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New stylized facts on occupational employment and their implications: Evidence from consistent employment data[☆]

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ABSTRACT

The business cycle properties of occupational employment have not yet been extensively explored because of inconsistencies in the aggregate employment series by occupation. Using consistent aggregate hours data constructed through the method of “conversion factors,” which was developed by the U.S. Census Bureau, we provide new empirical facts on the cyclical behaviors of occupational employment and discuss their implications. First, employment of the middle-skill occupation group is negatively affected by a technology shock, while those of high-skill and low-skill groups are positively correlated with it. Second, it is the middle-skill group that experiences the largest decline in employment volatility after the mid-1980s. Last, recessions since the 1980s have heterogeneous impacts on different occupations, defining the characteristics of each recession. We further discuss the value of having consistent employment data in studies of business cycles.

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1. Introduction

One of the fascinating topics in the labor economics and macroeconomics fields is the causes and consequences of structural changes in the labor market. In particular, “job polarization,” that is, the increase in job opportunities at the two ends of the skill distribution and the decline in opportunities in the middle, attracts

researchers to study the properties of occupational employment (see Acemoglu and Autor, 2011; Autor et al., 1998; Cortes, 2016; Autor and Dorn, 2013; and Jung and Mercenier, 2014). Interestingly, while the long-run properties of occupational employment (i.e., employment of high-skill, middle-skill, and low-skill occupation groups) have been well-documented in the literature, the business cycle properties of occupational employment have not yet been extensively explored.¹ Jaimovich and Siu (2014), Foote and Ryan (2014), Gaggli and Kaufmann (2015), and Smith (2013) are few exceptions that we are aware of. One major obstacle in the study of short-run fluctuations is the presence of inconsistencies in aggregate employment series by occupation because occupation classifications have changed over time and the changes in occupation codes overlap

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¹ High-skill (non-routine cognitive) occupations include “Managers,” “Professionals,” and “Technicians.” Middle-skill (routine) occupations include “Sales,” “Office and administration,” “Production, crafts, and repair,” and “Operators, fabricators, and laborers.” Low-skill (non-routine manual) occupations include “Protective services,” “Food prep, building and grounds cleaning,” and “Personal care and personal services.” See Acemoglu and Autor (2011) or Autor (2010) for details.

key moments of the business cycle such as recessions (see [Dorn, 2009](#) and [Foote and Ryan, 2014](#)). Despite such an obstacle, studying the business cycle properties of occupational employment is important because employment fluctuations affect the aggregate economy in many dimensions. For instance, they can affect the welfare cost of business cycles; when the asset market is incomplete, the welfare cost of business cycles depends heavily on labor income dynamics. As wage rates and skill premia are almost acyclical, employment fluctuations have sizable impacts on the welfare costs across occupation groups ([Castro and Coen-Pirani, 2008](#); [Shim and Yang, 2015](#)).

Our paper attempts to fill this gap in the literature in two ways. First, we provide consistent aggregate employment data for different occupation groups by using the method of “conversion factors.” While we are not the first to use this method (for example, [Beaudry et al. \(2016\)](#) and [Lefter and Sand \(2011\)](#) employed the same method, but they analyzed long-run trends only), we are the first to apply the method to study short-run behaviors of occupational employment. Second, using the consistent aggregate hours data by occupation, we provide several empirical regularities of occupational employment at the business cycle frequency that have not been documented before. This is particularly important when we need to identify the heterogeneous impacts of business cycles on different occupation groups. For instance, for implementing a labor market policy that attempts to help the workers who are mostly affected by a recession, we need information on the dynamics of the labor market, that is not contaminated by inconsistencies in data.

We first address the inconsistency issue by comparing aggregate employment and total hours series for each occupation group by using the following two methods: (1) occ1990dd classification and (2) conversion factors. Details of these methodologies are discussed in [Section 2](#). By comparing aggregate hours variables obtained through each method, as presented in [Section 3](#), we find that the method of conversion factors provides aggregate hours data without any discontinuities during the sample period. In contrast, the occ1990dd data and the raw data, which are constructed without any methods, exhibit breaks in aggregate data when occupation codes change. In principle, the occ1990dd classification is neither intended to construct aggregate employment series nor to be used for business cycle analysis; however, the method has been employed by several papers such as [Foote and Ryan \(2014\)](#) and [Gaggi and Kaufmann \(2015\)](#) that study business cycle properties of occupational employment. They circumvent the inconsistency issue by using growth rates of employment variables instead of using levels. In this sense, the data constructed through conversion factors enable researchers to conveniently use levels of aggregate employment series without discontinuities so that it can enrich our understanding of employment fluctuations.

