DISCUSSION PAPER SERIES

IZA DP No. 10340

Impact of the Great Recession on Industry Unemployment: A 1976-2011 Comparison

Yelena Takhtamanova
Eva Sierminska

November 2016

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

Impact of the Great Recession on Industry Unemployment: A 1976-2011 Comparison

Yelena Takhtamanova
Federal Reserve Bank of San Francisco

Eva Sierminska
LISER, DIW and IZA

Discussion Paper No. 10340
November 2016

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 10340
November 2016

ABSTRACT

Impact of the Great Recession on Industry Unemployment: A 1976-2011 Comparison

This paper studies the mechanisms driving the persistently high unemployment rate during the last recession and mild recovery. Previous studies have examined the demographic aspect of the recession. We focus on specific industries. Consequently, we propose a methodology to decompose changes in the unemployment rate into worker inflows and outflows across industry groups and outline the unique characteristics of the latest recession (including examining cyclical and structural forces). We use harmonized- reclassified industry data for 1976-2011 in the United States, which allows us to make comparisons previously not possible.

JEL Classification: J1, J6

Keywords: unemployment, worker flows, job finding rate, separation rate, industry

Corresponding author:

Eva Sierminska
LISER (Luxembourg Institute of Socio-Economic Research)
3, avenue de la Fonte
L-4364 Esch-sur-Alzette
Luxembourg
E-mail: eva.sierminska@liser.lu

1 Introduction

The recession the United States economy entered in December of 2007 is considered the most severe downturn the country experienced since the Great Depression. The unemployment rate peaked at over 10 percent in October 2009 - the highest seen since the 1982 recession. Adjusted for the change in labor force demographics, the unemployment rate was actually the highest since 1948 (the beginning of the data availability).

The dramatic increase in the national unemployment rate during the recession was not equally spread across demographic groups and industries (Autor (2011)). In this project we build upon our and other previous work, which finds that men, younger workers, the less educated and those from ethnic minorities have been impacted disproportionately more by the downturn (e.g. Sierminska and Takhtamanova (2011); Hoynes et al. (2012); Elsby et al. (2011)) and extend it to examine the impact on industries. We focus on the variation that exists across industries, as some are more affected by the business cycle (construction, manufacturing) than others (services, public administration).

How did this recession compare to other ones? What was the main driving force of rising unemployment? Was it fueled by higher worker inflows into unemployment or decreasing worker outflows? What are the differences across industries? We take a stab at answering these important questions by examining labor market experiences across several industries. First, we decompose changes in the unemployment rate by examining the contribution of each industry to the unemployment rate increase during the recession and decline during the recovery. Next, we examine worker flows into and out of unemployment. We focus on the contribution of job finding and separation probability to the aggregate unemployment rate during the recession and to the unemployment rate dynamics during the recovery. Since the most recent economic downturn has been driven by the housing market, we focus our interest on industries directly affected by the housing market weakness such as construction, and FIRE (finance, insurance and real estate). We contribute to the literature by employing industry-specific job finding and separation rates to investigate the increase in the unemployment rate during the recession and the stubbornly high unemployment rate during the recovery. We extend the existing methodology for decomposing the movements in the aggregate unemployment rate to the industry-specific case.

We find construction, manufacturing and services to be the three industries that contributed most to the aggregate unemployment rate increase during the most recent downturn. The burden of unemployment is not evenly distributed across these industries: the contribution of construction and manufacturing exceeds their share in the labor force. During the recovery, construction and manufacturing are strong "drivers" of unemployment rate decline, but the lack of new jobs in services, which employ almost 50% of the labor force dragged the decline in unemployment. In terms of job flows, the dramatic decline in the job finding probability is the main source of the recessionary unemployment rate increase. In particular, flows in services, manufacturing, construction and wholesale, and retail trade are large contributors. The continually low job finding probability prevented the unemployment rate from declining more rapidly during the recovery. Services and public administration stand out as sectors that provided relief in the past recoveries, but did not this time around.

Another relevant question is the extent to which recent changes in the unemployment rate are driven by structural forces (i.e. sector reallocation of workers) versus cyclical ones (lack of jobs in all sectors). Needless to say, this question is of prime importance to policymakers. Reallocation of workers across sectors takes time and, therefore, structural changes lead to longer unemployment spells (as it might take a long time for workers to acquire skills necessary to move from one sectors of the economy to another) and a higher overall unemployment rate. On the one hand, cyclical changes might not lead to long lasting changes in the unemployment rate. For policymakers, in the event that changes are largely cyclical, expansionary fiscal and monetary policy is easier to justify. On the other hand, if the increase in the unemployment rate is mostly structural, policy interventions that help to align workforce skills with job openings are instead more warranted.

Recent research finds that structural factors played a only a modest role. A comprehensive discussion of the recent developments in the literature on the relative importance of cyclical and structural forces behind the unemployment rate can be found in Elsby et al. (2011)). We contribute to this discussion by presenting evidence on the variation of job flows across industries. There is some variation in the job finding probability performance across industries, but we do not find evidence of large structural changes in the U.S. labor market.

2 Methodology

Unemployment rates inform us about the share of people in the labor force that are not working but are seeking a job in a given period of time or the probability that a randomly chosen person will be unemployed. Here, we take a dynamic approach and estimate the underlying movements of workers into and out of unemployment. These are typically referred to as the inflow rate (s_t), which is the pace at which workers move *into* unemployment and the outflow rate (f_t), the pace at which workers move *out of* unemployment.

During recessions, generally, we see more people losing jobs and becoming unemployed, hence we expect the inflow rate to increase. At the same time, it is harder for people to find jobs, hence we expect the outflow rates to decrease. Yet, there is a disagreement in the literature as to which is the main driver of the unemployment rate. Earlier literature found flows into unemployment to be the main driver of unemployment hence "The Ins Win" title of the seminal paper by Darby et al. (1986). Later work claimed the opposite with Robert Hall (e.g. Hall (2005a), Hall (2005b)) and Robert Shimer (e.g. Shimer (2005b), Shimer (2007)) being, perhaps, the strongest voices arguing that "outs" of unemployment explain much of unemployment dynamics. Finally, a recent strand of literature finds that "everyone's a winner"-i.e. both ins and outs are important for a complete understanding of cyclical unemployment (Elsby et al. (2009)). In this paper, we revisit this issue during the most recent downturn by extending the focus to industries.

We use Shimer's methodology for computing flows into and out of unemployment.[1] We assume that during period t the job finding (outflow) rate and job separation (inflow) rate are governed by a Poisson process with arrival rate f_t and s_t, respectively. That is unemployed workers find a job according to $f_t \equiv -log(1-F_t) \geq 0$ and employed workers lose a job according to $s_t \equiv -log(1-S_t) \geq 0$. F_t and S_t are finding and separation *probabilities*.[2]

In the model outlined in Shimer (2007) unemployment and short-term unemployment increase and fall according to

$$\dot{u}_{t+\tau} = e_{t+\tau}s_t - u_{t+\tau}f_t \tag{1}$$

$$\dot{u}^s_t(\tau) = e_{t+\tau}s_t - u^s_t(\tau)f_t \tag{2}$$

where $e_{t+\tau}$ is the number of employed workers at time $t+\tau$, $u_{t+\tau}$ is the number of unemployed workers, and $u^s_t(\tau)$ is short-term unemployment, i.e. workers who are unemployed at time $t+\tau$, but were employed at some time before $t' \in [t, t+\tau]$. Once the equation is solved and a number of simplifying assumption imposed, the number of unemployed workers at time $t+1$ is equal to the number of workers at time t who do not find a job (fraction $1 - F_t = \exp^{-f_t}$) plus the number of short-term unemployed workers u^s_{t+1}, those who are unemployed at $t+1$, but held a job at some point during time t:

$$u_{t+1} = (1-F_t)u_t + u^s_{t+1} \tag{3}$$

Thus the monthly job finding probability is equal to

$$F_t = 1 - \left[\frac{u_{t+1} - u^s_{t+1}}{u_t}\right] \tag{4}$$

[1]Elsby et al. (2011) point out that by using Shimer's methodology one underestimates total inflows into unemployment, in particular since 2010. This discrepancy does not impact our discussion of the recessionary increase in the unemployment rate (by our calculations, unemployment peaked prior to 2010, as is shown in Figure 6). However, it affects our findings for the recovery. We address this in our discussion of the results.

[2]*Probabilities* summarize the concentration of spells at each instant along the time axis, while *rates* summarize the same concentration at each point of time, but conditional on survival in that state up to that instant.

and the outflow hazard is then

$$f_t \equiv -\log(1-F_t) = -\log\left[\frac{u_{t+1}-u^s_{t+1}}{u_t}\right] \tag{5}$$

Finding the inflow hazard is more complicated as some workers that flow into the unemployment pool exit unemployment before the next period, hence they are not counted and as a result the measured stock of short-term unemployed is in fact underestimated. One can solve equation (1) to obtain an implicit expression for the separation probability

$$u_{t+1} = \frac{(1-\exp^{-f_t-s_t})s_t}{f_t+s_t}l_t + \exp^{-f_t-s_t} u_t \tag{6}$$

where $l_t \equiv u_t + e_t$ is the size of the labor force during period t.

This continuous time formulation allows us to avoid the time aggregation bias that occurs in a discrete time model in which the information on workers that lose and find a new job within the same period is omitted. For more details, see Shimer (2007).[3]

At any given time t, in a given industry i the number of people moving into unemployment is $s_i * E_i$ (where the separation probability for industry i is s_i and E_i is the number of people employed in this industry). The number of people moving out of unemployment in industry i (those that were previously employed in industry i) is $f_i * U_i$. These people may also be moving to work into other industries, but what we are concerned with here is the rate at which people are losing and finding jobs based on their past industry experiences in order to compare the dynamics across industries. Hence, we are able to directly specify our industry specific formulation analogously to equation (4) and (6):

$$F_{i,t} = 1 - \left[\frac{u_{i,t+1}-u^s_{i,t+1}}{u_{i,t}}\right] \tag{7}$$

and

$$u_{i,t+1} = \frac{(1-\exp^{-f_{i,t}-s_{i,t}})s_{i,t}}{f_{i,t}+s_{i,t}}l_{i,t} + \exp^{-f_{i,t}-s_{i,t}} u_{i,t} \tag{8}$$

2.1 Contributions of Flows to Aggregate Unemployment Rate Changes

In addition to computing flows into and out of unemployment, we want to understand he contribution of these flows to the increases in the unemployment rate during recessions and declines in unemployment rate during

[3] An alternative approach to correct the CPS data for the time aggregation bias would be to impute discrete weekly hazard rates. Elsby et al. (2009) show that both types of correction yield broadly similar results.

recoveries. Studies have shown that actual unemployment rate ($\tilde{u}_t$) dynamics are closely approximated by the steady state unemployment rate (u_t^*) (Shimer (2005a)).[4]

$$\tilde{u}_t \equiv \frac{u_t}{l_t} \approx u_t^* = \frac{s_t}{s_t + f_t} \tag{9}$$

We take advantage of this and compute a series of hypothetical unemployment rates that allow us to obtain these contributions. The recessionary change in the unemployment rate is approximated by $u_{t2}^* - u_{t1}^*$, where t_1 is the date of pre-recessionary trough and t_2 is the date of the recessionary peak in the *steady-state* unemployment rate series. The contribution of changes in job finding probability to the recessionary increase in the unemployment rate is then found by setting the job separation rate at its pre-recessionary trough unemployment rate value (i.e. set $s = s_{t_1}$) and computing the hypothetical unemployment rate for each period $t \in [t_1, t_2]$:

$$u_t^{H1} = \frac{s_{t_1}}{s_{t_1} + f_t} \tag{10}$$

Analogously, the contribution of job separation probability changes to the recessionary increase in the unemployment rate, is found by setting he job finding rate at its pre-recessionary trough unemployment rate value (i.e. set $f_t = f_{t_1}$) and computing the hypothetical unemployment rate for each period $t \in [t_1, t_2]$:

$$u_t^{H2} = \frac{s_t}{s_t + f_{t_1}} \tag{11}$$

Figure 6 presents the u^*, u^{H1} and u^{H2} series for the recessions in the sample and shows that the relative importance of job finding and separation probability changes over time. Both job finding and separation probabilities play similarly important roles early on in the recessions, but as the recession progresses job finding becomes dominant.

