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Explaining inflation in the aftermath of the Great Recession ☆

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ABSTRACT

This paper considers whether the Phillips curve can explain the recent behavior of inflation in the United States. Standard formulations of the model predict that the ongoing large shortfall in economic activity relative to full employment should have led to deflation over the past several years. I confirm previous findings that the slope of the Phillips curve has varied over time and probably is lower today than it was several decades ago. This implies that estimates using historical data will overstate the responsiveness of inflation to present-day economic conditions. I modify the traditional Phillips curve to explicitly account for time variation in its slope and show how this modified model can explain the recent behavior of inflation without relying on anchored expectations. Specifically, I explore reasons why the slope might vary over time, focusing on implications of the sticky-price and sticky-information approaches to price adjustment. These implications suggest that the inflation environment and uncertainty about regional economic conditions should influence the slope of the Phillips curve. I introduce proxies to account for these effects and find that a Phillips curve modified to allow its slope to vary with uncertainty about regional economic conditions can best explain the recent path of inflation.

1. Introduction

The economic downturn in the United States that began in late 2007, commonly known as the "Great Recession," was characterized by a sharp, although not historically unprecedented, decline in economic activity and a rapid rise in unemployment. Indeed, the recession of early 1980s exhibited a greater degree of economic slack. What has been unique about the recent recession is how long the weakness in the economy has persisted amidst a steep contraction in credit and a slow process of deleveraging debt. These characteristics set the recent recession apart from other post-World War II recessions and have led some to name it the "Second Great Contraction," the first one being the Great Depression.[1]

Real GDP fell short of its potential level by nearly 7.5% at the depth of the recent downturn compared to just over 8.0% during the recession of the early 1980s. But recovery from that earlier recession was rapid, with the GDP gap closing to under 2% only one and a half years after the business-cycle trough and under 1% in less than three years. By contrast, the shortfall in GDP was 5.5% four years after the trough of the Great Recession. This prolonged period of slow growth and substantial weakness in the economy has raised concern among policymakers and analysts that downward pressure on prices could develop

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[1] Reinhart and Rogoff (2009) point out that the recent recession has seen a sharp contraction in credit and substantial deleveraging of debt, elements not typical of other post-World War II recessions. They suggest referring to the recent recession as the "Second Great Contraction" rather than the "Great Recession" because it has differed in *kind* and not just *severity* from previous recessions.

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and lead to deflation. The successive rounds of quantitative easing by the Federal Reserve, along with its commitment to hold the federal funds rate near zero for the next few years, can be viewed in part as a response to this concern.

Standard models of inflation in the short run build upon the work of Friedman (1968) and posit that inflation depends on expected inflation and slack in the economy, where slack is usually measured by either the gap between unemployment and its natural rate or the gap between GDP and its potential level. These models typically employ past inflation as a proxy for expected inflation, so that the change in inflation is determined by the gap variable. This canonical accelerationist Phillips curve has been modified and adapted by numerous authors over the last several decades.[2]

In a recent paper, Ball and Mazumder (2011) explore the ability of the Phillips curve model to explain the behavior of inflation during the Great Recession. They illustrate how a standard Phillips curve estimated using data since 1960 predicts *deflation* over the period 2008–2010, although actual inflation remained positive. After accounting for a recent decline in the slope of the Phillips curve by estimating the model on data only since 1985, and using median inflation to measure underlying core inflation, Ball and Mazumder find the model predicts median inflation close to its actual path through the end of 2010. But with substantial economic slack persisting beyond 2010, Ball and Mazumder find that the Phillips curve again predicts deflation, unless expectations about inflation are at least partially anchored to the Federal Reserve's target inflation rate.

This paper revisits the question of why the standard Phillips curve has predicted deflation over the past several years. In particular, I modify the Phillips curve to allow its slope to vary continuously through time. I consider implications of price-setting models when prices are costly to adjust and when information is costly to obtain as reasons for time variation in the Phillips curve's slope. My analysis is not a formal test of these price-setting models but instead is an assessment of whether the models' implications help improve the ability of the Phillips curve to predict recent inflation. I find that modifying the Phillips curve to allow continuous time-variation in its slope greatly improves its ability to explain the recent behavior of inflation. Unlike Ball and Mazumder (2011), my approach does not rely on anchored expectations to avoid predicting deflation and thus provides an alternative explanation for why inflation has remained above zero.

The paper begins in Section 2 by estimating a standard Phillips curve using data since 1960 and illustrating its prediction of deflation over the past several years, confirming the findings of Ball and Mazumder (2011). I also show that the Phillips curve underpredicts inflation in the years leading up to the Great Recession although it performs very poorly only after 2008. Section 3 explores time variation in the slope of the Phillips curve and confirms that inflation has become much less responsive to economic activity during the past few decades. Estimates of this time variation indicate that the slope of the Phillips curve was close to zero in the years just prior to the Great Recession. I test for an unknown sample breakpoint and find a significant change in slope for the period after the early 1980s and possibly again during the early 1990s. I provide predictions for inflation using Phillips curves estimated on data from only the last few decades, again showing predictions of deflation, albeit less severe than when estimating over the entire sample. But when I simulate Phillips curves using slope estimates from the period of the Great Recession, I find they predict inflation above zero.

Section 4 considers reasons why the slope of the Phillips curve might vary continuously over time, focusing on implications of the sticky-price and sticky-information approaches to price adjustment. Under both approaches, uncertainty about market conditions—which I proxy by the variability of inflation and by the dispersion of regional economic conditions—will affect the response of inflation to aggregate demand. Sticky-price models of the type developed by Ball et al. (1988) imply a steeper slope when inflation is volatile rather than stable and when regional conditions are varied rather than similar because price setters facing fixed costs of adjusting prices will find it beneficial to change prices more often when uncertainty about aggregate and region-specific shocks is higher. By changing prices more often, these firms are able to keep their price closer to its optimal level. Sticky-information models of the sort presented by Mankiw and Reis (2002) imply a steeper slope when inflation is volatile and regional conditions are varied because price setters will find it beneficial to update information more often and, accordingly, change price paths more often.[3] Changing price paths more often helps ensure that the firm's price does not deviate too much from its optimal path. The two approaches diverge, however, on how the level of inflation influences the responsiveness of prices to aggregate demand. The sticky-price model predicts more frequent price changes when average inflation is high (holding constant its variability) compared to when it is low.[4] The sticky-information model, on the other hand, predicts that average inflation has no effect on the frequency of information updates because the price paths set by firms fully incorporate the average level of inflation.

These implications suggest that the inflation environment and the extent of uncertainty about regional economic conditions should influence the slope of the Phillips curve. I modify the Phillips curve by introducing proxies to account for these effects and find that the model in which the slope to varies with uncertainty about regional conditions can best explain the recent path of inflation. Importantly, this modified Phillips curve predicts that inflation will remain positive without relying on anchored expectations. The paper concludes in Section 5 with a summary of its findings and suggestions for further research.

[2] See, for example, Fuhrer (1995), Gordon (1982, 1990), Murphy (1999, 2000), and Staiger et al. (1997). Bernanke (2008) provides an overview of several key issues for Phillips curve analyses of inflation.

[3] Reis (2006) shows that the time between information updates depends inversely on uncertainty about a firm's market conditions.

[4] See Ball et al. (1988), who present evidence that the slope of the Phillips curve depends on the level of inflation.