We then present three stylized facts about cyclical properties of occupational employment, which have never been documented before: (1) the heterogeneous responses of occupational employment to technology shocks, (2) the degree of changes in volatility of hours worked of each occupation group since the mid-1980s, and (3) the asymmetric effects of recessionary episodes on occupational employment. We first show, using a vector autoregression (VAR, henceforth) with a long-run restriction à-la [Galí \(1999\)](#), that it is the middle-skill occupation group that is negatively affected by the technology shock; the high-skill and low-skill groups are instead positively related to the technology shock. This result suggests that the finding by [Galí \(1999\)](#) that hours negatively react to the identified technology shock might be driven by the middle-skill group. Importantly, this information cannot be obtained when data with discontinuities are used instead. We further discuss the possible implications of our finding on the shape of the production function.

Second, we analyze the changes in volatility of hours worked of each occupation group since the mid-1980s, which is relevant to the studies of job polarization in the following sense. Suppose

that we want to know if job polarization has made the employment of a specific occupation group more or less stable at the business cycle frequency; that is, a factor that causes job polarization at the low frequency may also cause some occupation group to be disproportionately affected by business cycles. This is equivalent to studying how volatility of the hours variables has changed since the mid-1980s, which is in line with [Castro and Coen-Pirani \(2008\)](#) and [Galí and van Rens \(2014\)](#). We find that the decline in employment volatility for middle-skill occupations is the largest among the three occupational groups. In order to highlight the importance of using consistent data, we report the statistics obtained from inconsistent data. We then analyze the implication of our finding on the welfare cost of business cycles by using a simple partial equilibrium model of consumer’s problem. When the change in employment volatility is the only change since the mid-1980s, the welfare cost for the high-skill occupation group after the mid-1980s is about 30% lower than before, that for the middle-skill group is about 65% lower than before, and that for the low-skill group shows little change.

Last, we show the extent to which different recessionary episodes since the 1980s affect the employment of different skill groups. This is relevant for the studies of business cycles because the group that is affected the most can characterize the recession. For instance, the 1981–1982 recession is characterized by substantial drop in employment of the middle-skill occupation group. This is because the manufacturing sector, which heavily depends on the middle-skill group, was severely affected by the recession. Moreover, the 1990–1991 recession is associated with a large decline in employment for middle-skill and low-skill occupation groups, while the 2001 recession exhibits the greatest job loss for the low-skill group.

We do not argue that the method of conversion factors is better than the occ1990dd classification system in every respect. As will be discussed in [Section 2](#), we can apply conversion factors when we need “aggregate” hours variables. Instead, the occ1990dd classification system, which constructs the balanced panel structure by occupation, is more useful for micro-level studies,² while aggregate hours variables constructed using the method exhibit discontinuities when occupation codes change. Hence, the appropriate method should be considered depending on research subjects.

2. Data construction

In this paper, we consider three data sets of aggregate hours variables by occupation. The first data set is the raw data series to which no particular method is applied, and this data set provides a benchmark when evaluating the performance of different methods. The second data set is obtained using the occ1990dd classification that was suggested by [Dorn \(2009\)](#). The last data set, which we mainly use in this paper, is obtained using the conversion factors that were originally developed by the U.S. Census Bureau. While the Bureau of Labor Statistics (BLS) publishes aggregate employment data for different occupation groups that are constructed using conversion factors, there are two major shortcomings associated with using data directly from the BLS. First, its data set covers the period only after 1983. While one can find aggregate employment data for the period before 1983,³ data for different periods are not directly comparable since the conversion factors are applied only for data after 1983. Second, the BLS publishes employment data only. In this paper, we show that conversion factors can be applied to the period before 1983 to construct consistent aggregate employment data and that the method can also be used to construct a total hours variable, which is not officially provided by the BLS.

² For example, [Autor and Dorn \(2013\)](#) use the occ1990dd classification to analyze long-term changes in occupation shares based on micro-level data.

³ Link: <http://fraser.stlouisfed.org/publication/?pid=60>.

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