

# **Dynamic Unemployment along Recessions and Recoveries: The U.S. Experience 1968 – 2015**

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*This research examines the dynamics of the unemployment rate and jobless recoveries in The United States. We find that GDP, productivity, and inflation are positively related to employment recovery and real wage growth has a negative impact on employment recovery. A low inflation rate is a major factor associated with lengthened recoveries. The unemployment rate is significantly negatively related with productivity, real wage, and lagged GDP growth. Rising imports as a percentage of GDP put upward pressure on the unemployment rate. We find that unknown and unmeasurable factors associated with recessions are positively related to the unemployment rate.*

## **INTRODUCTION**

The seemingly unpredictable changes in unemployment, both the extent and timing, or the dynamics of employment, as well as the recent jobless recovery have presented growing challenges to economists and policy makers. Recent researchers have focused on the slow recovery of employment, despite the growth of GDP, in the U.S. and around the world. Employment is often considered a lagging indicator and it is expected that employment will take time to return to the pre-recession level, however the length of time for employment or unemployment to return to prerecession levels has increased since World War II.

Gordon (1993) examines the relationship between productivity and employment following the U.S. recession from July 1990 through March 1991 and argues that the jobless recovery is a short-run phenomenon as the rapid productivity growth following the recession will fuel long-run economic growth. Aaronson et al. (2004) study the jobless recovery in the United States following the 2001 recession and report that it takes substantial time for jobless workers to be retrained to acquire the skills that employers seek, and the pace of sectoral reallocation had recently risen, the result, they argue, would be a temporary increase in the natural rate of unemployment and a temporary fall in employment growth. Reinhart and Rogoff (2009) and Reifschneider et al. (2013) build upon the concept of hysteresis discussed by Blanchard and Summers (1986), the theory of hysteresis demonstrates that, the natural rate of unemployment tends to increase following a deep contraction. Hysteresis is related to the concept of a jobless recovery, i.e., it takes the labor market much longer to adjust to a major shock to the economy than does GDP growth. Ball (2014) believes that the slowdown in employment growth following the deep

recession of 2007-2009, is caused by loss in potential GDP for the 23 OECD countries he examined. Blecker (2016) refers to the slow recovery of both GDP growth and the labor market in the United States as “secular stagnation”, he points out the weakness in household demand and its relationship to stagnant real wages and inequality and the resulting sluggish growth of the U.S. economy. A critical aspect of this research, as it relates to our research is the focus on the relationship between productivity, wages, and employment.

There have been seven recessions in the U.S. since 1968 as identified by the National Bureau of Economic Research. The depth and breadth of the seven recessions varies significantly, four of the seven recessions lasted fewer than 12 months and three recessions lasted 17 months or longer. “The Great Recession” lasted 20 months from December 2007 through June 2009, and is the longest period of contraction in the United States since the “Great Depression” from late 1929 through early 1933.

In this research we examine the dynamics of U.S. employment, employment loss rate and recovery rate, and factors that may have significant impacts on employment recovery and the unemployment rate; including productivity growth, real wage growth, GDP growth, inflation, labor force participation rate, and international trade. The purpose of this research is to understand some the factors and their impacts on the dynamics of the unemployment rate.

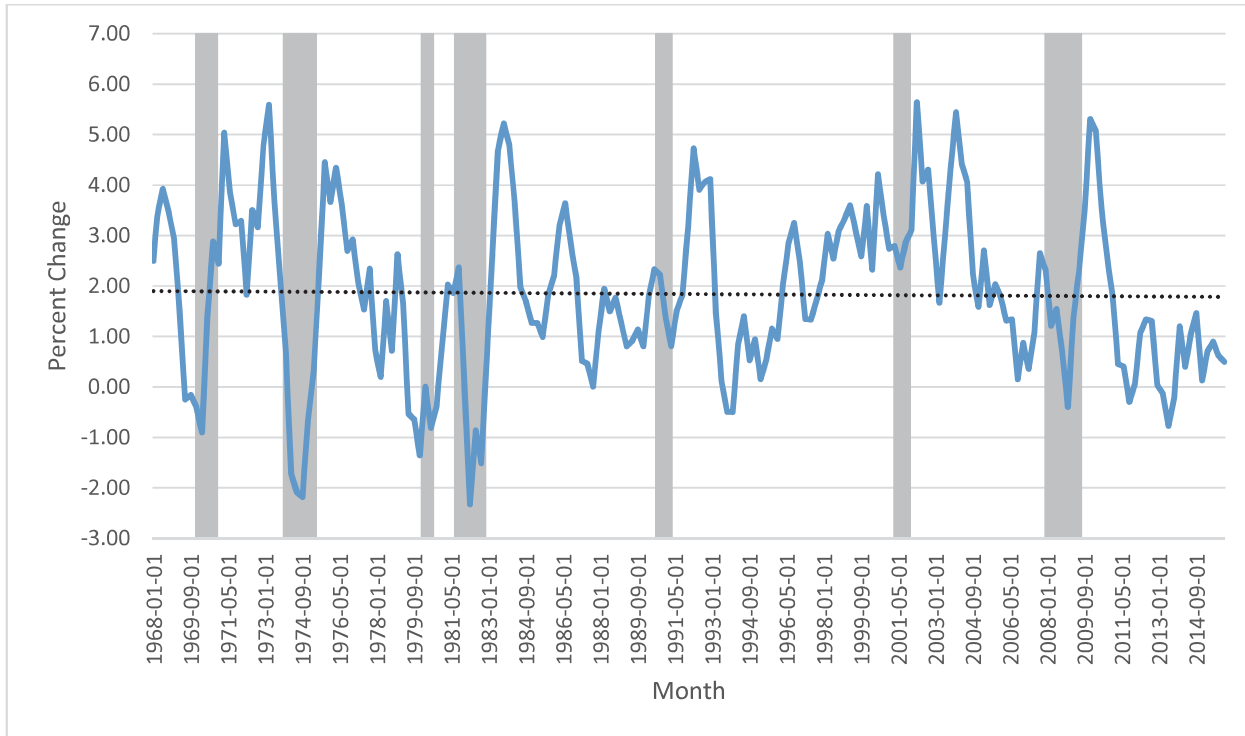
## **MAJOR FACTORS AND JOBLESS RECOVERY**

