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Learning-by-doing and unemployment dynamics ☆

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ABSTRACT

This paper attempts to assess the impact of skill loss on the persistence of cyclical unemployment. The observations from the Current Population Survey and the Bureau of Labor Statistics suggest a countercyclical total unemployment rate that exhibits high persistence. A framework that features search frictions is developed. Households choose search intensities, and firms create vacancies. Workers accumulate skills through past work experience, or a process of learning-by-doing. This paper extends the learning-by-doing framework to consider endogenous skill loss by the unemployed, or a process of loss-of-learning-by-not-doing. An adverse aggregate technological shock induces workers to reduce their search intensity and firms to reduce their creation of vacancies. As unemployment increases, workers lose their accumulated skills. The skill obsolescence causes a decline in the future marginal productivity of workers. The decline in productivity causes a persistence in the cyclical downturn, and a delay in the recovery of the economy. This allows the model to capture the observed unemployment persistence.

1. Introduction

The aftermath of the financial crisis and the cyclical downturn that ensued led to an unprecedented length of unemployment durations. Elsby et al. (2011) showed that continued labor market weakness after the crisis led to the highest level of long term unemployment in the postwar period. The persistence of unemployment spells after an economic contraction, and the delay in the economic recovery, has been the focus of several studies.

This paper attempts to assess the impact of skill loss and obsolescence on the persistence of unemployment over the business cycle. The evidence for unemployment persistence is well documented in previous studies. This paper uses aggregated data from the Current Population Survey, and aggregate data from the Bureau of Labor Statistics, to identify the cyclical pattern of unemployment. The observations confirm the previous findings of a countercyclical unemployment that exhibits high persistence over the business cycle.

The paper also develops a model to identify the underlying market interactions that are critical in generating the observed behavior. Endogenous skill acquisition and loss are introduced, in a framework of learning-by-doing. These interactions are captured in a dynamic stochastic general equilibrium model that features search frictions. In this framework, the unemployed choose their search intensity for occupations and firms create vacancies. A standard matching function matches searchers with occupations. Workers accumulate skills through past work experience, or a process of learning-by-doing, similar to the one introduced by Chang et al. (2002). In their work, learning-by-doing is found to provide an important propagation mechanism in real business cycle models. Their framework, however, did not consider equilibrium unemployment. This paper extends their analysis to consider skill loss by the unemployed, or loss-of-learning-by-not-doing. The extension allows the paper to succeed in capturing the observed unemployment persistence. An adverse aggregate technological shock induces workers to reduce their search intensity and firms to reduce their creation of vacancies. As unemployment increases, workers lose their accumulated skills. The skill obsolescence causes a decline in the future marginal productivity of workers. The decline in productivity causes a persistence in the cyclical downturn, and a delay in the recovery of the economy. This allows the model to capture the observed unemployment persistence.

This paper adopts a different approach compared to previous studies that attempted to explain the persistence of unemployment. Some studies considered the aspect of skill loss. For instance, Pissarides (1992) shows that when unemployed workers lose some of their skills, they become less attractive to firms. Thus, firms create less vacancies. The market becomes thin because job seekers have less skills. The thin market leads to more job shortage which in turn perpetuates the thinness. Accordingly, the effect of the shock persists. Ljunqvist and Sargent (1998) formulate a model in which workers' skills depreciate during unemployment spells. After a shock, generous unemployment compensation hinders the process of restructuring the economy. The unemployed lack the incentives to quickly accept new jobs in which skills will have to be accumulated. Consequently, there can be a lengthy

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transition with long term unemployment. The fact that welfare benefits are based on past earnings causes the unemployed with depreciated skills to bail out from the labor force.

Esteban-Pretel (2005) and Esteban-Pretel and Faraglia (2010) include the aspect of skill loss if unemployed for an extended period of time in a business cycle model. When the economy suffers an adverse shock, the creation of vacancies declines thus lengthening unemployment spells. The increase in the duration of unemployment causes workers to lose their skills. The increase in the unemployment of the unskilled, who have a lower probability of finding a job, raises the average duration of unemployment in the economy and accordingly the persistence of unemployment.

Khalifa (2012) shows that, in a cyclical downturn, skilled workers compete with unskilled workers over unskilled jobs. Thus, the former crowd out the latter into unemployment. This downgrading of jobs in a cyclical downturn, or the increase in the labor input of the skilled in unskilled occupations, and the subsequent crowding out of the unskilled into unemployment, provide a possible explanation to unemployment persistence. Khalifa (2013) argues that, in a cyclical downturn, there is a mismatch between the educational qualifications of the skilled workers and the educational requirements of the unskilled jobs they occupy. Skilled workers lose their skills not only while unemployed for an extended period of time, but also when employed in occupations that do not require their specific skills. As the mismatched skilled workers lose their skills, and become unskilled, they are more likely to be crowded out of unskilled occupations due to their higher separation rates. These mismatched workers who lose their skills and flow into unemployment as unskilled unemployed, in addition to the unemployed skilled workers who lose their skills and become unskilled unemployed, are less attractive to potential employers. This lowers the probability of employment, and causes unemployment to exhibit persistence.

