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An alternative measure of structural unemployment☆

Uluc Aysun [a,*], Florence Bouvet [b], Richard Hofler [a]

[a] University of Central Florida, Orlando, FL 32816, United States
[b] Sonoma State University, Rohnert Park, CA 94928, United States

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ABSTRACT

In this paper we derive an alternative measure for structural unemployment using a stochastic frontier analysis. This measure, by empirical design, is always less than total unemployment and it is, thus, more consistent with the theoretical description of structural unemployment than its usual interpretation as a smoothed long-run average of total unemployment. We find that our measure does not always track the long-run trends in total unemployment in the U.S. and when compared to the existing measures can provide different insights into the evolution of structural unemployment. Demographic and regional evidences offer some validation for our approach and allow us to determine how demographic and regional factors are related to the variation in structural unemployment across time and regions.

1. Introduction

According to the standard definition, structural unemployment is the form of unemployment that results from a mismatch between the characteristics of the unemployed workers and those of jobs available, notably in terms of skills, work experience and geographical location (Jackman and Roper, 1987). Structural unemployment is only one component of the natural rate of unemployment that is defined by classical theory. The natural rate of unemployment also includes frictional unemployment — short-run unemployment due to the frictions in the job search process. The other main form of unemployment, cyclical unemployment in contrast, results from workers losing jobs due to economic downturns.

Although labor theory that categorizes unemployment into its structural, frictional and cyclical forms is well-established, it is empirically difficult to separate structural unemployment from the other two main types of unemployment. In practice, structural unemployment is often used interchangeably with the natural rate of unemployment, and it is measured by passing total unemployment through smoothing filters, and/or by the non-accelerating inflation rate of unemployment (NAIRU) which is the rate at which the economy is neither expanding nor contracting (cyclical unemployment is zero).[1] By construction, these measures of the natural rate of unemployment represent a long-run average measure of total unemployment. Consequently, total unemployment is sometimes lower than structural unemployment.[2]

This behavior of the unemployment measures is hard to justify since structural unemployment, by definition, is only one component of total unemployment and should, therefore, always be smaller. In this paper, we construct an alternative measure of structural unemployment that is consistent with its standard definition. In doing so, we use a stochastic frontier analysis and assume that structural unemployment, the stochastic frontier, represents the minimum attainable point for total unemployment (net of frictional unemployment) and thus it is always smaller. Of course, structurally unemployed workers can find jobs and/or workers categorized under cyclically unemployed can become structurally unemployed during the business cycle. Our methodology,

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* Corresponding author at: University of Central Florida College of Business Administration, 4000 Central Florida Blvd., P.O. Box 161400, Orlando, FL 32816, United States. Tel.: +1 5305743951.
E-mail address: uaysun@bus.ucf.edu (U. Aysun).

[1] The practice of using NAIRU to measure structural unemployment has not been without its critics. Salemi (1999) and Grant (2002), for example, argue that the natural rate of unemployment reflects microeconomic features of the labor market, whereas the NAIRU is predominantly an empirical macroeconomic relationship. Galbraith (1997) similarly argues that measuring the natural rate of unemployment with NAIRU implies that inflation stems from labor-market pressures, which might have led policymakers to tolerate needlessly high unemployment rates.

[2] If the natural rate of unemployment is instead represented by the sum of frictional and structural unemployment then using NAIRU implies that total unemployment can be less than frictional plus structural unemployment.

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however, implicitly assumes that the total number of structurally unemployed workers is always smaller than the total number of unemployed. In other words, if a worker is structurally unemployed, *on average*, this worker will not find a job even if the economy is expanding. This is consistent with the theoretical description of structural unemployment. Specifically, if a worker for example lacks the skills to find a job, an expanding economy does not directly provide him with the necessary skills. We should note, however, that our measure of structural unemployment is not fully insulated from business cycles and that it can account for the stylized fact that during long lasting economic downturns (expansions), structural unemployment can increase (decrease).[3]

Stochastic frontier models originally designed by Aigner et al. (1977) and Meeusen and van den Broeck (1977) to allow for and identify technical efficiency in the production process (such as that described by a Cobb–Douglas production function) have been more commonly used to study microeconomic topics. Focusing on a macroeconomic topic, we make a first attempt in this paper at applying a stochastic frontier methodology to identify structural unemployment. In doing so, we follow two steps. We first extract the frictional rate of unemployment from total unemployment using a modified version of the trade frictions model in Warren (1991). We then use an expectations-augmented Phillips curve to extract cyclical unemployment and generate a time-varying measure of structural unemployment. Our methodology deviates from a standard stochastic frontier analysis in two ways. First, while a large majority of the studies in the literature model the frontier as the maximum attainable point, we measure it as the minimum point that total unemployment (net of frictional unemployment) can attain. Second, we reasonably assume that structural unemployment has persistence. This assumption generates a composite error term that is more complicated than the usual composite error term in stochastic frontier modeling. We follow a stochastic cost-frontier modeling strategy, and we prove that the composite error term has the same distribution as the usual error term. These steps allow us to generate our measure of structural unemployment.