Next, to quantify the relative contributions, we compute the contribution of job finding ($fcontr$) and job separation ($scontr$) probability changes to the recessionary aggregate unemployment increase as:

$$fcontr = u_{t2}^{H1} - u_{t1}^{H1} \tag{12}$$

and

$$scontr = u_{t2}^{H2} - u_{t1}^{H2}. \tag{13}$$

In the industry-specific case as before our focus is on the industry of previous employment. We define

[4]This holds quite well in our sample. The correlation between aggregate steady state and aggregate actual unemployment rates over the sample period is 0.98.

the industry specific steady state unemployment rate as the unemployment rate under the condition that there are no changes to the unemployment rate in the industry (the same condition that must be met when one derives the aggregate unemployment rate). This measure highly correlates with actual industry-specific unemployment rates (above 0.92 for all series). We are concerned with being able to decompose movements in the industry-specific unemployment rates into contributions of job finding and job separation probability. The expression s(i,t)/[s(i,t)+ f(i,t)] is (1) a good approximation for the actual industry-specific unemployment rate and (2) allows us to make the relevant decompositions. Whether it should be called "steady state" or something else is a matter for discussion.

Thus, we assume that the following holds for each industry i:

$$\tilde{u}_{i,t} \equiv \frac{u_{i,t}}{l_{i,t}} \approx u^*_{i,t} = \frac{s_{i,t}}{s_{i,t} + f_{i,t}} \tag{14}$$

We then compute the two hypothetical unemployment rates for industry i:

$$u^{H1}_{i,t} = \frac{s_{i,t_1}}{s_{i,t_1} + f_{i,t}} \tag{15}$$

and

$$u^{H2}_{i,t} = \frac{s_{i,t}}{s_{i,t} + f_{i,t_1}}. \tag{16}$$

The contributions of industry-specific job finding and separation probabilities to the group-specific unemployment rate increase are simply computed as:

$$fcontr_i = u^{H1}_{i,t2} - u^{H1}_{i,t1} \tag{17}$$

and

$$scontr_i = u^{H2}_{i,t2} - u^{H2}_{i,t1}, \tag{18}$$

where t_1 is the date of the pre-recessionary trough in the aggregate unemployment rate and t_2 is the date of recessionary peak. Finally, we compute the contribution of industry-specific job finding and separation probability to the aggregate unemployment increase rate as:

$$agfcontr_i = \frac{fcontr_i}{scontr_i + fcontr_i}(w_{i,t_2} * \tilde{u_{i,t_2}} - w_{i,t_1} * \tilde{u_{i,t_1}}) \tag{19}$$

and

$$agscontr_i = \frac{scontr_i}{scontr_i + fcontr_i}(w_{i,t_2} * \tilde{u_{i,t_2}} - w_{i,t_1} * \tilde{u_{i,t_1}}) \tag{20}$$

where $w_{i,t}$ is industry i's share in the labor force at time t.

We then repeat the exercise for post-recessionary unemployment rate declines. In that case, t_1 becomes the date of the recessionary peak in the aggregate unemployment rate and t_2 is the period 9 quarters after the beginning of the recession (the most recent data we have available).[5]

3 Data

We use current, publicly available data from the Current Population Survey (CPS). The CPS is a monthly survey of households conducted by the U.S. Bureau of Census for the Bureau of Labor Statistics. It provides data on the labor force, employment, unemployment, persons not in the labor force, hours of work, earnings, and other demographic and labor force characteristics. Three series are necessary to compute unemployment inflow and outflow rates by industry: the number of unemployed, the unemployment rate and the number of short-term unemployed (those unemployed for less than 5 weeks). These series are available for the broadest industry classification from BLS, but only from 2000. To compare the current downturns to those in the past we reach for monthly CPS microdata. Our task is complicated by the fact that there are several different "periods" of industry data because of changes in industry classification of the CPS: 1976-1982, 1983-2002 and 2003-2011. We create industry definitions based on the 2002 classification that are consistent across time by going to industry sub-categories. Next, an industry conversion table provided by the BLS[6] is used to reweigh the old industry categories into the new ones (Appendix Table A1). These factors are based on three-year average survey microdata (2000-2002) that were coded to both the old and new classification systems.[7] This exercise allows us to extend our data back to 1976 in a consistent manner. We have 9 industries: agriculture, mining, construction, manufacturing, transportation and public utilities, wholesale and retail trade, FIRE (finance, insurance and real estate), all services and public administration.[8] In order to check whether the generated results are reasonable we compare the generated series with the aggregates that are available from BLS from 2000 onward. Figure A1 provides a comparison of the generated series and the BLS published aggregate series for the labor force. The figure also provides the correlation coefficient between the BLS and the created series. We see that (aside from agriculture) the created series' match well the BLS published series' with a correlation above 0.97.

[5] Alternatively, one could make t_2 the date of unemployment rate trough after the recession, but at the time we are conducting this analysis, the trough in the aggregate unemployment rate has yet to be achieved.

[6] http://www.bls.gov/cps/cpsoccind.htm

[7] We use the industry names similar to the 1990 categories, but with industries being reclassified. For example, services include information, professional and business services, education and health services, leisure and hospitality and other services. When using these conversion factors we should keep in mind that the accuracy of the constructed series is affected by the changing employment distribution. The conversion factors are based on the distribution of employment that existed in 2000-02. That distribution may have changed over time, and, therefore, the constructed series may not reflect the actual employment distribution during earlier time periods.

[8] A finer disaggregation is not feasible as mapping becomes very difficult and few observations are present.

3.1 Descriptive statistics

Background information regarding the situation in the chosen industries can be found in Table 1. In the top panel we compare the average industry share of the labor force to better understand the role the industries play in the economy. For most industries, the share has been stable over time. Changes in terms of employment have been observed in the two largest sectors in terms of employment: manufacturing and services, with the share of labor diminishing in the former and increasing in the latter. In the second panel, we compare the average industry unemployment rate (1976-2010) with the one in this last recession, which indicates that construction, finance and manufacturing have been hit particularly severely (the severity being measured by the gap between industry's unemployment rate during the Great Recession and its average unemployment rate), followed by wholesale and retail, transportation, and services. In the public administration sector the unemployment rate has (so far) been less than the average rate. Finally, in the third panel you find the volatility of unemployment by looking at the standard deviation for each group. In the industry classification, mining and construction traditionally are seen as the most volatile sectors. In the last recession, all sectors have been more volatile compared to their historical average, except for public administration. In addition, construction, FIRE and manufacturing exhibit almost double their volatility (1.76, 1.88 and 1.88, respectively) indicating that this is a particularly unusual recession for these sectors by historical standards.

4 Results

Since the U.S. economy entered a severe recession in December 2007, aggregate unemployment rate peaked at over 10 percent in October 2009 (Figure 1) and, although the recession "officially" ended in June 2009,[9] unemployment remained stubbornly high for a while. The aggregate picture masks differences across various socio demographic sub-groups and sectors of the economy. During the Great Recession, researchers paid attention to experiences of different socio-demographic groups, identifying the young, minorities and men as the groups experiencing the greatest impact (e.g. Elsby et al. (2010)). Others also hypothesized that some of the variation in experiences for different socio-demographic groups comes from industry and occupation segregation (Sierminska and Takhtamanova (2011); Hoynes et al. (2012); Michaelides and Mueser (2012)). In this paper we focus on the situation within and across industries in terms of unemployment and industry unemployment flows.

In what follows we first examine the unemployment situation across industries and compare the contribu-

[9] According to the National Bureau of Economic Research, which is the agency charged with determining business cycle dates in the United States.

tion of each of them to the aggregate unemployment rate changes. Then, we look at industry specific flows into and out of unemployment. In the last section we analyze differences across industries by examining diffusion indices.

4.1 Industry-specific unemployment rates.

According to the industry-specific unemployment rates in Figure 1 public administration seems to have been a sector most sheltered during this recession and the unemployment rate in this sector remained well below the aggregate long-term average unemployment rate. By this measure, the twin recession of the early 1980s is a much more severe recession for this sector.

In terms of the industries most affected by the downturn by this measure, manufacturing, construction and FIRE (finance, insurance and real estate) stand out when we compare this recession to long-term averages in unemployment (Figure 2). The latter two industries have received particular attention during the downturn. Construction is a more cyclically sensitive sector of the two, displaying a higher than average unemployment rate and more volatility. During this recession, the unemployment rate in construction jumped to 20 percent, well above its own long-term average rate and the aggregate unemployment rate. In FIRE, for the first time since the 1970s , the unemployment rate reached a peak of slightly above 7 percent, which is also well above the long-term average unemployment rate for this industry and is close to the long-term average unemployment rates for all industries.

The evolution of the unemployment rate since the peak of the business cycle, shown in Figure 3, indicates industries are affected with a varying delay and the reduction in unemployment has also been occurring at different times. The highest rate of increase in the unemployment rate has occurred for manufacturing, then construction, followed by transportation and wholesale and retail. A slower pace of increase has been taking place in FIRE and there has been a much more delayed increase in public administration. Compared to other recessions this has been the most severe recession in terms of the speed of unemployment growth in construction, FIRE, manufacturing, services and transportation. For public administration it does not seem like unemployment has reached its peak. The recovery in most industries, but particularly in public administration and services seems to be very slow.

Next, we compare the latest recession to previous ones. To some extent our findings in Figure 4 confirm the results from the previous figure. In addition, we find that this latest recession has been the most severe out of the past four for all industries except services. Construction and manufacturing have been bouncing back (although to a smaller extent than in previous recessions–and not enough to cover the unemployment rate increase), but public administration, services, transportation and wholesale and retail trade are not.

Based on the growing labor share of services alone in the labor force this is a severe problem in the labor market. In the following section, we look at this in more detail, by examining the flows into and out of the labor market.

Industries contribution to the unemployment rate. Apart from examining how severely the recession has hit different sectors we observe, we look into the extent to which each industry has contributed to the change in the aggregate unemployment rate. The contributions are shown separately in Table 2 for the aggregate unemployment rate increase from the pre-recession trough (March 2007) to the recession peak (October 2009) in the top panel and then in the bottom panel for the aggregate unemployment rate decline from the recession peak to the latest observation available (December 2011).

In both panels in the first row we show the industry's average share in the labor force during each recession episode in our sample. The second row shows each industry's contribution to the aggregate unemployment rate increase (or decline) during the recession episode computed as following:

$$urcontr_i = \frac{w_{i,t_2} * u_{i,t_2} - w_{i,t_1} * u_{i,t_1}}{\sum_i (w_{i,t_2} * u_{i,t_2} - w_{i,t_1} * u_{i,t_1})}, \tag{21}$$

where $w_{i,t}$ is industry i's share in the labor force at time t, $u_{i,t}$ is industry i's unemployment rate at time t, t_1 and t_2 are either dates for the aggregate unemployment rate pre-recession trough and recession peak respectively (if industry's contribution to the recessionary increase in the aggregate unemployment rate is being calculated) or the dates for recession peak and the period 9 quarters since then (if the industry's contribution to the decline in the aggregate unemployment rate us being calculated).

