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Unemployment Index: A Multidimensional Measure Of Labor Market Efficiency

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ABSTRACT

The unemployment rate, which is measured by the Bureau of Labor Statistics as the proportion of labor force participants who are classified as being unemployed, is a traditional statistic that is used to evaluate labor market conditions. This conventional measure of unemployment considers incidence of unemployment and is a one-dimensional view of the unemployment experience. This analysis develops an alternative measure for evaluating labor market conditions that incorporates duration of unemployment. By aggregating the time that an individual is unemployed across the labor force, a measure of the gap between actual weeks of labor and potential weeks of labor is created. This ratio is then decomposed into familiar components of unemployment, incidence and duration. Incidence refers to the likelihood of experiencing unemployment and duration refers to the length of time spent unemployed. This framework provides a basis for creating an "unemployment index" in which the different components of unemployment are highlighted and used together as an indicator of labor market efficiency. Such an index can be useful for policy purposes when both incidence and duration are relevant in assessing economic conditions as well as in comparing the unemployment experience between different groups, identified by gender, race, age, state/regional residence, industry classification, or occupational classification.

INTRODUCTION

Unemployment refers to the labor force state in which a person does not have a job but is actively seeking employment. Because resources are scarce, it is a concern when labor is not being used in productive activities. Unemployment is observed continually and the desire is that unemployment be low.

There are several ways to measure unemployment. The standard measure in the United States is the unemployment rate, which is measured as the proportion of labor force participants who are classified as being unemployed based on the monthly Current Population Survey, and is announced by the Bureau of Labor Statistics:

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unemployment rate = U / (U+E)
= U / LF

where U = number of labor force participants who are unemployed
E = number of labor force participants who are employed
LF = number of labor force participants.

This measure is an "instantaneous" unemployment rate since it is an indicator of unemployment at a single point in time. The focus is on the incidence of unemployment. A limitation of this measure is that it does not take duration of unemployment or the number of spells of unemployment into consideration. Consequently, it reveals little about the burden of unemployment. Policies designed to combat the unemployment problem could differ according to whether a relatively large number of workers share the burden of unemployment and are unemployed for a brief time or whether a few individuals bear the brunt of the problem and are either unemployed for a long time or are chronically unemployed.

Furthermore, because this measure of unemployment is a time-specific ratio between two "stock" concepts, it does not capture the flow of individuals between different labor force classifications. For instance, if one is comparing unemployment rates for different time periods, a higher unemployment rate in one time period could reflect either a greater number of unemployed or fewer labor force participants. This is particularly relevant for groups whose members are not continuously in the labor force because those individuals who temporarily leave the labor force might have a higher or lower probability of being unemployed if they remained in the labor force than those who stay in the labor force continuously. Additionally, when the average labor force participation for a group is sufficiently less than one hundred percent, there is more room for variability in who actually experiences unemployment and how many individuals of the group experience unemployment.

Thus, although the unemployment rate has become the conventional standard measure of unemployment in the economy, it is limited in scope, ignoring other dimensions of the unemployment experience such as duration of unemployment or the number of unemployment spells experienced. A multidimensional measure of unemployment is developed in this paper. Applications of the index are explored briefly and potential areas for future consideration are suggested at the end.

LITERATURE REVIEW

Over time there have been a plethora of studies focusing on the dimensions of unemployment: incidence, duration, and number of spells. Labor force transition models provide a framework for analyzing incidence of unemployment, leading to possible explanations of differences in unemployment rates between different groups. Early studies include a study by Mincer (1966) who expressed unemployment rates in relation to labor force participation rates and another study by

Barrett and Morgenstern (1974) who addressed the higher observed incidence of unemployment among blacks and women. Other studies [Barron and Mellow (1981), DeBoer and Seeborg (1989), Fields (1976), Flinn and Heckman (1983), and Niemi (1975)] followed their lead in analyzing the incidence of unemployment within the context of a labor force transition. The notion underlying these studies is that unemployment is a temporary phase experienced by some people as part of the job search process. Many unemployed are changing jobs while others have entered (or re-entered) the labor force. They are unemployed until they either obtain employment or opt to leave the labor force. These studies focused on the likelihood that unemployment is experienced and on differential probabilities between groups. More recently, Shimer (2005) measured the probability that an employed worker will move from employment into unemployment (separation probability) and the probability that an unemployed worker will find a job (job finding probability). He found that the job finding probability is strongly procyclical but the separation probability is acyclical, especially over the past 20 years. As Shimer points out, “These findings sharply contradict the conventional wisdom that fluctuations in the separation probability (or in job destruction) are the key to understanding the business cycle” (p. 24).

Unemployment duration was initially modeled as part of the job search process in pioneering studies by Barron and Mellow (1979) and Sandell (1980). Alternative measures of the duration of unemployment and accompanying issues were explored in Akerlof and Main (1981, 1983), Carlson and Horrigan (1983), and Sider (1985). More recently the focus on the length of unemployment has shifted to the observed phenomena that unemployment duration has been gradually increasing over time [Groshen and Potter (2003), Mukoyama and Sahin (2004), and Valletta (1998, 2002)].

Although it is recognized that unemployment is experienced unevenly, with some people never experiencing unemployment while others experience repeated spells of unemployment, the frequency or number of unemployment spells has not been the subject of many analyses. Early studies that considered the number of spells of unemployment experienced by an individual include the studies by Akerlof and Main (1980) in which they compared the average duration of unemployment for those who experienced one spell of unemployment with those individuals who experienced multiple spells of unemployment, by Leighton and Mincer (1982) who identified repeated spells of unemployment as characteristic among teenagers, and by Corcoran and Hill (1985) who looked at the reoccurrence of the unemployment experience among adult men.

Attention to unemployment is usually focused on one dimension of the unemployment experience, primarily the unemployment rate. The contribution of the present study is that it develops a measure of aggregate unemployment that incorporates more than one dimension of unemployment, specifically, incidence and duration. Similarly, Carlson and Horrigan (1983) and Sider (1985) estimated the total number of unemployed people in a given time period to be the product of incidence and duration. Incidence is the inflow into unemployment and duration is the expected average duration of a completed spell of unemployment. The validity and applicability of this formula

depends upon a steady-state assumption and whether spells refer to completed spells of unemployment or in-progress spells. If the assumption holds that flows into and out of unemployment are constant over time, then unemployment can be measured as the product of incidence and average completed spell duration without being concerned that duration and incidence are interdependent. Both studies addressed potential biases in estimating mean completed spell length when the restrictive steady-state condition of constant unemployment flows is relaxed. In Sider's analysis, the observed biases were consistent with the expected biases.

