

Where Do Jobs Go When Oil Prices Drop?

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Abstract

In this paper, we estimate a factor augmented vector autoregressive (FAVAR) model to investigate the effect of oil price shocks on total private job flows as well as on industry-level job creation and destruction. We find that in the first year following the oil price decline, oil and gas extraction and support activities for mining exhibit a reduction in job creation and an increase in job destruction. Instead, industries in construction, manufacturing and services exhibit a rise in the net employment change. As a result of the oil price decrease the pace of job reallocation slows down. We demonstrate that the increase (decrease) in private job creation (destruction) observed during the first year is primarily driven by the response of exiting and entering firms in services and manufacturing. By the second year an expansionary effect on net employment is observed in most sectors.

Keywords: oil prices, job flows, job reallocation.

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1 Introduction

In April of 2015 the Bureau of Labor Statistics (BLS) reported that U.S. employment growth in 2014 had been concentrated in mining, especially in the oil and gas industries. These gains in employment were attributed to increased production due to improved technologies that allowed the U.S. to extract oil from formations with very low permeability such as shale (Bureau of Labor Statistics, 2015). Yet, with both Brent and West Texas Intermediate (WTI) prices experiencing large declines since July of 2014, the question that arises is where do jobs go when oil prices drop?

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This paper employs data on U.S. job flows to investigate the effect of unexpected oil price decreases on the labor market. We build up on the work by Davis and Haltiwanger (2001) and Herrera and Karaki (2015) who explore the effect of oil price shocks on job reallocation. Although, these papers underscore the need to use disaggregated data in order to better understand the allocative effect of oil price shocks, their sample only covers the manufacturing sector. Moreover, the period spanned by their data extends only to the 1990s. Here we use a sample of eighty seven 3-digit NAICS sectors that comprise industries in agriculture, mining, construction, manufacturing, and services. The series are quarterly and cover the period between 1992:Q2 and 2014:Q4. The motivation for using this sample is twofold. First, previous investigations into the effect of oil price shocks on labor markets have focused on aggregate employment, sectoral employment, or have used only disaggregated data for U.S. manufacturing.¹ Hence, these studies have largely ignored the impact on labor flows at the interior of the services and mining sectors. Given the secular increase in the share of employment accounted for by services and the role that both oil and gas industries have played in generating jobs after the Great Recession, it would seem key to include these sectors in any analysis aimed at understanding the response of job flows to oil price shocks. Second, the literature on labor market frictions and business cycles has emphasized the importance of using disaggregated data in gauging the impact of shocks on job reallocation. Moreover, work by Davis and Haltiwanger (2014) reveals a decrease in the fluidity of U.S. labor markets since the 1990s. This decline suggests that we should re-examine the degree of job reallocation generated by oil price shocks using data that extends beyond the 1990s.

We estimate the effect of an unexpected decline in the real price of oil using a factor augmented vector autoregressive (FAVAR) model. We thus posit that job creation and destruction flows in the U.S. private sector depend both on a set of macroeconomic variables and on some unobserved com-

¹See for instance Kilian and Vigfusson (2011a), Davis and Haltiwanger (2001), Herrera and Karaki (2015).

mon industry factors, which are derived from the industry level data on job creation and destruction rates. We find significant heterogeneity in the magnitude of the job creation and destruction responses across industries. On the one hand, oil and gas extraction and support activities for mining exhibit a decrease in the rate of change in net employment during the first year. On the other hand, industries in construction, manufacturing and services respond to the decline in oil prices by expanding employment via higher job creation and lower job destruction. In particular, industries that are more energy intensive experience larger job gains. As a result, the pace of job reallocation, measured by excess job reallocation, declines. These results suggest that even during this period of lower job market fluidity and higher domestic oil production, employment in the private sector responds positively to lower oil prices.

Next we proceed to investigate whether the bulk of the adjustment is made by existing or entering/exiting firms. To do so we modify our FAVAR by separating the industry level data into the job creation generated by opening and expanding firms and the job destruction stemming from closing and contracting firms. Estimates of this modified FAVAR reveal interesting dynamics. Up to one year after the shock, the increase in private net employment is mainly driven by the response of opening and closing firms in services and manufacturing. Yet, as time goes by, expanding firms in all sectors increase the pace at which they generate jobs and contracting firms reduce the rate at which they shed jobs.

The remainder of the paper unfolds as follows. Section 2 describes the data used in the empirical analysis. The following section presents the empirical strategy. The dynamic response for total and industry level job flows is discussed in section 4. Section 5 asks which establishments, expanding/contracting or opening/closing, are most affected by a decline in oil prices. We set forth our main conclusions in section 6.

2 Data

The macro data comprises the log growth of the real oil price, the quality spread, and the total job creation and job destruction rates for the private sector (hereafter total job creation and total job destruction). We use the imported U.S. crude oil refiners acquisition cost reported by the Energy Information Agency to measure the nominal price of oil and deflate it by the CPI. Job creation and job destruction rates are obtained from the Business Employment Dynamics (BED) of the BLS. We employ data on these job flows for the total private sector and 87 three-digit NAICS industries including agriculture, mining, construction, manufacturing, and services. The quality spread is measured as the difference between the 3 month commercial paper rate and the Treasury bill rate. The 3 month commercial paper rate and the Treasury bill rate are obtained from the Federal Reserve Economic data (FRED) of the Federal Reserve Bank of Saint Louis.

The job creation rate ($POS_{i,t}$) in industry i at time t is given by

$$POS_{i,t} = POS_{expanding,i,t} + POS_{opening,i,t}, \quad (1)$$

where $POS_{expanding,i,t}$ stands for the job creation rate from expanding establishments and $POS_{opening,i,t}$ refers to the job creation rate from opening establishments. Similarly, the job destruction rate in industry i at time t is defined as

$$NEG_{i,t} = NEG_{contracting,i,t} + NEG_{closing,i,t}, \quad (2)$$

where $NEG_{contracting,i,t}$ refers to the job destruction rate from contracting establishments and $NEG_{closing,i,t}$ stands from gross job destruction rate for closing establishments.

Following Davis, Haltiwanger and Schuh (1996) we compute the net change in jobs in industry

i between quarter $t - 1$ and t as

$$NET_{i,t} = POS_{i,t} - NEG_{i,t}; \quad (3)$$

the gross job reallocation as

$$SUM_{i,t} = POS_{i,t} + NEG_{i,t}; \quad (4)$$

and excess job reallocation as

$$EXC_{i,t} = SUM_{i,t} - |NET_{i,t}|. \quad (5)$$

Note that whereas NET allows us to capture the change in employment experienced by one sector, both SUM and EXC , enable us to track the reallocation effect triggered by oil price innovations. Moreover, because EXC quantifies the reallocation activity that exceeds what is needed to satisfy the net employment change, it is arguably a better measure of labor market flexibility (see Bauer and Lee, 2007, Cuñat and Melitz 2012, Micco and Pagés, 2004).

Tables 1a and 1b show the average quarterly job flows for the total private sector and the 3-digit NAICS industries computed over our sample. There is significant heterogeneity in the magnitude of job flows across industries. As expected, industries with higher job creation and job destruction rates tend to exhibit higher gross and excess job reallocation. Interestingly, for the majority of industries, the variation in job creation (destruction) is mainly driven by changes in the flows of expanding (contracting) establishments and not of opening and closing firms. These numbers put in evidence that adjustment by continuing firms and not by entry/exit constitutes the bulk of the job flows in the private sector.

Figures 1a and 1b plot the percentage change in the real price of oil and U.S. job flows over

time. The figures also report the average share of private employment accounted for by each of the represented industries. As other researchers have noted (see. e.g., Davis and Haltiwanger 2014) a secular decline in job flows is noticeable since the 1990s. In addition, a decline in gross job reallocation and a spike in excess job reallocation is observable during the global financial crisis for the private sector and many of the depicted industries. This spike coincides with the collapse of oil prices partially induced by lower world demand. A similar, but considerably muted, decrease (increase) in gross (excess) job reallocation is observed during the oil price decline observed in the last half of 2014, which was primarily associated with a slowing world economy (Baumeister and Kilian 2015). Now, whether unexpected declines in oil prices lead to a more intense process of reallocation in this age of low labor market fluidity is an open question.

3 Empirical Strategy

To study the effect of oil price shock on job flows, we use a factor augmented vector autoregressive (FAVAR) model along the lines of Bernanke, Boivin, and Elias (2005) and Boivin, Giannoni, and Mihov (2009). Traditionally, empirical studies investigating the effects of oil price shocks on macroeconomy have employed VAR models using a limited number of variables. For instance, Herrera and Karaki (2015) estimate, for each of the industries, a simultaneous equation model that includes the real oil price change and the industry's job creation and destruction rates. Instead, we employ a FAVAR model that allows us to expand the econometrician information set (see Forni and Gambetti, 2011) and enables us to consider the effect of common unobserved industrial factors on the macroeconomic variables. The FAVAR model assumes that the dynamics of the large panel of industry-level job flows are captured by some observed and unobserved common factors. The unobserved factors are extracted from a large set of industry-level data from the BED (i.e., job creation and destruction rates for the 3 digit NAICS industry groups).

We formalize the model by assuming that the behavior of the U.S. economy can be captured by a vector of observable variables (Y_t) and unobservable factors (F_t). The vector Y_t consists of the log growth of real oil price (o_t), the total private gross job destruction rate ($TNEG_t$), the total private job creation rate ($TPOS_t$), and the quality spread (i_t). The model has a VAR representation given by

$$\begin{bmatrix} Y_t \\ F_t \end{bmatrix} = A(L) \begin{bmatrix} Y_{t-1} \\ F_{t-1} \end{bmatrix} + e_t \quad (6)$$

where Y_t is a 4×1 vector of observed macroeconomic variables; F_t is a vector of $k \times 1$ unobserved factors; $A(L)$ is the matrix of lag polynomials of order $p = 4^2$; and e_t represents the reduced form residuals such that $e_t \sim N(0, \Omega)$.

Equation (6) cannot be estimated without knowledge of the unobserved factors, F_t . Thus, before we estimate (6) we need to extract the unobserved factors from a vector X_t , which consists of 174 series of job creation and destruction rates in eighty seven 3 digit NAICS industries (see Tables A.1a and A.1b of the appendix for a detailed list of the variables in X_t). The observation equation for the system can be written as

$$X_t = \Lambda^y Y_t + \Lambda^f F_t + u_t. \quad (7)$$

where Λ^y is a $N \times 4$ matrix of coefficients on the observable variables, Λ^f is a $N \times k$ matrix of factor loadings, and u_t is vector of series-specific components that are uncorrelated with the Y_t and F_t .

Note that the model considered in this paper is similar to Davis and Haltiwanger (2001) in that the same variables are included in the macro block. Nevertheless, an important difference in

²Hamilton and Herrera (2004) discuss the importance of including enough lags to capture the sluggish response of U.S. economic activity to oil price shocks. Therefore we opt for including 4 quarters of lags in the FAVAR.

the specification is that while Davis and Haltiwanger (2001) assume that neither contemporaneous nor lagged industry-level job flows have an effect on the macro block, here the unobserved factors allow for a lagged effect of the common industry factors. Another important difference is that we do not include the absolute value of the oil price change. This modeling choice stems from work by Herrera, Lagalo and Wada (2011) and Herrera and Karaki (2015) who find no evidence of an asymmetric response of U.S. manufacturing production and job flows to oil price increases and decreases.

We estimate the FAVAR model using the two step principal components approach proposed by Bernanke, Boivin, and Elias (2005). However, before we proceed to the estimation we have to determine the number of unobserved factors. We assume that the factors are unknown but remain constant over time and then use Bai and Ng (2002) IC_{p2} information criteria to determine the number of factors. The information criteria leads us to select a total of 7 factors that drive the job flows dynamics of the U.S. economy. The seven factors can be categorized as 4 observed factors (Y_t) and $k= 3$ unobserved common factors.

Having determined the number of factors we then extract three unobserved factors from a large data set of industrial level variables, X_t . The estimated factors are represented by $\hat{F}_t = [f_{1,t}, f_{2,t}, f_{3,t}]$ and can be interpreted as industry specific common factors that are not captured by the four observed variables in Y_t .

We then add the estimated factors \hat{F}_t to the four observed variables (i.e., $o_t, TPOS_t, TNEG_t, i_t$) in order to estimate the VAR model presented in equation (6). Once we have estimated the state-space system in equations (6)-(7), we employ the standard Cholesky decomposition method to identify the response of the macroeconomic and state-level variables to a 1% decrease in the real oil price. Note that our identification structure implies that oil price shocks do not have a contemporaneous effect on the aggregate job flows or the quality spread. This assumption

is consistent with work by Kilian and Vega's (2011), which suggests that aggregate output and employment do not affect oil prices contemporaneously. The assumption that job destruction is Wold-causally prior to job creation is plausible given the staggering of labor contracts. Point-wise confidence intervals for the impulse response functions are computed using a residual based wild bootstrap method (see Gonçalves and Kilian, 2004 and Yamamoto, 2012).