Our methodology has several advantages over more commonly used methodologies and our measure, compared to existing measures, illustrates different long-term trends in structural unemployment. A comparison with the time-invariant measures of structural unemployment shows that our measure is always smaller as expected (e.g. Rissman, 1986). Our measure, however, also has the advantage of illustrating the secular trends in structural unemployment possibly generated by hysteresis or the duration of economic downturns (expansions). Comparing with the time-varying measures obtained by using Hodrick–Prescott (HP) filters and Kalman filter estimations of NAIRU (as in Richardson et al., 2000; Staiger et al., 1997; Turner et al., 2001), we find conflicting results.[4] For example, the Congressional Budget Office's (CBO) Kalman filter based NAIRU measure indicates a decline in structural unemployment going from 1970s to 1980s, whereas our measure indicates an increase. Our methodology offers a distinct advantage over the CBO measure. The time variation in the CBO's measure of structural unemployment is generated by the participation rates of different demographic groups. The structural unemployment rates within each group are constant throughout the sample period and thus the time variation of these rates is not considered. By contrast, our measure represents both the participation rates of different demographic groups and the time variation within each group. In a more rigorous analysis, we show that this disparity between our measure and the CBOs measure can produce conflicting results. For example, when we hold structural unemployment in each group constant (as in the CBO methodology), we find that structural unemployment has decreased during the Great Recession. When we do not make this restriction (as in our baseline methodology), we find that it has increased.[5]

More generally, we find that although our measure is positively correlated with total unemployment, it does not always represent the long-run trends in total unemployment unlike the other time-variant measures of NAIRU.[6] For example, we find that the negative trend in total unemployment after 2001 was not due to a decrease in structural unemployment although the decline in total unemployment during the 1990s was accompanied by a decrease in structural unemployment. Therefore, our measure demonstrates conflicting trends when compared to the other measures of structural unemployment and does not represent a smoothed series of total unemployment.

In the second half of the paper we check the soundness of our analysis by investigating demographic and regional evidence. Consistent with the literature, we find that structural unemployment rates are higher for workers between ages 16 and 19 and for nonwhite workers. Our results, however, do not indicate a gender gap in structural unemployment.[7] In our regional analysis we investigate, controlling for demographic characteristics, the industrial structure of U.S. census regions as possible determinants of structural unemployment. Our panel model estimations show that primary (high-productivity) industry and secondary (low-productivity) industry shares, as expected, are negatively and positively related to structural unemployment, respectively. We find that these relationships are economically important. Specifically, if a region reallocates 1% of its production from its primary industry to its secondary industry, its structural unemployment increases by 0.2%.

The rest of the paper is organized as follows: in Section 2 we describe the model and the data used to identify frictional unemployment. In Section 3, we discuss our stochastic frontier methodology and describe how we obtain our measure of structural employment. In Section 4, we present our demographic and regional findings. Section 5 concludes.

2. Disentangling the frictional component of unemployment

To obtain the structural component of unemployment, we begin by generating a measure of unemployment that is net of frictional unemployment. In the next section, we will then separate this measure of net unemployment into its cyclical and structural components. In this section, we first identify frictional unemployment using a trade frictions model similar in essence to the model in Warren (1991).

In the model economy, workers can either be employed or unemployed, and the jobs can either be filled or vacant. Each period, unemployed workers entering or re-entering the labor market search for jobs and apply to vacant positions, while some workers are laid off or quit their jobs in the same period. Let V_t, J_t, E_t, U_t and L_t denote the number of job vacancies, the number of jobs, and the number of employed, the number of unemployed and the labor force, respectively. The number of vacancies and unemployed workers are then defined by,

$$V_t = J_t - E_t \quad (1)$$

[3] This behavior of our measure is consistent with the hysteresis and the duration hypothesis (Blanchard and Summers, 1987; Røed, 1997).

[4] We should also note that, although very few, there have been previous attempts at measuring structural unemployment using a Beveridge curve analysis. Jackman and Roper (1987) and Osberg and Lin (2000) for use this analysis to measure the structural unemployment rates in the United Kingdom and Canada, respectively.

[5] This is no surprise given that the labor force participation rates of demographic groups with high levels of structural unemployment throughout the whole sample period has decreased during the Great Recession.

[6] Of course, long lasting economic expansions (downturns) can accelerate (decelerate) skill acquisition but in general measuring structural unemployment as NAIRU or as a long run moving average of total unemployment can be misleading because the estimates might vary even when there is no change in the true natural rate of unemployment (see, Thirlwall, 1983). Estimates might exhibit a cyclical pattern, as short-term variations in NAIRU are more likely due to cyclical variation in demand rather than to changes in the labor market structures. This would tend to an overestimation of the natural rate of unemployment during economic downturns.

[7] We discuss the theoretical reasons for this finding later in the paper.