In considering the relationship between incidence and duration, both incidence and duration are expected to fluctuate counter-cyclically but not necessarily independently. When the business cycle is in an economic downturn, both incidence and duration are expected to increase. During an economic recovery, both incidence and duration are expected to decrease. However, the implication behind interdependency between incidence and duration is that longer duration implies a higher incidence at any point in time. If the unemployed are experiencing longer duration, the unemployment rate will be higher. Baker (1992) found that the countercyclical movement in duration applies uniformly to all individuals irrespective of expected duration but that those with a longer expected duration of unemployment are more likely to become unemployed during a downturn. This supports my hypothesis that a link between incidence and duration might exist but that the observed increase in duration over time might not systematically affect the pattern of incidence over time.

Looking over the long run, Valletta (1998) attributed the positive relationship between incidence and duration to permanent job loss. In the U.S. from 1967 to 1998, there has been an increase in the incidence of permanent job loss, which occurs when firms downsize, plants are closed, or firms declare bankruptcy. Permanent job loss is associated with longer unemployment duration, which in turn explains the observed lengthening of the national average duration of unemployment. This suggests that the countercyclical pattern of both incidence and duration reflects a structural change in the type of unemployment that has been occurring instead of a systematic cause-and-effect relationship between incidence and duration. Valletta's findings are consistent with those of Baker (1992).

Some studies debate the relative roles of duration and incidence in the unemployment rate. Blanchard and Diamond (1990) concluded that incidence plays a stronger role whereas Baker (1992) maintains that changes in duration have the predominant influence on the unemployment rate. Barrow (2004) assesses the use of the monthly reported unemployment rate as an indicator of the strength or weakness of the labor market over the business cycle. As a result of data availability, ease of conceptual understanding, and media coverage, the traditionally reported unemployment rate plays a major role in assessing the condition of the labor market, and hence the overall economy, among both professionals and the general public. Barrow focuses on changes in the labor market since 1990 that suggest that the reported unemployment rate is artificially low, conveying the

impression that the labor market is stronger than it really is. Some of the factors that contribute to declines in the unemployment rate are decreases in the size of the labor force because a higher proportion of the population is either institutionalized, on disability insurance, or has ceased to actively look for employment because they are discouraged or are engaged in an alternative activity until they perceive that the economy improves. She considers trends in alternative measures of the unemployment rate and labor market strength: percentage of marginally attached and part-time workers, labor force participation rates, employment-to-population ratios, and real average hourly earnings. By comparing the trends in these statistics between different business cycles, she concludes that there are no signs of labor market weakness that are not indicated by the unemployment rate. The recent low unemployment rates are consistent with a decreasing natural rate of unemployment or non-accelerating inflation rate of unemployment (NAIRU) since inflation rates have also remained low.

My study does not intend to challenge previous works or dispute the validity of the natural rate of unemployment. Rather, it seeks to augment our assessment of the condition of the labor market by developing a statistical measure of unemployment that is multidimensional. In summary, past studies of unemployment generally focus on only one dimension of unemployment, on the interplay between dimensions, or on the relative strength of the influence of individual dimensions. This analysis develops an alternative view of unemployment by extending a conventional measure of unemployment into an aggregated proportion of time in the labor force that is lost to unemployment. This ratio is then decomposed into its components, incidence and duration. The objective is to provide a formula for measuring unemployment that includes multiple dimensions of the unemployment experience and establish a framework for evaluating labor market conditions that incorporates duration of unemployment as part of the unemployment experience.

FRAMEWORK

Unemployment is a multidimensional experience. However, the conventional unemployment rate focuses only on the incidence of unemployment, ignoring duration. If we lengthen the period of the analysis beyond the survey week, another measure of unemployment is the proportion of time (in the labor force) that an individual spends in unemployment.

$$P_i = (S_i \cdot \bar{t}_{ui}) / t_{Li}$$
$$= t_{ui} / t_{Li}$$

where
- P_i = proportion of time unemployed by the i^{th} individual; i=1,2,…,N
- S_i = number of spells of unemployment by the i^{th} individual; i=1,2,…,N
- $\bar{t}_{ui}$ = average duration (per spell of unemployment) by the i^{th} individual; i=1,2,…,N
- t_{ui} = number of weeks in the period spent in unemployment by the i^{th} individual; i=1,2,…,N
- t_{Li} = number of weeks in the period spent in the labor force by the i^{th} individual; i=1,2,…,N.

Leighton and Mincer (1982) measured unemployment as time in the labor force that is lost to unemployment in their analysis of unemployment experiences among teenagers. Leighton (1978) used a similar derivation in an analysis of unemployment as experienced by males in the labor force and Sue (1996) augmented the analysis by incorporating observed labor force discontinuities in an analysis of female unemployment experiences. If we apply this concept of unemployment to the entire labor force as time that is lost in the economy to unemployment, we can measure unemployment as a ratio of the total time that labor force participants spend in unemployment to their total time in the labor force. Aggregating across the labor force, this ratio represents a gap between actual weeks of labor and potential weeks of labor. The larger is the gap, the less efficient is the market. We can then decompose this measure of labor market efficiency into structural components, incidence and duration of unemployment, according to the following formula:

$$\text{Proportion of time in the labor force lost to unemployment} = \sum t_{ui} / \sum t_{Li}$$

$$= (N/L) \cdot (\bar{t}_u / \bar{t}_L)$$

where N = number of people unemployed sometime during the period

L = number of people in the labor force sometime during the period

N/L = incidence of unemployment during the period

$\bar{t}_u$ = average number of time units spent in unemployment by the unemployed during the time period

$\bar{t}_L$ = average number of time units spent in the labor force by the labor force participants during the time period.

With this formula, a measure of aggregate unemployment has been developed as the fraction of time that is lost by the labor force to unemployment by labor force participants within a specified period of time, which provides an alternative assessment of labor market conditions. This measure of unemployment can be used as an index formed by the product of incidence of unemployment and the duration of unemployment, weighted by time spent in the labor force. In Appendix A, the index is expressed using time units that are measured as fractional proportions of the time period under consideration in the analysis.

This index highlights the factors that compose the structure of unemployment. Incidence refers to the likelihood of experiencing unemployment and duration refers to the length of time spent in unemployment. Weighting by the extent of labor force participation adjusts for variations in time spent in the labor force among labor force participants. The relevance of this unemployment measure is underscored by Valletta (1998): “Although the unemployment rate by itself is our key indicator of labor market conditions, the underlying distribution of unemployment spell durations provides important additional information” (p. 30).

Algebraically, numerical values of the index will range between zero and one. If nobody is unemployed during the specified period, the unemployment index will be zero. If everybody spends

his or her entire labor force time in unemployment, the index will have a value of one. A larger value of the index implies that more time was lost to unemployment and that the labor market was less efficient, because either more individuals experienced unemployment during the specified time period or the participants spent more time unemployed. Thus, the index reflects both incidence and duration of unemployment. Appendix B provides a refinement of the unemployment index as time that is lost to unemployment in terms that have been developed in labor turnover models for incidence and job search models for duration.