During the last recession almost 40 percent of the aggregate unemployment rate increase came from services. This is not surprising, given that services industry constituted almost half of the labor force during the recession (as shown in the first row of the figure). Thus, services' contribution to the aggregate unemployment rate increase was slightly below the sector's share in the labor force. The services' contribution is followed by manufacturing and construction.

The third row shows the ratio of each industry's contribution to the aggregate unemployment rate increase to the industry's share in the labor force. For services, this ratio was 0.8.[10] Thus construction and manufacturing have contributed the most to the unemployment rate increase in relation to their labor force share. In this recession public administration stands out as the most "sheltered" sector, followed by FIRE. This measure of industry's "burden" does not imply, however, that the burden borne by construction and manufacturing is unprecedented - for manufacturing, the twin recessions of the 1980s were as severe; for construction, the recession of the early 1990s appears to be as severe as the most recent one as well. Thus,

[10] A ratio of less than one indicates the industry's contribution was less than its labor force share.

in terms of the increase of the unemployment rate we do not find any spectacular differences compared to past recessions.

In the bottom panel of Table 2 we see the exact same figures for the industry's contribution to the aggregate unemployment rate decline during the recovery. In the most recent recovery, construction and manufacturing appear to have "bounced back" rather well and are the main contributors to the modest decline in the aggregate unemployment rate observed during the recovery as of the end of 2011. Their contribution to the decline seems to exceed several times their share in the labor force. On the other hand, the recovery in FIRE is rather stagnant and public administration is actually on the decline - this sector is providing upward pressure on the aggregate unemployment rate during the recovery. The biggest factor though seems to be services. The recovery here has yet to take place and given that it's share is almost half of the labor force this is what is dragging the fall in unemployment.

4.2 Job Flows

Aggregate job flows and their contributions to the aggregate unemployment rate changes Was it the job loss or the difficulty in finding a job that drove the unemployment rate to its impressive heights? In other words, did the job separation or job finding rate contribute more to the aggregate unemployment rate increase? We focus on the aggregate job finding and separation probabilities in the first instance to gain insight into the aggregate unemployment rate changes. Figure 5 plots both at a quarterly frequency. The average job finding probability during the period (January 1976 - December 2011) is 40.6 percentage points, while the average job separation probability is rather low at 3.4 percentage points. The job finding probability is more volatile.

Shimer (2007) points out a secular decline in job separation probability since the early 1980s. During the Great Recession, however, job separation probability increased noticeably from 2.5 percentage points at the pre-recession trough in the first quarter of 2007 to the 3.2 percentage points at the recessionary peak (reached in the fourth quarter of 2008). It does not appear, though, that this recently observed spike in job separation probability breaks the trend - the peak observed is still below those observed in the past recession.

It is the decline in job finding probability - from the peak of about 45 percentage points in the third quarter of 2006 to the unprecedented low of 20 percentage points in the first quarter of 2010 – that truly stands out. From Figure 5 we see the decline in job finding probability began slightly before the rise in job separation probability (the peak of job finding probability falls on the third quarter of 2006, whereas the trough of job separation probability occurs in the first quarter of 2007). Comparing the relative contributions of falling job finding probability and rising job separation probability over time will provide us with a greater understanding of the driving forces behind the increases in the unemployment rate.

Figure 7 shows the relative contributions of the two rates to the aggregate unemployment rate increase during the recession and aggregate unemployment rate decline during the recovery (computed as discussed in the methodology section). For all recessions shown, the job finding rate explains the majority of the recessionary peak-to-trough increases in the aggregate unemployment rate, and its role becomes increasingly important as the recession progresses. However, separation from employment also plays a significant role in unemployment rate fluctuations, especially early in the recession and particularly during the two most severe recessions in the sample (the twin recessions of the 1980s and the recession of 2007).

Job finding probability plays a dominant role in the unemployment rate decline during the recovery for the first three recessions in our sample (as is shown in the bottom panel of Figure 7). However, our results suggest that this is not the case in the most recent recovery. Our results imply that in the most recent recovery, job finding probability did not pick up sufficiently to drive down the unemployment rate. Thus, the modest decline in the unemployment rate observed over our sample has been driven by declines in job separation probability and job finding probability did not pick up enough to sufficiently drive down the aggregate unemployment rate. The question is whether this is the case for all industries.

Job flows by industry and their contributions to the aggregate unemployment rate changes To answer this question we focus on industry-specific flows. Historically speaking, public administration has had the lowest average job separation probability for the whole sample (1 percent) and construction has the highest (6 percent). In terms of job finding probability, the highest sample averages are observed in agriculture, services and wholesale and retail trade (44 percent for construction and 42 percent for both wholesale and retail trade and services), whereas public administration has the lowest average job finding probability (35 percent).

In figures 8 and 9, the job finding and separation probabilities are shown separately for each industry and for each recession. The figures show the dynamics of job finding and separation probabilities respectively from the peak of the business cycle. In figure 8 we see that the decline in job finding probability during the most recent downturn is considerably more pronounced than it was in the previous recessions for all the industries shown. As with the aggregate job finding probability series, during the most recent downturn, job finding probability for all industries reached its lowest point in the history of the series. Some industries were impacted sooner than others. Construction and manufacturing were among the first to experience a decline in the job finding probability (3^{rd} quarter of 2006), followed by wholesale and retail trade (1^{st} quarter of 2007), transportation and utilities and services (3^{rd} quarter of 2007) and then FIRE and public administration (4^{th} quarter of 2007). Although it was impacted later than other industries, FIRE stands out as the industry in which the job finding probability dropping below both the aggregate and industry-specific long-run average rates. Job finding probability appears to have begun recovering for construction, manufacturing and wholesale and retail trade industries, but it is stagnant for the other sectors. Irrespective of showing improvements, for all the industries, the job finding probability remains at remarkably low levels.

Turning to job separation probability (figure 9), the peak observed during the most recent downturn is not without precedent – job losses in previous recessions caused larger job separation probability spikes. Just like with job finding probabilities, some industries were impacted sooner than others. Construction, FIRE, manufacturing and public administration exhibit noticeable increases in job separation probability, with construction and manufacturing being "hit" first, followed by FIRE and then public administration.

The contributions of the job finding and job separation probabilities to the aggregate unemployment rate changes during recession and recovery are summarized in Table 3. The top panel of the table shows each industry's contribution to the aggregate unemployment rate increase (pre-recession trough to recessionary peak) for each of the four recessions. In the table, columns labeled "f" show the contribution of job finding probability to the unemployment rate change and column labeled "s" shows the contribution of job separation probability. For instance, the table shows that the decline in job finding rate in construction contributed 0.58 percentage points to the aggregate unemployment rate increase during the most recent downturn - the largest contribution of job finding in construction to the a recessionary unemployment rate increase during our sample period. The decline in job finding probability in services was by far the largest contribution to the aggregate unemployment rate increase - it was as high as 1.86 percent (which is not surprising, given that services have such a high share in the labor force). The job finding probability in manufacturing was the second highest contributor to the aggregate unemployment rate increase (0.63 percentage points), with wholesale and retail trade following close behind (0.6 percentage point). The increase in job separation rate in construction contributed 0.27 percentage points to the aggregate unemployment rate decrease. This was the largest contribution of industry job separation rate to the recessionary aggregate unemployment rate increase, followed by manufacturing (0.24 percentage points).

During the recovery (see the bottom panel of Table 3), our results imply that declines in job separation probability in construction and manufacturing played the largest role in the aggregate unemployment rate decline observed after the Great Recession over our sample. Improvements in job finding probability in these two sectors also provided sizeable contributions to the aggregate unemployment rate decline. Note that this contribution could be larger if in fact Shimer's methodology underestimates the job finding probability during the recovery. On the other hand, services, which typically would aid the recovery, have not been contributing to the aggregate unemployment rate decline in recent months. Hence, the conclusion that its contribution to the recovery is unusually low relative to other sectors stands under the assumption that the degree of downward bias in job finding probability estimates is similar across sectors. Contraction in public administration employment actually put upward pressure on the aggregate unemployment rate during the most recent recovery (in contrast to the past episodes). It is the low job finding probability in public administration, in particular that is at play. In light of the budget squeeze and contraction in employment at all levels of government in the United States taking place over our sample period, it is highly unlikely that the job finding probability is statistically significantly understated.

4.3 Diffusion indices

With the industry-specific job finding and separation probabilities in hand, we look at the dispersion of job finding probability to assess the degree of differences across industries. Large differences would signal presence of structural changes. As discussed in the introduction, structural and cyclical changes in the unemployment rate call for different policy response.

The original Lilien (1982) dispersion measure served as a way to quantify the degree of sectoral reallocation in an economy at any given time based on standard deviations of employment growth. Here, we examine the dispersion of flows out of unemployment (job finding probability) as a weighted average of squared deviations of industry flows from the aggregate. The idea is that if all sectors are recovering at the same pace the deviation will be close to zero. If there is sectoral allocation and some industries are recovering faster then the job finding probability for those will be greater than the average and in those recovering more slowly it will be smaller. Lilien's measure is given by

$$\sigma_{Lt} \equiv \sqrt{\left[\sum_i w_{it}(g_{it} - g_t)^2\right]}, \tag{22}$$

where w_{it} is each industry's share in the labor force, g_{it} is each industry's job finding rate and g_t is the aggregate job finding rate.[11] The dispersion index of job finding probabilities across industries can be found in Figure 10. Initially, the measure of dispersion rose during the most recent recession to levels comparable to those observed during the twin recessions of the 1980s, as job finding probability in some industries was falling sooner than in others. However, the dispersion index fell more recently, as job finding probability fell across all industries. When trying to assess the degree of job finding dispersion across industries we use a couple of useful benchmarks. First, we compare the dispersion attained during this recession to that achieved during the twin recession of the 1980s, as that recession is generally not thought of as the one with large structural changes (see Valletta and Kuang (2010)). As Figure 10 shows, the degree of dispersion attained

[11]It is well known that Lilien's dispersion measure may be over-stating the degree of structural changes in the economy Abraham and Katz (1986) and other measures have been developed (see, for instance Rissman (2009)). However, in our case, an alternative measure is not necessary (see the discussion that follows).

during this recession is not materially above that attained during the early 1980s. Another benchmark that can be used is the maximum degree of dispersion during the 2000-2007 period, which is the period associated with stable NAIRU.[12] Again, the level of dispersion attained during the recession of 2007 and the recovery is below that benchmark as well. Thus, based on this criteria, we do not have evidence in support of large structural changes under way in the U.S. economy.

As previously mentioned, the presented Lilien diffusion index is known for over-stating the degree of structural change. Given our conclusion, however, this does not appear to be an issue in our case as we do not find evidence to support the structural change hypothesis. Using a less biased estimate would likely only strengthen our conclusion.

