Labor Market Cycles and Business Cycles

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April 8, 2015

Abstract

This paper uses non-parametric dating algorithms to date turning points in various labor market indicators, and to estimate a common "labor market cycle." These methods allow us to further examine the relationship between cycles in the labor market and business cycles identified by the NBER. We find that NBER recessions and slack labor markets basically coincided up to the mid-1980's. Since then however, recessions have been both followed *and preceded* by prolonged periods of labor market weakness. It also appears that cyclical movements in job transition probabilities have become less synchronized with NBER recessions. We also find that significant increases in the separation probability for job losers have been a consistent feature of U.S. recessions.

JEL codes: E32,E24,C49
Keywords: Cycles, Jobless recoveries, Dating algorithm

1 Introduction

The past few recessions in the United States have been followed by "jobless recoveries," characterized by a sluggish rebound in the aggregate labor market well after the end of the business cycle trough and recovery in aggregate output. Understanding the sources of fluctuations in unemployment is critical to understanding this changing relationship of the labor market with

*Email for correspondence: psummers@highpoint.edu. We thank Kevin OfiBrien, Stephanie Crofton, Tim Hubbard, Adrian Pagan, Ellis Tallman, and Andres Vargas, as well as participants at the 2010 Economic Scholars Program conference at the Dallas Fed, for helpful comments. We also thank Michael Elsby, Ryan Michaels and Gary Solon for sharing their data. Matlab code to implement the dating algorithm used in this paper is available from www.ncer.edu.au; thanks to James Engel for making it available. We are solely responsible for any remaining errors. This research was begun while Warren was a Research Scholar in the Center for Undergraduate Research at Texas Tech University, and he gratefully acknowledges their financial support.

aggregate economic conditions. The sources of these fluctuations are the changes in inflows and outflows of workers to and from unemployment. What accounts for the elevated rates of unemployment in recessions is an actively debated topic. What this paper hopes to shed additional light on is what accounts for the changing relationship in the timing of these fluctuations in the labor market with the cyclical fluctuations in the broader economy

We document significant changes in the relationship between labor market outcomes and the business cycle since 1980. We identify these changes in the timing of the labor market cycle by applying non-parametric dating algorithms developed by Harding and Pagan (2002, 2006) to locate peaks and troughs in several data series reflecting various features of the labor market, and identifying an overall labor market cycle from the synchronization of these component cycles. Specifically, we consider a deterioration in the labor market as involving reductions in non-farm payroll employment, the employment-to-population ratio, and the job-finding rate, and increases in the unemployment rate and job separation rate. We find that prior to the early 1980's recessions, labor market cycle downturns roughly coincided with NBER recessions. Since then, peaks in the labor market cycle have occurred noticeably earlier, and troughs later, than NBER turning points. In fact, we show that the last three NBER recessions were not only followed by "jobless recoveries," they were also *preceded* by substantial periods of labor market weakness.

We also find substantial changes over time in the synchronization of cycles in the job transition rates and either the NBER business cycle or our labor market cycle. We examine rolling correlations of cycles in labor force transition probabilities with the overall labor market cycle and the NBER business cycle. Beginning in the 1990's, we find marked changes in the correlation between NBER recessions and periods of weakness in the job finding and losing rates. The correlations between the NBER dates and cycles in the job transition rates have fallen markedly since the 1980's. The lag in recovery of the labor market cycle relative to NBER is especially evident when looking at the job-finding rate. This is supported by the high correlation of the labor market cycle and the job-finding rate, despite the decline in correlation with the NBER dates. The separation rate does not exhibit as much sluggishness in rebounding, but its correlation with both the NBER and labor market cycle are weaker and have largely declined since the 1980's.

Finally, we find that the correlation between the separation probability and either the NBER business cycle or the labor market cycle is more evident when disaggregating these transition probabilities by reason for unemployment. The synchronization of these separation probabilities by reason supports Elsby et al.'s (2009) conclusion that changes in the inflow (to unemployment) probability should not be dismissed when trying to explain cyclical unemployment. By examining the separation probability by reason for unemployment (job loss, quits, or entry), they find that the pro-cyclicality of quits and the counter-cyclicality of job loss offset each other, making the overall separation probability roughly acyclical.

These declines of the aggregate separation probability's correlation with NBER recession dates likely contributes to the lack of consensus in the literature on the source of cyclical fluctuations in the labor market. Blanchard and Diamond (1990), Bleakley et al. (1999) and Davis and Haltiwanger (1999) find that recessions tend to be initiated by countercyclical worker separations. That is, a wave of layoffs causes a rapid increase in the number of unemployed, while reduced hiring by firms in response to lower aggregate demand reduces the number of new jobs available. Recently, Hall (2005) and Shimer (2012a) have challenged this view, arguing that separation probabilities stay relatively unchanged through the business cycle. Rather, cyclical movements in the unemployment rate are driven primarily by the job finding probability. The decreased correlation of the aggregate separation rate and business cycle over time along with the offsetting nature of its disaggregated components explains the recent findings by Shimer (2012a) and others that the aggregate inflow probability is acyclical.

2 Data

Using data from the Bureau of Labor Statistics (BLS), we examine five indicators of the state of the overall labor market: total non-farm payroll employment, the unemployment rate, the employment-to-population ratio, and the aggregate job-finding and separation probabilities calculated as in Elsby et al. (2009); EMS hereafter. To account for the reasons for entering or leaving unemployment, EMS use the monthly BLS Employment and Earnings Publications data, going back to May of 1968.[1] Labor force flows are described as movements into or out of a state of employment, unemployment, or non-participation from one time period to the next. We follow EMS and others and focus on movement into and out of unemployment. An inflow to unemployment is the transition from employment or non-participation to unemployment. An outflow is the transition from unemployment to a state of employment or non-participation.[2] The job finding rate, or outflow rate from unemployment, is calculated as follows:

$$F_t = 1 - \left[\frac{u_{t+1} - u^s_{t+1}}{u_t} \right]$$

Here, u_t is the total number of unemployed persons in month t, and u^s_t is the number of persons unemployed for five weeks or less. The associated outflow hazard is then:

$$f_t = -\ln(1 - F_t)$$

[1]The data by reason for unemployment are not seasonally adjusted. We made this adjustment using the Census X-12 procedure as implemented by gretl (www.gretl.sourceforge.net).

[2]Apart from a brief discussion below about the flows of entrants, we do not consider flows to or from non-participation in this paper.

To compute the hazard rate for the inflow to unemployment (the separation probability), we use the discrete-time aggregation bias correction method of EMS. This method produces estimates of the hazard rates one would observe if the CPS survey were taken weekly rather than monthly.[3] Given f_t above, and assuming that the labor force l_t is constant during a month, the inflow hazard s_t solves:

$$u_{t+1} = s_t l_t \sum_{n=0}^{3} (1 - s_t - f_t)^n + (1 - s_t - f_t)^4 u_t$$

The separation (inflow) probability is then given by $S_t = 1 - e^{-S_t}$. EMS argue that the continuous-time method used by Shimer arguably over-corrects for aggregation bias, since it imputes very short-term unemployment spells that would probably not be recognized in the official statistics if the CPS survey took place weekly.