Because the formula includes duration of unemployment and time spent in the labor force into the calculation, this index is conceptually different from the natural rate of unemployment, the non-accelerating inflation rate of unemployment (NAIRU), or the full-employment rate of unemployment. The idea behind these concepts is that the unemployment rate would never be zero due to frictional unemployment but that there is a rate towards which the actual unemployment rate gravitates. These are theoretical concepts that have been developed to augment our understanding of the macroeconomy. Any numerical values assigned to these concepts are subject to academic perspective, specific circumstances reflecting the time period or economy (country), and political predisposition. It is acknowledged that the unemployment rate would not be zero and most economists speculate that a range of 3 percent to 6 percent is reasonable for the natural rate of unemployment. Therefore, the index developed here would not take on a value of zero. Rather, a value of zero is a mathematical lower limit for the index, which it would approach if both the incidence and duration of unemployment were very low. Similar to the comfort level that economists feel when the unemployment rate is low (or lower than a subjective rate), a low value for the index could also be established as a comfort threshold that reflects a combined tolerance of incidence, duration of unemployment, and time spent in the labor force.

Measuring unemployment as time in the labor force that is lost to unemployment, in terms of its components, incidence and duration, extends the conventional view of unemployment beyond the unemployment rate, which is limited to incidence. Therefore, the index is a direct indicator of economic inefficiency. A higher value will occur if either more people in the labor force are unemployed (incidence) or the unemployed are experiencing a longer spell in unemployment (duration). This would indicate a larger gap between actual weeks of labor and potential weeks of labor and consequently a less efficient labor market. The index refers to current (“in-progress”) spells of unemployment, not completed spells of unemployment. By using “in-progress” spells, there are two potential biases. During an economic downturn, spells are likely to be longer which will increase incidence. On the other hand, the increase in the incidence of unemployment will include newly unemployed individuals which will lower the average duration of “in-progress” spells of unemployment. These biases have opposite effects on the index and potentially cancel each other. However, the objective is not to correct for the biases. On the contrary, the point is to develop a measure of unemployment that incorporates different dimensions of the unemployment experience.

By using the average duration of unemployment spells sampled while in-progress at the time of the survey, rather than the expected duration of completed spells, the index reflects the actual proportion of labor force time that is lost to unemployment.

APPLYING THE DATA

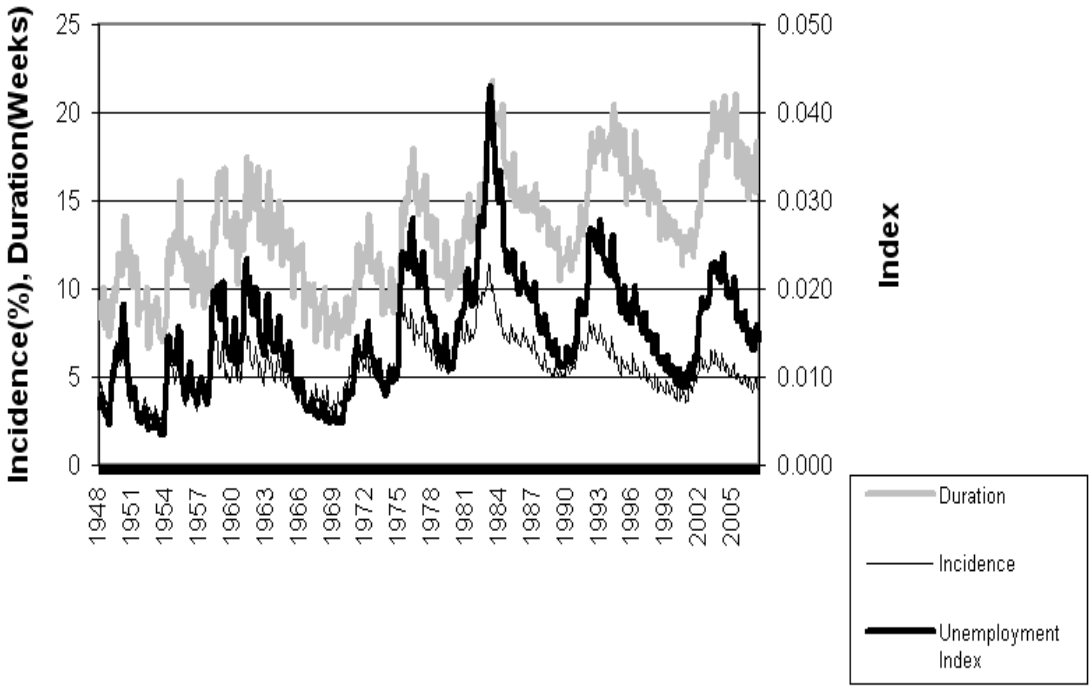
The next step is to calculate the unemployment index using data. Labor force data were obtained for the period from January 1948 to May 2007 from the Bureau of Labor Statistics using the Current Population Survey for individuals who were 16 years of age and older. The unemployment rate was used to measure incidence and the average weeks unemployed was used as a measure of duration. The average duration pertains to current (in-progress) spells of unemployment rather than completed spells. Data on the number of weeks spent in the labor force during the time period were unavailable. As a preliminary measure, it is assumed that the time period is 1 year (or 52 weeks) and that all labor force participants were in the labor force during the entire time period. This assumption is highly restrictive but it is made in the absence of information on the number of weeks spent in the labor force.[1] The unemployment index is calculated by obtaining the multiplicative product between incidence and duration for each month of the 713-month time period.

Figure 1 shows graphs of incidence, duration, and the index over the entire time period. This allows a comparison of time trends between incidence, duration, and an index of unemployment. Although both incidence and duration exhibit a similar cyclic pattern, the movement between the two components of unemployment appears to have been closer before mid-1981 than after that time. Since mid-1981, duration has been trending upward and is less consistent with incidence. For the period from November 1948 to June 1981, the correlation coefficient between the unemployment rate and average duration is 0.60. For the period from July 1981 to November 2006, the correlation coefficient is 0.32. The decrease in the correlation between incidence and duration strengthens the benefits of the index since it incorporates the trends in both components. Notably, since the early 1990s the pattern of the index is more similar to the pattern of duration. The conventional unemployment rate, which focuses on incidence of unemployment, ignores this aspect of unemployment.

Figures 2 (A through J) provide a more detailed view. Each figure highlights a graph of incidence, duration, and the unemployment index during one of the 10 business cycles as identified by the National Bureau of Economic Research (NBER, 2007) that have occurred since January 1948. Each cycle is measured from the peak of one cycle to the peak of the following cycle such that each period as graphed begins with an economic downturn followed by the time until the start of the next

FIGURE 1: Incidence, Duration, and the Unemployment Index

[Period: 1/1949-5/2007]

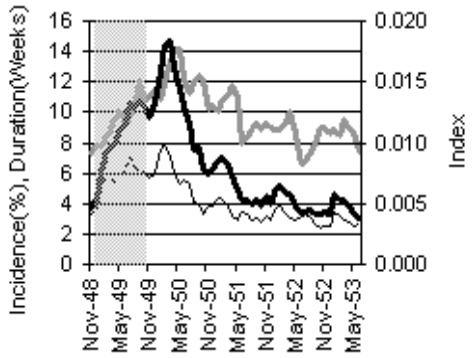


economic downturn. The shaded region in the graphs represents the economic downturn at the start of the business cycle. When economic conditions improve, the increase in economic activity leads to an increase in employment opportunities. Theoretically, the expectation is that the unemployment rate should decline after a downturn is over. Empirically, this does not necessarily occur. In general, the unemployment rate tends to decrease after the downturn ends, although not necessarily as soon as the economy starts to improve. The pattern for duration of unemployment usually continues to rise even after incidence decreases and then it eventually diminishes.