5 Summary and Discussion

In this paper, using uniquely constructed data for the US we find that during recessions (and recoveries) industries were affected with a different intensity and contributed differently to the unemployment rate. In the most recent downturn, services, manufacturing and construction contributed the most to the increase in the aggregate unemployment rate, but they were large contributors in the past recessions as well. Construction can be considered as much harder hit, as its contribution to the unemployment rate by far exceeds its labor force share. For services, the opposite is true as its contribution to the unemployment rate increase is relatively small considering it employs 50% of the labor force. Manufacturing is another relatively large sector (labor force share exceeds 10 percent) that suffered disproportionately more by this measure. FIRE, a sector of interest during the recent downturn, can be considered relatively unaffected, as it experienced an increase in unemployment below its share in the labor force.

During the recovery, unlike financial services, construction and manufacturing, rebounded relatively well, contributing more than their labor force share to the aggregate unemployment rate decline during the recovery. Services, on the other hand, dragged the recovery by not contributing to the unemployment rate decline sufficiently given its substantial participation in the labor force.

The severity of the situation is confirmed to some extent when data on unemployment duration is considered. Findings from 2010 indicate that across industries, jobless individuals from information, and financial activities are the most likely to be long-term unemployed (Autor (2010)). Our findings also point to what has been labeled as a jobless recovery possibly through job polarization characterized by a disappearance of middle-skill jobs in for example, Jaimovich and Siu (2012), which would include services.

[12]Periods of stable NAIRU can be classified as periods without large structural changes in the labor market. The CBO estimate of NAIRU for this entire period is 5 percent.

When job flows are considered we find that industries are affected at different times. FIRE is the last industry that saw the job separation probability hit its minimum point in this recession. At the same time its the last one to see its job finding probability hit the lowest point. The dramatic decline in the job finding probability seems to be the main source of the recessionary unemployment rate increase. In particular, flows in services, manufacturing, construction and wholesale, and retail trade are large contributors. The continually low job finding probability is preventing the unemployment rate from declining more rapidly during the recovery. Services and public administration stand out as sectors that provided relief in the past recoveries, but are not doing so this time around.

We do not find support of large structural changes in the U.S. labor market in our data, although, there is some variation in the job finding probability performance across industries. The diffusion index we considered is not unusually high in comparison to the chosen benchmarks.

Further analysis could be centered around not only identifying the pace of recovery among industries, but identifying in more detail, which occupations are dragging or energizing the recovery.

References

Abraham, K. G. and Katz, L. F. (1986). Cyclical unemployment: Sectoral shifts or aggregate disturbances? *Journal of Political Economy*, 94:507–522.

Autor, D. H. (2010). U.S. Labor Market Challenges over the Longer Term.

Autor, D. H. (2011). Impending labor market challenges: Males between the blades of the marshallian scissors.

Darby, M. R., Haltiwanger, J. C., and Plant, M. W. (1986). The ins and outs of unemployment: The ins win. NBER Working Papers 1997, National Bureau of Economic Research, Inc.

Elsby, M., Hobijn, B., and Sahin, A. (2010). The Labor Market in the Great Recession. *Brookings Papers on Economic Activity*, forthcoming.

Elsby, M. W. L., Hobijn, B., Sahin, A., and Valletta, R. G. (2011). The labor market in the great recession an update to september 2011. *Brookings Papers on Economic Activity*, 43(2 (Fall)):353–384.

Elsby, M. W. L., Michaels, R., and Solon, G. (2009). The Ins and Outs of Cyclical Unemployment. *American Economic Journal: Macroeconomics*, 1(1):84–110.

Hall, R. E. (2005a). Employment Efficiency and Sticky Wages: Evidence from Flows in the Labor Market. *The Review of Economics and Statistics*, 87(3):397–407.

Hall, R. E. (2005b). Job Loss, Job Finding, and Unemployment in the U.S. Economy Over the Past Fifty Years. NBER Working Papers 11678, National Bureau of Economic Research, Inc.

Hoynes, H., Miller, D. L., and Schaller, J. (2012). Who suffers during recessions? *Journal of Economic Perspectives*, 26(3):27–48.

Jaimovich, N. and Siu, H. E. (2012). The trend is the cycle: Job polarization and jobless recoveries. Working Paper 18334, National Bureau of Economic Research.

Michaelides, M. and Mueser, P. R. (2012). The role of industry and occupation in u.s. unemployment differentials by gender, race and ethnicity: Recent trends. *Eastern Economic Journal*, pages 1–29.

Rissman, E. (2009). Employment growth: Cyclical movements or structural change? *Federal Reserve Bank of Chicago Economic Perspectives*, 2009/Q4.

Shimer, R. (2005a). The cyclical behavior of equilibrium unemployment and vacancies. *American Economic Review*, 95:25–49.

Shimer, R. (2005b). The cyclicality of hires, separations, and job-to-job transitions. Technical Report Jul.

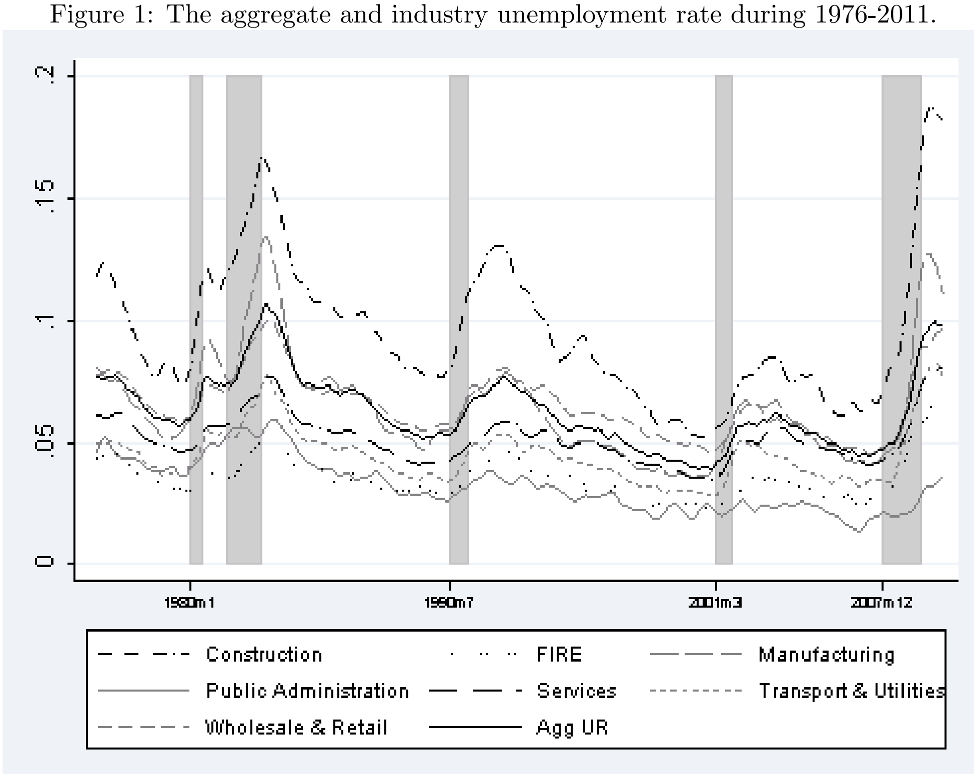
Shimer, R. (2007). Reassessing the ins and outs of unemployment. NBER Working Paper 13421, NBER.

Sierminska, E. and Takhtamanova, Y. (2011). Job flows, demographics and the great recession. *Research in Labor Economics*, 32:115–154.

Valletta, R. and Kuang, K. (2010). Is structural unemployment on the rise? *FRBSF Economic Letter*, 34.

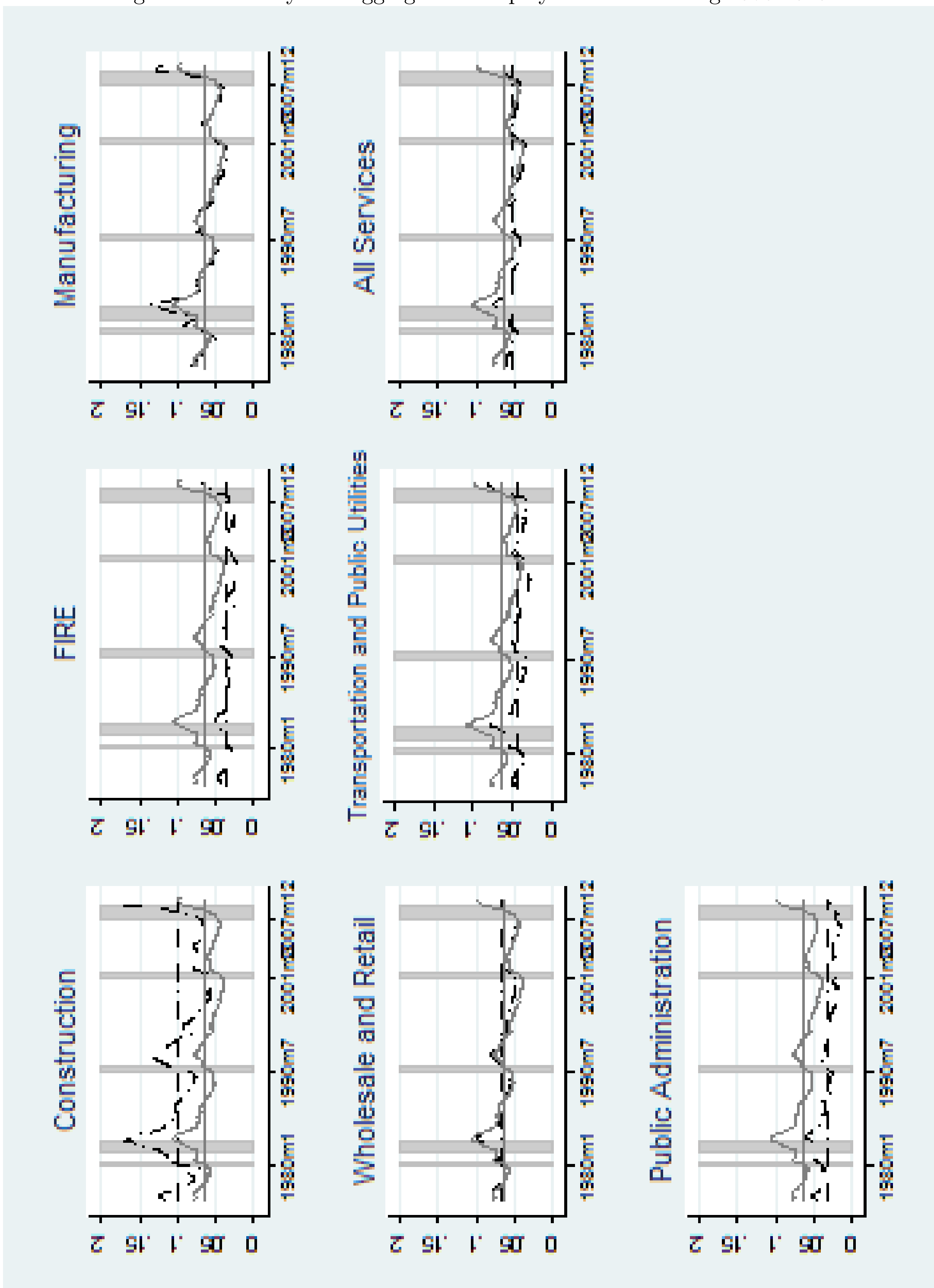
6 Tables and Figures

Figure 1: The aggregate and industry unemployment rate during 1976-2011.