3 Methods

Bry and Boschan (1971) made the first attempt to construct a dating rule or algorithm that could replicate the peak and trough dates identified for U.S. business cycles by the National Bureau of Economic Research. Recently, Harding and Pagan (2002) refined these procedures into a non-parametric pattern recognition algorithm that they term "Bry-Boschan Quarterly," or BBQ. They demonstrate that this algorithm not only performs very well at reproducing the NBER dates, but that it also provides additional information about the shape of business cycles such as the average duration and amplitude of the expansion and contraction phases. They then compare these features with those computed using simulated data from several popular business cycle models, such as Hamilton's (1989) Markov-switching model. Their conclusion is that such models often have difficulty replicating the characteristics of actual business cycles.

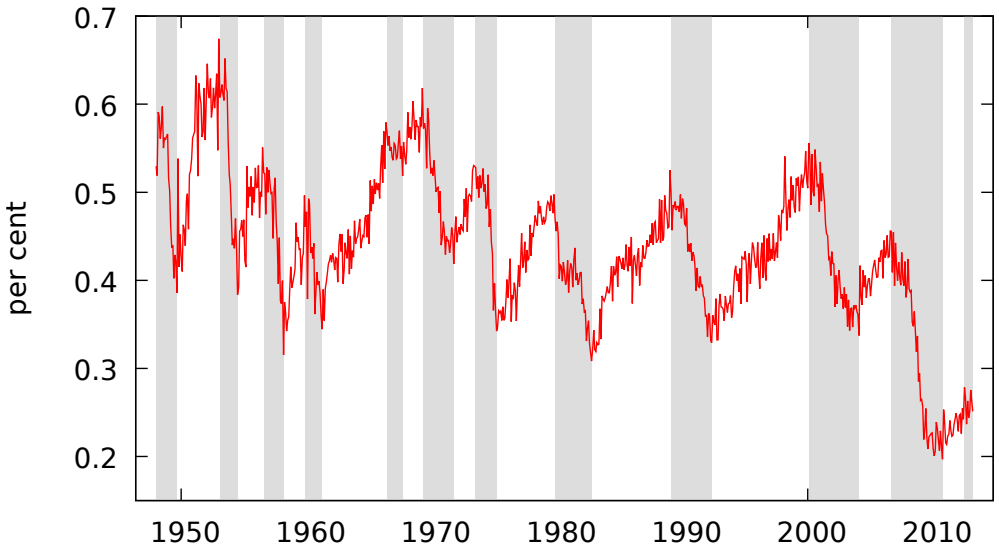
The steps in the algorithm are (see Harding and Pagan, 2002):

1. Get initial peak and trough dates by identifying local maxima and minima in the series y_t. For example, peaks are points at which $y_t > y_{t\pm k}$ for $k = 1, 2, ..., K$. Bry and Boschan (1971) recommend K = 5 for monthly data; Harding and Pagan (2002, 2006) use $K = 2$ for quarterly data. Because of the 'noisy' nature of monthly labor flows data, we use $K = 8$.

2. Ensure that peaks and troughs alternate.

[3] As Shimer (2005) has argued, some sort of adjustment is necessary due to the fact that an employed worker could experience short, unmeasured spells of unemployment between CPS surveys. Failure to account for this possibility would result in a downward bias in the separation hazard.

Figure 1: Job finding probability with its deterioration phases



3. Optionally, apply a set of *censoring rules* such as a minimum length for expansions, contractions, and complete cycles; ruling out turning points too near either end of the sample period, etc.

Note that censoring rules can be an alternative to smoothing, quarterly averaging, etc. This is because enforcing a minimum phase length helps ensure that only sustained movements in one direction or another will be identified as a contraction or expansion.

As an example, Figure 1 shows the job-finding probability along with shaded bars denoting the periods during which this probability falls, as identified by the BBQ procedure.[4] Note that the algorithm indicates that this probability peaked most recently in July, 2012.

As a result of applying the dating algorithm, we have a set of binary time series, which we normalize to equal 1 when the labor market is deteriorating and 0 when it is improving.[5] Harding and Pagan (2006) show how these constructed series can be used to test for the presence of synchronization between cycles in different series, and apply their methods to cycles in stock price indices and industrial production in several countries. Smith and Summers (2005) use these methods to examine the synchronization of business cycles in five countries.

Harding and Pagan (2006) show that tests for synchronization between two or more binary time series, say S_x and S_y, can be based on the simple coefficient of correlation between them. They also point out that basing inference on the usual t-statistic is inappropriate in this case.

[4]We imposed minimum phase lengths of 8 months, and a minimum full-cycle length of thirteen months.

[5]By a "deteriorating" labor market, we mean increases in the unemployment rate and the separation probability, and decreases in the level of employment, the job-finding probability, and the employment-population ratio. We define an improving labor market symmetrically.

This is due to the fact that these constructed binary time series usually exhibit a high degree of serial correlation. We follow their recommendation and construct a robust t-statistic using a generalized method of moments (GMM) estimator with heteroskedasticity-and-autocorrelation consistent (HAC) covariance matrix.

4 Results

4.1 Characterizing Cycles in Labor Market Variables

Table 1 presents the computed peak and trough dates for our five indicators of the state of the labor market. The last column of the table shows the turning points identified by the NBER for comparison. Note that by "peaks" we mean beginning dates of labor market weakness, so for example the unemployment rate begins to *increase* at peak dates.[6] This convention means that both NBER recessions and labor market downturns last from peak to trough.

Table 1 also shows that the cyclical behavior of the separation rate is much more pronounced than the other series or the NBER dates; there are 17 complete peak-to-trough cycles in the separation rate, compared to 11 in the NBER dates. There are several periods (1984, 1994-95, 1997-98 and 2004-05, for example) during which the separation rate experienced a cycle even when the other labor market indicators, and the overall economy, were in expansion.

The table also shows that the labor market series tend to have earlier peak dates and later trough dates than the NBER business cycles. This pattern is especially evident in the 1990-91, 2001, and 2007 recessions. In each of these periods the labor market series peaked roughly a year before the NBER peak. Additionally, the trough in the unemployment rate and the job finding rate lagged the 1991 business cycle by well over a year. Troughs in these series and the employment-population ratio lagged the 2001 cycle by nearly two years. The job finding rate did not begin increasing again until February 2004, 27 months after the official "end" of the recession. Notice that both job transition probabilities have also experienced at least one turning point since the end of the "Great Recession" in 2009.

Table 2 shows the correlation matrix of the binary variables for the labor market and the NBER recessions (in panel A), along with their associated t-statistics (panel B). As suggested by Harding and Pagan, the correlations of the binary data series should give a measure of the synchronization of the cyclical data.

Cycles in three of the labor market series have correlations of at least 0.5 with the NBER recession dates, and these correlations are significant at all conventional levels. In other words,

[6] Similarly, "troughs" are dates at which the labor market begins to improve.