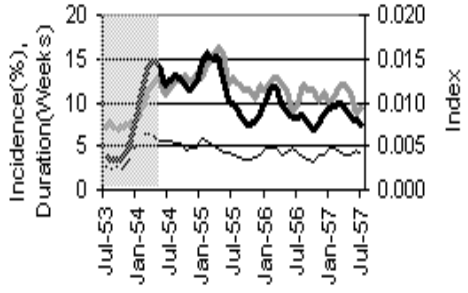
In particular, for the period from March 2001 through November 2006 in graph J, the unemployment rate (incidence) fluctuated modestly after the official end of the economic recession in November 2001 and did not trend downward until a year and a half later. However, for those who were unemployed for 27 weeks or more, the unemployment rate did not decline until early 2004, more than two years after the recession ended (U.S. Bureau of Labor Statistics, 2006). A plausible interpretation is that, as the economy improved, those who had been unemployed for a shorter term found jobs sooner than the longer-term unemployed. This would cause an increase in the average duration of all currently unemployed workers. As the longer-term unemployed found jobs, the average duration of

FIGURE 2: Incidence, Duration, and the Unemployment Index

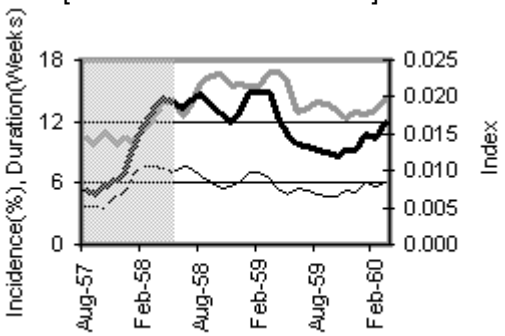
A. Business Cycle: 1/1949-6/1953
[Downturn: 11/1948-10/1949]



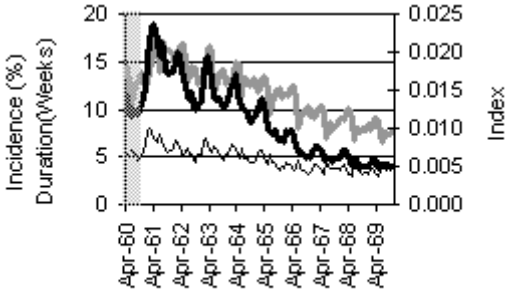
B. Business Cycle: 7/1953-7/1957
[Downturn: 7/1953-5/1954]



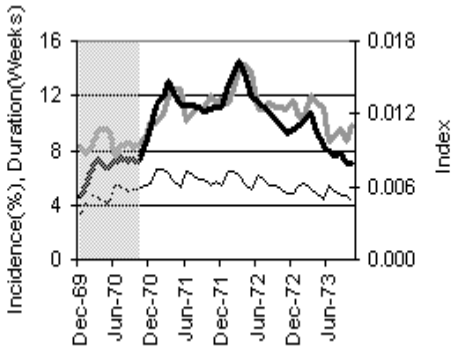
C. Business Cycle: 8/1957-3/1960
[Downturn: 8/1957-4/1958]



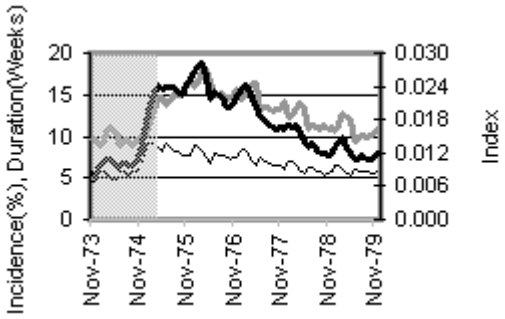
D. Business Cycle: 4/1960-11/1969
[Downturn: 4/1960-2/1961]



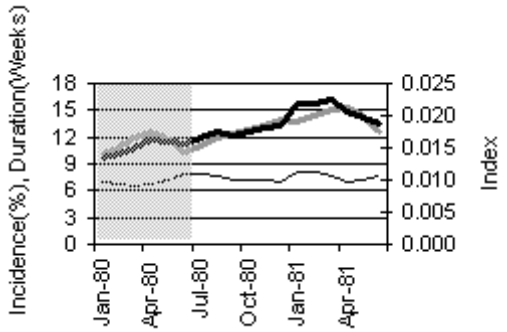
E. Business Cycle: 12/1969-10/1973
[Downturn: 12/1969-11/1970]



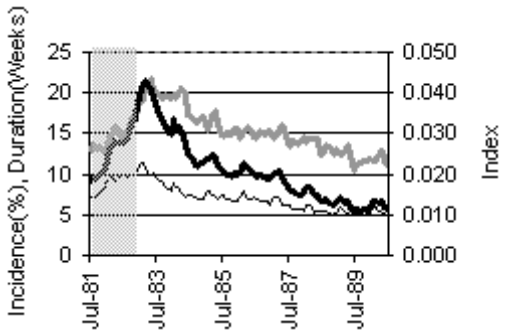
F. Business Cycle: 11/1973-12/1979
[Downturn: 11/1973-3/1975]



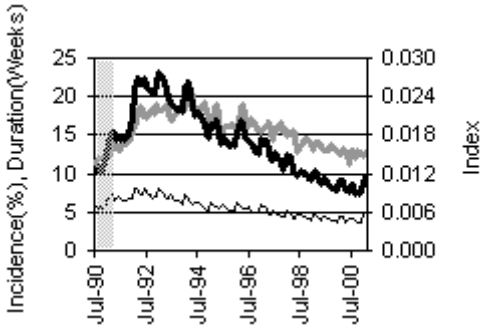
G. Business Cycle: 1/1980-6/1981
[Downturn: 1/1980-7/1980]



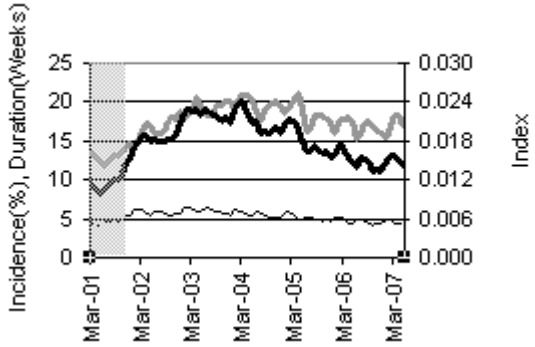
H. Business Cycle: 7/1981-6/1990
[Downturn: 7/1981-11/1982]



