



# Does the New Keynesian Phillips curve need countercyclical markups?<sup>☆</sup>



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## ABSTRACT

This paper examines the behavior of four types of markup measures and its implications for the new Keynesian Phillips curve (NKPC). The four types of measures are a procyclical measure, a weakly procyclical measure, an acyclical measure and a countercyclical measure. Motivated by the fact that the U.S. markup has shifted up dramatically since the early 2000s, the paper also presents both empirical dynamics and a new Keynesian model featuring nonstationary markups. After inspecting empirical dynamics of key macroeconomic variables and the performance of the model, it points out that weakly procyclical or acyclical markups are more consistent with the purely forward-looking NKPC. Moreover, a major shortcoming of standard new Keynesian models is their inability to trace the actual behavior of the markup in response to a demand shock.

## 1. Introduction

Countercyclical markups have played an important role in new Keynesian economics. Rotemberg and Woodford (1992) explore the possibility that countercyclical markups can be a potential source shifting labor demand in response to a demand shock. At the same time, Rotemberg and Woodford (1991, 1999) point out the difficulty of empirically finding countercyclical markups. They argue that this difficulty arises because the actual markup is likely to be affected by various factors such as overhead labor, overtime premium, adjustment costs for labor, and so forth. Researchers then shift attention to sticky price models to find an alternative propagation mechanism of demand shocks. Yet, in most of dynamic stochastic general equilibrium (DSGE) models that incorporate sticky prices, the markup shows a countercyclical movement after demand shocks. That is, the markup declines (in other words, real marginal cost increases) in response to a positive demand shock (e.g., an expansionary monetary policy shock). So far, however, empirical evidence for countercyclical markups is not strong. Moreover, recent work by Nekarda and Ramey (2013) shows that the markup is either procyclical or acyclical. They also report that the markup exhibits procyclical movements in response to a technology shock and it is either procyclical or acyclical in response to demand shocks. According to their argument, when there is a positive demand shock, factor prices would go up leading to an increase in marginal cost. Thus if prices are sticky, the markup (the ratio of price to marginal cost) should decline after a positive demand shock. They conclude that new Keynesian models based on sticky prices are inconsistent with procyclical or acyclical markups.

A proponent of countercyclical markups would argue that some other measures of the markup would be countercyclical, which may support sticky price models. However, this approach is always controversial since introducing different assumptions on production technology easily leads to a different cyclical property of the markup. So this paper takes a different route and attempts to reconcile conflicting views of new Keynesians and their opponents by asking whether countercyclical markups are necessary to support new Keynesian models. Specifically, rather than focusing on a particular type of measure, it compares the performance of four types of measures in explaining new Keynesian models. The four types of measures that I consider in this paper are a procyclical measure, a weakly procyclical measure, an acyclical measure and a countercyclical measure. Then the paper shows that countercyclical markups are not crucial for the validity of new Keynesian models, especially those represented by the purely forward-looking new Keynesian Phillips curve (NKPC). Furthermore, what is more interesting is that weakly procyclical or acyclical markups indeed help the NKPC to depict empirical inflation dynamics.

To draw these conclusions, I start with examining the cyclicity of alternative measures of the markup. The standard measure (inverse of the labor income share) is chosen as a procyclical measure. The other measures that exhibit different cyclical behavior are constructed under the assumption of overhead labor. Then I proceed to investigate the empirical responses of the markup and inflation using structural vector autoregression (VAR) models. The structural shocks that I consider in this paper are permanent markup shocks, technology shocks and demand shocks in general. The permanent markup shock is not well

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known to the profession as yet. Although many DSGE models analyze the effects of a temporary markup shock, studies on the effects of a permanent markup shock are scarce as yet. If one looks at the trend of the U.S. markup, one finds that the markup has shifted up, which is more pronounced since the 2000 s. The possibility of permanent shifts in the markup is pointed out by Kim (2010) who studies the behavior of U.S. markups during the period 1960:Q1–2005:Q4. So far researchers in the business cycle area do not pay much attention to this possibility. However, by now, it is more apparent that the U.S. markup undergoes a permanent change. Kim (2010) defines a permanent markup shock as an exogenous change that shifts the desired markup ratio permanently, and proposes a method to identify permanent markup shocks in a structural VAR framework. This paper applies Kim's method as well as long-run restrictions proposed by Blanchard and Quah (1989) and Gali (1999) to identify the three structural shocks at the same time.

According to estimation results from VARs that include each alternative measure of the markup, inflation responds quickly to a permanent markup shock and a technology shock whereas it exhibits a hump-shaped pattern after a positive demand shock. Regarding the behavior of the markup, one notable feature is that the response of the markup is positive for several quarters after a positive demand shock, but turns negative later on. In other words, real marginal cost decreases in early periods but increases in later periods. These results are qualitatively similar regardless of which measure of the markup is included in VARs. I also conduct historical decompositions based on the estimated VARs to investigate the cyclical behavior of the markup conditional on each structural shock. It turns out that, for all measures of the markup, the markup shows countercyclical movements after a permanent markup shock but it is procyclical in response to a demand shock. The cyclical behavior of the markup conditional on a technology shock varies depending on which measure of the markup is used in VARs. In a VAR with a procyclical or weakly procyclical measure, the markup is procyclical. By contrast, in a VAR with an acyclical or countercyclical measure, the markup is countercyclical.

