselves under competitive pressure for a long time.

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ABSTRACT

We analyse inflation and inflation differentials in the euro area allowing for long memory and a new type of limiting theory denoted fixed-bandwidth. Our results differ from those based on standard normal asymptotics and the short memory assumption, and we also find that the inflation differentials between "core" and "peripheral" countries are strongly persistent. "Core" economies appear to have less persistent differentials and may be more integrated, while "peripheral" countries with high inflation may find themselves under competitive pressure for a long time.

1. Introduction

In the last few years, inflation and inflation differentials in the euro area have raised the attention of many theoretical and empirical researchers. One of the main reasons behind this recent interest is that the European Central Bank (ECB) is a sovra-national institution to which member states have transferred powers: therefore it is important to monitor that this institution is acting in accordance with its mandate, that is targeting inflation as stipulated. However, monitoring national levels of inflation is equally important: even if the ECB succeeds in stabilizing inflation for the whole euro area, if one member state is significantly distant from the target, its participation to the euro may be destabilizing. In support of this view, Fendel and Frenkel (2009) found that the ECB took inflation differentials into account, for example holding back a restrictive monetary policy if this could have caused deflation in member states with low inflation.

The existence of inflation differentials poses a threat to the sustainability of the euro within the European Union because, without the possibility of devaluating the currency of the country with higher inflation, and given the currently narrow scope for fiscal transfers or other forms of adjustments, inflation differentials can eventually push some countries into extreme recession or in bankruptcy, see for example Wickens (2010), or Coudert et al. (2013), who showed that, after considering the role of macroeconomic fundamentals, currency misalignments and differential persistence have increased after the introduction of the euro. Quint (2016) argues that the tension generated from having a common monetary policy, instead of one designed to target inflation at national level, is not more than what is observed within the US or

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what had been observed within Germany when the Bundesbank run its monetary policy. However, this is not reassuring, as the euro area, contrary to the US or Germany, does not have area-wide mechanisms, such as relevant fiscal transfers, to counter this stress.

Much literature takes the existence of inflation differentials in the euro area as a stylized fact and focuses on investigating the causes. The reasons for inflation differentials in the euro area are many: they may reflect long term convergence of productivity and prices, especially in the early stages of the monetary union, or structural factors, such as differences in the labour market and different participation to trade outside the euro area, and also divergences originated by different macroeconomic policies, see for example ECB (2003, 2005); Andersson et al. (2009) mentioned the effect of administered prices and the lack of synchronization in the economic cycle. These differences may make it more probable for some countries to be hit by idiosyncratic shocks: for example, Honohan and Lane (2003) found that higher openness to trade outside the euro area was a major source of inflation differentials for Ireland. The role of structural differences in the labour or goods markets was also discussed by Pirovano and Van Poeck (2011); for Angeloni and Ehrmann (2007), demand, supply or exchange rate shocks, in this order, have been the main sources of inflation differentials. We refer to de Haan (2010) for a recent survey and further discussion. Interestingly, although the determinants of inflation differentials are many and possibly specific to each country, structural factors generating inflation persistence are themselves a source of persistent inflation differentials: even if two countries were hit by the same shock, different inflation persistence would eventually generate a visible inflation differential. Indeed, Angeloni and Ehrmann (2007) identify these as the main vehicle propagating inflation differentials.

In this paper we analyse the dynamics of inflation for each country, and with respect to the other member states, discussing both the existence and the persistence of inflation differentials. It is commonly taken for granted in the applied literature that some of these differentials are different from zero in the long run, and indeed standard asymptotic theory, according to which the inflation series are treated as weakly autocorrelated processes, would broadly support this assumption, as we also find in our analysis. Note that weak autocorrelation is characterized by a fast decay of the autocorrelations of the processes, therefore displaying the so-called short memory property. A traditional example of this type of behaviour is the stationary and invertible finite order autoregressive and moving average process. However, conclusions from standard analyses based on the assumption of weak autocorrelation need to be taken with caution for at least two reasons. First, assuming short memory, as it is done in most empirical works, might be in some cases appropriate, but it is important to emphasize that this is a very particular case of dependence. More general processes, like the fractional integrated proposed by Granger and Joyeux (1980), have recently featured prominently: the dependence on those processes is mainly driven by a memory parameter δ, so they might display short memory ($\delta = 0$), long memory ($\delta > 0$), for which the autocorrelations decay slowly, or be antipersistent ($\delta < 0$). Thus, taking an agnostic approach about the type of dependence which characterizes the process under study might avoid a problem of misspecification, especially noting that long memory in the series would distort the size of the standard test procedures based on the short memory assumption, leading for example to spurious rejections of the corresponding null hypotheses, see for example Wright (1998). Moreover, allowing for long memory in this empirical investigation seems of particular importance also because of the emphasis given to inflation persistence in the empirical literature: in the long memory framework the order of integration provides a natural, simple and intuitive measure of persistence, that can be easily compared across countries.