I. Business Cycle: 7/1990-2/2001
[Downturn: 7/1990-3/1991]



J. Business Cycle: 3/2001-5/2007
[Downturn: 3/2001-11/2001]



Legend:

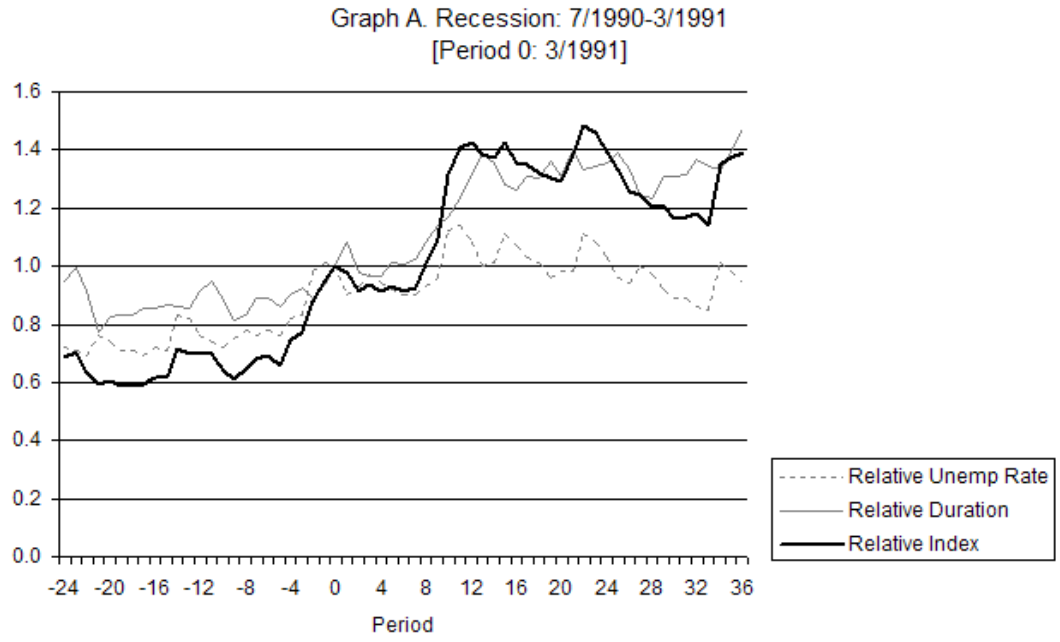
NOTE: The shaded area in each graph represents an economic downturn as defined by the National Bureau of Economic Research.

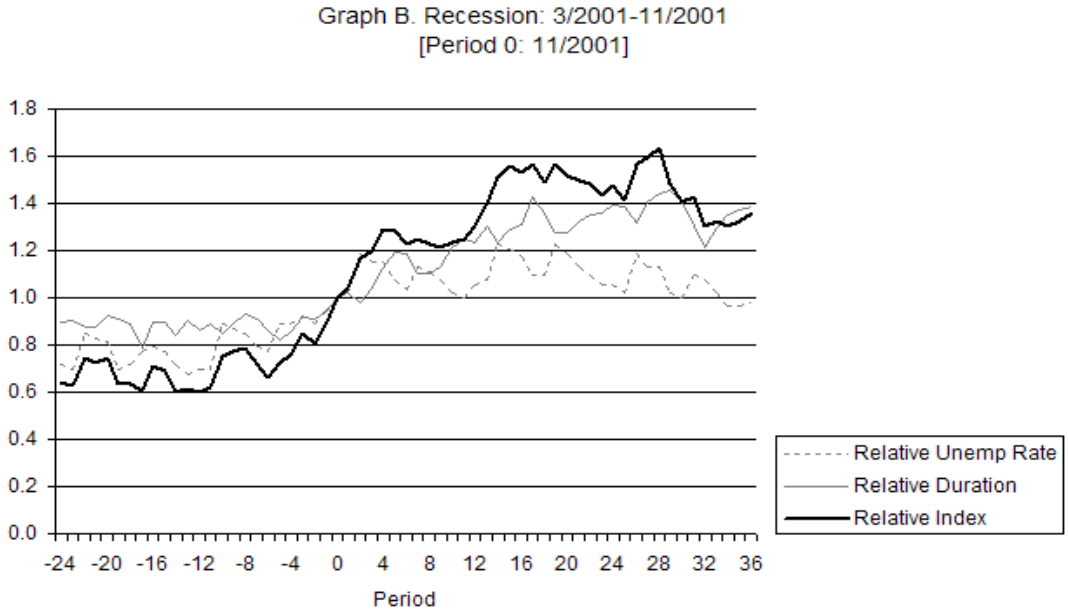
unemployment eventually decreased. In the graph, duration continued to trend upward until mid-2004, and although there subsequently appears to be a downward trend, average duration still remains above the level that prevailed at the beginning of the business cycle. The conventional unemployment rate (incidence) does not provide information on whether the shorter-term or longer-term unemployed

are finding jobs. But since this affects the duration of unemployment, the trend in the unemployment index, which includes duration, makes it a better indicator of the aggregate unemployment situation.

This addresses Barrow's concern (2004) that the official unemployment rate is misleading in representing labor market conditions during the most recent economic recovery. Historically, the number of nonfarm jobs in the economy exhibits rapid growth after the end of a recession. This was not observed in the recovery period after the last two recessions, even though the unemployment rate did not indicate a weak labor market. While she found that "there is little evidence in other labor market statistics that the labor market in this economic recovery is much weaker than in previous recovery periods of the past 30 years" (p. 33), I have adapted a technique used in her analysis and applied it to the unemployment index developed in this study in order to demonstrate the applicability of the index in evaluating the condition of the labor market. Figure 3 shows a graph of the relative unemployment index, computed as a ratio between the index in a particular month and the index at the time of the cycle trough. The month of the trough is identified as Period 0. In Period 0, the relative index is 1. The graph tracks the relative index for 24 months preceding the trough and 36 months following the trough. During months when the relative index is larger than 1, the index in that month exceeds the value of the index at the trough. When the relative index is less than 1, the index in that month is lower than the value of the index at the trough. A value of 1.2 indicates that the index in that month is 20 percent above the index at the time of the trough, and a value of .95 indicates that the index in that month is 5 percent below the index at the time of the trough. Relative measures were also calculated for the incidence of unemployment (unemployment rate) and duration of unemployment. Graph A pertains to the 1990-1991 recession in which the trough occurred in March 1991 and graph B pertains to the 2001 recession in which the trough occurred in November 2001, as dated by the National Bureau of Economic Research (NBER, 2007). For both recessions, during the 24-month period preceding the trough, the relative index was always less than 1 and increased dramatically in the months leading to the trough. During the recovery periods, the trends in the relative index differ. In graph A, the relative index was below 1 in the eight months following the trough and then fluctuates dramatically with values greater than 1. Comparing the relative index with the relative unemployment rate and the relative duration, the magnitude of the relative index reflects the magnitude of relative duration whereas the trend pattern follows that of the relative unemployment rate. In graph B, the relative index continually exceeds 1, and exhibits a pronounced upward trend for 28 months after the trough. The relative unemployment rate index varies between 1 and 1.2 with a downward trend at the end whereas the relative duration index is gradually increasing. Following this recession, the pattern of the relative index is dominated by the relative duration. With respect to post-recession labor market conditions, the steady movement of the relative unemployment rate is consistent with Barrow's conclusion that the suggested labor market weakness after the most recent recession is not detected in either the standard unemployment rate or other labor market measures. On the other hand, the elevated

FIGURE 3: Relative Unemployment Index





magnitude and indiscernible pattern of the relative index lend credence to the suspected weakness of the labor market during the recovery.