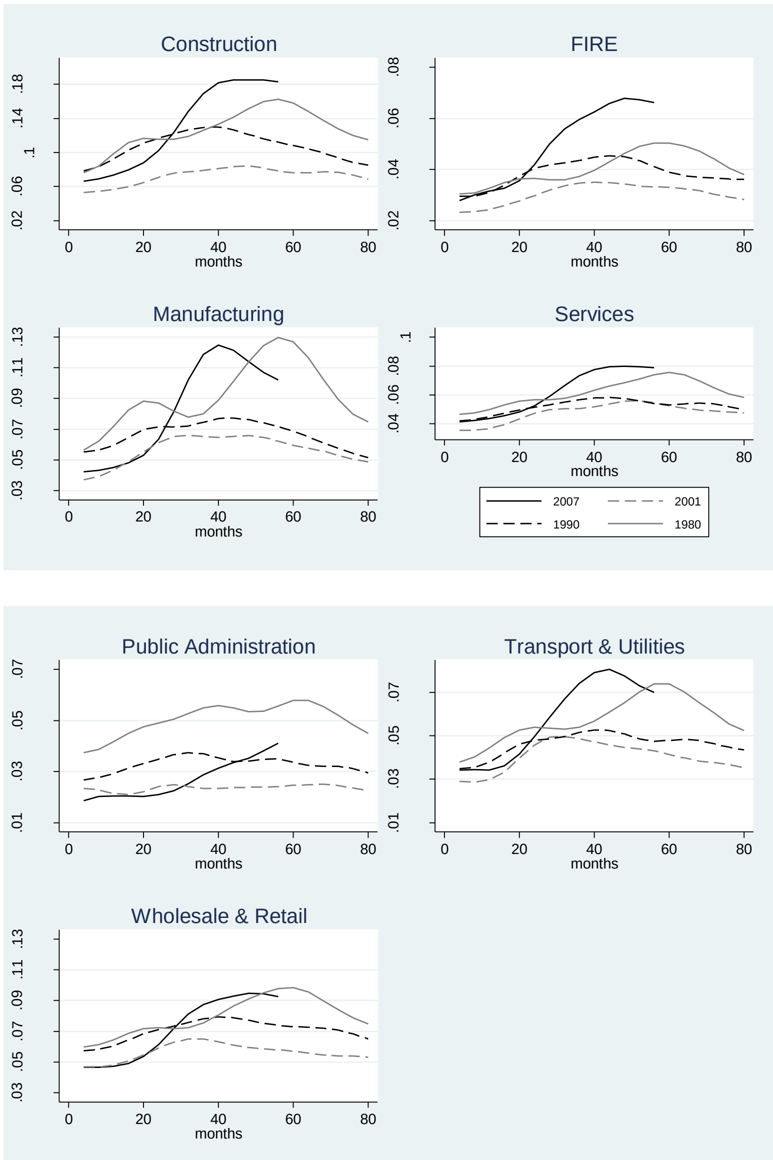
Source: Bureau of Labor Statistics, Current Population Survey.

Figure 2: Industry and aggregate unemployment rate during 1976-2010.



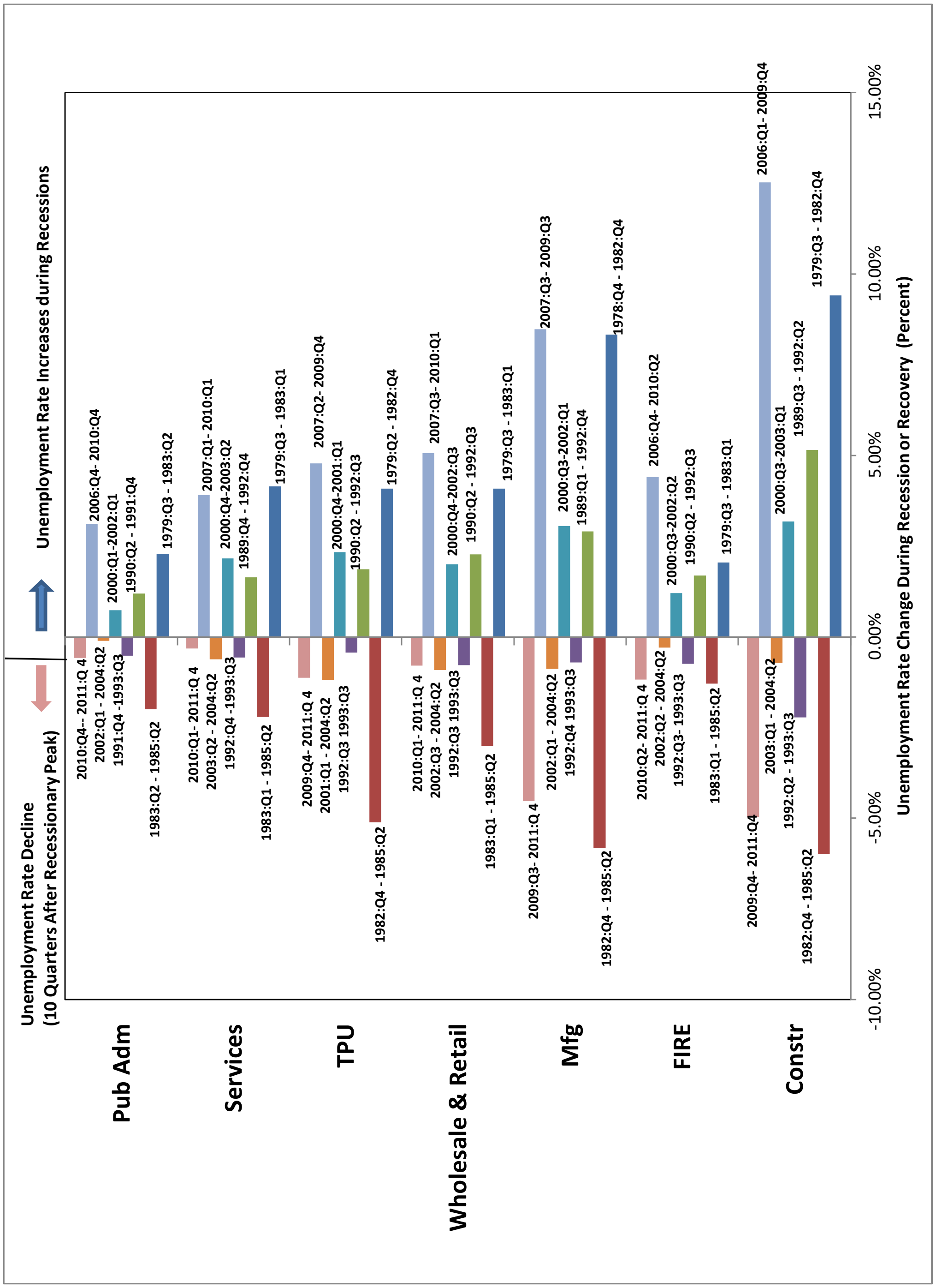
Source: Bureau of Labor Statistics, Current Population Survey.
Note: Sold lines represent the aggregate unemployment rate and the average aggregate unemployment rate. Dashed lines represent the industry unemployment rate and average industry unemployment rate during the period. Recession periods are shaded in gray.

Figure 3: Industry unemployment rate during 1976-2011 (months since peak of business cycle).



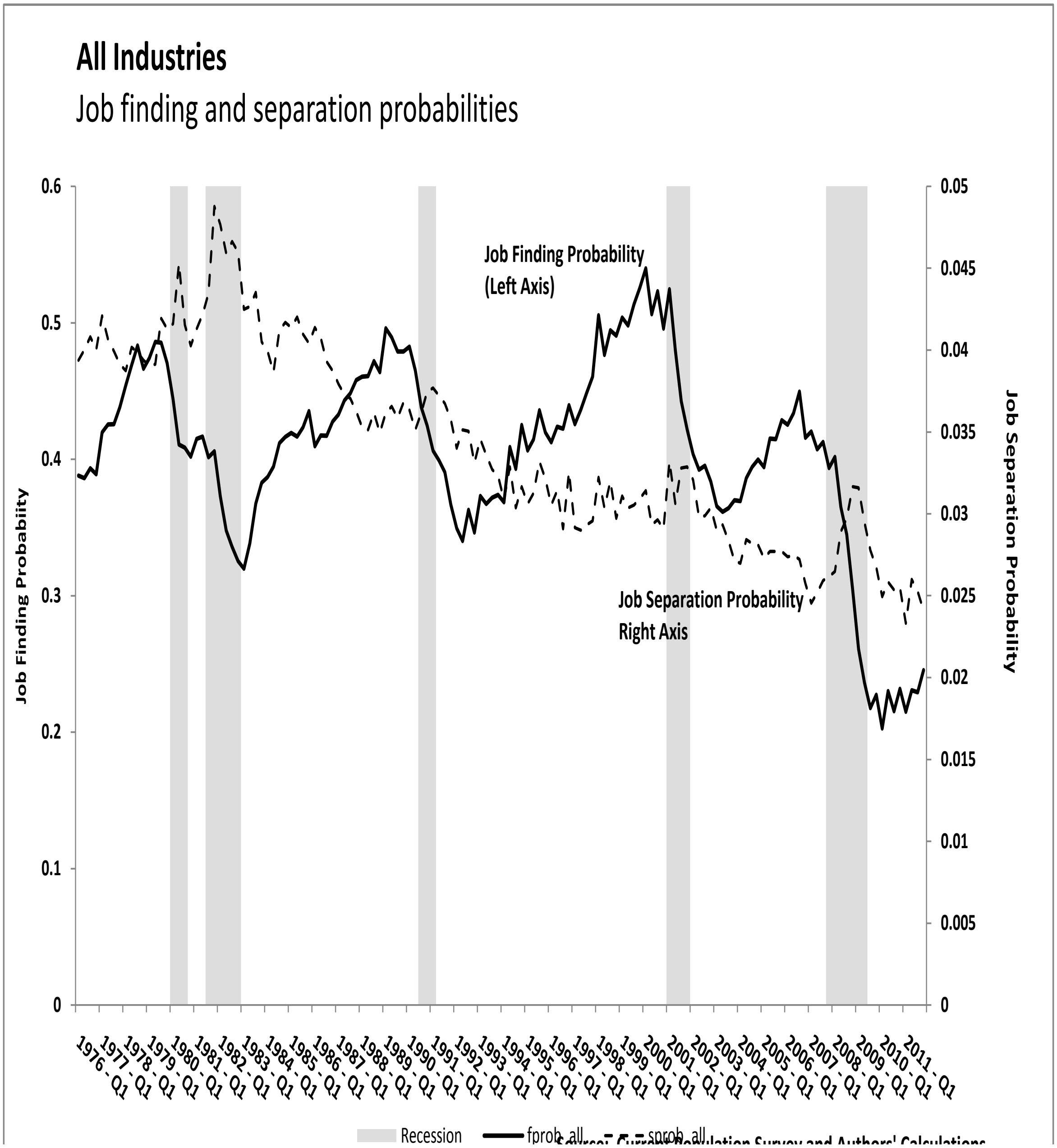
Source: Bureau of Labor Statistics, Current Population Survey.

Figure 4: The aggregate and industry unemployment rate decline and increase during 1976-2011. (The dates used for the computations in this figure are *industry-specific* peaks and troughs in the unemployment rates).