The relationship between unemployment and the growth rates of productivity, real wages, GDP, inflation, international trade, and the labor force participation rate may lead to alternate impacts on the economy. Recently, economists are debating whether increases in productivity increase or decrease employment. Microeconomic principles suggest that as workers become more productive, their marginal product of labor increases, and hence would lead to higher levels of employment as companies are willing to increase hiring. The result of rising productivity should generally precipitate increases in real wages for workers who have exhibited higher productivity. The alternative possibility is often referred to as the “Luddite theory”, the belief that improvements in technology and increases in productivity reduce demand for labor and hence lead to lower levels of employment or a higher unemployment rate, while GDP is increasing. Subscribing to this theory would stand in direct contrast to our experiences in economic growth since the Industrial Revolution. The trend has been that improvements in technology and increases in productivity lead to changes in the composition of the labor force and changes in sectoral allocation, that is, they will cause a shift in employment patterns in specific sectors, not a decrease in overall employment. Figure 1 plots the annual percentage change in U.S. nonfarm productivity from 1968 through 2015, measured as real output per hour of all persons, the data is obtained from the Bureau of Labor Statistics. The shaded areas represent recessions. From the figure one can see that productivity generally declines before recession and through the middle of recession, and rises from the middle of recession. The U.S. productivity growth fluctuates around 2 percent per year, with a slight downward trend. The average annual percentage change in productivity over the 1968-2015 period is 1.84 percent.

Although the average percentage change in productivity over the 47 year period provides some insight into the long-term trend in productivity, the time period under analysis includes specifically the “productivity slowdown” of the 1970s, which may suppress the average percentage change. The causes of the productivity slowdown have been studied and analyzed for roughly 40 years. Theories for the slowdown include measurement issues related to the shift from manufactures to services (Baily, et al., 1988), decreases in research and development spending (Griliches, 1979), decreases in infrastructure investment (Aschauer, 1989), and oil price shocks (Bruno and Sachs, 1985). To gain a better understanding of the relationship between productivity and the business cycle we present data on the percentage change in productivity during recessions and expansions in Table 1. The statistics provide insight into the changes in productivity over the business cycle. The relationship between productivity and employment is a key factor in forecasting fluctuations of the economy. As shown in Table 1, on average, productivity growth is lower during contractions than during expansions, or, productivity decreases as GDP declines during a contraction, and the lagging indicator unemployment rate has not yet

begun to rise. During the early stage of an expansion, however, employment and hours worked have not yet begun to increase with the rising

**FIGURE 1**  
**PERCENT CHANGE IN PRODUCTIVITY 1968-2015**



**TABLE 1**  
**PRODUCTIVITY OVER ECONOMIC CYCLES**

| Recession             | Average Annual Percentage Change in Productivity | Expansion              | Average Annual Percentage Change in Productivity |
|-----------------------|--|------------------------|--|
| Dec. 1969 – Nov. 1970 | 1.46   | Jan. 1968 – Dec. 1969  | 1.81   |
| Nov. 1973 – Mar. 1975 | 0.80   | Dec. 1970 – Oct. 1973  | 3.59   |
| Jan. 1980 – July 1980 | -0.39  | Apr. 1975 – Dec. 1979  | 1.82   |
| July 1981 – Nov. 1982 | -0.81  | Aug. 1980 – June 1981  | 1.77   |
| July 1990 – Mar. 1991 | 1.46   | Dec. 1982 – June 1990  | 2.02   |
| Mar. 2001 – Nov. 2001 | 2.62   | April 1991 – Feb. 2001 | 2.20   |
| Dec. 2007 – June 2009 | 1.83   | Dec. 2001 – Nov. 2006  | 2.79   |
|                       |  | July 2009 – Dec. 2015  | 0.97   |
| <b>Average</b>        | <b>1.00</b>                                      | <b>Average</b>         | <b>2.12</b>                                      |