Another potentially useful application of the unemployment index is in the area of program policy, such as extended unemployment benefits. Unemployment insurance benefits, which are intended as temporary financial assistance to qualifying unemployed workers, are administered at the state level. The amount of time during which a qualified unemployed person can collect unemployment insurance benefits is usually a maximum of 26 weeks. At the end of this time, if an individual is still unemployed when unemployment benefits are exhausted, the unemployed person might be eligible for additional weeks of benefits through an extended benefits program. Extended benefits, available during periods of high unemployment, are intended to relieve the longer-term unemployed from economic hardship (Franco, 2003). But how is a period of high unemployment determined? Under the Federally legislated Temporary Extended Unemployment Compensation (TEUC) program that was enacted in 2002, a high unemployment state was defined as one in which the insured unemployment rate is at least 4 percent and 120 percent of the rate over the prior 2 years or the total unemployment rate is at least 6.5 percent and 110 percent of either or both of the prior 2 years (Lake, 2002). That is, the criterion is based exclusively on the unemployment rate even though the intent is to relieve the hardship of those who are experiencing longer unemployment duration. As an alternative to basing the criterion for extended benefits solely on the unemployment rate, a threshold level for the index could be determined which would thereby define high unemployment or hardship in terms of a combination of both incidence and duration. Albeit subjective in choice, a possible threshold could be calculated as the product of a minimum tolerance-level unemployment rate and a minimum tolerance-level average duration, weighted by average duration of labor force participation. For example, suppose 4 percent is chosen as a minimum tolerance-level unemployment rate and 30 weeks is chosen as a minimum-tolerance-level average duration. The threshold index is then 1.2. For any month, if the current index were greater than 1.2, then the region would be identified as being in hardship or high unemployment whereas a current value that is less than 1.2 would not identify a high unemployment situation. If the unemployment rate increases dramatically at the same time that average duration decreases dramatically, the index could fall below the threshold level during a time of high incidence. However, since the unemployment rate and average duration tend to move together, this situation is unlikely to happen. A more likely occurrence is a decrease in the unemployment rate accompanied with a continual increase in duration. Under the current definition of high unemployment, eligibility for extended unemployment benefits could decline although hardship in terms of lengthy unemployment spells would still be pervasive. The formula for the index allows for a decrease (increase) in the unemployment rate along with an increase (decrease) in the average duration without reducing the functionality of the index in identifying high unemployment or hardship situations. For instance, if the unemployment rate were to decrease to 3 percent while average duration decreased to 14 weeks, the

index would still be 1.2. Since the index incorporates both incidence and duration of unemployment, a threshold level as an indicator of hardship or high unemployment is fundamentally appealing since the burden of unemployment increases when unemployment benefits are exhausted and a job seeker has yet to find a job. The importance of including duration in assessment labor market conditions is underscored by the observed upward trend in duration [Groshen and Potter (2003), Mukoyama and Sahin (2004), and Valletta (1998, 2002)]. While the existing criterion for an extended benefits program could be modified to include duration, the specification of a threshold level for the index as an indicator of hardship is a more inclusive alternative to the current measure of hardship, which is based solely on the unemployment rate (incidence).

Because the formula for the index incorporates both incidence and duration, it would be of interest to those analysts who consider both incidence and duration to be relevant. For example, Valletta (2003) compares labor market conditions in California to the U.S. as a whole as well as to two major regions within the state, the San Francisco Bay Area and Southern California. He considers the impact of the federally legislated extension of unemployment insurance benefits on unemployed workers whose regular UI benefits have been exhausted. Valletta uses both the unemployment rate (incidence) and average duration of unemployment to assess labor market conditions, which highlights the relevance of using both aspects of unemployment. The countercyclical tendencies of average duration and the unemployment rate imply that they will move together but not necessarily identically. Valletta observed that duration and incidence were higher for the state of California than for the nation in the 1990s but differences tended to dissipate towards the end of the 1990s and the first few years of the new millennium. Although the state compares similarly with the nation in the early 2000s, Valetta highlights regional differences within the state, with the San Francisco Bay Area experiencing both higher incidence and longer unemployment duration than Southern California. Significantly, Valletta looks at the unemployment rate and average duration of unemployment separately. An alternative would be to use the unemployment index developed in this paper. In Valletta's analysis, instead of tracking the trends in both incidence and duration, he could compare the trends in the indexes for California and the United States.

CONCLUSION

By looking at unemployment as time in the labor force that is lost in the economy to unemployment, an unemployment index is created as the product of its structural components, incidence and duration of unemployment, weighted by time spent in the labor force. As a measure of the gap between actual weeks of labor and potential weeks of labor, the index can be used as an indicator of economic efficiency, providing a simple yet insightful view of unemployment in a broader examination that extends beyond any one particular dimension of unemployment.

The focus of the current study was to develop the index, use available data to compute the index, and discuss useful applications of the index. The index appears to be particularly useful as an indicator

in assessing the strength of the labor market during the recent 2001 recession. A low unemployment rate was seemingly inconsistent with the slow employment growth that characterized the recovery phase, suggesting that the unemployment rate could be misleading as an indicator of labor market weakness. In comparison to its level at the end of the recession, the relative index did not suggest a strong labor market in the months after the business cycle reached its trough. The Conference Board produces a composite index of lagging indicators as a summary of the U.S. economy. Average duration of unemployment is the last of the seven statistical measures included in the weighted average (The Conference Board, 2001). As an alternative to duration, the unemployment index developed in this paper could be a suitable measure as a lagging indicator. Further exploration is warranted.

There are other avenues for future research that are beyond the scope of this paper. There is a body of literature on the full-employment (or natural) rate of unemployment, including discussions by Juhn, Murphy, and Topel (2002), Blanchard and Katz (1997), and Stiglitz (1997). Similarly, there is extensive literature on the Phillips Curve. The conventional unemployment rate is at the center of these areas. A potential path of research is whether substituting the unemployment index for the unemployment rate augments our understanding of either the natural rate of unemployment or the Phillips Curve and, if so, what insights can be gleaned.

