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# Real wages over the business cycle: OECD evidence from the time and frequency domains ☆

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ABSTRACT

We study differences in the adjustment of aggregate real wages in the manufacturing sector over the business cycle across OECD countries, combining results from different data and dynamic methods. Summary measures of cyclicality show genuine cross-country heterogeneity even after controlling for the impact of data and methods. We find that more open economies and countries with stronger unions tend to have less pro-cyclical (or more counter-cyclical) wages. We also find a positive correlation between the cyclicality of real wages and employment, suggesting that policy complementarities may influence the adjustment of both quantities and prices in the labor market.



## 1. Introduction

Empirical evidence about the direction and the extent of the response of aggregate real wages to business cycle fluctuations is inconclusive. In particular, the available results differ according to the data and methods that have been used. For example, in their survey of the literature, Abraham and Haltiwanger (1995) find that typical discrepancies across measures relate to differences in the data used, such as the wage measure, deflator, business cycle indicator, data frequency, sample period and sectors covered; and in methods, such as the precise measure of co-movement and the extent to which dynamics of real wages and output are taken into account. As a result, little is known about true cross-country variation in the adjustment of real wages over the business cycle and its potential determinants.

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We provide evidence of differences in the adjustment of aggregate real wages in the manufacturing sector over the business cycle across a large sample of OECD countries covering a time period of more than 40 years, starting from the 1960s. Our paper contributes to the empirical knowledge about aggregate real wage cyclicality in several ways. First, we use cross-country data to evaluate qualitative conclusions emerging from survey evidence on real wage cyclicality. In particular, we analyse the importance of differences in data and methods in determining cross-country differences in measured real wage cyclicality. We evaluate three dimensions that have been found to be important in previous literature: the deflators used to construct real wages, the measure of the business cycle and the methodology used to measure cyclicality.

Second, we provide a first systematic cross-country evidence of real wage cyclicality using empirical approaches that properly take into account the dynamic nature of the aggregate time series under consideration. Most studies in this literature have measured co-movement between real wages and the cycle using a static approach.[1] However, a number of authors beginning with Neftci (1978) have stressed that accounting for the dynamic properties of the data series, such as persistence over time, may matter for correctly understanding real wage cyclicality.[2] The dynamic properties of the data can indeed vary substantially across data series and countries as shown in Den Haan (2000) evidence on cyclicality based on simple static measures can be misleading. Den Haan argues that the measured cyclicality of prices depends on whether co-movement is measured over the short or the long run. A priori, this dimension is potentially even more relevant for measuring real wage cyclicality, as nominal wage contracts tend to be fixed for an extended time period. When nominal wages are rigid in the short-term, measured cyclicality of real wages in the short run is likely to be dominated by changes in the deflator as adjustment through the wage-setting process becomes evident only with a lag. We use two dynamic approaches: the time domain approach proposed by Den Haan (2000) and the frequency domain approach proposed by Croux et al. (2001). In addition to properly taking into account the dynamics of the data series these methods also allow us to evaluate different business cycle horizons as an additional dimension that may result in variation across countries. Few studies have used these methods to study real wage cyclicality so far. The exception is the short note by Den Haan and Sumner (2002), where real wages appear pro-cyclical in the G7 countries and more so at longer horizons. In a related paper Lamo et al. (2007) focus on the cyclicality of consumption, compensation and employment in the public sector. Camacho et al. (2006) apply the methods used here to measure business cycle co-movement in European countries.

Finally, we show that a measure of real wage cyclicality that is clean of systematic differences in data and methods differs across countries in a meaningful way. Cross-country results of real wage cyclicality in European countries based on static correlation analysis of detrended series can also be found in Christodoulakis et al. (1995). We extend these cross-country analyses by using dynamic methods, measuring the impact of different data and methods and documenting country heterogeneity after controlling for these differences.

Our study does not address two potentially important factors that could lead to cross-country differences in the adjustment of real wages over the business cycle: the composition of shocks and changes in the composition of the labor force. First, the adjustment of real wages over the business cycle is likely to depend on the nature of the shock, with supply shocks leading to predominantly pro-cyclical and demand shocks leading to counter-cyclical responses. We cannot exclude that the measures of real wage cyclicality across countries that we derive are affected by country specific shocks. However, as average real wage cyclicality is here measured over an extended time period, the impact of country specific shocks is likely to be less important. Instead, owing to institutional diversity, differences in real wage cyclicality across countries are more likely to reflect differences in the labor market response to common shocks. Our robustness analysis using two different sub samples supports this view. Second, following Solon et al. (1994) a number of studies based on micro data have found that changes in the composition of the labor force over the business cycle are important and may lead to lower (less pro-cyclical) aggregate estimates of real wage cyclicality. In addition, the extent of real wage adjustment may vary across other disaggregated dimensions, such as regions, firm type (e.g. firm size and ownership). The homogeneity of the manufacturing sector across countries along these dimensions is likely to mitigate the potential impact of composition effects on cross country comparisons of real wage cyclicality. Further, we argue that measuring real wage cyclicality at the macroeconomic level remains important for understanding the aggregate business cycle facts. In the absence of micro data that are both sufficiently comparable across countries and cover long time periods, cross-country comparisons of real wage cyclicality are only possible using macroeconomic data.

Our findings suggest that data and methods indeed matter for observed real wage cyclicality, thus confirming previous survey evidence. Among the several dimensions that we test, differences in the type of deflators used result in the largest and most robust differences across measures. In particular, real wage cyclicality is significantly more negative (more counter-cyclical) when the wage measure is deflated using producer prices, as opposed to the other deflators. While the use of dynamic methods is likely to provide more accurate measures of real wage cyclicality than static measures, we find that whether co-movement is measured in the short or the long run is not an important determinant of differences in real wage

[1] The chosen cyclicality measure has been either the unconditional correlation coefficient between the cyclical component of real wages and an indicator of the cycle or the coefficient of OLS regressions of a (de-trended) real wage series on a (de-trended) business cycle series. In both cases, only the contemporaneous values of real wages and the cycle have been taken into account.

[2] Within this branch of literature, most contributions have adopted distributed lag or VAR models to focus on the dynamic response of real wages to business cycle indicators, or have used larger structural VAR models with identifying restrictions to study the reaction of real wages to different types of shocks. A review of the available empirical literature on aggregate real wage cyclicality can be found in Messina et al. (2006).