To assess standard new Keynesian models are consistent with which measures of the markup, I present a new Keynesian model centered on the purely forward-looking NKPC but modified to incorporate permanent shifts in the markup. Then the model's impulse responses are compared with four sets of empirical impulse responses corresponding to each measure of the markup. It turns out that the model fairly well describes empirical responses of key variables to a permanent markup shock and to a technology shock. On the other hand, it behaves poorly to a demand shock. However, one of the most important findings of this paper is that this is not due to the NKPC, but because the dynamics of the markup or real marginal cost after a demand shock are not well captured by the existing new Keynesian models. This finding comes from the following experiment. According to the purely forward-looking NKPC, current inflation can be expressed as a discounted sum of present and expected future real marginal costs, which has been called fundamental inflation by Gali and Gertler (1999). By using the time path of real marginal cost (inverse of the markup) estimated in VARs, I compute fundamental inflation implied by the NKPC and compare fundamental inflation with actual inflation responses in VARs. If the purely forward-looking NKPC works well, the two should be similar. I conduct this experiment with the four sets of empirical impulse responses corresponding to each measure of the markup. Surprisingly, it is found that the purely forward-looking NKPC can explain empirical inflation responses to all structural shocks identified in this paper. Most importantly, the NKPC can produce inertial inflation in response to a demand shock if it is combined with the time path of real marginal cost from VARs estimated with weakly procyclical or acyclical measures of the markup.

The conclusions of this paper can be summarized as follows. First, even though the markup is procyclical in response to demand shocks, this does not invalidate the NKPC. What matters for the NKPC is the entire time path of present and future markups (or real marginal cost),

not the contemporaneous correlation between the markup and output. So new Keynesian models need not rely on countercyclical markups. Weakly procyclical or acyclical markups actually help to support the NKPC contrary to the argument in Nekarda and Ramey (2013). Second, the purely forward-looking NKPC in standard DSGE models generates an immediate rise in inflation after a positive demand shock. It is this feature of the purely forward-looking NKPC that led researchers to seek alternative Phillips curves such as the hybrid NKPC (Gali and Gertler, 1999; Christiano et al., 2005) or the sticky information Phillips curve (Mankiw and Reis, 2002). These alternative Phillips curves exhibit success to some extent in that they can capture inflation inertia and produce the hump-shaped response of inflation to a demand shock. However, as shown in Mankiw and Reis (2007) and Trabandt (2009), these alternative Phillips curves produce the hump-shaped response of inflation even to a technology shock, which is not consistent with empirical inflation dynamics. This paper presents evidence that the purely forward-looking NKPC is more consistent with empirical impulse responses and, in particular, can produce inertial inflation once the dynamics of real marginal cost are well captured. Hence, inflation models developed so far need to be reevaluated considering empirical findings of this paper. Finally, standard new Keynesian models fail to generate a hump-shaped response of inflation to a demand shock. If the NKPC works well, then it is likely that this failure is associated with their inability to depict the evolution of real marginal cost. Although it is not pursued in this paper, attention should be shifted to the dynamics of real marginal cost or the markup in order to explain why inflation rises slowly after an increase in aggregate demand.

The paper is organized as follows. In Section 2, I construct alternative measures of the markup, and compare their cyclical behavior. In Section 3, empirical responses of the markup and inflation are estimated with U.S. data, and the cyclical behavior of the markup conditional on each structural shock is investigated. Then in Section 4, a new Keynesian model is presented featuring nonstationary markups. In Section 5, it is examined whether the purely forward-looking NKPC is consistent with empirical results. Finally, Section 6 draws some conclusions.

## 2. Measures of the markup and their cyclical behavior

The standard measure of the markup is proportional to the inverse of the labor income share. By using the index for the labor income share (2009=100) published by the Bureau of Labor Statistics (BLS), one can construct the standard measure. Fig. 1 shows the trend of the markup (expressed in log scale) in the U.S. economy since 1950. The solid line is the markup for the nonfarm business sector and the dotted line

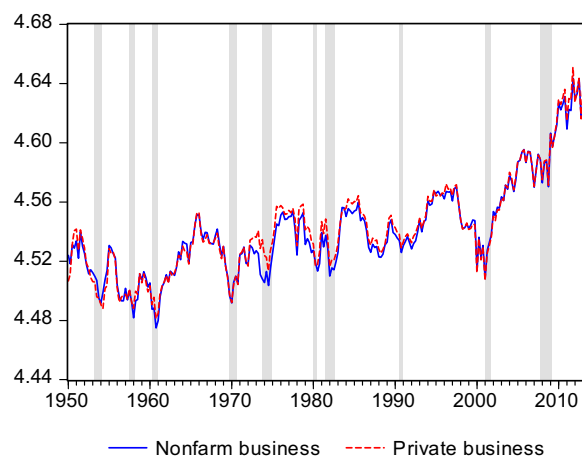


Fig. 1. Standard Measure of the Markup (Levels in Logs), Note: Shades indicate NBER recession periods.

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