DeFina (2002) explores the impact of unemployment on alternative poverty measures. His intent is to estimate the effect of aggregate unemployment on poverty. His findings conclude “whether and how aggregate unemployment affects poverty depend critically on the methods used to gauge poverty” (page 20). It is possible that the relationship between unemployment and poverty depends on the method used to gauge unemployment, offering a question for future research.

This preliminary analysis assumed that all labor force participants were in the labor force during the entire period from year to year. While this is a highly restrictive assumption, it does not prevent the theoretical development and initial exploration of the index as a valuable tool. In the current study, a time series analysis was implemented to provide an initial demonstration of the use and validity of the index. The availability of data on the number of weeks spent in the labor force would allow a refinement to the calculations of the index. This more complete construction could be useful in comparing the unemployment experience between different groups, identified by gender, race, age, state/regional residence, industry classification, or occupational classification.

ENDNOTES

1. Although data on the number of weeks spent in the labor force during the time period were not readily available using the Current Population Survey (CPS), there are other datasets such as the National Longitudinal Studies (NLS) as well as specific project datasets that contain information on time spent in the labor force that could be suitable in future research.

2. In this analysis, (re-) entering the labor force is a type of job separation.

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APPENDIX A

The unemployment measure is modified to express the time units as fractional time units in terms of the proportion of time in the period under consideration in the analysis.

time in the labor force lost to unemployment

$$= \sum t_{ui} / \sum t_{Li}$$

$$= (N/L) \cdot (\bar{t}_u / \bar{t}_L)$$

$$= (N/L) \cdot \{(\bar{t}_u/T)/(\bar{t}_L/T)\}$$

$$= (N/L) \cdot \{T_u/T_L\}$$

$$= (N/L) \cdot (T_u) \cdot 1/(1-T_o)$$

where N = the number of people unemployed sometime during the period

L = the number of people in the labor force sometime during the period

N/L = the incidence of unemployment during the period

$\bar{t}_u$ = the average number of time units spent in unemployment by the unemployed during the time period

$\bar{t}_L$ = the average number of time units spent in the labor force by the labor force participants during the time period

T = the number of time units in the period

T_u = the average fraction of the period spent in unemployment by the unemployed

T_L = the average fraction of the period spent in the labor force by the labor force participants

$T_o = (1- T_L)$ = the average fraction of the period spent out of the labor force by the labor force participants.

APPENDIX B

Unemployment as time that is lost to unemployment can be further refined, in terms of labor turnover models for incidence and job search models for duration.

Incidence of unemployment can be decomposed into the probability of making a labor force transition and the conditional probability of being unemployed, given that a transition is made. For an individual, incidence of unemployment refers to the occurrence of at least one spell of unemployment in a given period of time. For a group of labor force participants, incidence denotes the extent to which members of the group experience unemployment. It is measured by the proportion of labor force participants who experience unemployment and represents the average probability of being unemployed in a given time period for the group.

Unemployment is a transitory state in which a person is not working and is looking for a job. Unemployment originates by leaving a job or (re-) entering the labor force. A spell of unemployment can end with either employment or exiting from the labor force. Among those who exit from the labor force, they may stay out either temporarily or permanently. The transitional nature of unemployment makes the turnover model appropriate for analyzing the incidence of unemployment. Unemployment is related to labor turnover to the extent that a "job separation"[i] may lead to a spell of unemployment. Probabilistically, the probability of unemployment equals the probability of separating from a job multiplied by the conditional probability of being unemployed, given that a separation has occurred.

$$\text{incidence of unemployment} = N/L = P_u = P_s \cdot P_{u|s}$$

where N = number of people unemployed sometime during the period

L = number of people in the labor force sometime during the period

N/L = incidence of unemployment during the period

P_u = probability of being unemployed

P_s = probability of separating from a job

$P_{u|s}$ = conditional probability of being unemployed, given that a separation has occurred.

The model used in this analysis differs from the stock-flow model of the labor market that is used in Clark and Summers (1980), Blau and Robins (1986), and DeBoer and Seeborg (1989). The stock-flow model looks at flows of individuals between the various labor market states (employment, unemployment, and non-participation in the labor force). Empirically, the flows are monthly transitions.

[See Ehrenberg and Smith (2006, chapter 15) for a description of the stock-flow model.] In my analysis, labor force transitions refer to changes in employment and movements between labor force participation and non-participation, which is measured by the first component, P_s. Experiencing unemployment is accounted for in the second component, $P_{u|s}$, which is the probability of being unemployed, conditional on having made a labor force transition.

Duration can be defined as the length of time an unemployed person spends looking for a job. Job search models have been developed to analyze decisions such as whether or not to look for a job, setting realistic wage expectations, or when to stop searching. Job search activity can be pursued by either the unemployed or the employed. Since the job search model is used here in relation to duration of unemployment, the duration of job search is equivalent to the duration of unemployment.

The premise behind the job search model is that the job seeker is faced with a distribution of wage offers. The objective of the individual is to receive a job offer in which the wage is at least equal to the reservation (or acceptance) wage. The reservation wage is determined by equalizing the expected marginal benefit of an additional period of search with the marginal cost of searching one more period. It is the lowest wage acceptable to the job seeker. Although the job seeker knows his reservation wage, the seeker does not know which employers would offer him a job that meets his requirement nor does he know how many employers would do so. Generally, the higher the reservation wage, the smaller the probability that an acceptable job offer will be obtained in the next period. Moreover, the lower is the probability of obtaining an acceptable job offer, the longer will be the expected duration of job search. Hence, the duration of unemployment is inversely related to the probability of receiving an acceptable job when unemployed. Because it is possible that no jobs may be offered in the next search period, this probability can be further refined as the product of the probability of receiving any job offer (p) and the probability of receiving an acceptable job offer, given that a job offer has been received, (P_a):

$$\text{duration of unemployment} = \bar{t}_u = 1 / (p \cdot P_a)$$

where $\bar{t}_u$ = average number of time units spent in unemployment by the unemployed during the time period
p = probability of receiving a job offer
P_a = probability of receiving an acceptable job offer, given that a job offer has been received.

In this context, duration of unemployment can be decomposed into the inverse of the product of the probability of receiving a job offer and the probability of receiving an acceptable job offer, given that a job offer has been received.

