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Is inflation persistence different in reality?

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ABSTRACT

This study examines the inflation persistence using both online and official price indexes in Argentina, Brazil, China, Japan, Germany, South Africa, the UK and the US, using fractional integration technique. The main results suggest that the degree of persistence, estimated by the long-memory parameter, is smaller when using online price indexes (believed to be a more realistic measure of inflation), mainly in the cases of Argentina, Brazil, China and the UK. Monetary policy implications are discussed.

1. Introduction

The degree of inflation persistence is a relevant parameter of interest for different reasons. First, it plays a key role in the design of monetary policy, since it will determine the degree to which monetary policy authorities can maintain a stable level of output and inflation simultaneously, and thus, the performance of monetary policy (Rudebusch, 2002; Levin and Williams, 2003; Amano, 2007). Furthermore, and given the different implications of macroeconomic models (Dornbusch, 1976; Galí and Gertler, 1999; Christiano et al., 2005), an accurate estimate of inflation persistence will help us understand to what extent the different macroeconomic models are consistent with the empirical evidence. Both of these reasons explain the ample literature on the econometric modeling of this variable (Nelson and Schwert, 1977; Barsky, 1987; Hassler and Wolters, 1995; Hsu, 2005; Lee, 2005; Noriega and Ramos-Francia, 2009; Cuestas and Harrison, 2010; Hassler and Meller, 2014). However, despite the vast literature directed to estimate the integration order or persistence of this variable, the results are not yet conclusive (see, for example, Martins and Rodrigues, 2014, for a recent survey of the literature). One common characteristic of all these papers is the use of official Consumer Price Indexes (CPI) published by national agencies (US Bureau of Labor Statistics for US prices, Instituto Nacional de Estadística y Censos for CPI in Argentina, and so on), or international institutions, such as the International Monetary Fund, the World Bank or the Organization for Economic Co-operation and Development.

Accurately measuring prices and inflation has been a major concern among academics and different statistical agencies over the last fifty years (Griliches, 1961; Diewert, 1976, 1995; Hausman, 1997; Gordon and Griliches, 1997; Abraham, 1997; Boskin and Jorgenson, 1997) due to several factors, such as the existence of a millions of goods and services, the change in the quality of these goods or the introduction of new products in the market.[1] More recently, and following Cavallo (2013), who used online price data to provide alternative price indexes to the official ones in Argentina, online price indexes are being collected (see the Billion Prices Project at MIT, http://bpp.mit.edu) and used in different empirical analysis (Cavallo et al., 2014; Cavallo and Rigobon, 2016; Gorodnichenko et al., 2014; Gorodnichenko and Talavera, 2014; Alvarez et al., forthcoming). However, determining whether these two inflation measures (those based on official CPI and those based on online price indexes) have distinct dynamics is still an open question (Cavallo and Rigobon, 2016).

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[1] The Journal of Economic Perspectives, 1998, vol. 12, published a number of papers that deal with the difficulties of accurately measuring the CPI.

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Table 1
Persistence of monthly official and online inflation rates.

ARGENTINA	No regressors	An intercept	A linear time trend
ARG	0.84 (0.56, 1.40)	**1.11 (0.80, 1.53)**	1.12 (0.80, 1.53)
ARG_TA	0.57 (0.26, 1.14)	**0.97 (0.54, 1.42)**	0.96 (0.41, 1.40)
ARG_SS	0.61 (0.27, 1.21)	**1.06 (0.68, 1.49)**	1.06 (0.68, 1.49)
BRAZIL	No regressors	An intercept	A linear time trend
BRA	0.92 (0.66, 1.30)	**1.09 (0.72, 1.53)**	1.09 (0.72, 1.56)
BRA_TA	0.67 (0.41, 1.05)	**0.58 (0.40, 0.84)**	0.44 (0.18, 0.84)
BRA_SS	0.50 (0.24, 0.89)	**0.58 (0.43, 0.81)**	0.35 (0.03, 0.77)
CHINA	No regressors	An intercept	A linear time trend
CHN	1.02 (0.69, 1.47)	**1.23 (0.78, 1.81)**	1.24 (0.77, 1.81)
CHN_TA	0.88 (0.53, 1.54)	**0.63 (0.47, 1.04)**	0.37 (−0.07, 1.04)
CHN_SS	0.79 (0.47, 1.37)	**0.60 (0.42, 1.06)**	0.37 (0.02, 1.07)
GERMANY	No regressors	An intercept	A linear time trend
GER	1.07 (0.90, 1.32)	**1.04 (0.87, 1.26)**	1.04 (0.86, 1.24)
GER_TA	1.07 (0.85, 1.39)	**1.07 (0.87, 1.36)**	1.07 (0.87, 1.36)
GER_SS	1.03 (0.82, 1.33)	**1.00 (0.81, 1.26)**	1.00 (0.81, 1.26)
JAPAN	No regressors	An intercept	A linear time trend
JPN	0.96 (0.61, 1.38)	**0.97 (0.62, 1.39)**	0.96 (0.47, 1.39)
JPN_TA	0.97 (0.20, 1.89)	**1.00 (0.26, 1.92)**	1.03 (0.35, 1.94)
JPN_SS	0.98 (0.07, 2.07)	**1.33 (0.13, 2.12)**	1.33 (0.71, 2.14)
SOUTH AFRICA	No regressors	An intercept	A linear time trend
ZAR	0.53 (0.07, 1.31)	**0.23 (−0.41, 0.96)**	0.44 (−0.62, 0.99)
ZAR_TA	0.61 (0.07, 1.40)	**0.58 (0.11, 1.05)**	0.62 (0.07, 1.07)
ZAR_SS	0.60 (0.09, 1.38)	**0.64 (0.32, 1.05)**	0.64 (0.32, 1.05)
United Kingdom	No regressors	An intercept	A linear time trend
UK	1.07 (0.88, 1.38)	**1.08 (0.86, 1.46)**	1.08 (0.85, 1.46)
UK_TA	0.89 (0.70, 1.15)	**0.78 (0.58, 1.06)**	0.78 (0.55, 1.06)
UK_SS	0.94 (0.73, 1.22)	**0.93 (0.73, 1.22)**	0.94 (0.72, 1.22)
United States of America	No regressors	An intercept	A linear time trend
US	0.70 (0.42, 1.08)	**0.85 (0.36, 1.30)**	0.88 (0.44, 1.28)
US_TA	0.95 (0.68, 1.38)	**1.07 (0.76, 1.56)**	1.08 (0.78, 1.47)
US_SS	0.89 (0.67, 1.29)	**1.09 (0.75, 1.53)**	1.08 (0.79, 1.47)