4 The Effects of Oil Prices on Job Flows

Figures 2a and 2b plot the responses of job creation and job destruction to an unexpected negative oil price innovation of 1 standard deviation. Statistical significance at the 5%, 10% and 32% is denoted by squares, diamonds and circles, respectively. Note that the figures report impulse responses measured in percentage points. To conserve space, we depict the impulse responses functions for the total private sector and twenty three of the eighty seven 3-digit NAICS industries. The responses plotted in the figures correspond to industries that are energy intensive in production or consumption, represent a large proportion of employment, or have been identified by other studies as industries that are likely to respond to changes in gasoline prices (Edelstein and Kilian 2007, 2009; Ramey and Vine, 2010). The responses for the remaining industries are reported in the online appendix (see Figures A.1a-A.1d).³

4.1 The Response of Job Flows in the Private Sector

We first examine the effect of an unexpected decrease in real oil prices on the job creation and destruction rates for the total private sector. The top panel of Figure 2a shows that job destruction is more responsive than job creation. For instance at $h = 2$, the response of job destruction is twice as large as the response of job creation. Notice that one year after the shock the economy

³The online appendix is available at <http://gatton.uky.edu/faculty/herrera/documents/HKRappendix.pdf>

experiences a decrease in job destruction and an increase in job creation that results in a net increase in the employment generated by the private sector.

To get a more complete view of the impact such decrease in oil prices would have on total private job flows, we report the 1-year and 2-year cumulative effects on job creation, job destruction, net employment change, gross job reallocation and excess job reallocation in Tables 2a and 2b. The cumulative responses are measured in percentage points. The first row of Table 2a reveals that the 1-year and 2-year cumulative effects associated with a negative oil price shock on job creation (job destruction) are 0.016 (0.106) and 0.163 (-0.051) percentage points, respectively. Furthermore, the 1-year cumulative effect on net employment change, *NET*, is -0.090 percentage points, which seems economically significant since *NET* averaged 0.30 during our sample period. As for the effect of a decline in oil prices on job reallocation, the 1-year cumulative effect on gross job reallocation (excess job reallocation) equals 0.123 (-0.183) percentage points. These results suggest that a decline in oil prices considerably decreases the pace of job reallocation in the U.S. economy.

4.2 Dynamic Responses at the Industry Level

Where do jobs go when oil prices fall? Previous studies have found the response of U.S. manufacturing employment to exhibit considerable heterogeneity across industries. In particular, industries that are intensive in the use of energy either in production (e.g., rubber and plastics) or consumption (e.g., transportation equipment) tend to be more responsive to oil price shocks. Hence, one would expect a decline in oil prices to induce jobs to shift from less energy intensive to more energy intensive manufacturing industries. But, how do job flows in other sectors such as mining, construction and services respond to an oil shock? Answering this question is crucial to understanding how oil price movements may induce changes in the pace of job reallocation, especially since manufacturing accounts only for 12% of private sector employment.

Figures 2a and 2b (as well as Figures A.1a-A.1d of the online appendix) show important heterogeneity in the responses of job creation and job destruction across sectors.⁴ Consider first the dynamic response of agriculture and forestry, Figure A.1a depicts job flows responses that greatly differ across industries. For instance four quarters after the shock, the responses of job creation and destruction are almost identical for crop production and hunting, fishing and trapping; yet, they diverge for animal production, and forestry and logging. Tables 2a and 2b indicates that the quantitative effect of an unexpected oil price shock is smaller for industries in this sector of the economy. Similarly, the effect on utilities is moderate, although a statistically significant decline in job creation is observed around three quarters after the shock.

Let us now shift our attention to the industries in the construction and mining sectors. Figure 2a reveals that for the oil and gas industry, a negative oil price shock has no significant effect on job destruction, but job creation falls sharply at low horizons and then starts to increase two quarters after the shock. As for the support activities for mining, a negative oil price shock triggers a decrease (increase) in job creation (job destruction) for $h < 2$. Starting $h = 2$, job creation (destruction) starts to increase (decrease). This result indicates that in the short-run, the net employment change for these industries decreases importantly. Moreover, Table 2a evidences a reduction in excess job reallocation following the unexpected decline in oil prices. For instance, the 1-year (2-year) cumulative change in excess job reallocation rate equals -0.398 (-1.020) and -0.519 (-1.345) percentage points for mining (except oil and gas) and construction of buildings, respectively. Note how the decline in the excess job reallocation rate persists 2 years after the shock.

Regarding manufacturing industries, job destruction tends to be more responsive than job creation, especially for wood manufacturing, plastics and rubber products, and transportation equipment (see Figures 2a and 2b). Unlike most manufacturing industries, there is very little change

⁴For the sake of brevity we only report the responses of 23 of the 87 industries in the paper. The responses for the remaining industries can be found in Figures A.1a-A.1d of the online appendix.

in the rate at which firms in petroleum and coal products create and shed jobs. In addition, in the year following the oil price drop, significant declines in excess job reallocation take place for 17 of the 21 manufacturing industries (see Table 2a). The largest reductions in the excess job reallocation rate occur in industries that are energy intensive in production (such as fabricated metals, primary metal manufacturing, plastics and rubber products manufacturing) and in use (such transportation equipment). Overall our results are consistent with Herrera and Karaki (2015) and Davis and Haltiwanger (2001) who –using data that ends before 2000- find considerable heterogeneity and a stronger job flow response for energy intensive industries in the manufacturing sector.

Last but not least, let us consider the dynamic response of services. Note how, soon after the shock ($h = 1$), industries in the service sector exhibit a stronger response in job destruction than job creation (See Figure 2b). For instance, by the end of the first year the rate at which firms in credit intermediation shed jobs has declined 0.251 percentage points whereas the job creation rate has increased by 0.164 percentage points. As a result, net employment has increased by 0.414 percentage points a year after the shock. Interestingly, Tables 2a and 2b reveal a 1-year cumulative decline in excess job reallocation rate for 49 out of 54 industries in the service sector. Given that services represent about 79% of private employment, this result is indicative of a sizeable effect on job reallocation for the U.S. economy.

To gain additional insight into which sectors experience larger changes in job flows we computed Spearman’s rank correlation coefficient between the 1-year cumulative change in job creation (destruction) and the degree of energy intensity measured by the production of oil and gas extraction required, both directly and indirectly, to deliver one dollar to final use of each industry. To compute these total requirements we use the 2007 input-output tables produced by the BEA.⁵ The results suggest that the more energy intensive industries are, the larger the increase in job creation as

⁵2007 represents the first year when the industry input-output tables are integrated with the industry account and the national income and product accounts. It is also the most recent version of the detailed tables.

the Spearman's rank correlation is significant at the 5% level. In contrast, the correlation between energy intensity and job destruction is statistically insignificant.

Summarizing, we find that an unexpected decrease in oil prices shifts jobs away from oil and gas extraction and support activities for mining towards industries in construction, manufacturing and services. In particular, job creation in industries that are energy intensive tend to experience a larger boom. Moreover, because mining accounts for a small proportion of total employment, the positive effect on private employment prevails at the aggregate level. As a result of the change in job flows, excess job reallocation declines in the private sector and the majority of 3-digit NAICS level industries.

5 Entry/Exit Versus Existing Establishments

The average job creation rate for the U.S. private sector was 7.18% during the period of analysis, whereas the average job destruction rate was 6.88%. This high pace of reallocation is mostly driven by existing firms. Indeed, the job creation (destruction) rate for expanding (contracting) firms averaged 5.71% (5.52%). In contrast, the job creation rate for entering (exiting) firms was much lower, equaling 1.47% (1.36%). Estimation results show that the pace of reallocation declines when oil prices drop. An open question is whether most of the adjustment occurs through flows from existing or entering and exiting firms. More precisely, do changes in job creation (destruction) stem mainly from the response of expanding (contracting) establishments or opening (closing) establishments?

To answer this question we modify the model in (6)-(7) by separately including in the vector of industry-level variables X_t the job creation rates of expanding and entering establishments and the job destruction rates of contracting and exiting establishments. As in the previous section, we estimate the FAVAR model using the two step principal components approach proposed by

Bernanke Boivin, and Eliasz (2005) and impose the same identification restrictions.

5.1 Job Creation: Expanding and Opening Establishments

Figures 3a and 3b report the impulse response functions for job creation from expanding and opening establishments for the total private sector and twenty three 3-digit NAICS industries. For the sake of brevity, we report the impulse response functions for the remaining sixty four industries in Figures A.2a-A.2d of the online appendix.

What drives the response of job creation in the private sector? Figure 3a reveals that, in the short run ($h < 2$), expanding establishments decrease the rate at which they create jobs, whereas the rate increases at opening establishments. At longer horizons the response of job creation for expanding establishments increases and remains above that of opening firms. Additional insight is gained from Tables 3a and 3b where we report the 1-year and 2-year cumulative effects on job creation for expanding and opening establishments. Notice how the 1-year and 2-year cumulative effects associated with a negative oil price shock on job creation from expanding (opening) establishments equal -0.064 (0.071) and 0.060 (0.096) percentage points, respectively. These results suggest that the expansionary effect on private job creation is initially driven by entry. That is, a decline in real oil prices causes entering firms to increase the rate at which they create jobs. As time goes by, existing firms do also create more jobs.

The industry level responses depicted in Figures 3a and 3b provide additional evidence regarding the importance that existing and opening/closing establishment play in driving the changes in job creation and destruction. In particular, the figures illustrate how job creation from expanding establishments is more responsive to oil price shocks than job creation from opening establishments. For instance, the response of job creation from expanding establishments declines sharply in the short run ($h < 2$) for oil and gas extraction and mining and support activities. In contrast, no

significant changes are observed in the rate at which opening establishments create jobs in these industries. In brief, the negative 1-year cumulative change in the job creation rate for oil and gas extraction, and support activities for mining reported in Table 3b are essentially due to the contraction in job creation at expanding establishments.

Let us now focus on the responses of job creation for construction industries. Note that for construction of buildings, and heavy and civil engineering construction the responses of job creation from expanding establishments fall for $h < 2$ and exhibit an important increase afterwards. In contrast, the responses of job creation from opening establishments is largely muted. For instance, the 1-year and 2-year cumulative change in the job creation rate from expanding establishments for heavy and civil engineering construction are 0.103 and 0.456 percentage points whereas the corresponding changes for opening establishments are 0.060 and 0.086 percentage points.

With respect to the manufacturing industries, Figures 3a and 3b reveal strong heterogeneity in the responses of job creation from expanding and opening establishments to a negative oil price shock. For instance for wood manufacturing, there is an important increase in job creation from expanding establishments and no change in the response of job creation from opening establishments for $h = 3 - 8$. Petroleum and coal products experience a decrease in job creation for opening establishments and no significant change for expanding establishments. The job creation responses from expanding establishments for fabricated and primary metals tend to exhibit a drop for $h < 2$ and an increase for $h = 4 - 8$. Moreover, the 1-year and 2-year cumulative change in job creation from expanding (opening) establishments is positive for 5 (18) and 15 (19) out of 21 manufacturing industries (see Table 3a), which suggest a faster response to the oil price shock for entering than existing establishments.

In the services sector, the job creation responses for expanding and opening establishments also exhibit heterogeneity (see Figure 3b). In particular, the job creation response for opening

establishments is considerably larger for administrative and support services industries than for other industries in this sector. Yet, whereas for real estate the magnitudes of the responses for opening and expanding establishments is somewhat similar, the effect of the shock on opening firms that provide administrative and support services is stronger for opening than for expanding firms in the short run ($h < 2$). All in all, we find more evidence of an expansionary effect of oil price decreases on the rate of job creation for opening than expanding service firms. Note that the 1-year and 2-year cumulative change in job creation from expanding (opening) establishments is positive for 10 (43) and 26 (48) out of 54 industries in this sector (see Table 3b).

Summarizing, although we find a significant degree of heterogeneity in the job creation responses of expanding and opening establishments across industries, there are two noticeable common features. First, evidence of an increase in job creation is more widespread for opening firms in manufacturing and services during the first year. Second, by the second year, increases in job creation are also apparent for expanding firms in construction, manufacturing, and services. In other words, whereas the short-run increase of private job creation is mainly explained by opening firms, at longer horizons expanding firms also contribute to private job gains.