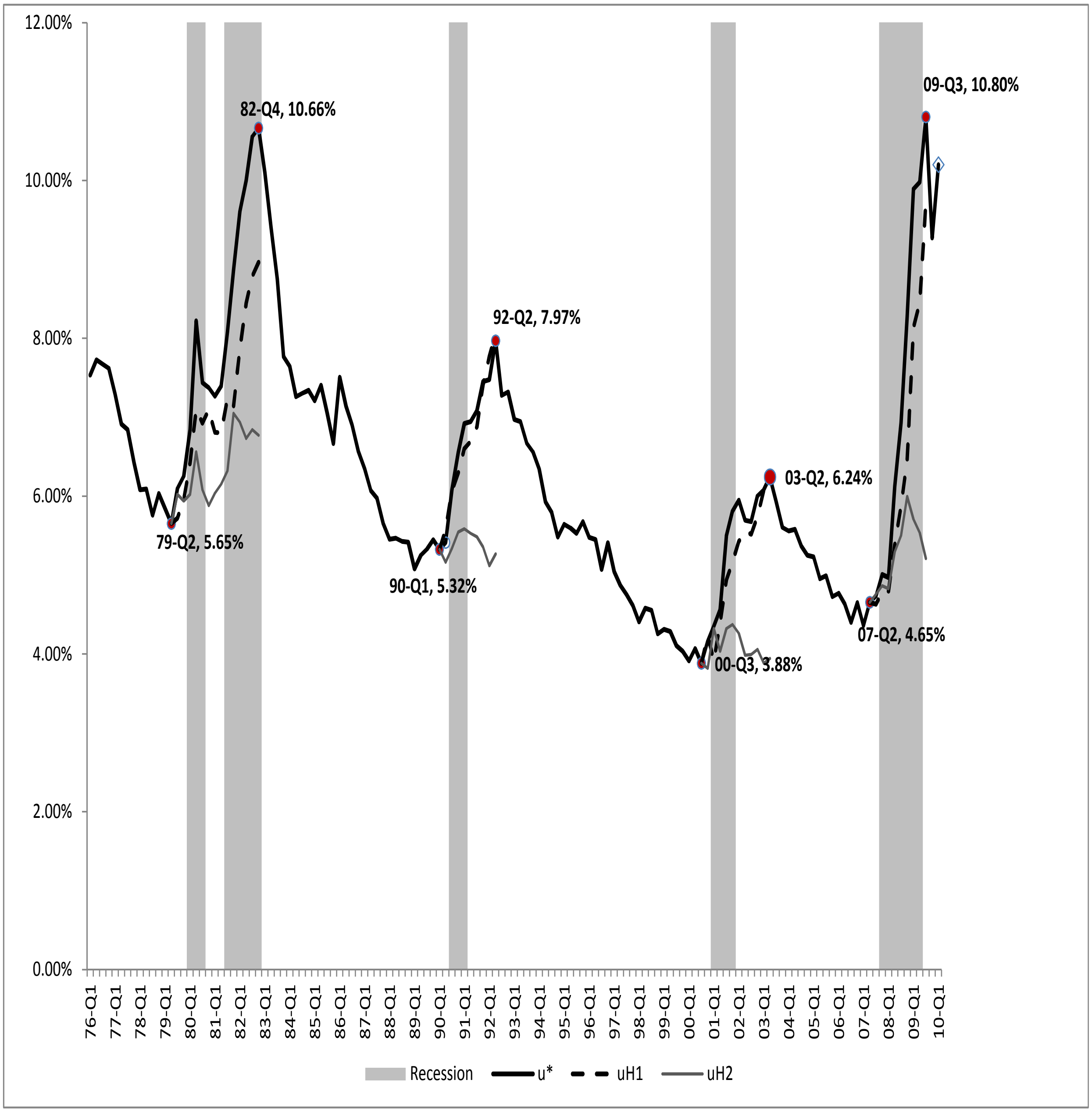
Source: Bureau of Labor Statistics, Current Population Survey.

Figure 5: Aggregate flows during 1976-2010.



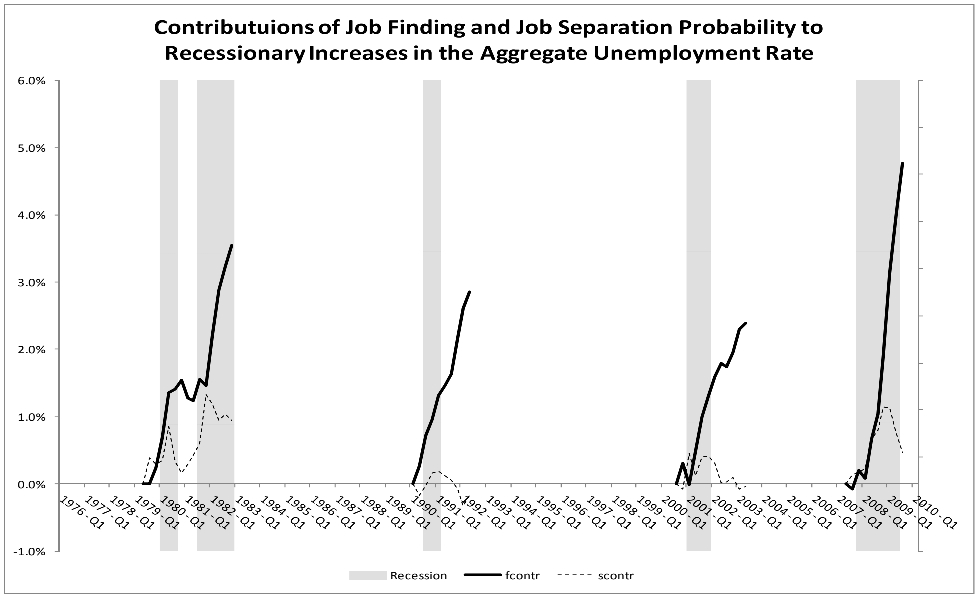
Source: Bureau of Labor Statistics, Current Population Survey.

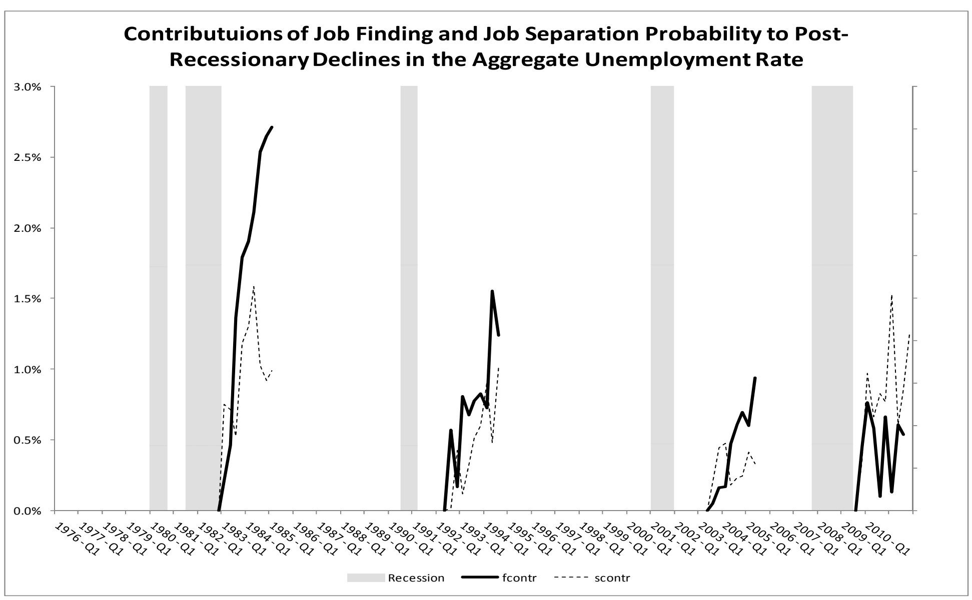
Figure 6: Computing Contributions of Job Finding and Separation Rates to the Aggregate Unemployment Rate Increase.



Source: Bureau of Labor Statistics, Current Population Survey.

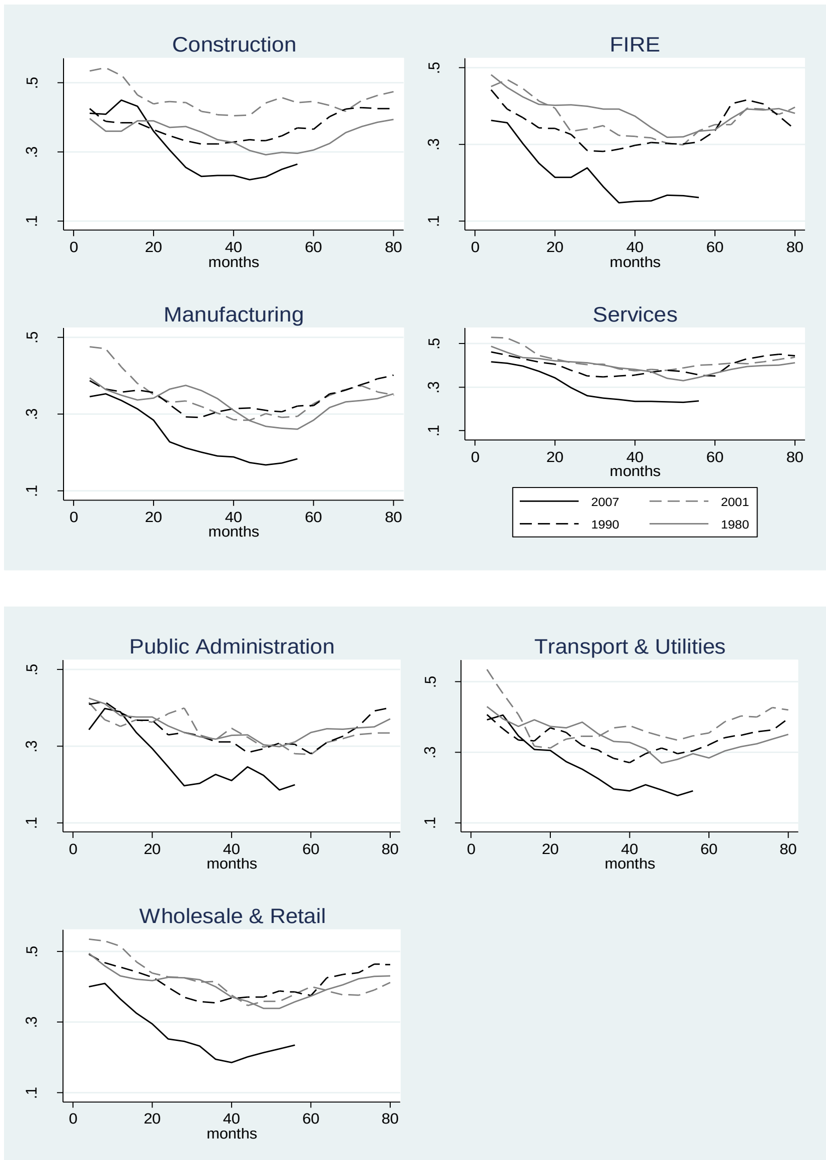
Figure 7: Flows contribution to the aggregate unemployment rate (1976-2010).