Note: The values in parenthesis refer to the 95% confidence bands for the values of d. We report in bold the significance cases, according to the deterministic terms; TA (SS): monthly version of daily inflation rates based on Temporal Aggregation (Systematic Sampling).

In this context, the objective of this note is to test whether there are significant differences in the degree of persistence using these two measures of inflation in a sample of countries that include Argentina, Brazil, China, Germany, Japan, South Africa, the United Kingdom (UK) and the United States of America (US), by means of applying fractional integration techniques. To the best of our knowledge, this is the first paper that tries to test whether there are differences in the degree of inflation persistence when official CPI indexes and online prices are used to calculate inflation rates in this sample of countries.

Our results indicate that the degree of inflation persistence, estimated by the long-memory parameter, is smaller when using online price indexes (that is believed to be a more realistic measure of inflation), mainly in the cases of Argentina, Brazil, China and the UK.

The remainder of the paper is structured as follows: Section 2 describes the methodology. Section 3 presents the data and the main empirical results, while Section 4 contains some concluding comments and policy implications.

2. Methodology

The methodology used in this paper is based on the concept of fractional integration. For this purpose, we need to define first an integrated of order 0 or $I(0)$ process. We define a process $\{x_t,\ t = 0, \pm1, \ldots\}$ as integrated of order 0 (and denoted as $x_t \approx I(0)$) if it is a covariance stationary process with a spectral density function that is positive and finite at the zero frequency. Alternatively, it can be defined in the time domain as a process where the infinite sum of the autocovariances is finite. Having said this, a process is integrated of order d, (and denoted as $x_t \approx I(d)$) if it can be represented as

$$(1 - L)^d x_t = u_t, \quad t = 0, \pm1, \ldots, \tag{1}$$

with $x_t = 0$ for $t \leq 0$, and $d > 0$, where L is the lag-operator ($Lx_t = x_{t-1}$) and u_t is $I(0)$. By allowing d to be fractional, we permit a much richer degree of flexibility in the dynamic specification of the series, not achieved when using the classical approaches based on integer differentiation, i.e., $d = 0$ (for stationarity) and $d = 1$ (for nonstationarity). Processes with $d > 0$ in (1) display the property of "*long memory*", characterized in this way because the spectral density function of the process is unbounded at its origin. Note that under fractional integration, if d is smaller than 0.5 the process is still covariance stationary and if d is smaller than 1, it is mean reverting with shocks disappearing in the long run.

The methodology employed here to estimate the fractional differencing parameter is parametric and based on the Whittle function in the frequency domain (Dahlhaus, 1989). Other parametric and semiparametric methods based on both the time and the frequency domain produced essentially the same type of results.

3. Data and empirical results

For each of the eight countries (Argentina (ARG), Brazil (BRA), China (CHN), Germany (GER), Japan (JPN), South Africa (ZAR), the United Kingdom (UK) and the United States of America (US)), we use three different inflation measures at monthly frequency. Year-on-year official inflation rates are calculated as the rate of change of CPI of a specific month relative to the same month in the previous year. The official CPI data for each of the countries are sourced from