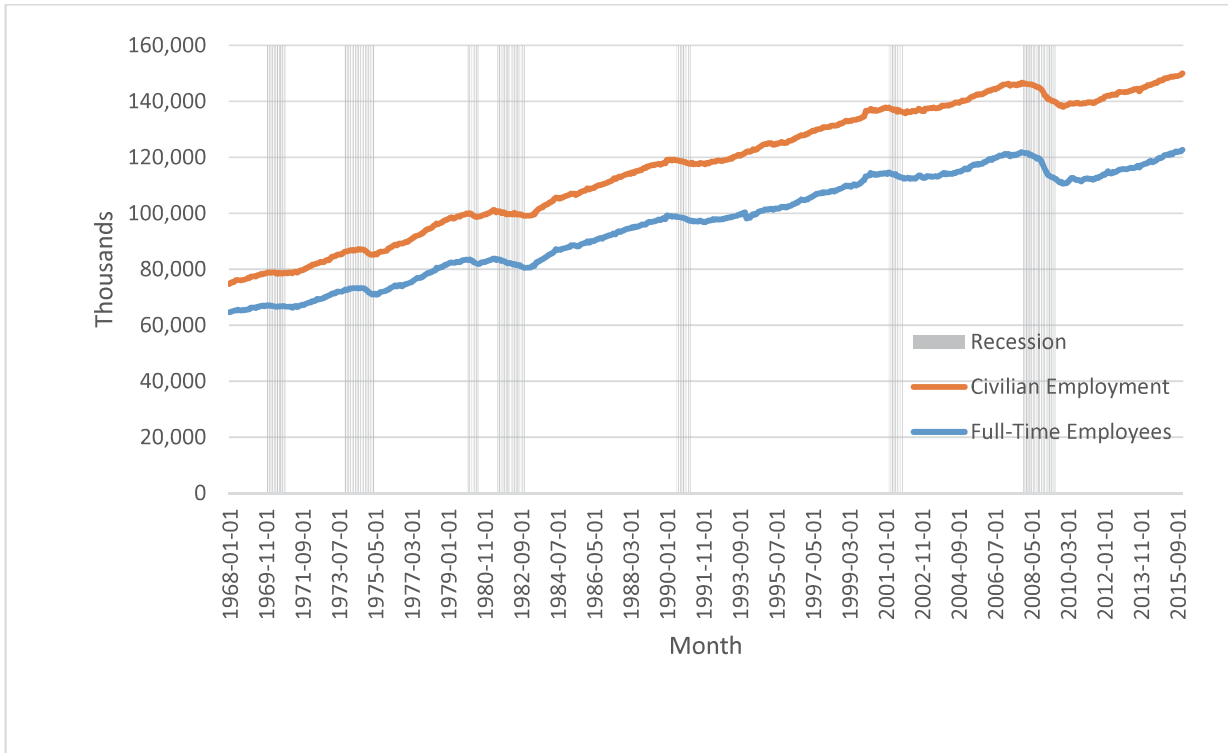
Source: Author calculations, Nonfarm Business Sector: Real Output Per Hour of All Persons, Bureau of Labor Statistics.

GDP, therefore a larger level of GDP is spread over static hours worked, which is the result of higher productivity of workers.

We then examine the monthly Civilian Employment and the Full-Time Employment series that are collected by the Bureau of Labor Statistics and display them in Figure 2. There is a well-known

relationship between employment and the business cycle, that is, employment tends to increase during an expansion and decrease during a contraction.

**FIGURE 2**  
**U.S. CIVILIAN AND FULL-TIME EMPLOYMENT, 1968-2015**



To further our understanding of employment over the economic cycle we create two statistics, the “Loss Rate” and the “Recovery Rate”. The motivation for these two statistics is to provide evidence that the recovery rate following the three most recent recessions has been slower than the recovery rate for the earlier recessions in our sample.

$$\text{Loss Rate} = (\text{Prerecession Employment} - \text{Nadir Employment}) / \text{Months}$$

$$\text{Recovery Rate} = (\text{Above Prerecession Employment} - \text{Nadir Employment}) / \text{Months}$$

We calculate these two statistics for both Civilian Employment and Full-Time Employment and present the results of loss rate in Table 2 and recovery rate in Table 3.

For the recessions since 1990, the economy has experienced much longer employment recovery periods than previous recessions, or the time it takes employment to reach the pre-contraction level has increased over time, hence the common phrase, “jobless recovery”. Particularly, in December 2007, U.S. civilian employment stood at 146.3 million workers, employment declined to 139.9 million workers in June 2009, a loss of 6.3 million jobs during the “Great Recession”. Further, U.S. civilian employment had not surpassed the pre-recession level until July 2014 when employment stood at 146.4 million workers, the length of time to return to the prerecession level was 82 months. The situation is similar for full-time employment. In December 2007, there were 121.6 million full-time employees, the number declined to 112.7 million in June 2009, a loss of 8.9 million full-time jobs. Full-time employment had not reached its pre-recession peak until July 2015, when there were 121.6 million full-time employees, it took 95 months from the beginning of the contraction. The significant decline in employment in both series during the

December 2007 – June 2009 recession and the slow recovery in employment has created a renewed interest in understanding how the economy behaves during a “jobless recovery”.

**TABLE 2**  
**EMPLOYMENT LOSS**

| Civilian Employment   |                                   |   |           |
|-----------------------|-----------------------------------|---|-----------|
| Recession             | Number of Months During Recession | Number of Months to Reach Nadir (From Beginning of Recession) | Loss Rate |
| Dec. 1969 – Nov. 1970 | 12                                | 7   | 18,286    |
| Nov. 1973 – Mar. 1975 | 18                                | 17  | 47,059    |
| Jan. 1980 – July 1980 | 7                                 | 6   | 208,500   |
| July 1981 – Nov. 1982 | 17                                | 20  | 70,333    |
| July 1990 – Mar. 1991 | 9                                 | 11  | 140,273   |
| Mar. 2001 – Nov. 2001 | 9                                 | 11  | 173,727   |
| Dec. 2007 – June 2009 | 20                                | 25  | 343,280   |
| Average               | 13.14                             | 13.86   | 143,066   |
| Full-Time Employment  |                                   |   |           |
| Dec. 1969 – Nov. 1970 | 12                                | 16  | 47,063    |
| Nov. 1973 – Mar. 1975 | 18                                | 20  | 75,200    |
| Jan. 1980 – July 1980 | 7                                 | 7   | 23,286    |
| July 1981 – Nov. 1982 | 17                                | 20  | 162,294   |
| July 1990 – Mar. 1991 | 9                                 | 18  | 115,444   |
| Mar. 2001 – Nov. 2001 | 9                                 | 14  | 123,357   |
| Dec. 2007 – June 2009 | 20                                | 25  | 452,640   |
| Average               | 13.14                             | 17.14   | 172,612   |

Source: Author calculations, Full-Time Employment, Bureau of Labor Statistics.