Table 1: Peak and trough dates in labor market variables and NBER dates

	Payroll Employment	Unemployment Rate	Job finding Probability	Separation Probability	E/P Ratio	NBER
P	Sep-48					Nov-48
T	Oct-49	Oct-49	Sep-49	Sep-49	Aug-49	Oct-49
P		May-51		May-51		
T		Aug-52		Jul-52		
P	Jul-53	Jun-53	Jan-53	Apr-53	Mar-53	Jul-53
T	Aug-54	Sep-54	Jul-54	Jun-56	Aug-54	May-54
P	Apr-57	Mar-57	Jul-56	Feb-57	Feb-56	Aug-57
T	Jun-58	Jul-58	Mar-58	Feb-58	Aug-58	Apr-58
P	Apr-60	Feb-60	Nov-59	Jan-60	Jun-60	Apr-60
T	Feb-61	May-61	Apr-61	Nov-60		Feb-61
P				Jan-62		
T				Oct-62	Feb-63	
P		Nov-66	May-66			
T		Oct-67	Sep-67			
P	Mar-70	Feb-69	Apr-69	Jan-69	Dec-69	Dec-69
T	Nov-70	Dec-70	Oct-71	Sep-70	Aug-71	Nov-70
P	Jul-74	Oct-73	May-73	Nov-72	Mar-74	Nov-73
T	Apr-74	May-75	Mar-75	Dec-74	Jun-75	Mar-75
P		May-79	Oct-79	May-76	Feb-80	Jan-80
T				Mar-77		Jul-80
P	Jul-81			Apr-79		Jul-81
T	Dec-82	Dec-82	Oct-82	Dec-81	Mar-83	Nov-82
P				Apr-84		
T				Dec-84		
P	Jun-90	Mar-89	Jan-89	Jun-88	Mar-90	Jul-90
T	May-91	Jun-92	May-92	Jan-91	Feb-92	Mar-91
P				Sep-94	Apr-95	
T				Aug-95	Jan-96	
P				Jun-97		
T				Sep-98		
P	Feb-01	Apr-00	Feb-00	Nov-00	Apr-00	Mar-01
T	Aug-03	Jun-03	Feb-04	Oct-01	Oct-03	Nov-01
P				Jan-04		
T				Oct-05		
P	Jan-08	Mar-07	Aug-06	Feb-07	Feb-07	Dec-07
T	Feb-10	Oct-09	Oct-10	Dec-08	Aug-11	Jun-09
P			Jul-12	Jan-11		
T				Jul-12		

Dates in the first five columns were estimated using the algorithms of Harding and Pagan (2002) as described in the text. NBER recession dates are taken from http://www.nber.org/cycles/cyclesmain.html.

Table 2: Correlation matrix of cycles

A. Correlation coefficients

Unemp. Rate	Job finding prob.	Separation prob.	E/P ratio	NBER	
0.601	0.524	0.139	0.562	0.673	Employment
1.000	0.705	0.367	0.523	0.569	Unemp. Rate
	1.000	0.218	0.605	0.511	Job finding prob.
		1.000	0.199	0.345	Separation prob.
			1.000	0.436	E/P ratio

B. Robust t-statistics

Unemp. Rate	Job finding prob.	Separation prob.	E/P ratio	NBER	
24.790	30.242	1.717	40.008	9.326	Employment
–	13.553	4.336	6.828	37.371	Unemp. Rate
	–	2.444	9.037	57.847	Job finding prob.
		–	2.445	4.881	Separation prob.
			–	12.724	E/P ratio

t-statistics were computed using HAC standard errors.

periods of labor market slack tend to be associated with recessions, and vice versa.[7] Furthermore, the five labor market component cycles are all positively correlated with each other. All the pairwise correlations except between the separation probability and employment are significant at the 0.015 level or lower (two-sided).

The strongest correlation, 0.704, is between the job finding probability and the unemployment rate. This result lends support to the argument of Shimer (2005) and Hall (2005) that movements in the unemployment rate are driven primarily by changes in the job finding rate (although of course we cannot infer a causal relationship from this table). Cycles in the unemployment rate are less strongly correlated with cycles in the separation probability (though this correlation is statistically significant). Indeed, the smallest correlations in the table are associated with cycles in the separation probability. This is also suggestive of this series having a weaker cyclical component.

Since unemployment is often thought of as a lagging indicator of economic activity, it may not be useful to compare the state of S or F at time t with the NBER cycle at time t, but rather at a lag. Figure 2 shows a cross-correlogram of cycles in F and S with the NBER dates.[8] The separation probability achieves its highest correlation with the NBER dates at a 2 month lead. That is, cycles in S tend to lead NBER cycles by about 2 months. In contrast, the correlation of turning points in the job finding probability with NBER dates is roughly constant at 0.5 at leads

[7] The lower correlation between the NBER dates and cycles in the employment-population ratio may reflect the importance of secular factors (e.g., demographics) in driving the latter series.

[8] That is, the figure shows $corr(F_t, NBER_{t-j})$ for j between -12 and 12, and similarly for S_t.

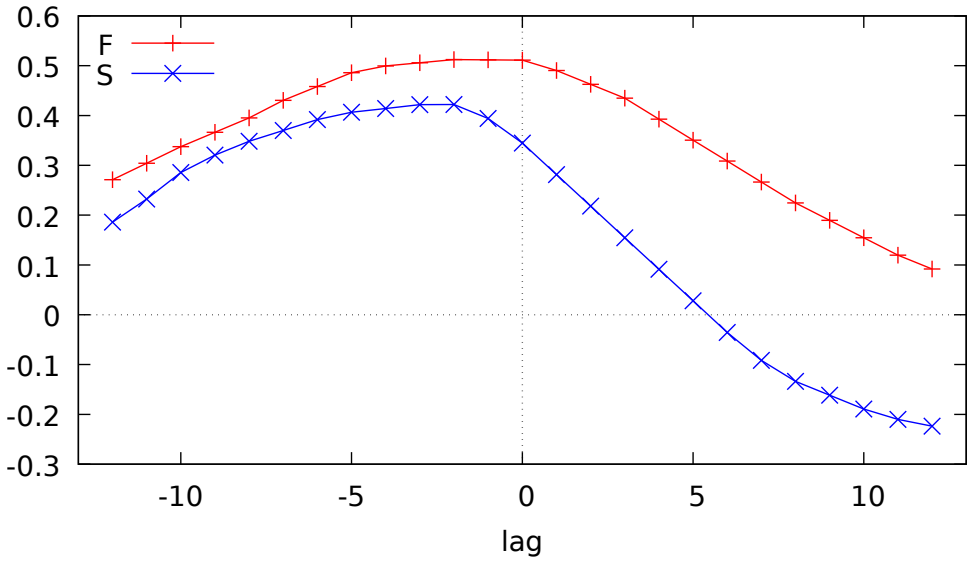


Figure 2: Correlations of job finding rate (F) and separation rate (S) with lagged NBER recessions

from 0 to 5 months.