Pries (2004) argues that even though unemployed workers find jobs quickly, due to the high job finding rate following a shock that triggers a burst of job loss, the newly found jobs often last only a short time. After an initial job loss, a worker may experience several short lived jobs before settling into more stable employment. This recurring job loss contributes to the persistence of unemployment.

Several studies attempted to explain unemployment persistence introducing the aspect of ranking of job applicants. Blanchard and Diamond (1994) argue that when firms receive multiple applications, they hire the worker who has been unemployed for the least amount of time. This leads to the persistence of unemployment spells. Eriksson and Gottfries (2005) argue that employers use information on whether the applicant is employed or unemployed as a hiring criterion, since the perceived productivity of an unemployed worker may be lower than that of an employed worker. This ranking of job applicants by employment status increases the level and persistence of unemployment. Eriksson (2006) extends this framework to argue that long term unemployed workers do not compete well with other job applicants because they lost the abilities that employers find attractive. In a model with short term and long term unemployed workers, firms prefer to hire the unemployed who have not lost their human capital. This ranking of job applicants results in a lengthy adjustment process, and is capable of generating persistence after an adverse shock. Ravenna and Walsh (2012) show that following an adverse shock to the economy, the share of low efficiency workers in the pool of unemployed increases. This decreases the incentive of firms to create vacancies. Therefore, heterogeneity in worker's efficiency amplifies unemployment fluctuations and leads to persistent buildups of unemployment.

This paper, however, argues that unemployment persistence can be reproduced in a model without the aspects of recurring job loss, ranking of job applicants, job competition, or labor mismatch, and improves upon the studies that incorporate skill loss by introducing the aspect of endogenous skill obsolescence through a process of loss-of-learning-by-not-doing.

The paper offers several contributions: First, this is the first study that incorporates the feature of learning-by-doing in an equilibrium unemployment framework. Second, this is the only study that uses the aspect of endogenous skill loss to explain unemployment persistence in a business cycle framework. Third, this is the first study to expand the learning-by-doing framework to include endogenous skill loss, or loss-of-learning-by-not-doing. Fourth, the paper is able to replicate the persistence of unemployment spells after an adverse shock to the economy using these additional features.

The remainder of the paper is organized as follows: Section 2 presents the stylized facts, Section 3 develops the model, Section 4 discusses the calibration, Section 5 analyzes the results, Section 6 includes the sensitivity analysis, Section 7 concludes, and Section 8 includes the data and derivations appendices. References, tables and figures are included thereafter.

2. Observations

To derive the business cycle patterns of unemployment, a time series is compiled from the Outgoing Rotation Group of the Current Population Survey CPS[1]. This Survey provides monthly information from January 1979 until December 2008 on the participants' employment status. To compile a time series out of this survey, the labor market participants in each monthly file are divided into those employed and those unemployed. The proportion of the unemployed out of the total sample is calculated. This monthly time series of the unemployment rate is transformed into quarterly data by taking three months' averages. The data average during the period understudy of the proportion of the employed out of the total labor force is 0.94, which gives an average total unemployment rate of 6%.

The cross correlation coefficients between real gross domestic product in period t and the total unemployment rate in lag and lead periods are displayed in Table 3. These patterns demonstrate that the total unemployment rate is countercyclical where the cross correlation coefficient of -0.8877 is statistically significant. In addition to the aggregated unemployment rate compiled from the Current population Survey CPS, Table 3 also shows the cyclical pattern of the aggregate unemployment rate extracted from the Bureau of Labor Statistics BLS. The pattern shows that the total unemployment rate is countercyclical where the cross correlation coefficient of -0.8834 is statistically significant.

Table 4 displays the serial correlations of the total unemployment rate. The observations from the aggregated CPS data show the high persistence of total unemployment. The persistence of the aggregate unemployment rate from the BLS data is consistent with that of the CPS data. For instance, the first lagged serial correlation is 0.870 in the CPS, and 0.878 in the BLS. The remaining lagged serial correlations are similar in both data sets as well.

3. Model

Consider an economy where time is infinite and discrete. The representative household chooses optimally the search intensity. The representative firm chooses optimally the creation of vacancies. Searchers and vacancies are matched through a standard matching function. Employed workers acquire skills through past work experience, or learning-by-doing. Unemployed workers lose their skills, through a process of loss-of-learning-by-not-doing.

3.1. Households

Let N_t denote the number of the employed workers, and U_t denote the number of the unemployed workers. The labor force is normalized

[1] Detailed data description is included in Appendix 8.1.