5.2 Job Destruction: Contracting and Closing Establishments

Figures 4a and 4b illustrate the job destruction responses of contracting and closing establishments for the total private sector and twenty three 3-digit NAICS industries. (The responses for the remaining sixty four industries are reported in Figures A.3a-A.3d of the online appendix.) Figure 4a reveals a short-run increase in job destruction for contracting establishments whereas the rate for closing establishments declines. At longer horizons, both contracting and closing establishments exhibit an increase in the rate at which they shed jobs. Table 3a reveals that the 1-year and 2-year cumulative effects associated with a negative oil price shock on job destruction from contracting

(closing) establishments are 0.067 (0.074) and -0.190 (0.050) percentage points, respectively. These results suggest that most of the increase in job destruction following an oil price decrease stems from the response of closing firms.

Figures 4a and 4b show considerable heterogeneity in the response of job destruction for contracting and closing establishments. However, a common feature across industries is that job destruction in contracting establishments is more responsive than in closing establishments. Interestingly for the oil and gas industry, the response of job destruction from contracting establishments increases one year after the shock while little change takes place for closing establishments. Furthermore, in the short-run ($h < 2$), job destruction at contracting establishments increases sharply for mining (except oil and gas) and support activities for mining. The increases experienced during the first year in job destruction for mining (except) oil and gas extraction and support activities for mining are essentially due to job losses in contracting establishments (see Table 3a).

Regarding industries in the construction sector, note that construction of buildings and heavy and civil engineering construction exhibit a short run ($h < 2$) increase in job destruction for contracting establishments followed by a decline. In comparison, the response of job destruction from closing establishments is largely muted. For instance, the 1-year and 2-year cumulative change in the job destruction rate from contracting (closing) establishments are 0.286 (0.117) and -0.127 (-0.021) percentage points.

As for manufacturing, Figures 4a and 4b reveal strong heterogeneity in the job destruction responses from contracting and closing establishments. For instance for wood manufacturing, there is an important decrease in job destruction for contracting establishments for medium to long horizons ($h = 3 - 8$) and virtually no change in the response for closing establishments. In contrast, petroleum and coal exhibit an increase in job destruction for closing establishments and no significant change for contracting establishments. Contracting establishments in the fabricated metals

and primary metals industries show an increase in the rate at which they shed jobs up to two quarters after the shock, yet the rate drops afterwards. Over time a decline in real oil prices leads to reductions in job losses in the manufacturing sector. Indeed the 1-year and 2-year cumulative change in job destruction from contracting (closing) establishments is negative for 3 (1) and 19 (20) out of 21 manufacturing industries.

As for the services sector, Figures 4a and 4b put in evidence some differences in the responses for contracting and closing establishments across industries. Compared to other industries, the response of the job destruction rate from closing establishments is larger for the administrative and support services industry. For the latter, contracting establishments account for more of the short-run response in job destruction, whereas closing establishments represent the bulk of the change in the longer run. Moreover, we find that a year after the decline in the real oil price, 17 (43) of the 54 service industries experience a reduction in the job destruction rate for contracting (closing) establishments.

To summarize, most of the short-run reduction in private job destruction due to an unexpected oil price shock stems from a decrease in job destruction for services. Closing establishments in this sector react faster to the oil price decline than contracting firms. However, as time goes by, existing establishments in all sectors respond by lowering the rate at which they shed jobs.

6 Conclusions

In this paper we explored the response of job flows to unexpected oil price declines during an age of reduced labor market fluidity. Using a FAVAR we found that an unexpected decrease in real oil prices has a positive effect on private employment as it increases the rate of job creation and lowers the rate of job destruction. Furthermore, the pace of job reallocation declines.

We then inquired into the dynamics of job flows at the industry level. Our results suggested

that the positive effect of a decline in oil prices is not limited to the manufacturing sector studied by previous researchers (see Davis and Haltiwanger 2001, Herrera and Karaki 2015). Instead, it extends to the construction and service sectors. These sectors, as well as manufacturing, experience an increase in the net employment change and a reduction in excess job reallocation. Interestingly, we found that the negative effect of a decline in oil prices on the mining sector is rather short lived. In particular, a decrease in job creation and an increase in job destruction that leads to a reduction in the net employment change is observed for oil and gas extraction and support activities for mining during the first year. Yet, by the second year, the expansion experienced by other sectors of the economy appear to drive the demand for goods produced by these sectors and thus to undo the recessionary impact of the oil price drop. Our results suggested that, the first year after an oil price decline, jobs flow out from mining towards other sectors of the economy such as construction, mining and services. The impact on job flows in agriculture and forestry, instead, is rather small.

Finally, we explored whether the expansionary effect of an oil price drop on employment stems from changes in job flows in existing or entering/exiting firms. Using a modified version of the FAVAR we found that opening and closing firms respond faster to an oil price decline. Thus, during the first year, most of the increase (decrease) in private job creation (destruction) stems from changes in job flows from entering/exiting firms in services and manufacturing. However, by the second year, existing firms in all sectors respond to the oil price decline and, thus, net employment in the private sector expands.

To conclude let us return to the question we posed at the beginning of the paper: where do jobs go when oil prices fall? We found that in the U.S. the pace of job creation (destruction) declines (increases) in the mining sector, especially in oil and gas extraction and support activities for mining, thus inducing a decline in the net job change for these industries that lasts about a year. In the meantime, jobs flow to construction, manufacturing and service industries expand.

Not surprisingly, lower oil prices have a larger expansionary impact on industries that are more energy intensive. The employment boom experienced in the first year, is essentially explained by the response of entering and exiting firms in services and manufacturing. All in all, even though oil production in the U.S. has greatly increased during the past five years –mainly due to technological improvements that allow for extraction from shale formations– the mining sector continues to represent only a small fraction of private employment. Hence, even though the mining sector contracts employment during the first year, lower oil prices have a beneficial effect on the number of jobs generated by the U.S. economy.

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Table 1a: Magnitude of gross job flows by sectors

Sectors	POS			NEG			NET	SUM	EXC
	Total	Expand	Open	Total	Contract	Close			
Total Private	7.18	5.71	1.47	6.88	5.52	1.36	0.30	14.06	13.47
Crop Production	25.77	22.26	3.51	25.77	22.27	3.50	0.00	51.54	50.25
Animal Production	7.59	6.15	1.44	7.11	5.98	1.13	0.48	14.69	14.10
Forestry & Logging	11.15	8.20	2.95	11.61	8.42	3.19	-0.47	22.76	21.45
Hunting, Fishing & Trapping	22.36	11.59	10.76	22.60	11.79	10.81	-0.25	44.96	41.79
Support Act. for AgrFor	30.18	24.09	6.09	29.96	24.40	5.56	0.21	60.14	57.12
Oil & Gas Extraction	4.76	3.76	1.00	4.54	3.54	1.00	0.21	9.30	8.00
Mining (except Oil & Gas)	5.58	4.77	0.81	5.91	4.97	0.94	-0.33	11.49	10.46
Support Act. for Mining	8.63	7.15	1.48	7.46	5.99	1.46	1.17	16.09	13.21
Utilities	2.56	2.11	0.45	2.81	2.41	0.39	-0.25	5.36	4.90
Construction of Buildings	12.76	9.54	3.22	12.58	9.46	3.12	0.18	25.34	24.09
Heavy & Civil Eng. Construction	12.99	11.09	1.90	12.79	10.99	1.80	0.20	25.78	24.45
Specialty Trade Contractors	12.38	9.81	2.57	12.04	9.49	2.55	0.34	24.42	23.06
Food Manuf.	5.48	4.90	0.58	5.51	4.87	0.64	-0.03	10.99	10.62
Beverage & Tobacco Manuf.	5.42	4.78	0.64	5.28	4.66	0.62	0.14	10.70	9.81
Textile Mills	3.44	3.02	0.43	4.96	4.29	0.67	-1.52	8.40	6.74
Textile Product Mills	5.34	4.61	0.72	6.09	5.15	0.94	-0.75	11.43	10.33
Apparel Manuf.	6.73	5.26	1.47	8.77	6.51	2.26	-2.04	15.50	13.39
Leather & Allied Product Manuf.	4.60	4.04	0.55	5.85	5.07	0.78	-1.25	10.45	8.85
Wood Product Manuf.	5.31	4.66	0.65	5.66	4.86	0.80	-0.35	10.97	9.66
Paper Manuf.	2.83	2.51	0.32	3.40	2.96	0.44	-0.57	6.23	5.55
Printing & Related Support Act.	4.41	3.75	0.66	5.12	4.16	0.96	-0.71	9.54	8.70
Petroleum & Coal Manuf.	4.03	3.45	0.57	4.25	3.59	0.66	-0.22	8.28	7.36
Chemical Manuf.	2.96	2.52	0.44	3.17	2.73	0.45	-0.22	6.13	5.70
Plastics & Rubber Manuf.	3.94	3.55	0.39	4.13	3.62	0.50	-0.19	8.06	7.20
Nonmetallic Mineral Manuf.	5.09	4.45	0.64	5.38	4.69	0.69	-0.29	10.48	9.54
Primary Metal Manuf.	2.97	2.68	0.28	3.49	3.13	0.36	-0.52	6.46	5.38
Fabricated Metal Manuf.	4.64	4.11	0.53	4.69	4.08	0.61	-0.04	9.33	8.39
Machinery Manuf.	3.84	3.43	0.41	4.01	3.50	0.51	-0.17	7.84	6.85
Computer & Electronic Manuf.	3.26	2.77	0.49	3.77	3.20	0.56	-0.51	7.03	6.01
Electrical Equipment Manuf.	3.27	2.92	0.35	3.74	3.28	0.46	-0.47	7.01	6.18
Transp. Equipment Manuf.	3.44	3.11	0.32	3.74	3.37	0.37	-0.30	7.17	6.08
Furniture Product Manuf.	4.95	4.29	0.66	5.54	4.59	0.94	-0.58	10.49	9.31
Miscellaneous Manuf.	4.66	3.95	0.71	4.87	4.02	0.85	-0.21	9.53	9.01
Wholesalers, Durables	5.35	4.36	0.99	5.15	4.06	1.09	0.20	10.51	9.80
Wholesalers, Nondurables	5.70	4.76	0.94	5.56	4.50	1.07	0.14	11.27	10.84
Wholesale Electronic Markets	8.16	5.59	2.56	7.93	5.20	2.74	0.22	16.09	15.21
Motor Vehicle & Parts Dealers	5.17	4.34	0.84	4.89	4.04	0.85	0.28	10.06	9.33
Furniture Stores	7.74	6.24	1.49	7.66	6.17	1.49	0.08	15.40	14.29
Electronics & Appliance Stores	8.22	6.56	1.66	7.91	6.24	1.67	0.31	16.13	14.75
Building Mat. & Garden Equip.	6.55	5.51	1.05	6.11	5.23	0.88	0.44	12.67	11.43
Food & Beverage Stores	5.36	4.16	1.20	5.23	4.28	0.95	0.13	10.60	10.22
Health & Personal Care Stores	6.88	5.63	1.25	6.54	5.47	1.07	0.33	13.42	12.68

Notes: Expand, Open, Contract and Close stand for expanding, opening, contracting and closing establishments, respectively.