Our results regarding the job-finding probability are consistent with Fujita and Ramey (2009), who found that this probability is procyclical and lags the cycle by two to three quarters. However, Fujita and Ramey also found that the separation probability is highly countercyclical and contemporaneous with the cycle. Our divergent results are likely due to the differing methods we use. Fujita and Ramey measured the cycle in their series as deviations from a Hodrick-Prescott trend, and used labor productivity as an indicator of the overall business cycle.[9]

4.2 A Labor Market Cycle

The five series in Table 1 each measure different aspects of "the labor market." It is clear from the table that there are many cases in which their turning points are clustered near each other, and many of these cases occur near NBER recessions. To investigate this further, we used the non-parametric method of Harding and Pagan (2006) to extract a common "labor market cycle" from the turning points in the component series. Briefly, the method proceeds as follows (see their paper for further details):

1. For each of the five labor market series in Table 1, determine the number of months between each date and the next peak and the next trough. This produces two $5 \times T$ matrices, say P and T.

[9] Their results are broadly similar with first-differenced data.

2. Compute the median of each row of P and T (i.e., the median time to the next peak or trough), and call the resulting $1 \times T$ vectors p and t.

3. Find the local minima in p and t, and use these as candidate turning points for the common cycle. Note that if the turning points in the component series coincided exactly, these local minima would all be zero. In general, the more "tightly clusteredfi the turning points are in P and T, the lower will be the values of the local minima in p and t. Following Harding and Pagan (2006), we set the maximum cluster width to 24 months. That is, we eliminated local minima in p or t that were greater than 24 months apart.

4. Check that the resulting peaks and troughs alternate, and impose minimum durations for each phase and completed cycle as described above for the BBQ algorithm.

The resulting common cycle turning points are listed in Table 3, along with the NBER recession dates and the lead/lag relationship between these two series. The relationship between the two sets of cycles is shown graphically in Figure 3. Table 3 reinforces our result discussed above, that the peaks (troughs) in the labor market cycle have tended to occur sooner (later) than those in the NBER series since 1979. The table also shows that while the average duration of NBER recessions is essentially unchanged in the later period, the duration of the average labor market cycle has increased by over a year, from 26 to 39 weeks. This pattern is also clear in Figure 3; labor market recessions were roughly coincident with NBER recessions until about 1983 (especially if the 1980's "double-dip" recessions are considered as one), but have been substantially longer since then.[10]

There have been many references to the "jobless recoveries" from the last three NBER recessions; see Jaimovich and Siu (2012), Shimer (2012b), Groshen and Potter (2003), Schreft and Singh (2003), or Schreft et al. (2005), for example. However, our results show that these recessions were also *preceded* by extended periods of labor market weakness. For example, the latest recession began in December 2007, but the labor market began deteriorating nine months earlier.

Plots of the various labor market series against the common cycle dates are shown in Figures 4- 6 below.[11] The figures clearly show that the common cycle does in fact correspond to broad-based periods of labor market slack. Figure 6 shows that, unlike previous post-war recessions, the 1990-91 and 2001 recessions did not feature large increases in the separation probability. This is also consistent with Hall (2005) and Shimer (2005). There is however a caveat to this result,

[10]Note that in cases where the labor market cycle nearly coincides with an NBER recession, the corresponding bars in Figure 3 will appear mainly blue. This happens with the 1960-61 and 1973-75 recessions, for example.

[11]Figure 4 also shows the level of short-term unemployment; the number of people unemployed for less than five weeks. We used this series in constructing the job-finding rate, but not directly in constructing the labor market cycle.

Table 3: Turning points in aggregate labor market cycle and NBER recessions

	Cycles		Lead(−) or Lag(+) at	
	Labor market	NBER	Troughs	Peaks
T	Oct-49	Oct-49	0	
P	Jun-53	Jul-53		-1
T	Sep-54	May-54	4	
P	Apr-57	Aug-57		-4
T	Aug-58	Apr-58	4	
P	Apr-60	Apr-60		0
T	Apr-61	Feb-61	2	
P	Apr-69	Dec-69		-8
T	Dec-70	Nov-70	1	
P	Nov-73	Nov-73		0
T	May-75	Mar-75	2	
P	Aug-79	Jan-80		-5
T		Jul-80		
P		Jul-81		
T	Dec-82	Nov-82	1	
P	Dec-88	Jul-90		-19
T	May-92	Mar-91	14	
P	Apr-00	Mar-01		-11
T	Sep-03	Nov-01	22	
P	Mar-07	Dec-07		-9
T	May-10	Jun-09	11	
Avg. lead/lag vs. NBER		Pre-1979	2.17	-3
		Post-1979	12	-11
Avg. Duration (P-T)		NBER Recessions	Pre-1979	11
			Post-1979	11
		Labor market downturns	Pre-1979	16.20
			Post-1979	39

Labor market cycles are the common cycle of the five labor market variables in 1, estimated using the algorithms of Harding and Pagan (2006) as described in the text. NBER recession dates are taken from http://www.nber.org/cycles/cyclesmain.html. Average leads (negative), lags (positive), and durations are in months.

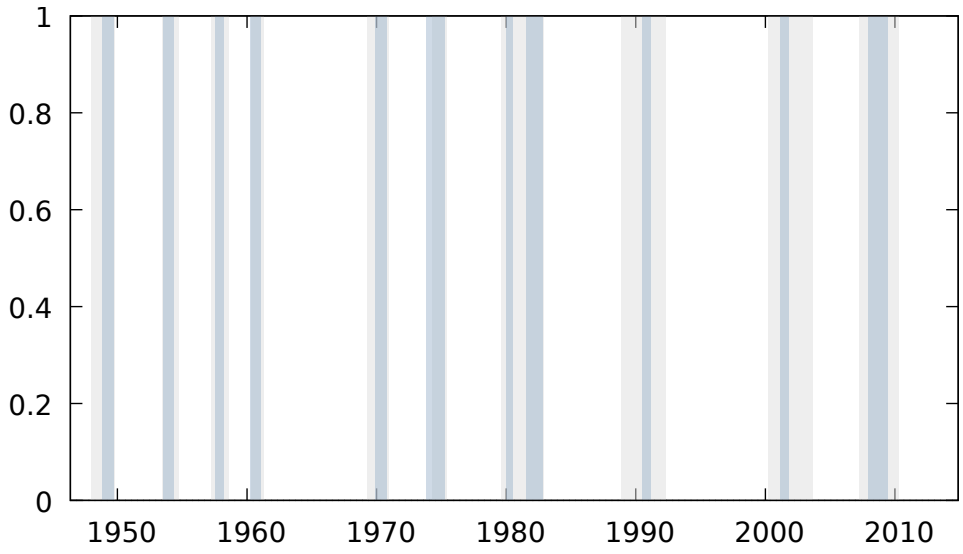


Figure 3: NBER Recessions (blue bars) and labor market downturns (gray bars)

which we explain in Section 4.4. In the 2007-09 labor market recession, the job finding probability apparently fell before the separation probability began to rise substantially.

4.3 Changes Over Time

To determine if there has been a change in the synchronization of these series over time, we also computed rolling correlations of the cycles in the transition probabilities with the NBER dates and the labor market cycle. Figure 7 shows rolling ten-year correlations for cycles in the separation probability, while Figure 8 does the same for the job finding probability. The figures show that there has been substantial variation over time in all of these correlations. Prior to the early 1980's, cycles in the separation probability were nearly equally correlated with the NBER business cycle and the labor market cycle (see Figure 7). However, in the later part of the sample this transition probability has tended to be more highly correlated with the labor market cycle than with the business cycle. In the last decade, cycles in the separation rate have often been negatively correlated with the overall labor market cycle. That is, there have been substantial periods of time when the separation rate was increasing even as the labor market strengthened, or vice versa.