The resulting specification for the measure of unemployment is:

time in the labor force lost to unemployment

$$= (N/L) \cdot (\bar{t}_u / \bar{t}_L)$$
$$= P_u \cdot \bar{t}_u \cdot (1/\bar{t}_L)$$
$$= P_s \cdot P_{u|s} \cdot \bar{t}_u \cdot (1/\bar{t}_L)$$
$$= (P_s \cdot P_{u|s}) \cdot (1 / (p \cdot P_a)) \cdot (1/\bar{t}_L)$$
$$= (P_s \cdot P_{u|s}) / (p \cdot P_a \cdot \bar{t}_L)$$

where $\bar{t}_L$ = average number of time units spent in the labor force by the labor force participants during the time period

The attractiveness of this decomposition of the unemployment rate is that it identifies components that affect the unemployment rate, and provides a specification that allows us to empirically measure the contribution of each component to the unemployment rate. Because the formula is weighted by time spent in the labor force (i.e., rather than by time spent in employment), this derivation for the index is a general formula that can be applied to both continuous labor force participants and those who have spent some time out of the labor force.

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i. In this analysis, (re-) entering the labor force is a type of job separation.

APPENDIX C

Source of Data

The source of the data used in this analysis is from the Current Population Survey (CPS), Bureau of Labor Statistics, U.S. Department of Labor. Data were obtained for the period from January 1948 to May 2007 for the U.S. civilian population who were 16 years of age and older.

The table on the following page is a sample of the raw data for the time period January 2000 through May 2007, which includes the most recent business cycle as dated by the National Bureau of Economic Research (NBER, 2007).

a. The unemployment rate was used to measure incidence (UR):
   Units: percent; not seasonally adjusted
   Series ID: LNU04000000
b. The average weeks unemployed was used as a measure of duration (Duration):
   Units: Number of weeks; not seasonally adjusted
   Series ID: LNU03008275
c. The number of weeks spent in the labor force during the time period was unavailable.
d. The unemployment index is calculated for each month of the 713-month time period, using the f following mathematical specification:

$$\text{Index} = UR * \text{Duration} / (100 * 52).$$

Sample of Raw Data (1/2000 – 5/2007)

DATE	R	Duration	INDEX	DATE	R	Duration	INDEX	DATE	R	Duration	INDEX
Jan-00	.4		0.0	Jan-03	.6		0.0	Jan-06	.5		0.0
	.5	12.6	109		.5	17.8	223		.1	16	157
Feb-00	.4		0.0	Feb-03	.6		0.0	Feb-06	.5		0.0
	.4	12.6	107		.4	18.6	229		.1	17.9	176
Mar-00	.4		0.0	Mar-03	.6		0.0	Mar-06	.4		0.0
	.3	13.3	110		.2	18.9	225		.8	17.8	164
Apr-00	.3		0.0	Apr-03	.5		0.0	Apr-06	.4		0.0
	.7	13.1	093		.8	20.6	230		.5	18	156
May-00	.3		0.0	May-03	.5		0.0	May-06	.4		0.0
	.8	12.8	094		.8	19.6	219		.4	17.5	148
Jun-00	.4		0.0	Jun-03	.6		0.0	Jun-06	.4		0.0
	.1	11.3	089		.5	18.4	230		.8	15.1	139
Jul-00	.4		0.0	Jul-03	.6		0.0	Jul-06			0.0
	.2	12.9	104		.3	18.4	223		.5	16.1	155
Aug-00	.4		0.0	Aug-03			0.0	Aug-06	.4		0.0
	.1	12.9	102		.6	19.1	220		.6	17.2	152
Sep-00	.3		0.0	Sep-03	.5		0.0	Sep-06	.4		0.0
	.8	12.1	088		.8	19.5	218		.4	17.5	148
Oct-00	.3		0.0	Oct-03	.5		0.0	Oct-06	.4		0.0
	.6	13	090		.6	19.6	211		.1	16.7	132
Nov-00	.3		0.0	Nov-03	.5		0.0	Nov-06	.4		0.0
	.7	12.4	088		.6	20.1	216		.3	16.6	137
Dec-00	.3		0.0	Dec-03	.5		0.0	Dec-06	.4		0.0
	.7	12.8	091		.4	20	208		.3	15.9	131
Jan-01	.4		0.0	Jan-04	.6		0.0	Jan-07			0.0
	.7	12.2	110		.3	19	230		.5	15.5	149
Feb-01	.4		0.0	Feb-04			0.0	Feb-07	.4		0.0
	.6	12.8	113		.6	20.3	234		.9	16.7	157
Mar-01	.4		0.0	Mar-04			0.0	Mar-07	.4		0.0
	.5	13.4	116		.6	20.8	240		.5	18.4	159
Apr-01	.4		0.0	Apr-04	.5		0.0	Apr-07	.4		0.0
	.2	13.1	106		.4	21	218		.3	18.3	151
May-01	.4		0.0	May-04	.5		0.0	May-07	.4		0.0
	.1	12.4	098		.3	20.3	207		.3	17.1	141
Jun-01	.4		0.0	Jun-04	.5		0.0				
	.7	11.8	107		.8	18.8	210				
Jul-01	.4		0.0	Jul-04	.5		0.0				
	.7	12.3	111		.7	17.5	192				
Aug-01	.4		0.0	Aug-04	.5		0.0				
	.9	13.2	124		.4	18.7	194				
Sep-01	.4		0.0	Sep-04	.5		0.0				
	.7	13.1	118		.1	19.5	191				

Oct-			0.0	Oct-			0.0
01	5	13.5	130	04	.1	19.8	194
Nov	5		0.0	Nov	5		0.0
-01	.3	14.4	147	-04	.2	20	200
Dec	5		0.0	Dec	5		0.0
-01	.4	14.7	153	-04	.1	19.5	191
Jan-	6		0.0	Jan	5		0.0
02	.3	14.1	171	-05	.7	18.5	203
Feb	6		0.0	Feb	5		0.0
-02	.1	15	176	-05	.8	19.2	214
Mar	6		0.0	Mar	5		0.0
-02	.1	16.2	190	-05	.4	20.4	212
Apr-	5		0.0	Apr-	4		0.0
02	.7	17.2	189	05	.9	21.1	199
May	5		0.0	May	4		0.0
-02	.5	17.1	181	-05	.9	19.1	180
Jun-			0.0	Jun	5		0.0
02	6	15.9	183	-05	.2	16.3	163
Jul-	5		0.0	Jul-	5		0.0
02	.9	15.9	180	05	.2	16.5	165
Aug	5		0.0	Aug	4		0.0
-02	.7	16.3	179	-05	.9	18.4	173
Sep	5		0.0	Sep	4		0.0
-02	.4	17.5	182	-05	.8	18.2	168
Oct-	5		0.0	Oct-	4		0.0
02	.3	18	183	05	.6	18.3	162
Nov	5		0.0	Nov	4		0.0
-02	.6	17.8	192	-05	.8	17.8	164
Dec	5		0.0	Dec	4		0.0
-02	.7	18.8	206	-05	.6	17.5	155

Source: Current Population Survey (CPS), Bureau of Labor Statistics, U.S. Department of Labor
Key: UR – Unemployment Rate, percent, U.S. civilian population 16 years and over; not seasonally adjusted; Series ID: LNU04000000
Duration – Average Weeks Unemployed, Number of weeks, U.S. civilian population 16 years and over; not seasonally adjusted; Series ID: LNU03008275