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Revisiting the Phillips curve for India and inflation forecasting☆

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ABSTRACT

This paper focuses on modeling and forecasting inflation in India using an augmented Phillips curve framework. Both demand and supply factors are seen as drivers of inflation. Demand conditions are found to have a stronger impact on non-food manufactured products (NFMP) inflation vis-a-vis headline wholesale price inflation; moreover, NFMP inflation is found to be more persistent than headline inflation. Both these findings support the use of NFMP inflation as a core measure of inflation. But, the impact of global non-fuel commodities on NFMP inflation is found to be substantial. Inflation in non-fuel commodities is seen as a more important driver of domestic inflation rather than fuel inflation. The exchange rate pass-through coefficient is found to be modest, but nonetheless sharp depreciation in a short period of time can add to inflationary pressures. The estimated equations show a satisfactory in sample as well as out-of-sample performance based on dynamic simulations. Nonetheless, forecasting challenges emanate from volatility in international oil and other commodity prices and domestic food supply dynamics.

1. Introduction

Low and stable inflation is a key objective of monetary policy for central banks, whether inflation targeting or otherwise. However, achievement of low and stable inflation is quite challenging. It is well-known that monetary policy affects output and prices with lags, which are both long and variable. Accordingly, monetary policy has to be forward-looking, i.e., monetary policy needs to act today in anticipation of future growth and inflation trajectory. Therefore, forecasts of growth and inflation play a critical role in the conduct and formulation of monetary policy and its ultimate success in achieving price stability. This, in turn, depends upon success in modeling and forecasting inflation and growth.

In India, low and stable inflation remains a key objective of monetary policy along with growth and financial stability. Inflation dynamics in emerging economies like India are, however, relatively more complex than advanced economies in view of recurrent supply shocks and large weight of volatile components such as food items in the various price indices. This makes inflation modeling and forecasting more challenging in countries like India.

Inflation in India has remained persistently high since early 2010, with headline WPI moving in a range of 9–10% until October 2011, significantly above its average of around 5% recorded during the 2000s. Non-food manufactured products (NFMP) inflation, a measure of underlying inflation, also increased over the course of 2011 to a range of 7–8%. What explains these inflation dynamics? Can these be explained by standard models and approaches such as the Phillips curve framework?

☆ The views expressed in the paper are those of the author and not necessarily of the institutions to which he belongs.

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Empirical analysis undertaken in this paper indicates that the Phillips curve framework is able to explain inflation dynamics in the Indian context. Demand conditions are found to have a stronger impact on NFMP inflation vis-a-vis headline WPI inflation. The impact of inflation in global non-fuel commodities on NFMP inflation is found to be substantial. Although the exchange rate pass-through coefficient is modest, sharp depreciation can add to inflationary pressures. While the Phillips curve framework provides a satisfactory forecasting performance, forecasting challenges nonetheless emanate from volatility in international commodity prices and domestic food supply dynamics.

Against this backdrop, Section 2 undertakes a review of the Phillips curve approach to modeling and forecasting inflation and discusses both the traditional Phillips curve and the New Keynesian Phillips Curve (NKPC) approaches. This section also assesses the available cross-country empirical evidence for or against the Phillips curve. Section 3 attempts to model inflation in India based on the Phillips curve framework and assesses the forecasting performance of this approach. Section 4 concludes.

2. Modeling inflation in the Phillips curve framework: theory and evidence

The Phillips curve framework provides one way of forecasting inflation. Actual inflation movements are influenced not only by demand side pressures but also by supply shocks. Inflation also exhibits an inertia indicating that expectations are largely adaptive. Lagged inflation, therefore, remains an important determinant of inflation and the lags could reflect the structure of the economy. Incorporating demand and supply factors as well as inflation expectations leads to an augmented Phillips Curve – also termed as the 'triangle model of inflation' (Gordon, 1998). The phrase triangle stresses that inflation depends on a tripartite set of basic determinants: inertia (in inflation), demand and supply shocks.

$$\Pi_t = a(L)\Pi_{t-1} + b(L)D_t + c(L)Z_t \tag{1}$$

where Π_t, D_t and Z_t denote inflation, a measure of excess demand (unemployment gap or output gap) and supply shocks (imported inflation, exchange rate movements and weather-related shocks such as drought/excessive rainfall), respectively; $a(L)$, $b(L)$ and $c(L)$ are lag polynomials.

2.1. New Keynesian Phillips curve

As against the above traditional backward-looking ad hoc Phillips curve, in recent years, the Phillips curve has been derived from micro-foundations, with optimal price setting by forward-looking monopolistically competitive firms. Such a formulation leads to the NKPC, a purely forward-looking Phillips curve. In this specification, inflation depends, inter alia, upon expected *future* inflation ($E_t\Pi_{t+1}$); in contrast, inflation depends on expected *current* inflation ($E_{t-1}\Pi_t$) in the traditional expectations-augmented standard Phillips curve. The purely forward-looking Phillips curve, however, does not get much empirical support. Lagged inflation remains an important determinant of inflation, and a purely backward-looking Phillips curve seems to be preferred by the data, which has led to ad hoc hybrid Phillips curve – with both forward- and backward-looking inflation components (Gali & Gertler, 1999; Gali, Gertler, & Lopez-Salido, 2005). Gali et al. (2005) find that the coefficient on expected inflation is higher than that of lagged inflation, which they argue as evidence in favor of the NKPC.

However, the NKPC and its empirical estimates are subject to serious identification issues as these specifications do not allow us to distinguish forward-looking models from backward-looking models; the higher weight on expected inflation may be due to misspecification resulting from omission of explanatory variables from the main equation. Typically, expected inflation is instrumented through lagged inflation amongst the instrument set and this can bias the coefficient on expected inflation to be higher and the NKPC can yield large estimates of the coefficient on expected inflation even when forward-looking behavior is completely absent (Rudd & Whelan, 2007). Moreover, while many studies find that the forward-looking behavior dominates, the robust confidence intervals are so wide that the results are consistent both with no backward-looking dynamics as well as very substantial backward-looking behavior (Kleibergen & Mavroeidis, 2009).

2.2. Phillips curve forecasts: an assessment

While the Phillips curve framework remains the workhorse model for modeling inflation and thinking about policy issues, question marks have been raised over its forecasting abilities. According to Atkeson and Ohanian (2001), random walk (naive) forecasts beat the (backward-looking) Phillips curve forecasts. Stock and Watson (2009) note that the Phillips curve forecasts are better than other multivariate forecasts, but their performance is episodic, sometimes better than and sometimes worse than a good univariate benchmark. Peach, Rich, and Cororation (2010) find threshold effects in the Phillips curve, i.e., if the output gap (or unemployment gap) is within a certain threshold, the relationship between inflation and activity is weak, but when the output gap is outside these thresholds, there is a significant impact of economic activity on inflation. For the US, they estimate the threshold in terms of the unemployment gap to be 1.56%; thus, if the unemployment gap is within ±1.56%, there is no impact of unemployment on inflation, and the effect on inflation is significant only when the unemployment gap is outside this threshold of ±1.56%. Meyer and Pasaogullari (2010) find that no single specification outperforms all others over all time periods; for example, for the US, they find that the median and 16% trimmed-mean measures outperform all other specifications during the 1990s, and survey-based inflation expectations seem to do better during volatile periods. On the other hand, Fuhrer, Olivei, and Tootel (2009b) find that the forecasting performance of the Phillips curve is better if changing dynamics of inflation, in particular the weakening impact of oil prices on inflation, are taken into account.