4.4 Differences by Reason for Unemployment

Since EMS mention that the inflow to unemployment was more cyclical when disaggregated by reason for entering unemployment, we examined the inflow hazard by reason and compared each

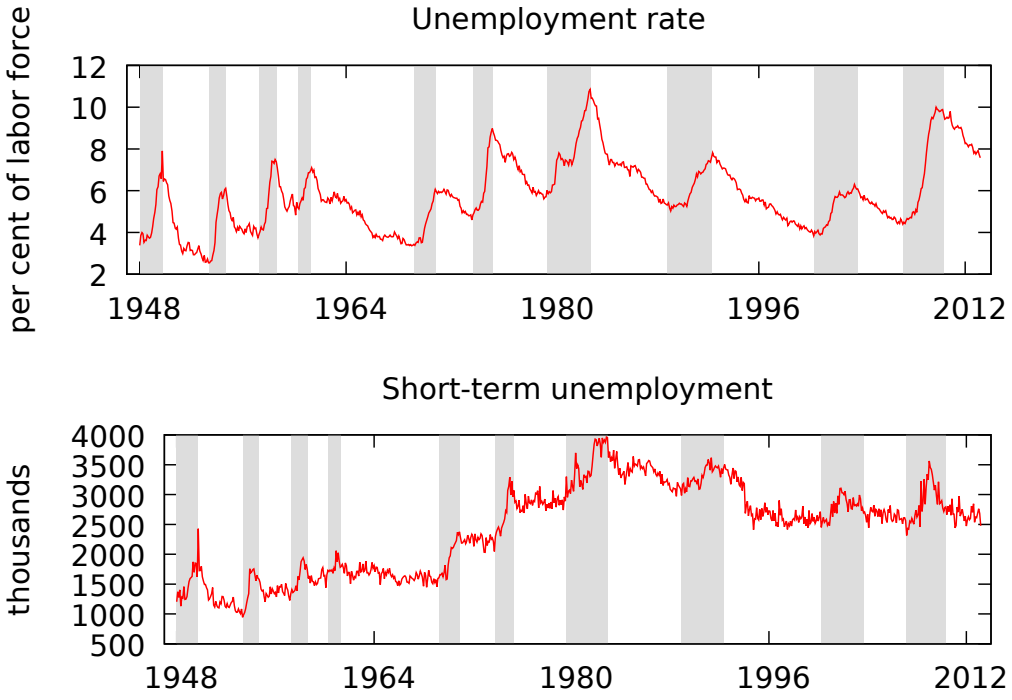


Figure 4: Unemployment rate, short-term unemployment, and labor market downturns

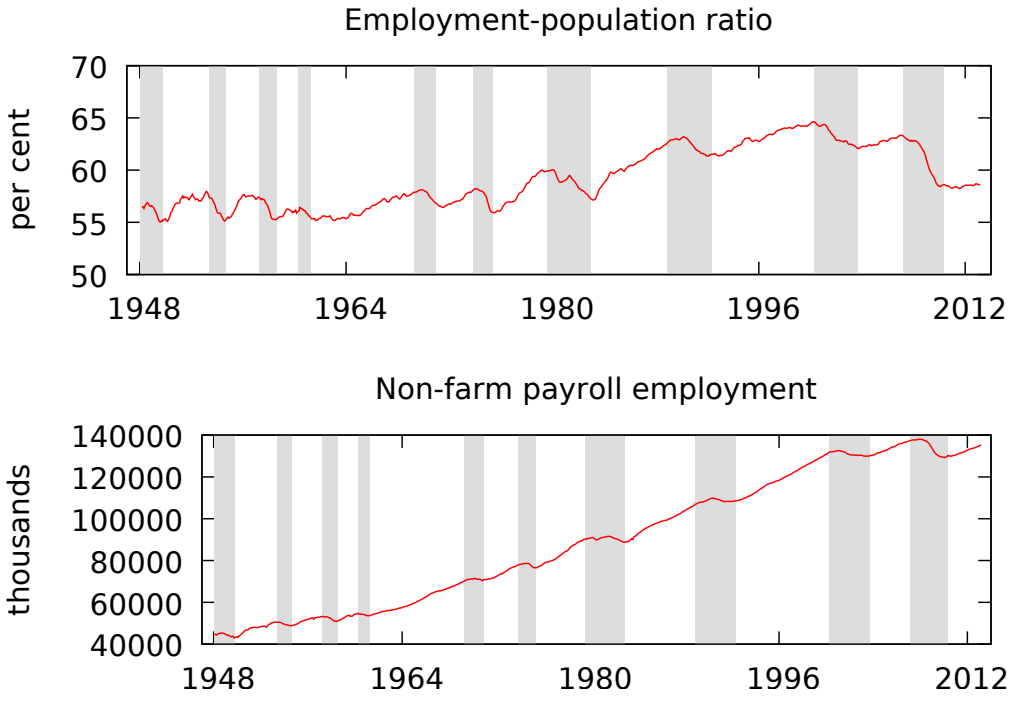


Figure 5: Total employment, employment-to-population ratio, and labor market downturns

