Journal of Macroeconomics 41 (2014) 42–52

Contents lists available at ScienceDirect

Journal of Macroeconomics

journal homepage: www.elsevier.com/locate/jmacro

In the long run, US unemployment follows inflation like a faithful dog

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ARTICLE INFO

Article history:
Received 8 October 2013
Accepted 19 April 2014
Available online 9 May 2014

JEL classification:
E24
E31

Keywords:
Inflation
Unemployment
The long-run

ABSTRACT

Conventional wisdom holds that, in the long run, the Phillips curve is vertical. We re-examine the relationship between inflation and unemployment in the long run, using quarterly US data from 1952 to 2010, and state-of-the art econometric methods. Using a band-pass filter approach, we find strong evidence that a positive relationship exists, where inflation leads unemployment by some 3–3$\frac{1}{2}$ years, in cycles that last from 8 to 25 or 50 years. Tests for multiple structural changes at unknown dates show that this relationship is stable. Our statistical approach is atheoretical in nature, but provides evidence in accordance with the predictions of Friedman (1977) and the recent New Monetarist model of Berentsen et al. (2011): the relationship between inflation and unemployment is positive in the long run.

1. Introduction

Since the publication of Bill Phillips' (1958) seminal paper, the relationship between inflation and unemployment has been a central focus for macroeconomists and policymakers. Most of this focus has been directed at establishing whether or not a negative relationship exists in the short run and what this may imply for policy (e.g., Lucas, 1972). However, the prevailing view has been that, in the long run, the Phillips curve is vertical. That is, conventionally, in the long run, the unemployment rate has been seen as being independent of inflation and monetary policy. Famously, in his Presidential Address to the American Economic Association, Milton Friedman (1968) introduced the concept of the "natural" rate of unemployment, which led to this view. Somewhat less famously (although in his Nobel lecture) Friedman (1977) also argued that, in the long run (beyond the business cycle frequency), a positive relationship may exist between these two variables, due to the distortionary effects of the inflation tax. Moreover, at the time, he found evidence of this positive relationship in US data, by observing average values for successive quinquennia. This long-run relationship has received considerably less attention but is, arguably, at least as important to consider. Further, empirical evidence for the long-run relationship, though, has been difficult to establish (King and Watson, 1997).[1]

More recently, Berentsen et al. (2011) have argued that, in the long run, inflation and unemployment are positively correlated – both theoretically and empirically. Theoretically, they constructed a model that combines the search-theoretic elements of Mortensen and Pissarides (1994) in the labor market with those of Lagos and Wright (2005) in the goods market

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[1] They found that a positively sloped Phillips curve, as well as a vertical long-run Phillips curve, are not inconsistent with their empirical results, depending on specific assumptions made about short and long-run trade-offs. We applied their method to our data and found that these inconclusive results also hold for our sample period.

http://dx.doi.org/10.1016/j.jmacro.2014.04.003
0164-0704/

and showed that, in the steady state equilibrium of this model, higher rates of inflation, by increasing the cost of holding money, induce people to economize on money holdings – thereby reducing trade and profit – and increase the unemployment rate. Empirically, they provided preliminary evidence for this effect from the US, over 1955–2005, using Hodrick–Prescott filters of varying strengths to remove high frequency fluctuations, and demonstrated that the trends exhibit positive correlation.

In this paper, we examine the empirical side of this argument more closely. An immediate concern with the Berentsen et al. (2011) approach is that the long-run stochastic trend of the Hodrick–Prescott filter is likely not covariance-stationary for inflation and unemployment and, therefore, may potentially cause spurious correlations among filtered components.[2] Thus, the positive correlations found by Berentsen et al. (2011) could conceivably be induced by the Hodrick–Prescott filters they used, rather than by the data itself. As a check, in this study, we considered a similar experiment using alternative band-pass filters, which *do* produce covariance-stationary filtered components. We considered three such filters, based on the work of Baxter and King (1999), Christiano and Fitzgerald (2003), and Corbae and Ouliaris (2006), and extracted covariance-stationary cycles of 8–50 years, i.e., cycles in the long run below the business cycle frequency. All three filters delivered similar results and, in this paper, we focus on those produced by the Christiano and Fitzgerald (2003) filter.[3] We then analyzed the dynamic cross-correlations of the filtered inflation with unemployment series in order to establish whether or not there is a relationship in the long run.