In Table 3 we present the recovery rates following the seven recessions and major related factors, including; productivity growth in recovery period, real wage growth, GDP growth, and the inflation rate, and their correlation coefficients, inflation rate is measured by percentage change in Personal Consumption Expenditures Excluding Food and Energy. The correlation coefficients indicate that growth in productivity and inflation are positively related to the recovery rate. We also find that real wage growth has a negative impact on employment recovery, or higher (lower) real wage growth reduces (increases) employment recovery. However, GDP growth shows a positive correlation with civilian employment recovery but a negative correlation with full-time employment recovery.

Table 4 presents information on the number of months it takes for employment to reach or exceed the prerecession level from the beginning of a recession, generally full-time employment recovery lengths are substantially longer than that of the broader measure of civilian employment. Beginning with the 1990 recession, both civilian and full-time employment have taken considerably longer to return to their prerecession levels. For the 1990 and 2001 recessions, civilian and full-time employments reached their nadir two months after the official end of the recession, but reached or exceeded their prerecession levels 30 to 36 months from the beginning of recession. For the 2007 recession, it took 82 and 95 months, respectively, for civilian and full-time employments to return to the prerecession level. In contrast, both the 1973 and 1981 recessions were nearly as long as the 2007 recession, but employment had reached or surpassed the prerecession level in 27 months or less from the official beginning of the recessions.

**TABLE 3**  
**RECOVERY RATES AND MAJOR RALATED FACTORS**

| Civilian Employment  |               |  |                        |               |                  |
|----------------------|---------------|--|------------------------|---------------|------------------|
| Recession            | Recovery Rate | Productivity<br>Growth in Recovery<br>Period | Real<br>Wage<br>Growth | GPD<br>Growth | PCE<br>Inflation |
| 1969-70              | 68000         | 3.42   | 1.07                   | 0.34          | 4.50             |
| 1973-75              | 209400        | 3.06   | 0.75                   | 2.45          | 9.56             |
| 1980                 | 181857        | 1.34   | -1.27                  | 1.37          | 10.32            |
| 1981-82              | 266833        | 3.02   | 0.07                   | 1.32          | 5.40             |
| 1990-91              | 81947         | 2.06   | -0.28                  | 1.89          | 3.60             |
| 2001                 | 180714        | 3.59   | 1.04                   | 2.45          | 0.78             |
| 2007-09              | 154754        | 1.23   | 0.78                   | 1.10          | 1.00             |
| Correlation          | 1             | 0.09   | -0.14                  | 0.38          | 0.30             |
| Full-Time Employment |               |  |                        |               |                  |
| 1969-70              | 176800        | 3.42   | 1.07                   | 0.34          | 4.50             |
| 1973-75              | 267167        | 3.06   | 0.75                   | 2.45          | 9.56             |
| 1980                 | 215667        | 1.34   | -1.27                  | 1.37          | 10.32            |
| 1981-82              | 276800        | 3.02   | 0.07                   | 1.32          | 5.40             |
| 1990-91              | 117889        | 2.06   | -0.28                  | 1.89          | 3.60             |
| 2001                 | 87000         | 3.59   | 1.04                   | 2.45          | 0.78             |
| 2007-09              | 164214        | 1.23   | 0.78                   | 1.10          | 1.00             |
| Correlation          | 1             | 0.00   | -0.22                  | -0.13         | 0.72             |

Source: Author calculations, Bureau of Labor Statistics.

Groshen and Potter (2003) examine the jobless recovery following the 2001 recession and argue that the cause of the slow recovery was structural change to the U.S. economy. They argue that, in addition to the cyclical impacts of the recession there was also an increase in structural unemployment. The authors provide evidence that changes in the structural mix of the U.S. economy and changes in the locations of available openings contributed to the jobless recovery following the 2001 recession. Calvo et al. (2012) present evidence that following a financial crisis the recovery will be characterized by either a “jobless” or “wageless” recovery. The researchers demonstrate that a country that exhibits low inflation at the time of the contraction will have wages that are inflexible downward, forcing the adjustment to take place through employment. These results would lend credence to the statistics in Tables 3 and 4, which show that the U.S. economy has experienced relatively low inflation and jobless recoveries from 1990 to 2014. Shimer (2012) argues that following a one-time shock to the economy, the loss of capital, as it deviates from trend, will generate a jobless recovery.

**TABLE 4**  
**RECOVERY LENGTH AND MAJOR RELATED FACTORS**

| Civilian Employment  |  |  |                        |               |                  |
|----------------------|--|--|------------------------|---------------|------------------|
| Recession            | Number of Months<br>to Reach or Exceed<br>Precession Level<br>With No Further<br>Decline<br>(From Beginning of<br>Recession) | Productivity<br>Growth in Recovery<br>Period | Real<br>Wage<br>Growth | GPD<br>Growth | PCE<br>Inflation |
| 1969-70              | 11   | 3.42   | 1.07                   | 0.34          | 4.50             |
| 1973-75              | 22   | 3.06   | 0.75                   | 2.45          | 9.56             |
| 1980                 | 13   | 1.34   | -1.27                  | 1.37          | 10.32            |
| 1981-82              | 24   | 3.02   | 0.07                   | 1.32          | 5.40             |
| 1990-91              | 30   | 2.06   | -0.28                  | 1.89          | 3.60             |
| 2001                 | 32   | 3.59   | 1.04                   | 2.45          | 0.78             |
| 2007-09              | 82   | 1.23   | 0.78                   | 1.10          | 1.00             |
| Correlation          | 1  | -0.49  | 0.29                   | -0.01         | -0.62            |
| Full-Time Employment |  |  |                        |               |                  |
| 1969-70              | 21   | 3.42   | 1.07                   | 0.34          | 4.50             |
| 1973-75              | 26   | 3.06   | 0.75                   | 2.45          | 9.56             |
| 1980                 | 16   | 1.34   | -1.27                  | 1.37          | 10.32            |
| 1981-82              | 27   | 3.02   | 0.07                   | 1.32          | 5.40             |
| 1990-91              | 36   | 2.06   | -0.28                  | 1.89          | 3.60             |
| 2001                 | 36   | 3.59   | 1.04                   | 2.45          | 0.78             |
| 2007-09              | 95   | 1.23   | 0.78                   | 1.10          | 1.00             |
| Correlation          | 1  | -0.48  | 0.33                   | -0.10         | -0.64            |

Source: Author calculations, Bureau of Labor Statistics.