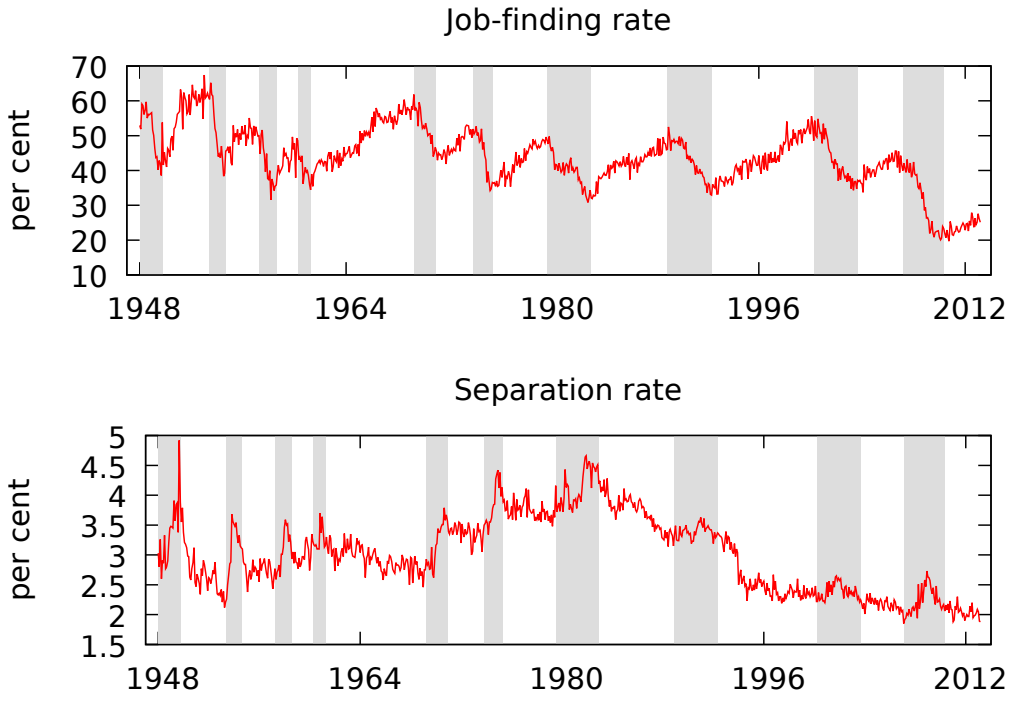


Figure 6: Job transition probabilities and labor market downturns

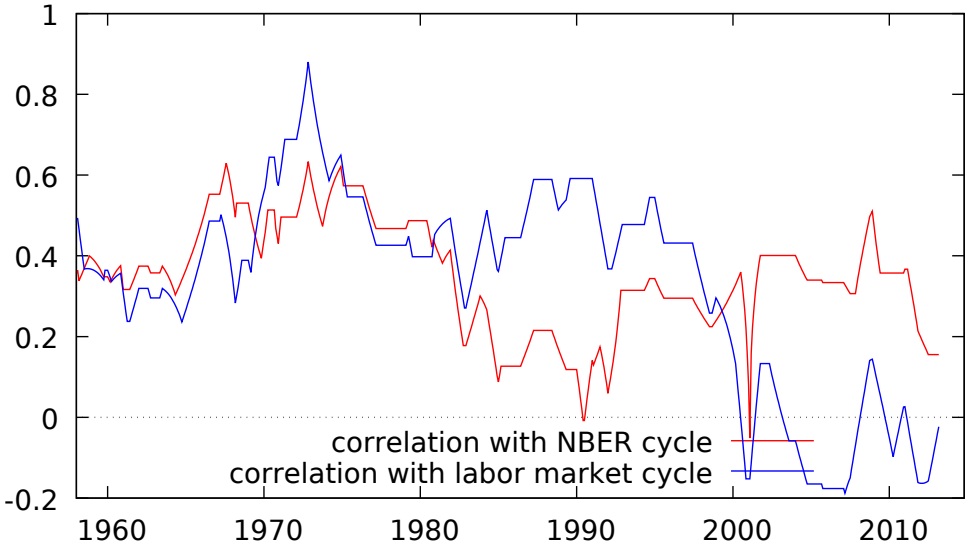


Figure 7: Ten-year rolling correlation of S cycles with NBER and labor market cycles

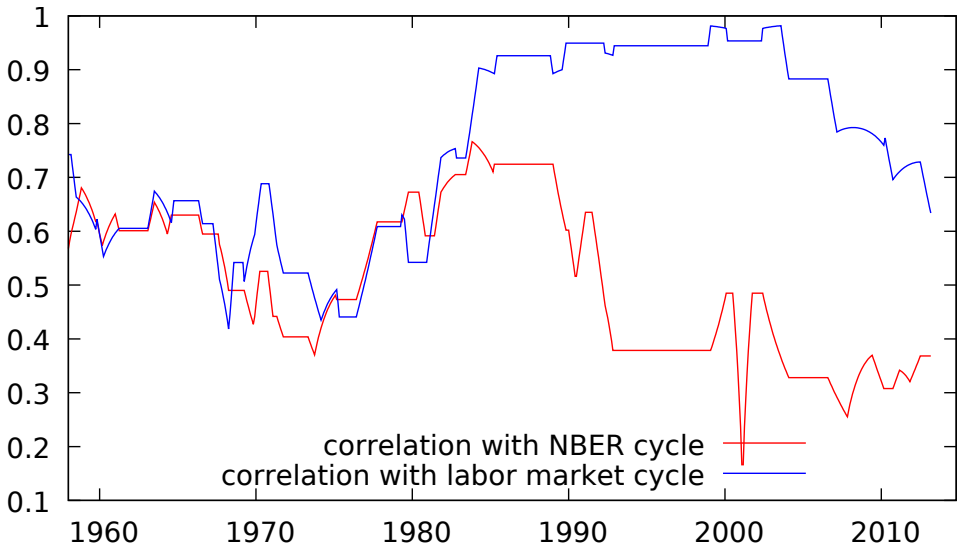


Figure 8: Ten-year rolling correlation of F cycles with NBER and labor market cycles

component with the labor market cycle dates.[12] Figure 9 plots the job finding rate by reason for unemployment against labor market recessions, while Figure 10 does the same for the separation rates by reason (both figures show three-month moving averages). The separation rate for job losers seems to be very countercyclical, increasing in recessions and decreasing during expansions. Its volatility lessens substantially through the Great Moderation period. The job-leavers series is procyclical, decreasing in labor market recessions.

Figure 4 shows the correlations of the cycles in labor flows by reason with the NBER and labor market recessions. It is evident that the separation rate for job losers is positively correlated, and the job leaving rate is negatively correlated, with both the NBER and labor market cycles. That is, the job losing rate rises and the job leaving (quit) rate falls, in both types of recessions. The job finding probabilities are all positively correlated, more strongly so for labor market cycles than NBER cycles.

Finally, we present two figures that illustrate the dynamics of the jobless recoveries from the last three recessions. First, Figure 11 shows the (headline) unemployment rate and the separation rate for job losers, along with the NBER recession dates. It is clear from this figure that sharp increases in layoffs or other job terminations have been a feature of all recessions since 1968, including the last three.[13] Each increase in the unemployment rate was associated with a clear

[12]The data for unemployment by reason start in May, 1968. We used the procedure of EMS to adjust these data for changes in the Current Population Survey, and seasonally adjusted them using the X-12-ARIMA procedure as implemented in gretl (available at gretl.sourceforge.net). We are grateful to EMS for providing these data and the details of their procedures.

[13]To improve visual clarity, Figure 11 and Figure 12 show three-month moving averages of the job finding and job losing probabilities.

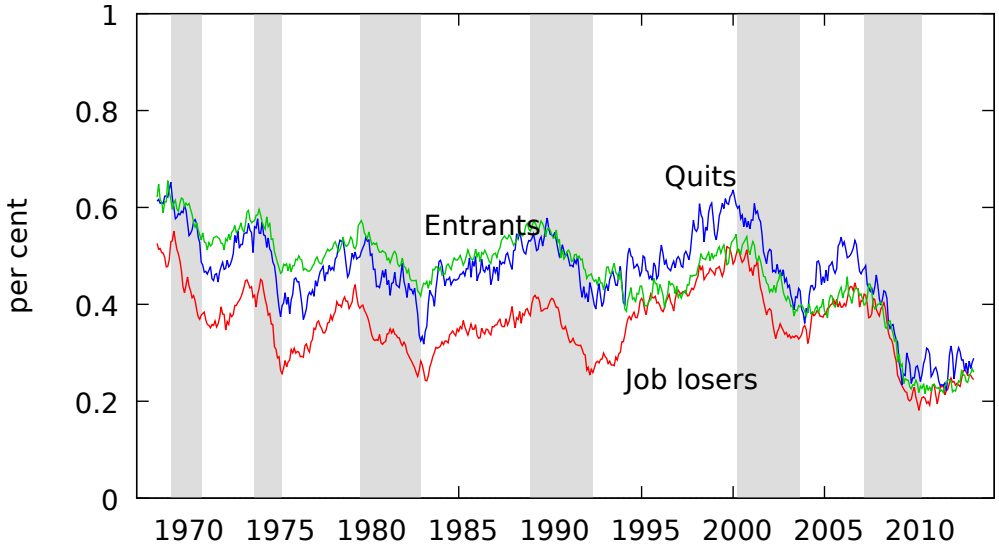


Figure 9: Job-finding rates by reason for unemployment and labor market downturns