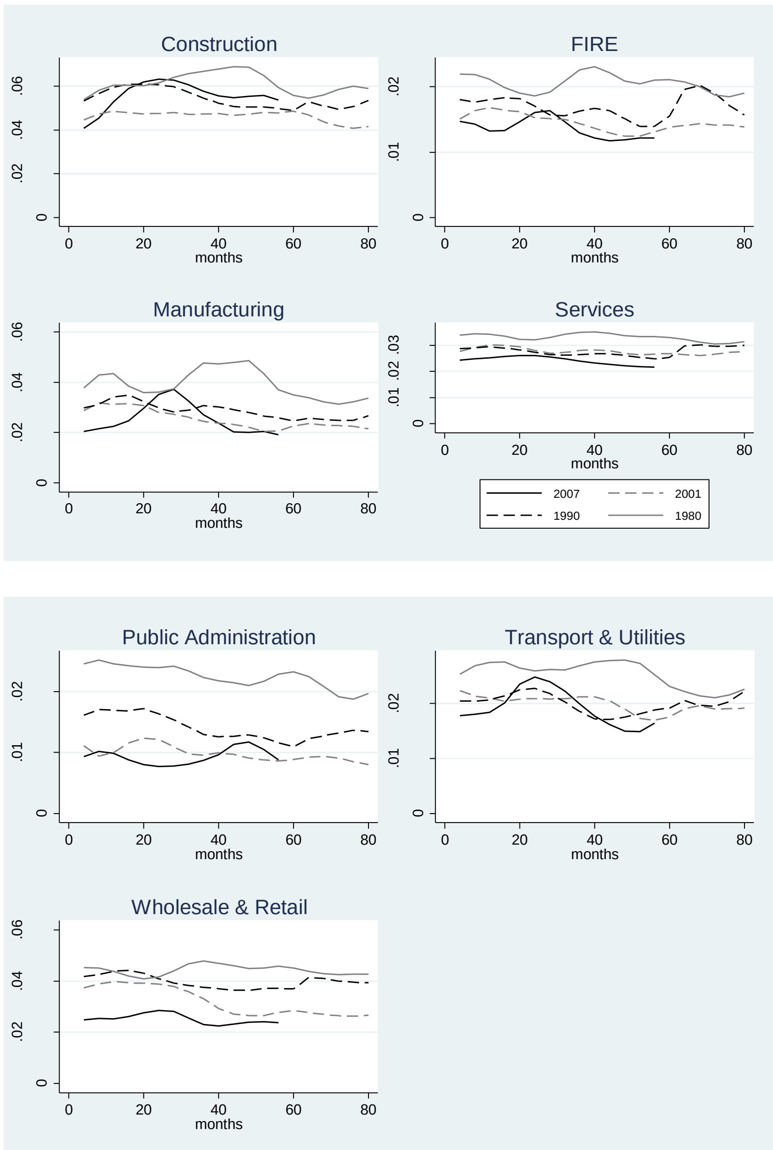
Source: Bureau of Labor Statistics, Current Population Survey.

Figure 8: Job finding probability by industry during 1976-2011.



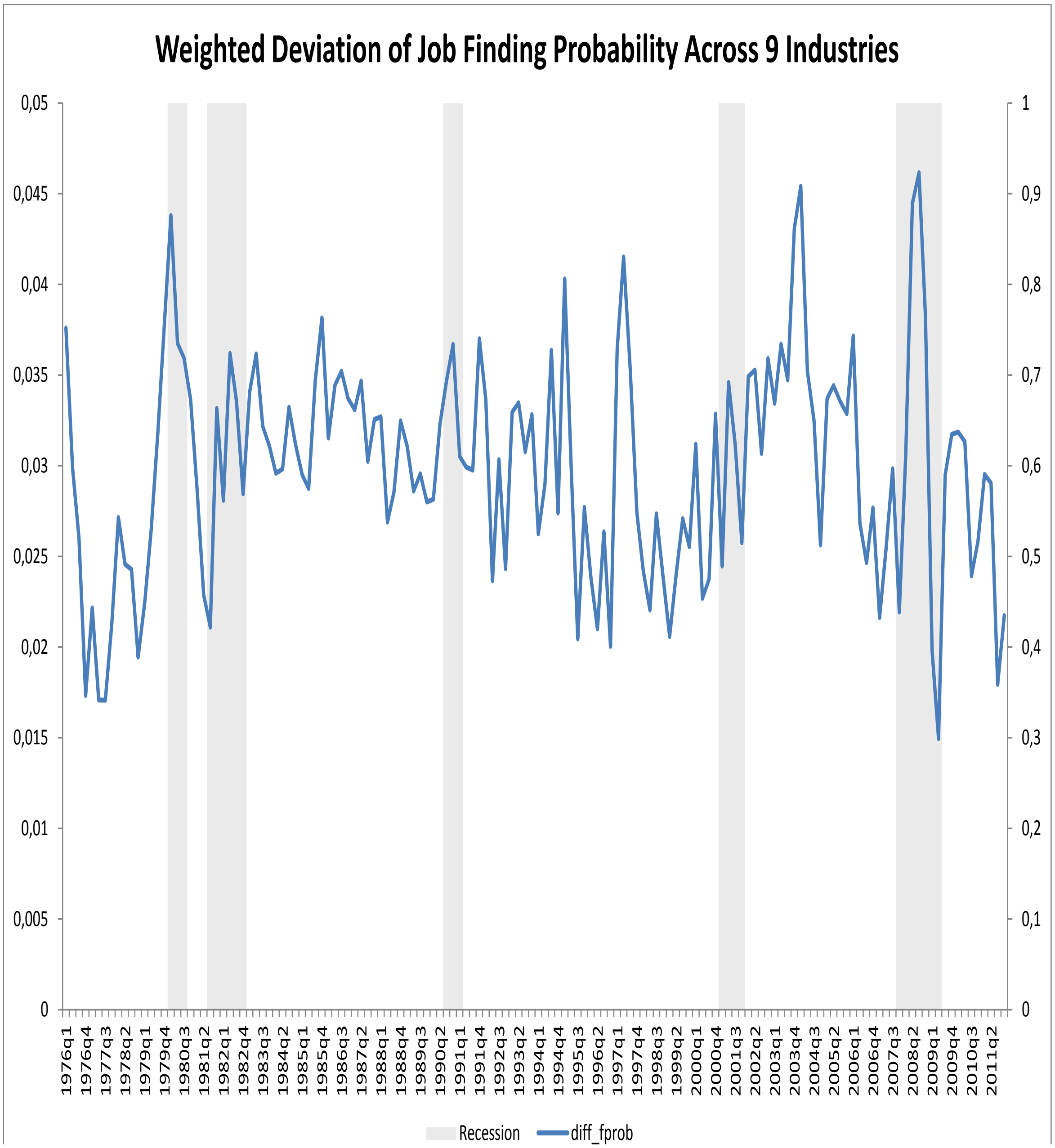
Source: Bureau of Labor Statistics, Current Population Survey.

Figure 9: Job separation probability by industry during 1976-2011.



Source: Bureau of Labor Statistics, Current Population Survey.

Figure 10: Dispersion in Job Finding Probability across Industries.



Source: Bureau of Labor Statistics, Current Population Survey.

Table 1: Descriptive statistics by industry.

	Agric.	**Mining**	**Constr.**	**FIRE**	**Mfg**	**Whlsl**	**Transp.**	**Serv.**	**Admin**	**All**
Average share in Labor Force										
1976:1-1979:12	0.027	0.008	0.067	0.059	0.209	0.148	0.047	0.384	0.052	1
1980:1-1989:12	0.024	0.008	0.069	0.066	0.185	0.149	0.050	0.403	0.047	1
1990:1-1999:12	0.021	0.005	0.068	0.068	0.155	0.149	0.051	0.438	0.046	1
2000:1-2007:11	0.017	0.004	0.078	0.070	0.124	0.148	0.052	0.463	0.044	1
2007:12-2010:5	0.016	0.004	0.078	0.068	0.107	0.142	0.052	0.488	0.046	1
Total sample	0.021	0.008	0.072	0.066	0.156	0.147	0.050	0.435	0.047	1
Average Unemployment Rate										
1976:1-1979:12	0.059	0.045	0.096	0.038	0.059	0.068	0.044	0.057	0.042	0.067
1980:1-1989:12	0.077	0.095	0.114	0.037	0.072	0.072	0.051	0.058	0.042	0.073
1990:1-1999:12	0.069	0.056	0.091	0.034	0.053	0.064	0.041	0.049	0.029	0.058
2000:1-2007:11	0.079	0.057	0.069	0.029	0.051	0.053	0.038	0.037	0.022	0.050
2007:12-2010:5	0.063	0.051	0.142	0.053	0.092	0.077	0.063	0.065	0.026	0.078
Total sample	0.072	0.065	0.104	0.038	0.067	0.067	0.048	0.052	0.030	0.065
Standard deviation of Unemployment Rate										
1976:1-1979:12	0.007	0.009	0.018	0.006	0.010	0.008	0.006	0.006	0.005	0.008
1980:1-1989:12	0.013	0.038	0.025	0.007	0.021	0.012	0.012	0.010	0.010	0.015
1990:1-1999:12	0.012	0.018	0.025	0.007	0.011	0.009	0.008	0.008	0.006	0.010
2000:1-2007:11	0.007	0.012	0.010	0.005	0.011	0.007	0.007	0.006	0.004	0.007
2007:12-2010:5	0.018	0.030	0.044	0.015	0.032	0.019	0.018	0.015	0.007	0.020
Total sample	0.011	0.021	0.025	0.008	0.017	0.011	0.010	0.009	0.007	0.012

Source: Bureau of Labor Statistics, Current Population Survey. FIRE - Finance, Insurance and Real Estate

Table 2: Industry-specific contributions to the recessionary aggregate unemployment rate increase and decline 9 quarters after recessionary peak.

Increase		Const.	Ag.	Mining	FIRE	Mfg	Whlsl & Rtl	Serv	Trnsp. and Pub Util	Public Adm.
Avg. Share in LF	1979:Q2 - 1982:Q4	6.8%	2.3%	0.9%	6.1%	20.2%	14.6%	38.2%	4.8%	5.0%
	1990:Q1 - 1992:Q2	6.9%	2.0%	0.6%	6.8%	16.5%	14.8%	42.1%	5.1%	4.6%
	2000:Q3 - 2003:Q2	7.5%	1.7%	0.4%	6.8%	13.2%	14.7%	45.8%	5.2%	4.4%
	2007:Q2 - 2009:Q2	8.0%	1.5%	0.5%	6.9%	10.9%	14.2%	48.1%	5.2%	4.5%
Contr. To UR Increase (Percent)	1979:Q2 - 1982:Q4	13.1%	2.2%	2.5%	2.9%	32.4%	13.8%	26.7%	4.5%	1.8%
	1990:Q1 - 1992:Q2	16.1%	2.0%	0.7%	4.8%	15.2%	16.8%	37.7%	4.8%	1.8%
	2000:Q3 - 2003:Q2	12.4%	0.5%	0.6%	4.2%	16.3%	9.9%	53.3%	3.2%	-0.4%
	2007:Q2 - 2009:Q2	17.5%	2.0%	1.0%	4.4%	17.9%	12.3%	39.0%	4.6%	1.3%
Industry's "Burden": Industry's Contr / Industry's LF Share	1979:Q2 - 1982:Q4	1.9	1.0	2.9	0.5	1.6	0.9	0.7	0.9	0.4
	1990:Q1 - 1992:Q2	2.3	1.0	1.3	0.7	0.9	1.1	0.9	0.9	0.4
	2000:Q3 - 2003:Q2	1.7	0.3	1.6	0.6	1.2	0.7	1.2	0.6	-0.1
	2007:Q2 - 2009:Q2	2.2	1.3	1.9	0.6	1.6	0.9	0.8	0.9	0.3
Decline		**Const.**	**Ag.**	**Mining**	**FIRE**	**Mfg**	**Whlsl & Rtl**	**Serv**	**Trnsp. and Pub Util**	**Public Adm.**
Avg. Share in LF	1982:Q4 -- 1985:Q1	6.9%	2.3%	0.8%	6.4%	18.6%	14.9%	39.5%	5.0%	4.5%
	1992:Q2--1994:Q3	6.7%	2.0%	0.5%	6.7%	15.6%	14.9%	43.1%	5.2%	4.6%
	2003:Q2 - 2005:Q3	7.8%	1.6%	0.4%	7.0%	11.9%	15.1%	46.5%	5.0%	4.4%
	2009:Q2 - 2011:Q4	7.2%	1.6%	0.5%	6.6%	10.3%	14.2%	49.5%	5.1%	4.7%
Contr. To UR Decline (Percent)	1982:Q4 -- 1985:Q1	11.0%	1.4%	2.4%	2.1%	38.3%	13.9%	23.9%	4.0%	3.0%
	1992:Q2--1994:Q3	24.9%	0.8%	1.0%	4.2%	33.2%	13.7%	18.0%	3.1%	1.1%
	2003:Q2 - 2005:Q3	11.9%	2.5%	1.4%	3.2%	25.6%	9.0%	41.2%	4.5%	0.7%
	2009:Q2 - 2011:Q4	46.1%	-1.4%	1.9%	4.3%	46.9%	1.2%	1.7%	2.4%	-3.1%
Industry's "Burden": Industry's Contr / Industry's LF Share	1982:Q4 -- 1985:Q1	1.6	0.6	2.9	0.3	2.1	0.9	0.6	0.8	0.7
	1992:Q2--1994:Q3	3.7	0.4	1.9	0.6	2.1	0.9	0.4	0.6	0.2
	2003:Q2 - 2005:Q3	1.5	1.5	3.6	0.5	2.2	0.6	0.9	0.9	0.1
	2009:Q2 - 2011:Q4	6.4	-0.9	3.5	0.7	4.6	0.1	0.0	0.5	-0.7

