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In search of the Phillips curve for India

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ABSTRACT

The economics literature suggests that the Phillips curve is nonexistent in India. This study finds that supply shocks, namely droughts and oil crises, and the liberalization-policy shock of the early 1990s are the main reasons for the absence of the Phillips curve in India. Once I account for these shocks by reconstructing the data of inflation and the output gap in crop year instead of fiscal year, and move to the industrial sector, the Phillips curve emerges in the conventional fashion. Thus, the short-run tradeoff between inflation and industrial output is still possible in India, as it is in other developed economies.

1. Introduction

Identifying the Phillips curve, which posits a negative relationship between inflation and unemployment, has been of great importance to macroeconomic policymakers. As unemployment is countercyclical, the relationship between inflation and the output gap becomes positive. The empirical accelerationist Phillips curve, which says that the level of inflation is positively related to economic activity, is a robust characteristic of the United States (US) and other developed economies (Gordon, 1977; Phillips, 1958). Explaining the pattern in terms of microeconomic behavior has been, and remains, a key topic of macroeconomic theory (Friedman, 1968; Phelps, 1968; Rudd and Whelan, 2006).

The Phillips curve helps the policymakers decide on policy with inflation and output. Hence, the estimation of the Phillips curve has been applied to economies like the US (Gali and Gertler, 1999; Gordon, 1977; Roberts, 1995; Sbordone, 2002), Australia (Gruen et al., 1999), the UK (Balakrishnan and Lopez-Salido, 2002), Turkey (Domac, 2004), and China (Scheibe and Vines, 2005), in recent years. Rumler (2005) has estimated the new Keynesian Phillips curve (NKPC) for nine euro-area countries: Austria, Belgium, Finland, France, Germany, Greece, Italy, Spain, and the Netherlands. The specialty of the NKPC is that it uses forward-looking expected inflation since prices are sticky by assumption in this model (Roberts, 1995). Bolt and van Els (2000) considered the relationship between the output gap and inflation in various European Union countries as well as Japan and the US.

In less-developed economies, the existence of an empirical Phillips curve is often evasive or absent (Bhattacharya, 1984; Dholakia, 1990; IMF, 1996). Many studies, specifically in India, have failed to find the conventional Phillips-curve pattern. In addition, most studies uncovered an unexpected *negative* relation between inflation and the output gap. The studies that suggest the nonexistence of the Phillips curve for India include Bhalla (1981), Chatterji (1989), Rangarajan (1983), Samanta

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(1986), Bhattacharya and Lodh (1990), Dholakia (1990), Rangarajan and Arif (1990) and Virmani (2004). Since most studies contradict the possibility of the Phillips curve for India, the topic itself, though interesting, remains unclear. Overall, the existing literature leaves us with three questions: (1) Does the Phillips curve for India really exist? (2) Is it different from the conventional Phillips curve like the one in developed economies? (3) If yes, how and why is it different from those in the developed countries? My study is an attempt to answer these questions.

In this paper, I show that there is a Phillips curve for the industrial sector in India. In order to observe the curve, it is necessary to control for supply shocks such as global oil crises, domestic droughts, and finally the liberalization-policy shock of the early 1990s. Once I account for these shocks by reconstructing the data of inflation and the output gap in crop year instead of fiscal year, and move to the industrial sector, the Phillips curve emerges in the conventional fashion. Thus, the short-run tradeoff between inflation and industrial output is still possible in India, as it is in other developed economies.

Section 2 of the paper outlines a theoretical approach to the Phillips curve. Section 3 describes the existing literature on inflation in India. In Section 4, I describe the role of supply and policy shocks in influencing Indian inflation. Section 5 presents the estimations with the Phillips curve for the industrial sector of India after controlling for supply and policy shocks. Section 6 concludes.

2. A theoretical approach to the Phillips curve

The Phillips curve, originally due to Phillips (1958), measured a negative relationship between the rate of wage inflation and that of unemployment. Later on, the curve moved into the product market by substituting price inflation for wage inflation. In the late 1970s, Friedman (1968) and Phelps (1968) included expected inflation, which formed the expectations augmented Phillips curve (EAPC) as shown below:

$$\pi_t = -\theta(u_t - u_n) + {}_{t-1}\pi_t^e \tag{1}$$

where π_t is inflation at time t, u_t refers to the unemployment rate whereas u_n is the natural rate of unemployment. θ is the coefficient on the difference between the current rate of unemployment and the natural rate of unemployment. Simply, θ is a parameter measuring the response of inflation to cyclical unemployment. The relationship between inflation and unemployment as shown by θ, is negative. This implies that other things being equal, higher unemployment will be associated with a lower inflation rate. ${}_{t-1}\pi_t^e$ denotes expectations of current inflation formed in the previous period, and thus, expected inflation. By making the use of Okun's law (Okun, 1962), we can replace unemployment with output in Eq. (1). The difference between the actual rate of output and the natural rate of output is the output gap. Then Eq. (1) becomes:

$$\pi_t = \beta y_t + {}_{t-1}\pi_t^e \tag{2}$$

where β is the coefficient on the output gap, y_t. As the unemployment rate is countercyclical, the relation between the output gap and inflation is positive. In the wake of the first energy crisis in the early 1970s, Gordon (1975, 1977) added supply shocks to the estimation of US inflation in order to recover the Phillips curve. Supply shocks are exogenous events that shift the aggregate supply curve of the economy. A drought, for example, can shift the aggregate supply curve up causing simultaneously a higher price level and lower output than before. Any event which shifts the supply curve up a fixed demand curve raises inflation and unemployment simultaneously (Gordon, 1977). After adding supply shocks to Eq. (2) we get the Gordon style expectations augmented Phillips curve as shown below:

$$\pi_t = \beta y_t + {}_{t-1}\pi_t^e + SShocks_t \tag{3}$$

where $SShocks_t$ denotes supply shocks. There are no data on expected inflation in many developing countries including India. In that case, expected inflation based on past realizations of inflation as suggested by Gordon (1977, Eq. 9) is the only way to estimate the Phillips curve. Here we can use one lag of inflation as a proxy for expected inflation. Now Eq. (3) can be estimated in the following specification:

$$\pi_t = c_0 + c_1\pi_{t-1} + \beta y_t + \gamma SShocks + \varepsilon_t \tag{4}$$

where c_0 is a constant, c_1 is the coefficient on the lagged inflation, and γ is the coefficient on supply shocks. ε_t is the error term. Here the existence of the Phillips curve requires a significantly positive β, which shows the relation between the contemporaneous output gap and inflation.

Thus, the Gordon style expectations augmented Phillips curve, which strongly emphasizes supply shocks, is applied to my study. Accordingly, I will use Eq. (4) to estimate the Phillips curve for India. Now I need to review the existing literature that highlights the relation between the output gap and inflation in the Indian context.

3. Literature on inflation in India: an analytical review

Existing literature on inflation in India includes papers in a Phillips-curve framework, papers in a Lucas-supply-function framework, and papers that treat inflation as a variable in a larger system of equations or in a vector autoregressive (VAR) model.