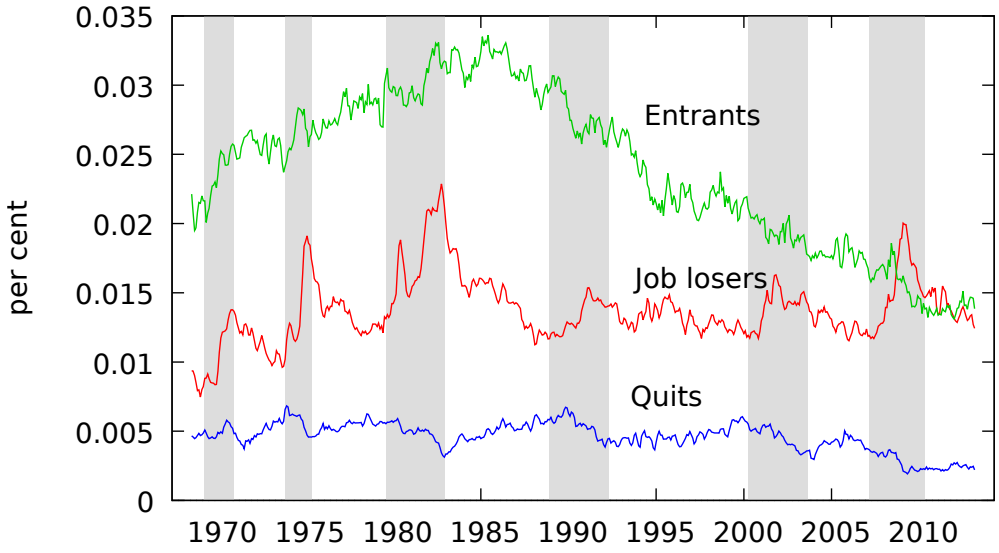


Figure 10: Separation rates by reason for unemployment and labor market downturns

Table 4: Correlation of transition probabilities by reason for unemployment

Job finding rates			Separation rates			Cycles			
F_{Loser}	F_{Leaver}	$F_{Entrant}$	S_{Loser}	S_{Leaver}	$S_{Entrant}$	Labor	NBER		
1.000	0.364	0.090	0.193	−0.260	−0.052	0.579	0.370	F_{Loser}	Job finding rates
	1.000	0.316	0.291	−0.510	−0.114	0.408	0.337	F_{Leaver}	
		1.000	0.325	−0.272	−0.147	0.319	0.217	$F_{Entrant}$	
			1.000	−0.292	0.114	0.480	0.344	S_{Loser}	Separation rates
				1.000	−0.070	−0.415	−0.292	S_{Leaver}	
					1.000	−0.040	0.072	$S_{Entrant}$	
						1.000	0.562	Labor	Cycles
							1.000	NBER	

Table entries are correlations between cycles (turning points) in the indicated series.

jump in the probability of losing one's job. This reinforces arguments made by EMS and Elsby et al. (2010). Figure 12 shows the unemployment rate and the corresponding job finding rate for job losers. The "jobless recoveries" stand out as periods during which the job finding rate kept falling or stayed unusually low, compared to its behavior in previous recoveries.

5 Conclusions

This paper has extracted a common labor market cycle from five component series. Comparing this cycle to the NBER business cycle, we reach several conclusions. First, we have documented significant changes in the relationship between labor market outcomes and the business cycle since 1980. Prior to the early 1980's recessions, labor market downturns roughly coincided with NBER recessions. Since then, peaks in the labor market have occurred earlier, and troughs later, than NBER turning points. Not only were the last three recessions followed by "jobless recoveries," they were also *preceded* by a year or more of labor market weakness. The peak in the last labor market recession occurred in April 2007, eight months prior to the NBER peak.

We have also documented substantial changes over time in the synchronization of cycles in the job transition rates and both the NBER business cycle and our labor market cycle. The separation rate cycle was positively correlated with both other cycles from 1958 until the mid-1970's. The synchronization with the NBER cycle dropped sharply and briefly became negative in the early 1980's before increasing through most of the 1990's. Synchronization with the labor market cycle fell during the late 1990's and was negative for most of the last decade. Since about 1980, the cycle in the job finding rate has been consistently positively correlated with the labor market cycle, while its correlation with the NBER cycle has dropped from roughly 0.6 to 0.3.

Finally, we have found that the correlation between the separation probability and either the

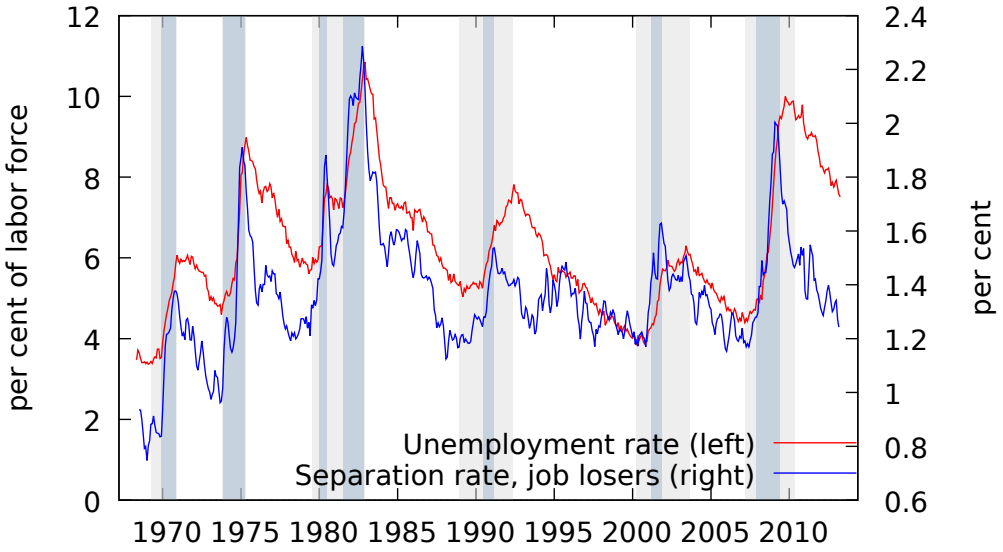


Figure 11: Unemployment rate, separation rate for job losers, NBER and labor market recessions