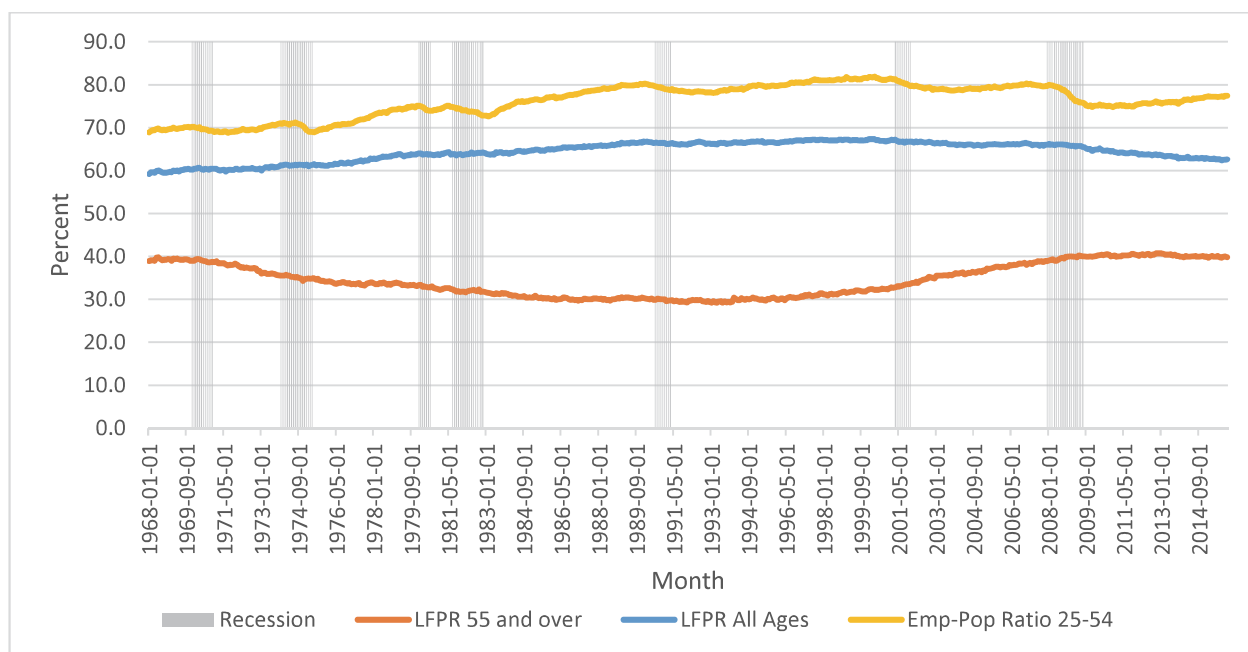
The correlation coefficients in Table 4 reveal that growth in productivity, GDP and inflation help to reduce the employment recovery length, or length of employment recovery is negatively related to growth in productivity, GDP and inflation. The negative correlation between recovery length and inflation confirms the finding of Calvo et al. (2012). Substantially different productivity growth rates among different sectors may support the structural argument of Groshen and Potter (2003). And real wage growth has a positive relationship with employment recovery length, which indicates that higher (lower) real wage growth increases (reduces) employment recovery length. The fact that wage growth was higher than inflation during the 2007-09 great recession period contributed to the slow recovery. Significantly different real wage growth among different sectors may also support the structural argument of Groshen and Potter (2003).

The statistics in Tables 2-4 are clear reminders of the depth of the 2007 recession. Full-time employment declined by approximately 453 thousand jobs per month for 25 months following the official onset of the recession in December 2007. This was followed by a recovery rate of approximately 164 thousand jobs per month for 70 months following the nadir in full-time employment. The average loss rate in civilian employment is approximately 143 thousand from the onset of a recession to the nadir in

employment. The average recovery rate in civilian employment is approximately 155 thousand from the nadir to levels above the prerecession level. One can see from Table 3 that the 1973, 1980, and 1981 recessions all had much higher recovery rates than the 1990, 2001, and 2007 recessions for both civilian employment and full-time employment.

Changes in the labor force participation rate may also have an impact on the officially reported unemployment rate. From Figure 3 one can see a declining trend in labor force participation rate for all ages since the late 1990s, to 62.6 percent in December 2015, which is 1.8 percentage points below the 1968-2015 average of 64.4 percent and 4.2 percentage points below the peak of 66.8 percent reached in January 1990. The major cause is the decline in participation rate for ages 25-54 as the participation rate for ages 55 and over was increasing from 1993 through the great recession period. There is a slight recovery in the participation rate for adults of ages 25-54 after the great recession but not in the overall labor force participation rate, because the rate for ages 55 and over peaked in 2012 at 40.7 percent, and then declined to 39.8 percent in December 2015. There are a large number of baby-boom generation Americans that began reaching retirement age during the 2007 recession, some of these workers had made the decision following a job separation to exit the labor force, rather than search and/or wait for new employment opportunities.

**FIGURE 3**  
**U.S. LABOR FORCE PARTICIPATION STATISTICS, 1968-2015**



Also, there is a drop in the employment to population ratio for adults 25-54 during the great recession. Prior to the 2007 recession, the ratio for adults 25-54 was 79.7 percent in November 2007, it decreased to 74.8 percent in December 2009. The ratio increased to 77.4 percent by December 2015, which is 1.2 percentage points above the 1968-2015 average of 76.2 percent.