Table 1b: Magnitude of gross job flows by sectors

Sectors	POS			NEG			NET	SUM	EXC
	Total	Expand	Open	Total	Contract	Close			
Gasoline Stations	7.56	6.06	1.50	7.66	6.11	1.55	-0.10	15.22	14.74
Clothing & Accessories Stores	10.47	8.76	1.71	10.30	8.73	1.57	0.17	20.77	19.91
Sport, Hobby, Music & Books	11.01	9.23	1.78	10.84	9.16	1.68	0.16	21.85	20.93
General Merchandise Stores	6.23	5.47	0.76	5.95	5.52	0.43	0.28	12.18	11.01
Miscellaneous Store Retailers	9.74	7.49	2.25	9.56	7.44	2.12	0.18	19.30	18.32
Nonstore Retailers	8.29	7.00	1.29	8.22	6.79	1.43	0.07	16.51	15.49
Air Transp.	2.74	2.40	0.34	2.82	2.52	0.30	-0.08	5.55	4.46
Water Transp.	6.29	5.42	0.86	6.42	5.51	0.90	-0.13	12.70	11.52
Truck Transp.	7.05	5.59	1.45	6.83	5.23	1.60	0.22	13.88	13.06
Transit & Ground Pass. Transp.	7.19	5.91	1.28	6.78	5.33	1.45	0.41	13.97	13.17
Pipeline Transp.	3.87	3.06	0.81	4.17	3.27	0.90	-0.30	8.04	6.97
Scenic & Sightseeing Transp.	18.01	13.72	4.29	17.63	13.67	3.96	0.38	35.63	30.74
Support Act. for Transp.	7.35	5.95	1.41	6.88	5.49	1.39	0.47	14.24	13.32
Couriers & Messengers	6.04	5.46	0.58	5.51	4.92	0.59	0.53	11.55	9.43
Warehousing & Storage	5.49	4.79	0.71	5.17	4.51	0.65	0.33	10.66	9.84
Publishing Industries (no Internet)	3.88	3.18	0.70	4.08	3.27	0.82	-0.21	7.96	7.26
Movie Picture & Sound Industries	11.51	9.01	2.50	11.38	8.90	2.47	0.13	22.89	20.69
Broadcasting (no Internet)	4.64	3.68	0.96	4.53	3.52	1.01	0.11	9.17	8.60
Telecommunications	5.05	3.99	1.06	5.17	4.14	1.04	-0.12	10.23	9.15
Data Proc., Host. & Related Serv.	6.33	4.95	1.39	5.85	4.40	1.45	0.48	12.18	10.73
Other Information Serv.	6.60	5.07	1.53	5.29	3.95	1.34	1.31	11.89	9.76
Credit Intermed. & Related Act.	5.07	4.04	1.02	5.01	3.89	1.12	0.06	10.08	9.45
Financial Investments	5.50	4.06	1.44	4.94	3.56	1.38	0.56	10.44	9.36
Insurance Carriers & Related Act.	4.65	3.62	1.04	4.53	3.45	1.08	0.12	9.18	8.82
Funds, Trusts & Other Finan. Veh.	6.58	3.81	2.77	6.08	3.52	2.55	0.50	12.65	11.23
Real Estate	7.99	5.70	2.29	7.73	5.45	2.28	0.26	15.71	15.20
Rental & Leasing Serv.	7.89	6.27	1.62	7.80	6.08	1.72	0.09	15.70	14.71
Lessors	7.09	5.43	1.66	6.57	4.89	1.69	0.51	13.66	12.23
Profess., Scient. & Tech. Serv.	7.83	5.87	1.96	7.25	5.31	1.94	0.59	15.08	14.21
Management of Comp. & Enterp.	4.05	3.49	0.55	3.94	3.44	0.50	0.11	7.98	7.50
Administrative & Support Serv.	10.65	8.74	1.91	9.87	8.03	1.83	0.78	20.51	19.14
Waste Manag. & Remed. Serv.	7.56	6.04	1.53	7.39	5.76	1.63	0.18	14.95	14.36
Educational Serv.	7.16	6.17	0.99	6.44	5.54	0.90	0.72	13.60	12.83
Ambulatory Health Care Serv.	6.13	4.90	1.24	5.41	4.18	1.23	0.73	11.54	10.81
Hospitals	1.91	1.61	0.31	1.55	1.31	0.24	0.36	3.47	3.08
Nursing & Resid. Care Facilities	4.04	3.37	0.67	3.60	2.96	0.65	0.44	7.64	7.16
Social Assistance	7.36	5.75	1.61	6.35	5.04	1.31	1.02	13.71	12.69
Perform. Arts & Spectator Sports	19.23	15.68	3.55	18.95	15.33	3.61	0.28	38.18	37.05
Museums, Historical Sites & Sim.	8.00	7.22	0.77	7.32	6.70	0.62	0.68	15.31	14.28
Amus., Gambling & Recreation	14.62	12.07	2.55	14.09	11.77	2.32	0.53	28.71	27.07
Accommodation	7.41	5.94	1.47	7.31	5.95	1.36	0.10	14.72	13.99
Food Serv. & Drinking Places	8.95	6.36	2.59	8.48	6.59	1.90	0.46	17.43	16.83
Repair & Maintenance	8.21	6.17	2.03	8.05	6.01	2.03	0.16	16.25	15.67
Personal & Laundry Serv.	7.78	5.85	1.93	7.65	5.74	1.91	0.14	15.43	15.04
Religious, Grant, Civic, Profes.	8.17	6.93	1.24	7.77	6.58	1.20	0.40	15.94	15.32

Notes: Expand, Open, Contract and Close stand for expanding, opening, contracting and closing establishments, respectively.

Table 2a: Cumulative change in job flows due to a 1 s.d. negative oil price shock

Sectors	POS		NEG		NET		SUM		EXC	
	1 year	2 year	1 year	2 year	1 year	2 year	1 year	2 year	1 year	2 year
Total Private	0.016	0.163	0.106	-0.051	-0.090	0.214	0.123	0.113	-0.183	-0.496
Crop Production	0.431	0.504	0.201	0.110	0.230	0.395	0.633	0.614	0.248	0.065
Animal Production	-0.003	0.107	0.057	0.006	-0.060	0.102	0.054	0.113	-0.169	-0.272
Forestry & Logging	0.260	0.287	0.077	-0.220	0.183	0.507	0.337	0.067	-0.305	-0.899
Hunting, Fishing & Trapping	0.022	0.335	-0.492	-0.529	0.515	0.864	-0.470	-0.195	-1.369	-1.443
Support Act. for AgrFor	0.227	0.393	0.574	0.411	-0.347	-0.018	0.801	0.804	-0.119	-0.445
Oil & Gas Extraction	-0.127	0.021	-0.037	-0.006	-0.090	0.026	-0.164	0.015	-0.536	-0.473
Mining (except Oil & Gas)	0.104	0.115	0.149	-0.162	-0.045	0.276	0.253	-0.047	-0.398	-1.020
Support Act. for Mining	-0.205	0.125	0.200	-0.487	-0.406	0.613	-0.005	-0.362	-1.839	-3.214
Utilities	-0.045	-0.014	0.075	0.118	-0.120	-0.132	0.029	0.104	-0.106	-0.043
Construction of Buildings	0.187	0.518	0.041	-0.372	0.146	0.890	0.228	0.146	-0.519	-1.345
Heavy & Civil Eng. Construction	0.207	0.454	0.224	-0.107	-0.017	0.560	0.430	0.347	-0.307	-0.968
Specialty Trade Contractors	0.162	0.443	0.097	-0.344	0.065	0.787	0.259	0.099	-0.441	-1.324
Food Manuf.	0.060	0.143	0.069	0.085	-0.009	0.058	0.128	0.228	0.033	0.065
Beverage & Tobacco Manuf.	-0.019	0.118	0.106	0.083	-0.124	0.035	0.087	0.201	-0.164	-0.210
Textile Mills	-0.049	0.001	0.204	-0.386	-0.252	0.386	0.155	-0.385	-0.821	-2.000
Textile Product Mills	-0.055	0.063	0.144	-0.249	-0.199	0.312	0.089	-0.186	-0.738	-1.525
Apparel Manuf.	-0.149	-0.055	0.346	-0.033	-0.495	-0.022	0.197	-0.089	-0.708	-1.467
Leather & Allied Product Manuf.	0.009	0.086	0.284	-0.026	-0.275	0.112	0.294	0.059	-0.313	-0.934
Wood Product Manuf.	0.130	0.274	-0.030	-0.636	0.160	0.909	0.100	-0.362	-0.739	-1.950
Paper Manuf.	0.000	0.074	0.129	-0.052	-0.129	0.127	0.130	0.022	-0.247	-0.610
Printing & Related Support Act.	-0.021	0.135	0.201	-0.093	-0.222	0.228	0.180	0.042	-0.383	-0.971
Petroleum & Coal Manuf.	0.084	0.134	0.063	-0.022	0.021	0.156	0.147	0.112	-0.134	-0.304
Chemical Manuf.	0.044	0.119	0.169	0.029	-0.125	0.090	0.213	0.147	-0.038	-0.319
Plastics & Rubber Manuf.	-0.044	0.096	0.218	-0.194	-0.262	0.290	0.174	-0.097	-0.694	-1.518
Nonmetallic Mineral Manuf.	0.024	0.183	0.068	-0.415	-0.044	0.599	0.092	-0.232	-0.561	-1.527
Primary Metal Manuf.	-0.063	0.017	0.446	-0.313	-0.509	0.331	0.383	-0.296	-0.819	-2.338
Fabricated Metal Manuf.	-0.085	0.108	0.355	-0.176	-0.440	0.285	0.270	-0.068	-0.701	-1.763
Machinery Manuf.	-0.087	0.076	0.365	-0.186	-0.452	0.263	0.278	-0.110	-0.728	-1.832
Computer & Electronic Manuf.	-0.144	0.041	0.435	0.077	-0.579	-0.036	0.291	0.118	-0.535	-1.251
Electrical Equipment Manuf.	-0.122	0.028	0.383	-0.058	-0.505	0.086	0.261	-0.031	-0.585	-1.468
Transp. Equipment Manuf.	-0.003	0.090	0.159	-0.432	-0.162	0.522	0.156	-0.342	-0.783	-1.966
Furniture Product Manuf.	0.036	0.210	0.240	-0.340	-0.204	0.551	0.277	-0.130	-0.652	-1.813
Miscellaneous Manuf.	-0.019	0.127	0.102	-0.083	-0.121	0.210	0.084	0.044	-0.300	-0.672
Wholesalers, Durables	-0.039	0.160	0.199	-0.042	-0.238	0.202	0.159	0.118	-0.370	-0.851
Wholesalers, Nondurables	0.021	0.153	0.081	0.000	-0.060	0.153	0.102	0.153	-0.102	-0.263
Wholesale Electronic Markets	-0.046	0.069	0.062	-0.070	-0.107	0.139	0.016	-0.001	-0.275	-0.538
Motor Vehicle & Parts Dealers	0.030	0.146	0.053	-0.166	-0.024	0.312	0.083	-0.020	-0.413	-0.852
Furniture Stores	0.065	0.253	-0.029	-0.403	0.094	0.656	0.037	-0.150	-0.494	-1.242
Electronics & Appliance Stores	-0.221	-0.045	0.078	-0.184	-0.299	0.139	-0.143	-0.229	-0.894	-1.419
Building Mat. & Garden Equip.	0.049	0.214	-0.010	-0.146	0.059	0.360	0.038	0.068	-0.300	-0.571
Food & Beverage Stores	-0.070	0.037	0.013	0.009	-0.083	0.029	-0.057	0.046	-0.194	-0.204
Health & Personal Care Stores	-0.148	-0.001	0.011	-0.017	-0.158	0.016	-0.137	-0.019	-0.373	-0.429

Table 2b: Cumulative change in job flows due to a 1 s.d. negative oil price shock