Note: This table uses peak and trough dates for the aggregate hypothetical unemployment rates as presented in Figure 6 and discussed in the methodology section.

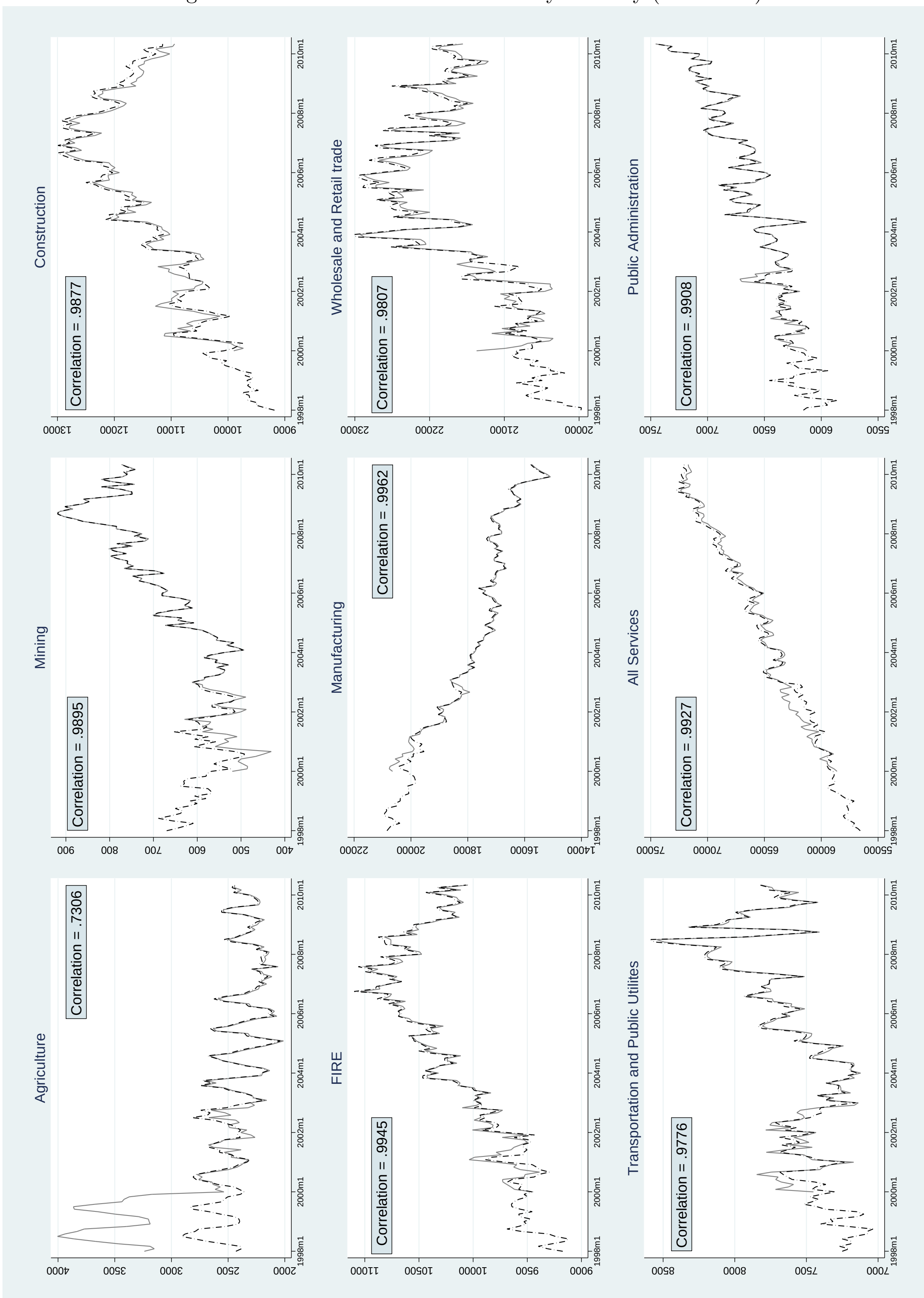
Table 3: Contributions of Industry-Specific Job Finding and Separation Rates to Recessionary Unemployment Rate Increases and Declines (percentage points).

Increases	**Const**		**Ag**		**Mining**		**FIRE**		**Mfg**	
	f	**s**	**f**	**s**	**f**	**s**	**f**	**s**	**f**	**s**
1979:Q2 - 1982:Q4	0.41%	0.18%	0.08%	0.02%	0.02%	0.10%	0.11%	0.02%	1.04%	0.42%
1990:Q1 - 1992:Q2	0.24%	0.09%	0.04%	0.00%	0.01%	0.00%	0.11%	-0.02%	0.35%	-0.04%
2000:Q3 - 2003:Q2	0.20%	0.04%	0.02%	-0.01%	0.01%	0.00%	0.10%	-0.02%	0.34%	-0.02%
2007:Q2 - 2009:Q2	0.58%	0.27%	0.04%	0.05%	0.02%	0.03%	0.22%	-0.01%	0.63%	0.24%
	Whls & Rtl		**Serv**		**Transp & Pub Utl**		**Pub Admin**			
	f	**s**	**f**	**s**	**f**	**s**	**f**	**s**		
1979:Q2 - 1982:Q4	0.56%	0.06%	1.08%	0.13%	0.15%	0.05%	0.08%	0.00%		
1990:Q1 - 1992:Q2	0.41%	-0.07%	0.95%	-0.18%	0.11%	-0.01%	0.05%	-0.01%		
2000:Q3 - 2003:Q2	0.29%	-0.09%	0.97%	0.08%	0.07%	0.00%	-0.04%	0.04%		
2007:Q2 - 2009:Q2	0.60%	0.00%	1.86%	0.03%	0.20%	0.03%	0.05%	0.01%		

Declines	**Const**		**Ag**		**Mining**		**FIRE**		**Mfg**	
	f	**s**	**f**	**s**	**f**	**s**	**f**	**s**	**f**	**s**
1982:Q4 - 1985:Q1	-0.21%	-0.13%	-0.06%	0.02%	-0.02%	-0.06%	-0.06%	0.00%	-0.75%	-0.44%
1992:Q2 - 1994:Q3	-0.23%	-0.08%	0.00%	-0.01%	0.00%	-0.01%	-0.12%	0.07%	-0.22%	-0.18%
2003:Q2 - 2005:Q3	-0.07%	-0.05%	-0.04%	0.01%	0.00%	-0.02%	-0.05%	0.01%	-0.21%	-0.06%
2009:Q2 - 2011:Q4	-0.19%	-0.29%	0.01%	0.01%	0.00%	-0.02%	-0.03%	-0.01%	-0.10%	-0.39%
	Whls & Rtl		**Serv**		**Transp & Pub Utl**		**Pub Admin**			
	f	**s**	**f**	**s**	**f**	**s**	**f**	**s**		
1982:Q4 - 1985:Q1	-0.38%	-0.05%	-0.66%	-0.09%	-0.09%	-0.03%	-0.08%	-0.01%		
1992:Q2 - 1994:Q3	-0.23%	0.07%	-0.45%	0.23%	-0.04%	0.00%	-0.01%	0.00%		
2003:Q2 - 2005:Q3	-0.08%	-0.02%	-0.39%	-0.05%	-0.03%	-0.01%	0.00%	-0.01%		
2009:Q2 - 2011:Q4	0.00%	-0.01%	0.00%	-0.02%	-0.01%	-0.02%	0.04%	0.00%		

Note: This table uses peak and trough dates for the aggregate hypothetical unemployment rates (as presented in Figure 6 and discussed in the methodology section.)

Figure A1: Matched labor force series by industry (2000-2010).



Source: Bureau of Labor Statistics, Current Population Survey.
Note: Sold lines represent the BLS published series. Dashed lines represent the industry labor force series after reclassification.

Table A1: Distribution of employment from the 1990 to the 2002 Census Industrial Classification by major industry group (percent distribution).

	1990 Industry Group								
2002 Industry Group	Agric.	Mining	Constr.	Manuf.	Transp.	Wholesale	FIRE	Services	Pub.admin.
Total for industry (in 000s)	3,318	534	9,682	19,245	9,799	28,096	8,949	51,006	6,141
Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture, forestry, fishing, and hunting	58.8	0.2	0.1	0.7	0.1	0.3	[1]	0.3	0.2
Mining	[1]	80.4	0.1	0.1	0.1	0.1	[1]	[1]	[1]
Construction	0.9	2.1	92.4	1.2	1.2	0.9	1.0	0.6	0.8
Manufacturing	0.7	6.0	1.3	86.2	1.0	3.5	0.3	1.0	0.4
Wholesale and retail trade	1.9	4.7	1.2	2.7	1.4	65.2	0.5	1.2	0.4
Transportation and utilities	0.3	2.3	0.9	0.5	67.1	0.7	0.2	0.5	0.8
Public administration	0.2	0.2	0.8	0.2	0.7	0.1	0.4	0.9	89.8
Financial activities	0.1	0.9	0.3	0.2	0.6	0.5	93.2	1.6	0.7
Services:									
Professional and business services	33.8	2.5	1.4	2.1	6.4	1.5	2.3	21.3	1.6
Education and health services	0.4	0.2	0.2	0.5	1.6	0.6	0.9	51.2	3.9
Leisure and hospitality	0.5	0.1	0.2	0.4	0.6	25.5	0.3	7.8	0.5
Information	[1]	0.1	0.4	4.6	19.0	0.5	0.2	1.9	0.2
Other services	2.3	0.4	0.8	0.5	0.5	0.6	0.7	11.7	0.5

Source: Bureau of Labor Statistics, Current Population Survey.
Note: [1] Value less than 0.05. Estimates are based on three-year average employment (2000-2002). FIRE - Finance, Insurance and Real Estate