Figure 4 shows the monthly U.S. unemployment rate from 1968-2015, reported by the Bureau of Labor Statistics from the household survey. The behavior of the unemployment rate represents one of those stylized facts discussed above, that is, the unemployment rate is inversely related to GDP growth. The average unemployment rate over the sample period is 6.3 percent. Prior to the 2007 recession, the unemployment rate in November 2007 was 4.7 percent, rising to 10.0 percent in October 2009. The unemployment rate had fallen to 5.0 percent by December 2015, which is 1.3 percentage points below the 1968-2015 average. If we focus only on the time period 1983-2007, often considered a period of



relatively stable monetary and fiscal policy, referred to as the “Great Moderation”, the average unemployment rate is 5.8 percent. Finally, the slight upward trend in the unemployment rate over the sample period may be evidence of hysteresis as discussed by Blanchard and Summers (1986). The trend may also provide additional evidence that jobless recoveries have become more common since the 1981 recession.

**FIGURE 4**  
**U.S. UNEMPLOYMENT RATE, 1968-2015**

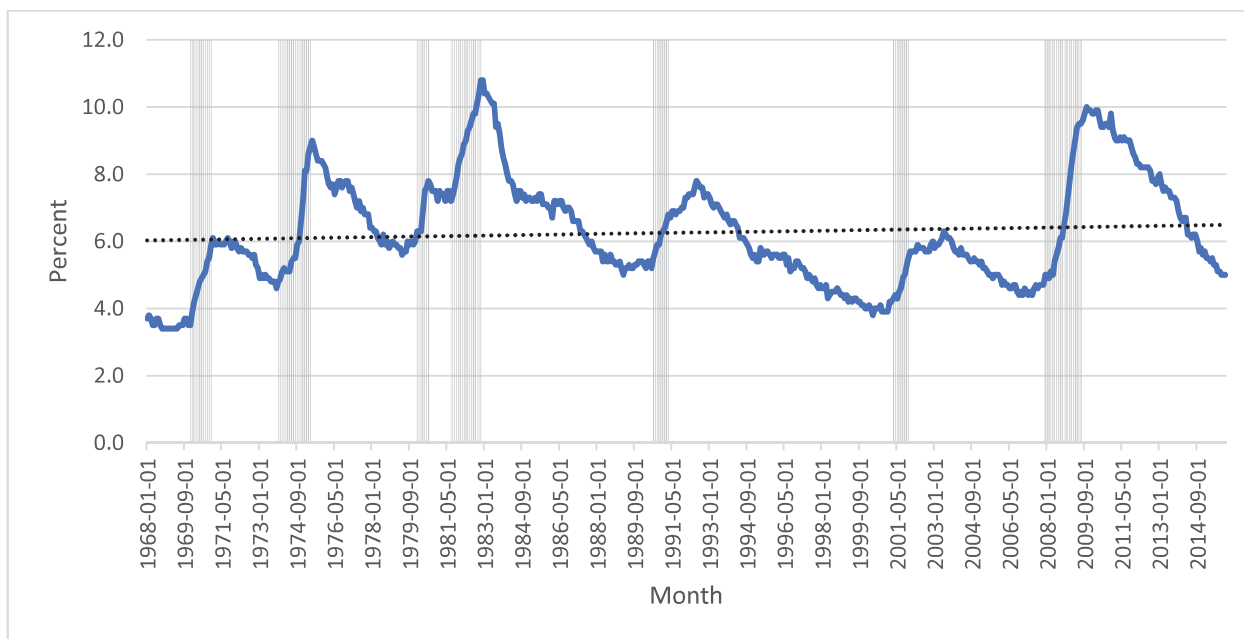


Table 5 presents the U.S. unemployment rate over the business cycle. We calculate the average unemployment rate in the month prior to the seven recessions in our sample to be 5.1 percent. This unemployment rate would represent a reasonable approximation of the natural rate of unemployment for the U.S. economy. These numbers help to shape our thinking regarding jobless recoveries, in that, the unemployment rate 18 months after a recession is consistently above the prerecession level, the only outlier is the 1981 recession where the unemployment rate 18 months following the recession (7.4 percent) lies below the prerecession level (7.5 percent). The average unemployment rate measured at the end of each of the seven recessions is 7.9 percent, while the unemployment rate measured 18 months after the end of the seven recessions is 7.5 percent. During the 1969, 1973, 1981 and 2007 recessions, the unemployment rate 18 months after the recession is lower than the unemployment rate in the final month of the recession. For the 1980, 1990 and 2001 recessions, the unemployment rates 18 months after the recession are higher than the unemployment rate in the final month of the recession. This confirms the stylized fact that the unemployment rate is considered a lagging indicator for the economy. The fact that the unemployment rate has not decreased as quickly as it had for earlier recessions has led to the assumption that there has been a change in the way the labor market operates following a recession in more recent years.

Next we examine the behavior of wages and inflation and their role in employment over the business cycle, and more specifically during and following recessions. Microeconomic theory suggests that real wage increases with productivity. During a recession, prices and wages tend to be depressed as firms decrease production in response to weaker demand for their products. When the economy begins to recover, firms begin to increase production prior to increasing hiring. During this period, productivity and

real wages increase. One benefit of modest inflation is that it automatically decreases the real wage and the downward pressure on real wages would increase hiring by companies.