Sectors	POS		NEG		NET		SUM		EXC	
	1 year	2 year	1 year	2 year	1 year	2 year	1 year	2 year	1 year	2 year
Gasoline Stations	0.008	0.117	-0.010	-0.048	0.018	0.165	-0.001	0.069	-0.203	-0.280
Clothing & Accessories Stores	-0.112	0.100	0.029	-0.032	-0.142	0.133	-0.083	0.068	-0.338	-0.462
Sport, Hobby, Music & Books	-0.106	0.139	0.149	0.026	-0.255	0.112	0.043	0.165	-0.477	-0.723
General Merchandise Stores	0.018	0.112	0.173	0.082	-0.154	0.030	0.191	0.194	-0.034	-0.216
Miscellaneous Store Retailers	-0.127	0.075	0.093	0.000	-0.220	0.075	-0.034	0.075	-0.554	-0.739
Nonstore Retailers	-0.197	0.074	0.319	0.133	-0.516	-0.059	0.122	0.208	-0.646	-1.018
Air Transp.	-0.112	0.028	0.598	0.332	-0.710	-0.304	0.486	0.360	-0.367	-0.899
Water Transp.	-0.099	0.126	0.145	0.028	-0.244	0.098	0.047	0.153	-0.384	-0.619
Truck Transp.	0.098	0.252	0.146	-0.150	-0.048	0.401	0.244	0.102	-0.270	-0.861
Transit & Ground Pass. Transp.	0.098	0.166	0.282	0.231	-0.184	-0.065	0.380	0.398	0.093	-0.008
Pipeline Transp.	0.064	0.120	0.372	0.343	-0.308	-0.224	0.436	0.463	0.012	-0.045
Scenic & Sightseeing Transp.	0.260	0.331	-0.048	-0.453	0.308	0.784	0.212	-0.122	-0.819	-1.629
Support Act. for Transp.	0.051	0.261	0.294	0.026	-0.243	0.236	0.345	0.287	-0.191	-0.728
Couriers & Messengers	0.013	0.330	0.222	-0.122	-0.209	0.453	0.235	0.208	-0.687	-1.376
Warehousing & Storage	0.029	0.225	0.122	-0.057	-0.093	0.282	0.151	0.168	-0.276	-0.634
Publishing Industries (no Internet)	-0.068	0.096	0.213	-0.001	-0.281	0.097	0.146	0.096	-0.325	-0.753
Movie Picture & Sound Industries	0.080	0.362	0.000	-0.007	0.080	0.368	0.080	0.355	-0.375	-0.388
Broadcasting (no Internet)	-0.086	0.133	0.131	0.085	-0.217	0.048	0.045	0.218	-0.314	-0.407
Telecommunications	-0.153	-0.028	0.433	0.202	-0.585	-0.230	0.280	0.173	-0.360	-0.822
Data Proc., Host. & Related Serv.	-0.435	-0.082	0.615	0.353	-1.050	-0.435	0.179	0.272	-1.041	-1.564
Other Information Serv.	-0.788	-0.461	0.619	0.166	-1.407	-0.627	-0.168	-0.296	-1.755	-2.663
Credit Intermed. & Related Act.	0.164	0.197	-0.251	-0.281	0.414	0.478	-0.087	-0.085	-0.501	-0.563
Financial Investments	-0.158	-0.036	0.308	-0.043	-0.466	0.007	0.150	-0.079	-0.511	-1.214
Insurance Carriers & Related Act.	0.050	0.163	0.002	-0.001	0.049	0.164	0.052	0.162	-0.100	-0.106
Funds, Trusts & Other Finan. Veh.	0.708	1.580	0.740	1.142	-0.032	0.438	1.448	2.722	0.621	1.425
Real Estate	0.007	0.141	-0.127	-0.183	0.134	0.324	-0.120	-0.042	-0.298	-0.411
Rental & Leasing Serv.	-0.015	0.218	0.101	-0.133	-0.116	0.351	0.086	0.084	-0.422	-0.890
Lessors	-0.240	-0.025	0.056	-0.049	-0.296	0.024	-0.184	-0.074	-0.823	-1.033
Profess., Scient. & Tech. Serv.	-0.128	0.075	0.191	0.019	-0.319	0.056	0.063	0.094	-0.409	-0.752
Management of Comp. & Enterp.	-0.039	0.085	0.136	0.023	-0.176	0.063	0.097	0.108	-0.190	-0.418
Administrative & Support Serv.	0.292	0.505	0.379	0.035	-0.087	0.470	0.672	0.540	-0.025	-0.714
Waste Manag. & Remed. Serv.	0.112	0.276	0.135	0.095	-0.023	0.181	0.247	0.371	-0.025	-0.106
Educational Serv.	-0.015	-0.013	0.034	-0.012	-0.049	-0.001	0.019	-0.025	-0.140	-0.233
Ambulatory Health Care Serv.	0.030	0.098	-0.086	-0.006	0.115	0.104	-0.056	0.092	-0.172	-0.054
Hospitals	0.016	0.053	-0.007	0.044	0.023	0.009	0.009	0.097	-0.046	0.015
Nursing & Resid. Care Facilities	0.075	0.088	-0.004	0.043	0.079	0.045	0.070	0.131	-0.036	-0.018
Social Assistance	0.111	0.276	0.016	0.039	0.095	0.237	0.127	0.315	0.032	0.078
Perform. Arts & Spectator Sports	-0.065	0.194	0.007	-0.009	-0.072	0.203	-0.058	0.186	-0.315	-0.347
Museums, Historical Sites & Sim.	-0.117	0.060	0.130	0.004	-0.247	0.056	0.014	0.064	-0.352	-0.604
Amus., Gambling & Recreation	0.152	0.340	0.213	0.036	-0.062	0.304	0.365	0.375	0.064	-0.292
Accommodation	-0.057	0.129	0.223	0.009	-0.281	0.121	0.166	0.138	-0.431	-0.860
Food Serv. & Drinking Places	0.011	0.119	0.010	-0.036	0.002	0.155	0.021	0.084	-0.089	-0.180
Repair & Maintenance	-0.030	0.100	0.047	-0.070	-0.078	0.170	0.017	0.030	-0.295	-0.529
Personal & Laundry Serv.	-0.084	0.031	0.013	-0.034	-0.097	0.065	-0.071	-0.003	-0.278	-0.372
Religious, Grant, Civic, Profes.	-0.028	0.070	0.116	0.072	-0.143	-0.001	0.088	0.142	-0.125	-0.213

Table 3a: Cumulative change in job flows due to a 1 s.d. negative oil price shock

Sectors	NEG contracting		NEG closing		POS expanding		POS opening	
	1 year	2 year	1 year	2 year	1 year	2 year	1 year	2 year
Total Private	0.067	-0.190	0.074	0.049	-0.064	0.071	0.060	0.096
Crop Production	0.015	-0.224	0.013	-0.042	0.110	0.059	0.186	0.263
Animal Production	-0.002	-0.116	0.064	-0.009	-0.086	-0.048	0.058	0.102
Forestry & Logging	0.108	-0.211	0.095	-0.041	0.138	0.230	0.113	0.136
Hunting, Fishing & Trapping	0.152	0.061	-0.701	-0.369	-0.086	0.116	0.203	0.382
Support Act. for AgrFor	0.648	0.526	0.206	-0.070	-0.555	-0.480	0.239	0.290
Oil & Gas Extraction	0.145	0.268	0.048	0.000	-0.156	-0.068	0.021	0.100
Mining (except Oil & Gas)	0.129	-0.219	0.002	-0.003	-0.039	-0.132	-0.002	-0.011
Support Act. for Mining	0.761	0.061	-0.024	-0.048	-0.603	-0.232	-0.032	0.006
Utilities	0.068	0.067	0.020	-0.005	-0.061	-0.057	0.045	0.076
Construction of Buildings	0.033	-0.497	0.074	-0.042	0.044	0.417	0.083	0.181
Heavy & Civil Eng. Construction	0.286	-0.127	0.117	-0.021	0.103	0.456	0.060	0.086
Specialty Trade Contractors	0.123	-0.428	0.099	-0.035	0.002	0.343	0.055	0.106
Food Manuf.	-0.040	-0.117	0.049	-0.006	-0.037	-0.009	0.042	0.072
Beverage & Tobacco Manuf.	0.185	0.147	-0.065	-0.039	-0.221	-0.032	-0.002	-0.009
Textile Mills	0.176	-0.674	0.043	-0.020	-0.019	0.105	0.023	0.021
Textile Product Mills	0.113	-0.499	0.111	-0.009	-0.045	0.141	-0.012	-0.013
Apparel Manuf.	0.343	-0.129	0.178	-0.026	-0.196	-0.091	-0.022	0.017
Leather & Allied Product Manuf.	0.148	-0.342	0.065	-0.019	-0.053	0.075	0.049	0.047
Wood Product Manuf.	-0.087	-1.012	0.086	-0.018	0.128	0.383	0.034	0.041
Paper Manuf.	0.110	-0.175	0.041	0.002	0.015	0.122	0.006	0.010
Printing & Related Support Act.	0.230	-0.162	0.076	-0.017	-0.074	0.107	0.024	0.046
Petroleum & Coal Manuf.	-0.082	-0.182	0.293	-0.004	-0.056	-0.065	0.232	0.307
Chemical Manuf.	0.181	-0.024	0.093	-0.003	0.005	0.094	0.106	0.157
Plastics & Rubber Manuf.	0.162	-0.510	0.086	-0.006	-0.088	0.122	0.038	0.058
Nonmetallic Mineral Manuf.	0.162	-0.506	0.074	-0.009	0.003	0.268	0.023	0.041
Primary Metal Manuf.	0.541	-0.421	0.123	-0.013	-0.074	0.102	0.077	0.083
Fabricated Metal Manuf.	0.438	-0.267	0.065	-0.008	-0.157	0.094	0.015	0.049
Machinery Manuf.	0.459	-0.245	0.061	-0.015	-0.197	0.010	0.031	0.047
Computer & Electronic Manuf.	0.497	0.066	0.114	-0.010	-0.318	-0.197	0.092	0.138
Electrical Equipment Manuf.	0.455	-0.127	0.032	-0.009	-0.240	-0.054	0.066	0.086
Transp. Equipment Manuf.	0.090	-0.877	0.028	-0.008	0.016	0.143	0.006	0.030
Furniture Product Manuf.	0.210	-0.668	0.058	-0.021	-0.018	0.273	0.039	0.056
Miscellaneous Manuf.	0.069	-0.240	0.033	-0.012	-0.072	0.086	0.030	0.052
Wholesalers, Durables	0.187	-0.158	0.101	-0.005	-0.137	0.077	0.059	0.096
Wholesalers, Nondurables	0.032	-0.113	0.035	-0.007	-0.065	0.048	0.030	0.059
Wholesale Electronic Markets	0.050	-0.130	0.079	-0.016	-0.150	-0.034	0.044	0.037
Motor Vehicle & Parts Dealers	0.023	-0.347	0.050	-0.018	-0.014	0.151	0.017	0.042
Furniture Stores	-0.147	-0.664	0.027	-0.052	0.071	0.341	-0.013	0.000
Electronics & Appliance Stores	-0.180	-0.406	0.160	-0.043	-0.220	-0.078	-0.049	-0.069
Building Mat. & Garden Equip.	-0.096	-0.433	0.031	-0.006	-0.027	0.221	-0.049	-0.077
Food & Beverage Stores	-0.019	-0.078	-0.019	-0.027	-0.165	-0.125	-0.032	-0.003
Health & Personal Care Stores	0.032	-0.017	0.105	-0.001	-0.148	-0.030	0.000	0.055

Table 3b: Cumulative change in job flows due to a 1 s.d. negative oil price shock

Sectors	NEG contracting		NEG Closing		POS expanding		POS opening	
	1 year	2 year	1 year	2 year	1 year	2 year	1 year	2 year
Gasoline Stations	-0.081	-0.163	0.061	-0.007	-0.137	-0.077	0.068	0.105
Clothing & Accessories Stores	-0.141	-0.370	-0.007	-0.019	-0.112	0.122	-0.040	-0.008
Sport, Hobby, Music & Books	0.152	-0.104	0.009	-0.013	-0.219	-0.018	0.007	0.079
General Merchandise Stores	0.103	-0.146	0.101	-0.011	-0.355	-0.330	0.038	0.040
Miscellaneous Store Retailers	0.105	-0.078	0.051	-0.012	-0.267	-0.103	0.019	0.064
Nonstore Retailers	0.252	-0.037	0.073	-0.005	-0.313	0.020	0.017	0.079
Air Transp.	0.622	0.208	0.009	-0.007	-0.211	-0.057	-0.016	-0.012
Water Transp.	0.101	-0.118	0.228	0.009	-0.090	0.157	0.100	0.232
Truck Transp.	0.074	-0.323	0.085	-0.021	-0.013	0.173	0.074	0.110
Transit & Ground Pass. Transp.	0.160	0.054	0.049	-0.006	0.038	0.037	0.057	0.080
Pipeline Transp.	0.254	0.160	0.260	-0.005	-0.017	-0.024	0.086	0.107
Scenic & Sightseeing Transp.	0.115	-0.305	0.330	-0.014	-0.444	-0.468	0.080	0.075
Support Act. for Transp.	0.208	-0.182	0.147	-0.006	-0.141	0.076	0.063	0.068
Couriers & Messengers	0.299	-0.106	0.049	-0.011	-0.028	0.334	0.014	0.020
Warehousing & Storage	0.043	-0.256	0.066	-0.002	-0.123	0.084	0.045	0.075
Publishing Industries (no Internet)	0.207	-0.117	0.052	-0.004	-0.132	0.033	0.004	0.032
Movie Picture & Sound Industries	-0.059	-0.214	0.384	0.004	-0.292	-0.215	0.080	0.227
Broadcasting (no Internet)	0.231	0.122	-0.016	-0.045	-0.064	0.098	-0.031	0.063
Telecommunications	0.357	0.046	0.325	-0.008	-0.196	-0.049	0.099	0.092
Data Proc., Host. & Related Serv.	0.469	0.164	0.362	-0.014	-0.470	-0.060	-0.044	0.110
Other Information Serv.	0.410	-0.110	0.298	-0.050	-0.919	-0.571	-0.194	-0.057
Credit Intermed. & Related Act.	-0.281	-0.385	0.013	-0.013	0.252	0.280	0.044	0.073
Financial Investments	0.239	-0.215	0.130	-0.017	-0.255	-0.112	0.035	0.038
Insurance Carriers & Related Act.	-0.040	-0.077	0.094	0.001	0.117	0.199	0.028	0.070
Funds, Trusts & Other Finan. Veh.	0.189	0.108	0.646	-0.053	0.037	0.299	0.366	1.209
Real Estate	-0.121	-0.281	-0.030	-0.010	-0.026	0.074	0.069	0.108
Rental & Leasing Serv.	0.196	-0.160	0.086	-0.021	-0.144	0.104	0.002	0.060
Lessors	-0.273	-0.373	0.093	-0.031	-0.434	-0.308	0.013	0.073
Profess., Scient. & Tech. Serv.	0.132	-0.112	0.092	-0.008	-0.146	0.054	0.037	0.107
Management of Comp. & Enterp.	0.126	-0.042	0.033	-0.005	-0.082	0.038	0.036	0.062
Administrative & Support Serv.	0.303	-0.221	0.156	-0.029	0.191	0.453	0.120	0.129
Waste Manag. & Remed. Serv.	0.161	0.051	0.176	0.005	0.020	0.208	0.181	0.259
Educational Serv.	-0.011	-0.091	0.071	-0.006	-0.034	-0.078	0.019	0.047
Ambulatory Health Care Serv.	-0.007	0.055	0.007	-0.021	-0.029	-0.017	0.036	0.069
Hospitals	-0.042	-0.007	-0.011	-0.012	0.031	0.007	0.019	0.040
Nursing & Resid. Care Facilities	-0.058	-0.002	0.071	0.003	0.005	-0.042	0.048	0.073
Social Assistance	-0.051	-0.092	0.050	-0.002	-0.041	-0.006	0.651	0.864
Perform. Arts & Spectator Sports	0.163	0.216	0.093	-0.090	0.064	0.427	0.115	0.168
Museums, Historical Sites & Sim.	0.135	-0.091	0.036	-0.005	-0.277	-0.061	0.056	0.081
Amus., Gambling & Recreation	0.051	-0.205	0.222	-0.061	-0.153	-0.022	0.081	0.136
Accommodation	0.251	-0.112	0.081	-0.002	-0.153	-0.020	0.055	0.075
Food Serv. & Drinking Places	-0.069	-0.219	0.041	-0.018	-0.108	-0.028	-0.002	-0.006
Repair & Maintenance	0.029	-0.174	0.071	-0.008	-0.157	-0.052	0.025	0.063
Personal & Laundry Serv.	0.011	-0.112	0.015	-0.001	-0.166	-0.082	0.002	0.029
Religious, Grant, Civic, Profes.	0.109	0.037	0.142	0.002	-0.092	-0.017	0.066	0.090