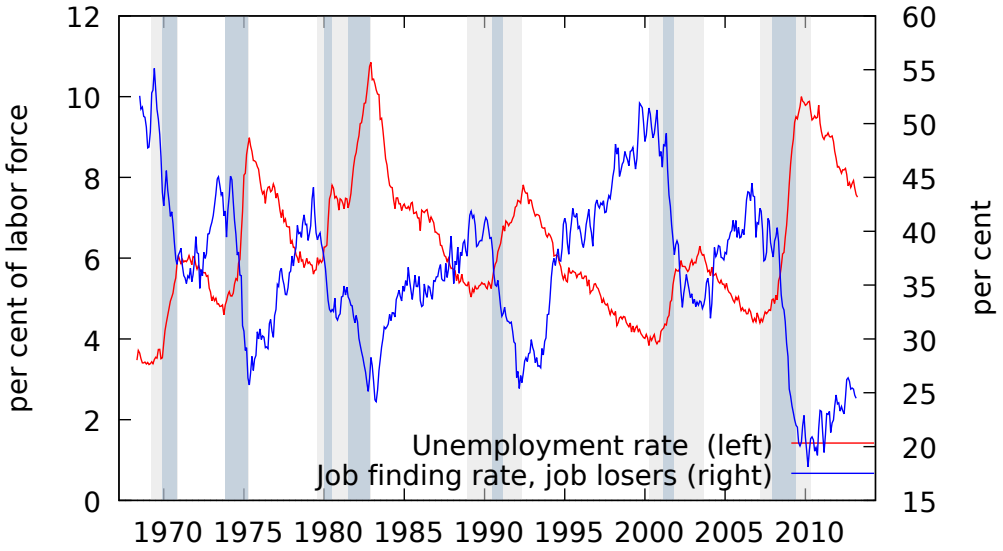


Figure 12: Unemployment rate, job finding rate for job losers, NBER and labor market recessions

NBER business cycle or the labor market cycle is best understood by examining these transition probabilities by reason for unemployment. The synchronization of these probabilities supports Elsby et al.'s (2009) conclusion that the job separation probability should not be dismissed when trying to explain cyclical unemployment. There also appears to be a change in the relationship and volatility of these transition probabilities over the Great Moderation. This changing relationship seems to be a key factor in explaining recent findings by Shimer (2012a) and others that the separation probability is acyclical.

6 Appendix

6.1 Common cycle chronologies with measures of hours and employment slack

This appendix reports the common labor market cycle dates using additional labor market indicator series beyond the five discussed in the main text. In order to allow for possible effects of under-utilization of labor, we redo our analysis using two other series: the average weekly hours worked in manufacturing and the number of persons employed part-time for economic reasons. The following three tables report the labor cycle chronologies using each of these series added to the other five, both one at a time (Table 5 and Table 6) and together (Table 7). Our main results are robust to the addition of these other series.

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Table 5: Turning points in aggregate labor market cycle and NBER recessions. Aggregate cycle augmented with average weekly hours worked in manufacturing

	Cycles		Lead(−) or Lag(+) at	
	Labor market	NBER	Troughs	Peaks
T	Nov-49	Oct-49	1	
P	Jun-53	Jul-53		-1
T	Sep-54	May-54	4	
P	Dec-56	Aug-57		-8
T	Jun-58	Apr-58	2	
P	Apr-60	Apr-60		0
T	Mar-61	Feb-61	1	
P	Aug-69	Dec-69		-4
T	May-71	Nov-70	6	
P	Jan-74	Nov-73		2
T	May-75	Mar-75	2	
P	Oct-79	Jan-80		-3
T		Jul-80		
P		Jul-81		
T	Jan-82	Nov-82	2	
P	Oct-88	Jul-90		-9
T	Dec-92	Mar-91	9	
P	Aug-00	Mar-01		-7
T	Nov-03	Nov-01	24	
P	Jan-07	Dec-07		-11
T	Dec-10	Jun-09	6	
Avg. lead/lag vs. NBER		All	5.7	-4.6
		Post-1979	10.25	-7.50
Avg. Duration (P-T)		NBER Recessions	Pre-1979	11
			Post-1979	11
		Labor market downturns	Pre-1979	23.5
			Post-1979	34.1

See notes to Table 3

Table 6: Turning points in aggregate labor market cycle and NBER recessions. Aggregate cycle augmented with the number of persons employed part-time for economic reasons (available from May, 1955; cycles before this date are identical to those in Table 3).

	Cycles		Lead(−) or Lag(+) at	
	Labor market	NBER	Troughs	Peaks
T	Oct-49	Oct-49	0	
P	Jun-53	Jul-53		-1
T	Sep-54	May-54	4	
P	Dec-56	Aug-57		-8
T	Jun-58	Apr-58	2	
P	Mar-60	Apr-60		-1
T	Apr-61	Feb-61	2	
P	Mar-67	Dec-69		n/a
T	Jun-68	Nov-70	n/a	
P	Aug-69	Nov-73		-4
T	Jun-71	Mar-75	7	
P	Jun-73	Jan-80		-5
T	May-75	Jul-80	2	
P	Oct-79	Jul-81		-3
T		Jul-80		
P		Jul-81		
T	Dec-82	Nov-82	1	
P	Sep-89	Jul-90		-10
T	Dec-91	Mar-91	9	
P	Feb-00	Mar-01		-13
T	Oct-03	Nov-01	23	
P	Dec-06	Dec-07		-12
T	May-10	Jun-09	11	
Avg. lead/lag vs. NBER		All	6.1	-6.3
		Post-1979	11	-9.50
Avg. Duration (P-T)		NBER Recessions	Pre-1979	11
			Post-1979	11
		Labor market downturns	Pre-1979	25.1
			Post-1979	36.8

See notes to Table 3

Table 7: Turning points in aggregate labor market cycle and NBER recessions. Aggregate cycle augmented with average weekly hours worked in manufacturing and number of persons employed part-time for economic reasons.

	Cycles		Lead(−) or Lag(+) at	
	Labor market	NBER	Troughs	Peaks
T	Oct-49	Oct-49	0	
P	Jun-53	Jul-53		-1
T	Sep-54	May-54	4	
P	Dec-56	Aug-57		-8
T	Jun-58	Apr-58	2	
P	Apr-60	Apr-60		0
T	Jun-61	Feb-61	4	
P	Jun-67			n/a
T	May-68		n/a	
P	Aug-69	Dec-69		-4
T	Jun-71	Nov-70	7	
P	Jun-73	Nov-73		-5
T	May-75	Mar-75	2	
P	Oct-79	Jan-80		-3
T		Jul-80		
P		Jul-81		
T	Dec-82	Nov-82	1	
P	Sep-89	Jul-90		-10
T	Dec-91	Mar-91	9	
P	Jun-95			n/a
T	Mar-96		n/a	
P	Feb-00	Mar-01		-13
T	Dec-03	Nov-01	25	
P	Dec-06	Dec-07		-12
T	May-10	Jun-09	11	
Avg. lead/lag vs. NBER		All	6.5	-6.2
		Post-1979	11.5	-9.5
Avg. Duration (P-T)		NBER Recessions	Pre-1979	11
			Post-1979	11
		Labor market downturns	Pre-1979	23.4
			Post-1979	31.6

See notes to Table 3

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