**TABLE 5**  
**U.S. UNEMPLOYMENT RATES OVER THE BUSINESS CYCLE**

| Recession             | Unemployment Rate in<br>Month Prior to<br>Recession | Unemployment Rate in<br>Month at the End of the<br>Recession | Unemployment Rate 18<br>Months After the<br>Official End of the<br>Recession |
|-----------------------|---|--|--|
| Dec. 1969 – Nov. 1970 | 3.5   | 5.9  | 5.7  |
| Nov. 1973 – Mar. 1975 | 4.6   | 8.8  | 7.7  |
| Jan. 1980 – July 1980 | 6.0   | 7.8  | 8.6  |
| July 1981 – Nov. 1982 | 7.5   | 10.8   | 7.4  |
| July 1990 – Mar. 1991 | 5.2   | 6.8  | 7.6  |
| Mar. 2001 – Nov. 2001 | 4.2   | 5.5  | 6.1  |
| Dec. 2007 – June 2009 | 4.7   | 9.5  | 9.1  |
| Average               | 5.1   | 7.9  | 7.5  |

Source: Author calculations, Unemployment Rate from the Household Survey, Bureau of Labor Statistics.

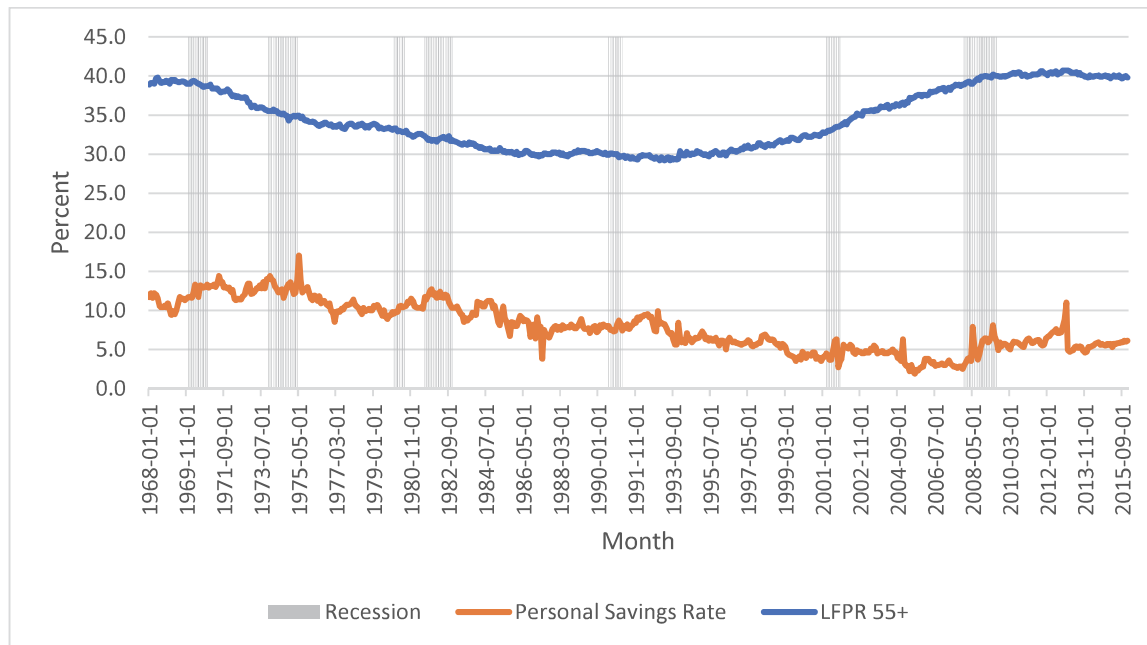
As presented in Table 6, an obvious difference between the 2001 and the 2007-09 recessions and prior recessions is that inflation was significantly lower, i.e., 2.65 percent and 1.83 percent, respectively, compared to 7.8 percent on average for the earlier recessions. Lower rates of inflation during the past two recessions is likely the result of two important factors, first, increased globalization and trade has kept downward pressure on U.S. consumer prices and second, the Federal Reserve has become better able to manage the economy in the period after 1982. The much lower rate of inflation during the 2007-09 recession also resulted in a positive wage-inflation differential of 1.38, or wage growth was higher than inflation over the time period. In terms of demographics the table also reveals a situation where a larger percentage of older Americans remained part of the labor force than in any previous recession, with a labor force participation rate for those 55 and older of 39.61 percent. The higher labor force participation rate among older workers from the early 1990s to 2015 may be the result of many factors including increases in life expectancy, more opportunities, and possibly lower savings rates among Americans that causes them to remain attached to the labor force longer than previous generations.

To visualize the relationship between declining savings and labor force participation we present the time series plot of the two variables in Figure 5. The personal savings rate tends to be more volatile. The correlation between the two variables is weak but negative (-0.089). The higher rate of labor force participation among older workers may be an important contributing factor to jobless recoveries. During recessions over the past forty years we have seen much lower labor force participation among older workers, than during the 2007-09 recession. The increase in labor force participation among older workers combined with the natural increase in the labor force, as younger workers begin seeking jobs, at a time when firms are decreasing their hiring may have contributed to the jobless recovery.

**TABLE 6**  
**AVERAGE VALUES OF KEY INDICATORS DURING RECESSIONS**

|   | 1969.12<br>to<br>1970.11 | 1973.11<br>to<br>1975.03 | 1980.01<br>to<br>1980.07 | 1981.07<br>to<br>1982.11 | 1990.07<br>to<br>1991.03 | 2001.03<br>to<br>2001.11 | 2007.12<br>to<br>2009.06 |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Inflation   | 6.42                     | 9.54                     | 11.18                    | 6.61                     | 5.23                     | 2.65                     | 1.83                     |
| %Δ Nominal Wage<br>Wage-Inflation<br>Differential | 5.33                     | 7.17                     | 7.40                     | 5.14                     | 2.72                     | 3.30                     | 3.21                     |
| %Δ Real Personal Income                           | -1.10                    | -2.37                    | -3.77                    | -1.48                    | -2.51                    | 0.65                     | 1.38                     |
| LFPR 55 and over                                  | -0.02                    | -1.41                    | -2.32                    | 0.47                     | -3.05                    | -1.87                    | -2.43                    |
| LFPR All Ages                                     | 38.98                    | 35.14                    | 33.00                    | 31.94                    | 29.90                    | 33.23                    | 39.61                    |
| Emp-Pop Ratio 25-54                               | 60.37                    | 61.25                    | 63.84                    | 63.89                    | 66.37                    | 66.78                    | 65.90                    |
| UNRATE  | 69.71                    | 70.54                    | 74.49                    | 73.89                    | 79.18                    | 80.46                    | 78.13                    |
|   | 4.77                     | 6.01                     | 6.96                     | 8.98                     | 6.14                     | 4.76                     | 6.84                     |

