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# State-level wage Phillips curves

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## Abstract

Two reduced-form versions of New Keynesian wage Phillips curves based on either sticky nominal wages or real-wage rigidity using monthly US state-level data for the period 1982-2016 are examined, taking account of the endogeneity of unemployment by instrumentation and the use of common correlated effects (CCE) and mean group (MG) methods. This is the first time that this methodology has been applied in this context. These are important issues, as ignoring them may lead to substantial biases. The results show that while the aggregate data do not provide estimates that are consistent with either of the theoretical models examined, the panel methods do. Moreover, use of an appropriate MG CCE estimator leads to economically significant changes in parameters (primarily a steeper Phillips curve) relative to those from inappropriate but widely used panel methods, and in the real-wage rigidity case is required to deliver results that have a theoretically admissible interpretation.

**JEL Codes:** E24, E31, E32.

**Keywords:** Wage Phillips curves, state-level data, panel estimation, CCE.

## 1 Introduction

Phillips (1958) uncovered an empirical relationship between (UK) wage inflation and unemployment, spanning the period between 1861 and 1957. The eponymous curve has subsequently remained firmly at the heart of macroeconomics in both wage and price inflation space. Phillip’s original exercise was purely empirical, but theoretical interpretations with a simple excess-demand mechanism followed. Since then theory has changed, with expectations and various forms of nominal or real rigidity playing crucial roles in the current New Keynesian incarnations, which lie at the heart of modern DSGE models. The curve is uniquely important in the conduct of monetary policy, as without it prices are flexible and monetary policy has no role. The parameters and specification of the Phillips curve are therefore of huge interest, not only from a purely academic view but also from the perspective of optimal policy. Most estimates are undertaken using aggregate data, and where disaggregated data have been used, the specifications tend not to have a modern structural interpretation. As is explained in more detail below, this may be highly important. Estimated aggregate specifications where there are heterogeneous disaggregate dynamic relationships are subject to aggregation bias. Moreover, no disaggregated

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studies address all the relevant econometric issues (including heterogeneity of parameters, common correlated effects and endogeneity of regressors). Our paper addresses these deficiencies.

In the remainder of this introduction, we relate our work to the Phillips curve literature, briefly allude to the econometric issues and cite some related work, none of which take the comprehensive approach we adopt in this study.

## 1.1 Phillips curves

Although now more usually associated with price inflation, the original Phillips curve explained wage inflation. Phillips fitted his eponymous curve with a bespoke method suggesting that a non-linear relationship between nominal wage inflation and the level (but also the change) of unemployment existed in the UK. He presented it as a type of regularity, rather than as a theoretical relationship. [Lipsey \(1960\)](#) used more conventional methods to estimate the relationship and introduced price inflation as an explanatory variable. In these versions driven by a market excess-demand adjustment mechanism, it was odd that the specification was one of rates of change in wages, when the underlying idea was one of adjustment to an equilibrium wage, a tension that still remained in the [Phelps \(1967\)](#) and [Friedman \(1968\)](#) notion of the expectations augmented Phillips curve. Some later specifications in this tradition, such as the NAIRU interpretation expounded at length in [Layard et al. \(1991\)](#), were based on wage and price setting where unemployment, productivity and other factors determine the long-run real wage.

The Phillips curve in its modern New Keynesian configuration (the NKPC) is by contrast the forward-looking relationship between price inflation and marginal costs, the latter often proxied by real unit labour costs, or a capacity measure such as the output gap or unemployment, presumed to be correlated with marginal costs. In this interpretation, the driver is not excess demand but marginal cost, and the specification may be seen as either price/wage setting, demand for labour or supply of output: all are derived from the same maximisation problem. Marginal cost may be measured directly or by some assumed related proxy for excess demand (the output gap or unemployment). The specification exploits the recursive nature of the dynamic problem to generate a specification that looks similar to a traditional Phillips curve,<sup>1</sup> although the interpretation is different. The relationship is so well-known as to hardly require a reference, but [Woodford \(2003\)](#) is a common citation for an exposition. Interest has been maintained by policymakers as the relationship between activity, wages and prices is a key part of the inflationary process. Similarly, the wage Phillips curve in macro models is typically also modelled as a forward-looking process with staggered wage setting or other rigidities, and has the same interpretation. At the heart of the relationship is a relative price, the real wage or real labour costs. As [Galí \(2011\)](#) notes, there has been less empirical attention to the wage setting process than to prices, which he hoped to partially rectify by specifying and estimating a New Keynesian Wage Phillips Curve (NKWPC), and it is this approach that we follow.

## 1.2 Econometric issues

What is missing, however, is a recognition that labour markets are local. From the beginning, some of the literature on Phillips curves considered the relationship to be a consequence of aggregation over specific markets in varying excess demand ([Hansen \(1970\)](#); [Evans \(1985\)](#)), but recently, it has only infrequently been considered. This is important, because despite the fact that it is often ignored, in general aggregation has a large impact on the dynamics of aggregate relationships in the presence of heterogeneity at the disaggregate level, typically leading to more persistence. [Robertson and Symons \(1992\)](#) spell out why there is distortion of the dynamics from aggregation; [Imbs et al. \(2005\)](#) is an example of an application to the real exchange rate where the consequences of ignoring aggregation are profound. In another highly pertinent paper, [Imbs et al. \(2007\)](#)

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<sup>1</sup>In its ‘expectations-augmented’ form, e.g. [Phelps \(1967\)](#).



