When considering this relationship we found that the peaks and troughs of the two filtered series are not aligned in time, with the misalignment involving several years. We therefore considered both leads and lags. We found that the only correlations that are significant at the 10% level are those at leads 4–24 (1–6 years), where inflation peaks ahead of unemployment. At these leads, all correlations are positive. The correlations at leads 9–18 are significant at the 1% level. The maximum correlation occurs at lead 13 ($3\frac{1}{4}$ years) and takes a relatively large value of 0.8338.

We considered a variety of robustness checks for the results. For example, we considered other cycle lengths, such as 8–25 years and found similar results. We also considered two other, alternative, indicators of inflationary activity: money growth and nominal interest rates. We found that the results using money growth were broadly similar to those using inflation but the results using nominal interest rates were quite different. In particular, we found that nominal interest rates were not correlated with the unemployment rate at the 5% level for any leads and lags. This, then, calls into question the robustness of the Fisher relationship in the long run.

Overall, we conclude that a significant long-run relationship between inflation and unemployment does indeed exist, and it is positive, with inflation leading unemployment by roughly $3\frac{1}{4}$ years. This long-run relationship is stable over time despite changes in monetary and fiscal policies. Visually, this result is quite stark, when the two filtered series are plotted, as in Fig. 4 (in Section 3.3): for every turn that inflation makes, unemployment is bound to follow, approximately $3\frac{1}{4}$ years later.

The remainder of the paper is structured as follows. Section 2 describes the data. Section 3 covers the main results, with the following Section 3.1 examines the persistence in the data, Section 3.2 checks for structural breaks in the raw data, Section 3.3 discusses the band-pass filtered data, Section 3.4 provides estimates for the dynamic cross-correlations, Section 3.5 covers the sensitivity analysis, and Section 3.6 presents the results from tests of structural breaks in the filtered data. Section 4 provides a conclusion.

2. The data

The quarterly U.S. data cover the period from 1952Q1 to 2010Q1. The last observation was the most recent available one when the data were collected in June and July of 2010. All data were seasonally adjusted at the source and downloaded from the Federal Reserve Economic Data (FRED) base at the Federal Reserve Bank of St. Louis, except for the sweep-adjusted monetary aggregate.

The consumer price index (series CPIAUCS2) is for all items based on an index setting prices in the period 1982–1984 to 100. The CPI-based inflation rate was calculated as the quarterly year-on-year percentage change: $\{ln(P_t) - ln(P_{t-4})\}100$, where P is the CPI-index.[4] As an alternative measure of inflation, we calculated the percentage changes for the GDP-deflator. The implied GDP-deflator was calculated based on the ratio of the nominal GDP (series GDP) and the real GDP (series GDPC1) in chained 2005 dollars. The civilian unemployment rate (series UNRATE) covers persons 16 years of age and older. The CPI-based inflation rate and the unemployment rate are depicted in Figs. 1 and 2.

The treasury bill rate is from the secondary market for 3-month bills (TB3MS). The monetary aggregate is taken from two sources. The M1 data (series M1SA) for the period from 1952Q1 to 1958Q4 was taken from the historical monetary data web site of the Federal Reserve Bank of St. Louis. There were no sweep programs operating in that time period and the series definition is consistent with the one that we use for subsequent years. The data for the period from 1959Q1 to 2009Q4 are from a web site that reports M1 adjusted for balances in retail and demand deposit sweep accounts. [5] M1 is defined

[2] See Granger and Newbold (1974).

[3] For a more detailed analysis, please see our working paper: Haug and King (2011). The Christiano and Fitzgerald filter was used, for example, in Fuhrer and Rudebusch (2004), Fisher (2006), and Haug and Dewald (2012).

[4] Using instead the annualized quarter-on-quarter changes, $\{ln(P_t) - ln(P_{t-1})\}400$, leads to very similar results that are not reported. All qualitative results remain the same.

[5] http://sweepmeasures.com by Cynamon et al. (2006), "Sweep-Adjusted Monetary Aggregates for the United States", retrieved in June 2011.