The second piece of warning is that standard inference for weakly autocorrelated processes is typically based on testing procedures where the corresponding studentized (by means of an adequate nonparametric estimator of the long run variance) and centred sample means are assumed to have a $N(0, 1)$ limiting behaviour. This is a direct consequence of relying on a consistency argument for the estimator of the long run variance, which is typically achieved by means of an increasing smoothing. As Kiefer and Vogelsang (2005) indicate, this might lead to tests suffering from an important size distortion.

Recently, Hualde and Iacone (2017) have dealt with both concerns. From one side, they proposed a test procedure for the mean of a general covariance stationary process which might exhibit short memory, long memory or antipersistency, where it is not required to make a priori assumptions about the type of dependence characterizing the data. From the other, their test procedure is based on a smoothed periodogram estimator of the long run variance, where, unlike in the traditional approach, the degree of smoothing is kept fixed. This leads to a limiting distribution, denoted fixed-bandwidth, which appears to be closer than the more traditional one (large-bandwidth) to the true sampling distribution of the studentized sample mean. This finding complements similar results achieved by McElroy and Politis (2012, 2013) and, interestingly, opens the door to revisiting previous empirical evidence, allowing now for an agnostic view about the type of dependence characterizing the series under study and using a more accurate limiting result. Thus, in the present paper we analyse along these lines inflation levels and inflation differentials in the euro area, with the aim of confirming or questioning previous well established evidence.

In the next section we carry out the empirical analysis and in Section 3 we present the main conclusions.

2. An application to inflation differentials in the euro area

We collected monthly inflation at annual rates (i.e., 12 times the monthly inflation rate, defined as the 100 times the difference of the logarithm of the price index) of the euro area countries, for the period January 1999–October 2015. We report in Table 1 the sample means of those inflation rates for each country ($\overline{\pi}$). Specifically, we construct the inflation rate from the series of the Harmonized Index of Consumer Prices (All Items), which were collected from the FRED database, at the Federal Reserve Bank of St. Louis, and are from Eurostat. In the tables we use the acronyms EU, BG, FR, OE, FN, GR, BD, IT, IR, LX, NL, ES, PT for the euro area, Belgium, France, Austria, Finland, Greece, Germany, Italy, Ireland, Luxemburg, the Netherlands, Spain, Portugal, respectively (the series for the euro area is adjusted according to changes in the membership).

Our purpose is twofold. First we analyse whether there are significant deviations from the long run inflation target. Then we explore whether inflation differentials between pairs of countries are significant. Specifically we test for the null hypotheses that the corresponding population mean deviations from the target or that population mean inflation differentials are zero. For this purpose we will use three different testing procedures where, in all the cases, we consider two sided alternatives. In the first test procedure, we use a studentized sample mean, where the long run variance is estimated by a weighted periodogram as in Hualde and Iacone (2017). Letting x_t, $t = 1, \ldots, T$, be the difference between the inflation and the target or the differential between the inflation rates of two countries, denote by $w_x(\lambda) := (2\pi T)^{-1/2}\sum_{t=1}^{T} x_t e^{i\lambda t}$ the Fourier transform of x_t and by $I(\lambda) := |w_x(\lambda)|^2$ the periodogram. We use a simple estimator of the long-run variance σ^2, given by $\widehat{\sigma}^2 := 2\pi m^{-1}\sum_{j=1}^{m} I(\lambda_j)$, where $\lambda_j := 2\pi j/T$ are Fourier frequencies, for a user-chosen m which will be specified below.