**FIGURE 5**  
**U.S. LFPR 55+ AND PERSONAL SAVINGS RATE, 1968-2015**



### THE REGRESSION ANALYSIS

In order to further examine the impacts of productivity growth, real wage growth, GDP growth, imports as a percentage of U.S. GDP, labor force participation rate and other factors on unemployment rate, we apply the regression model:

$$Unrate_t = \alpha_0 + \beta_1 Productivity\ Growth + \beta_2 Real\ Wage\ Growth + \beta_3 GDP\ Growth_{t-24} + \beta_4 Imports/GDP_t + \beta_5 LFPR_t + \beta_5 Recession_t + e_t \quad (1)$$

Where, Unrate represents unemployment rate, LFPR represents total labor force participation rate, and Recession is a dummy variable, i.e., recession period = 1, otherwise 0, in order to capture the impacts of unknown and unmeasurable factors during recessions. We use the growth rate of GDP with a lag of 24 months, based on the average length of time it takes employment to return to its pre-recession level<sup>1</sup>. We include imports as a percentage of GDP to account for the increasing level of trade and globalization which keeps downward pressure on prices and may have pressure on employment in the United States. After calculating growth rates and accounting for the lag in GDP there are 551 observations included in our sample. The regression equation is estimated with White heteroskedasticity-consistent standard errors. Results of the regression analyses are presented in Table 7.

**TABLE 7**  
**REGRESSION RESULTS**

| Table 7: Regression Results           |             |                |             |             |
|---------------------------------------|-------------|----------------|-------------|-------------|
| Dependent Variable: Unemployment Rate |             |                |             |             |
| Variable                              | Coefficient | Standard Error | t-Statistic | Probability |
| Constant                              | 6.914       | 0.111          | 62.169      | 0.000       |
| Percent Change in Productivity        | -0.078      | 0.042          | -1.871      | 0.062       |
| Percent Change in Real Wage           | -0.861      | 0.225          | -3.823      | 0.000       |
| Imports as a Percent of GDP           | 15.680      | 7.455          | 2.103       | 0.036       |
| Labor Force Participation Rate        | -16.449     | 25.946         | -0.634      | 0.526       |
| Percent Change in Real GDP, t - 24    | -2.031      | 0.233          | -8.724      | 0.000       |
| Recession                             | 0.516       | 0.199          | 2.592       | 0.010       |
| R-squared                             | 0.159       |                |             |             |
| Adjusted R-squared                    | 0.150       |                |             |             |
| S.E. of regression                    | 1.415       |                |             |             |
| Sum squared residuals                 | 1088.666    |                |             |             |
| Log likelihood                        | -969.443    |                |             |             |
| F-statistic                           | 17.149      |                |             |             |
| Prob(F-statistic)                     | 0.000       |                |             |             |
| Wald F-statistic                      | 17.327      |                |             |             |
| Prob(Wald F-statistic)                | 0.000       |                |             |             |
| Mean dependent variable               | 6.382       |                |             |             |
| S.D. dependent variable               | 1.534       |                |             |             |
| Durbin-Watson statistic               | 0.131       |                |             |             |

Included observations: 551 after adjustments

White heteroskedasticity-consistent standard errors & covariance

The coefficient on productivity growth is negative and statistically significant, this result confirms the microeconomic principle, i.e., the unemployment rate decreases as workers become more productive, and vice versa. The growth rate of the real wage is also significantly negatively associated with unemployment rate, which indicates that real wages grow as firms increase hiring, this is also consistent with microeconomic principles. As would be predicted by standard economic theory, from Okun's Law (1962), the growth rate of lagged GDP growth has a negative impact on unemployment, the regression

produces a significantly negative coefficient for the variable. There is a significantly positive relationship between the unemployment rate and imports as percentage of GDP, which implies that increases in imports tend to put downward pressure on the domestic unemployment rate. The coefficient for the labor force participation rate variable is negative but insignificant, however, the expected sign is positive. Finally, the coefficient for the recession dummy variable is significantly positive, this indicates that unemployment rate moves in the same direction with recession and there are factors related to recessions that are still unknown or unmeasurable, including “animal spirits”.

## CONCLUSION

The dynamics of the unemployment rate and jobless recoveries have presented growing challenges to economists and policy-makers. In this research we examine the changes in the unemployment rate and major factors and reveal their dynamic impacts on the unemployment rate. We find that growth in productivity, GDP, and inflation have positive impacts on employment recovery. We also find that real wage growth has negative impact on employment recovery. The research also reveals significantly negative relationships between the unemployment rate and productivity and real wage growth, which confirms the microeconomic principle that the unemployment rate decreases as workers become more productive, and as real wages rise. We find that lagged GDP growth has a significantly negative impact on unemployment rate, which is consistent with standard economic theory. We also find that the unemployment rate and imports as percentage of GDP are significantly positively related, which implies that increases in imports tend to put upward pressure on the domestic unemployment rate. Finally, the unemployment rate has a significantly positive relationship with recessions and the factors of recessions that are still unknown or unmeasurable.

## ENDNOTES

1. Real GDP and Real Imports are converted from quarterly data to monthly data using a linear transformation.

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