Figure 1a: Oil prices and job flows

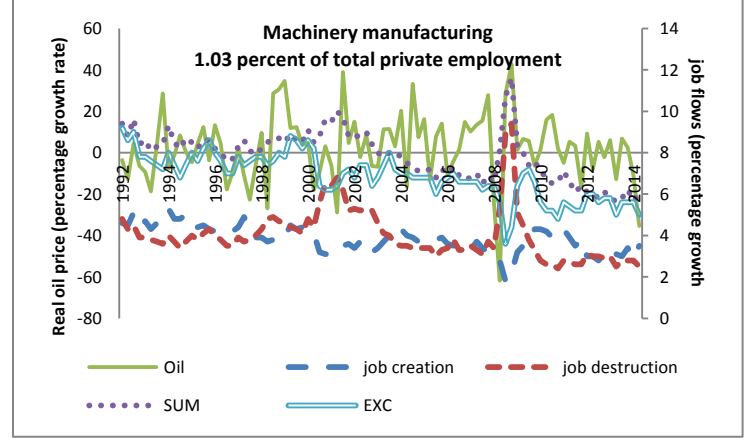
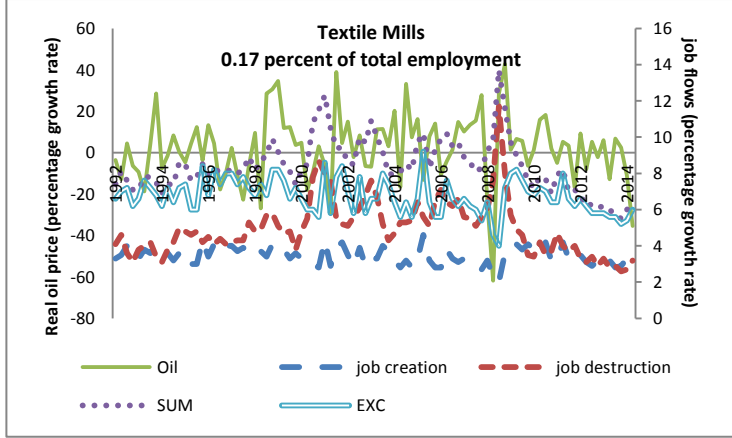
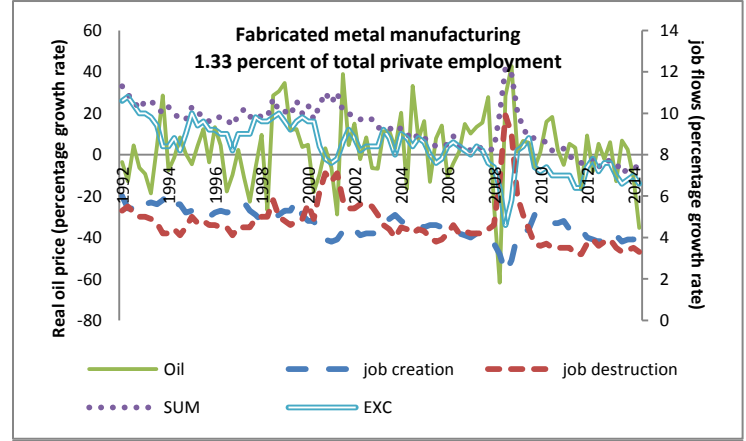
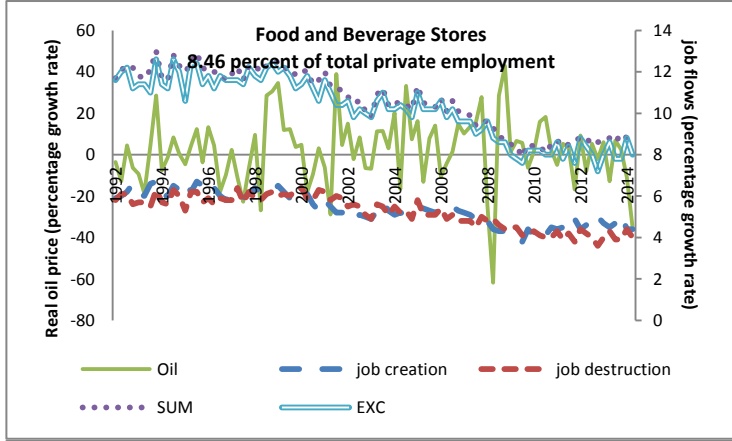
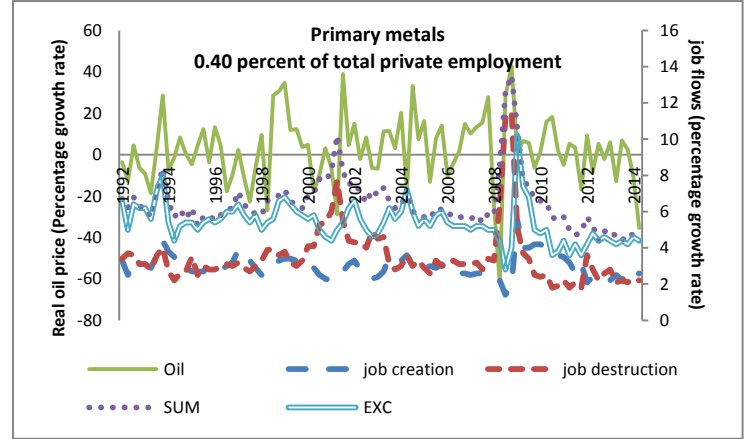
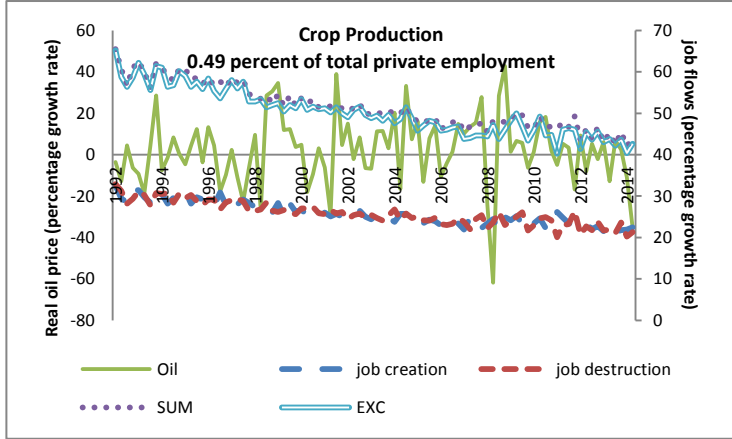
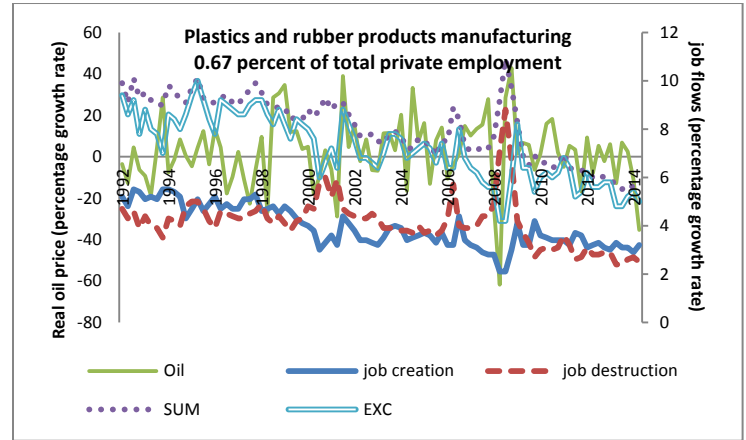
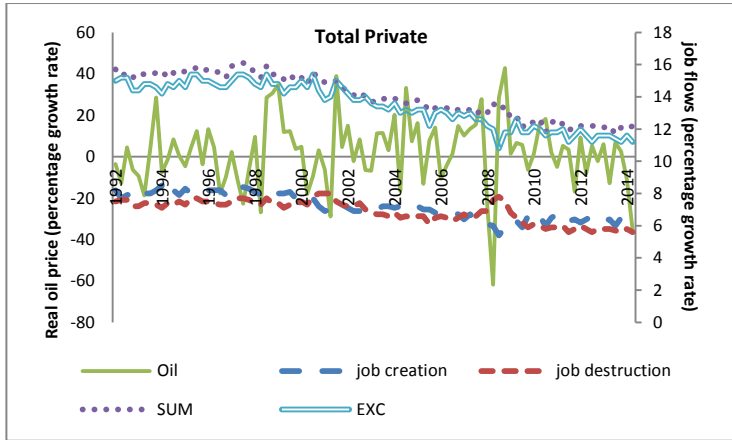


Figure 1b: Oil prices and job flows

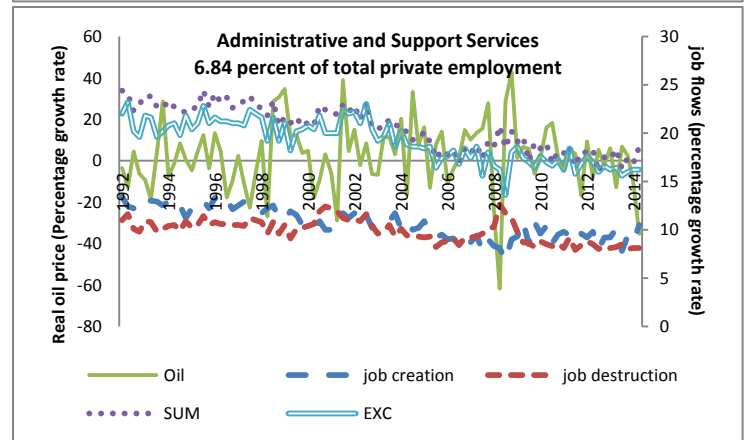
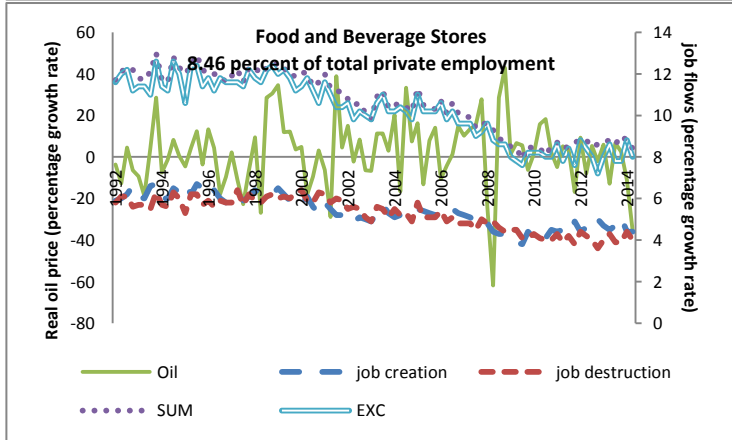
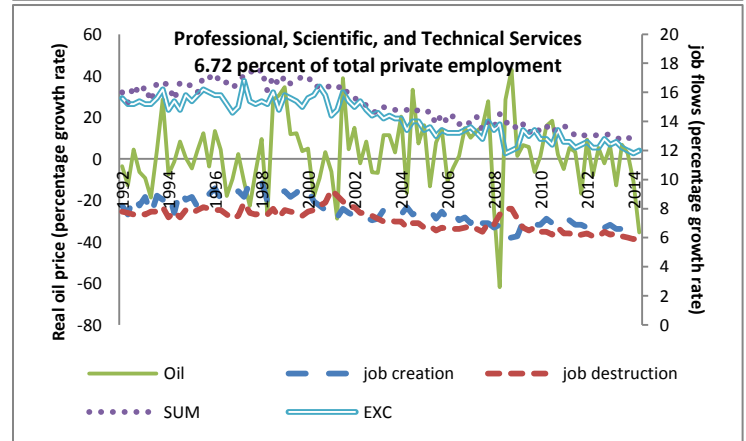
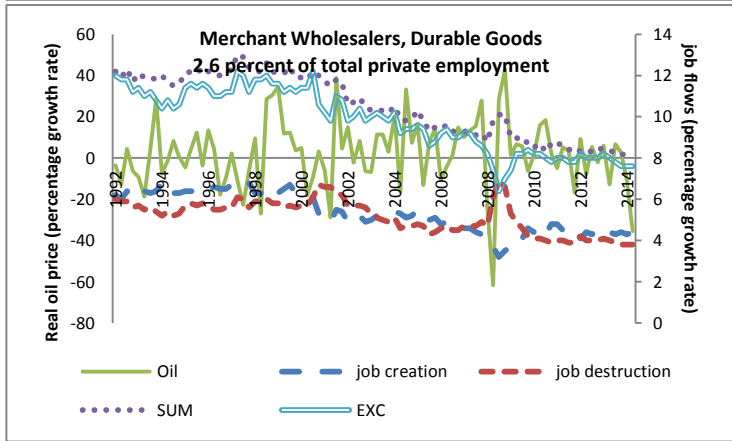
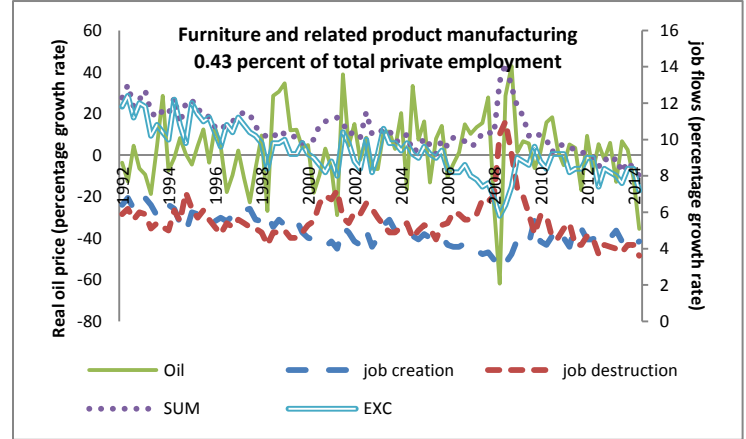
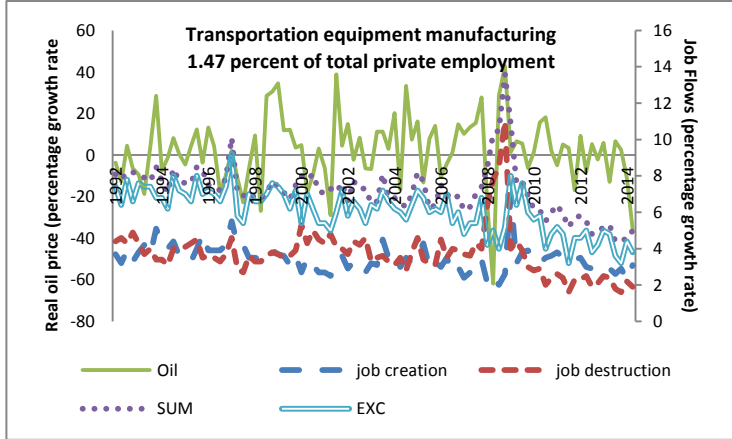
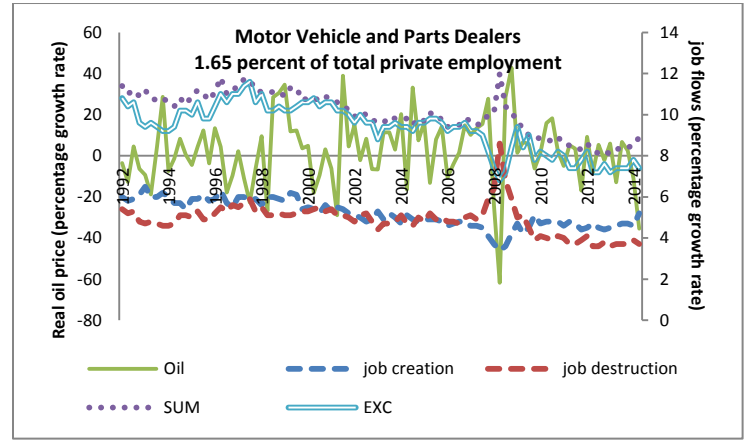
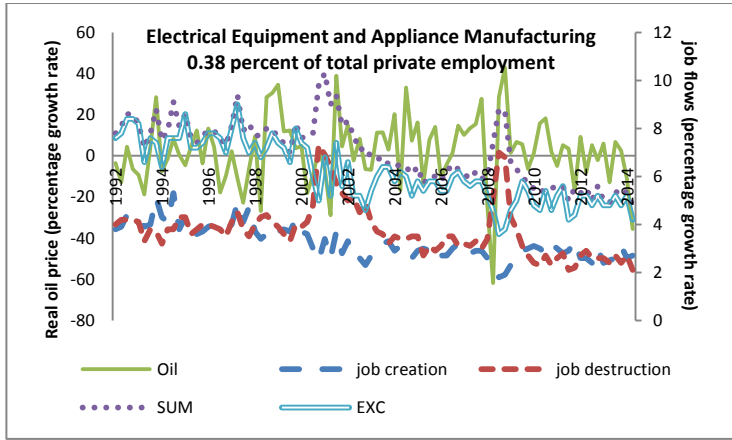
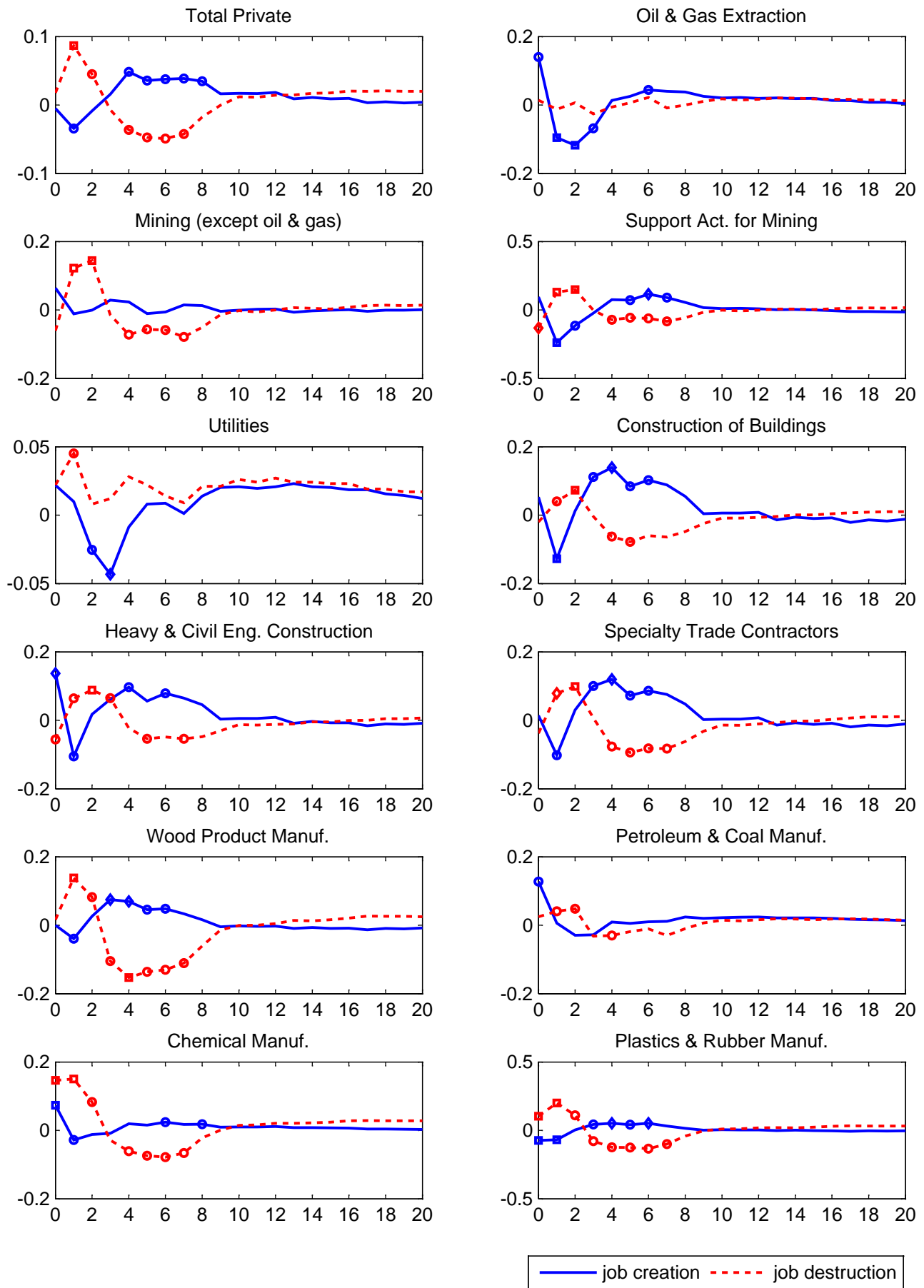
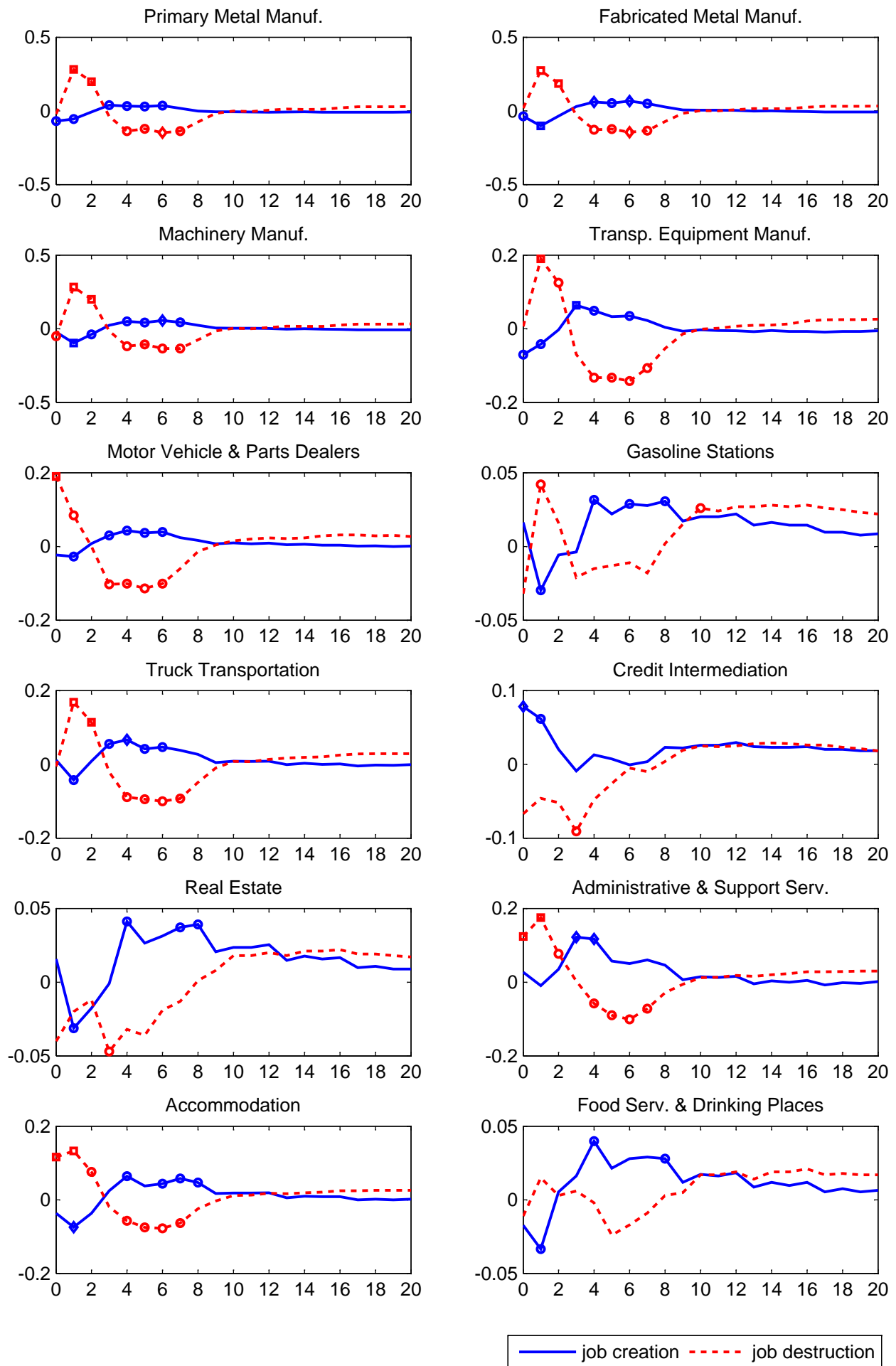


Figure 2a: Responses of job creation and job destruction to a negative oil price shock of 1 s.d.



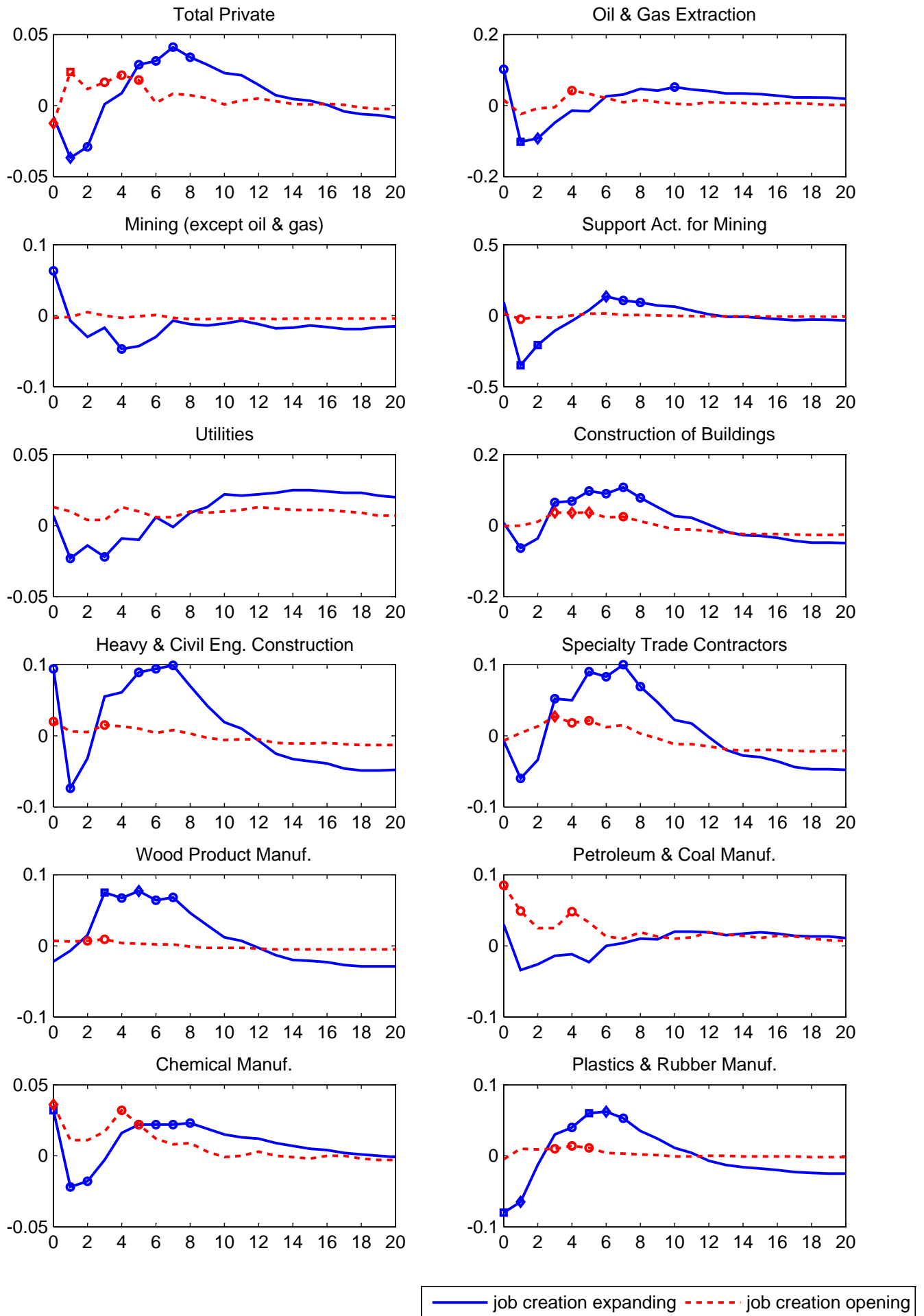
Notes: Squares, diamonds and circles represent significance at the 5%, 10% and 32%, respectively

Figure 2b: Responses of job creation and job destruction to a negative oil price shock of 1 s.d.



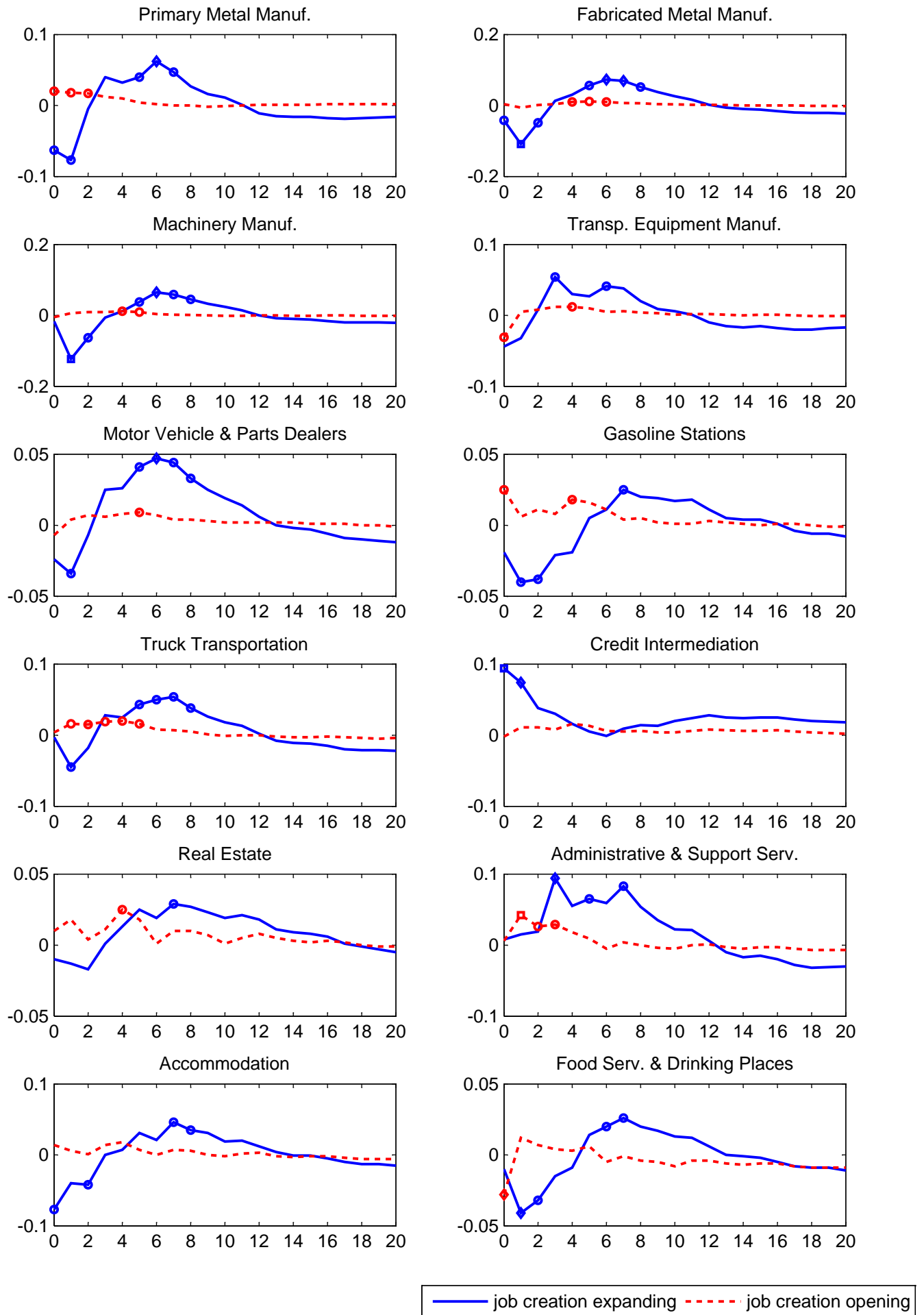
Notes: Squares, diamonds and circles represent significance at the 5%, 10% and 32%, respectively

Figure 3a: Responses of job creation from expanding and opening establishments to a negative oil price shock of 1 s.d.



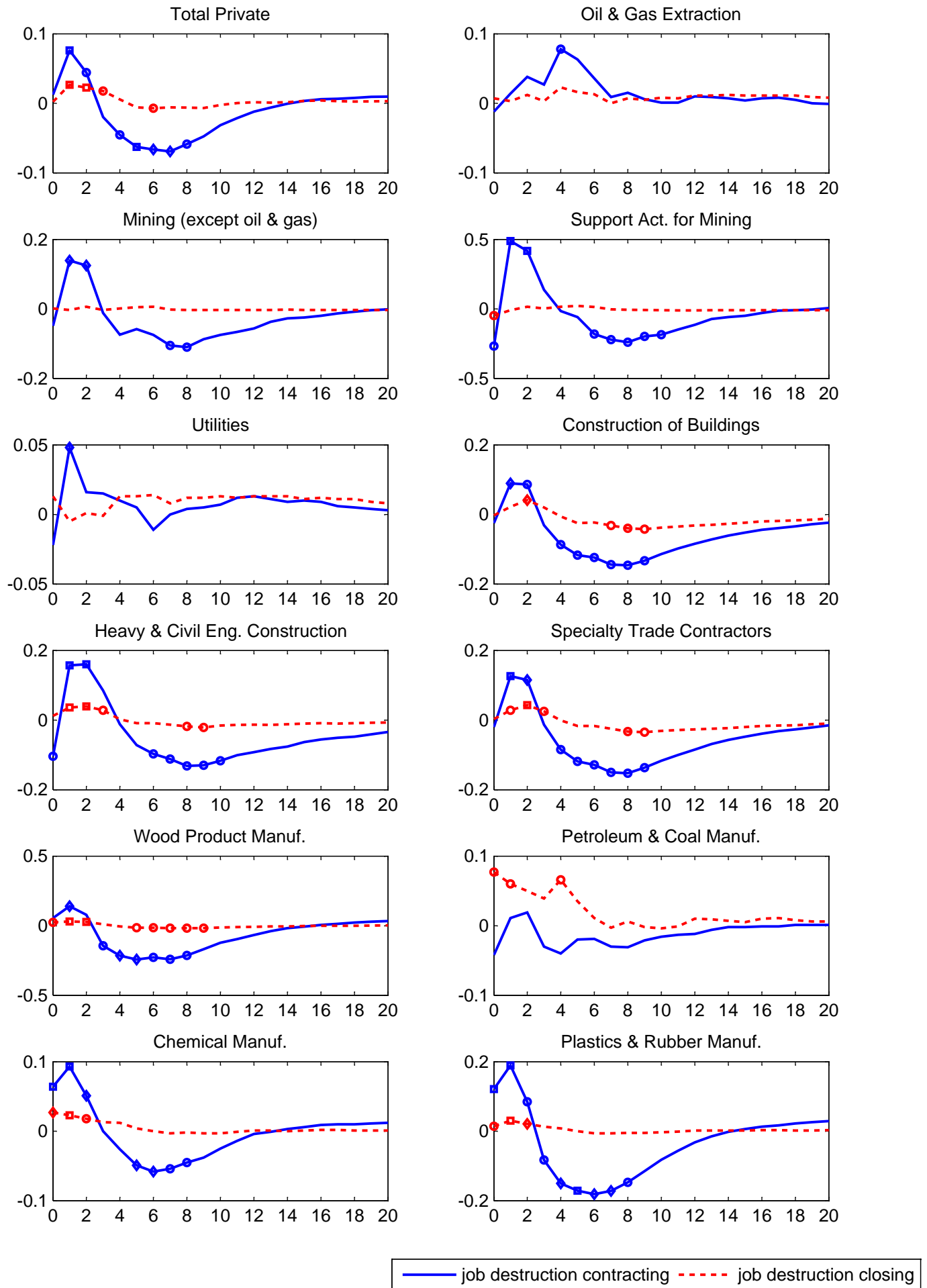
Notes: Squares, diamonds and circles represent significance at the 5%, 10% and 32%, respectively

Figure 3b: Responses of job creation from expanding and opening establishments to a negative oil price shock of 1 s.d.



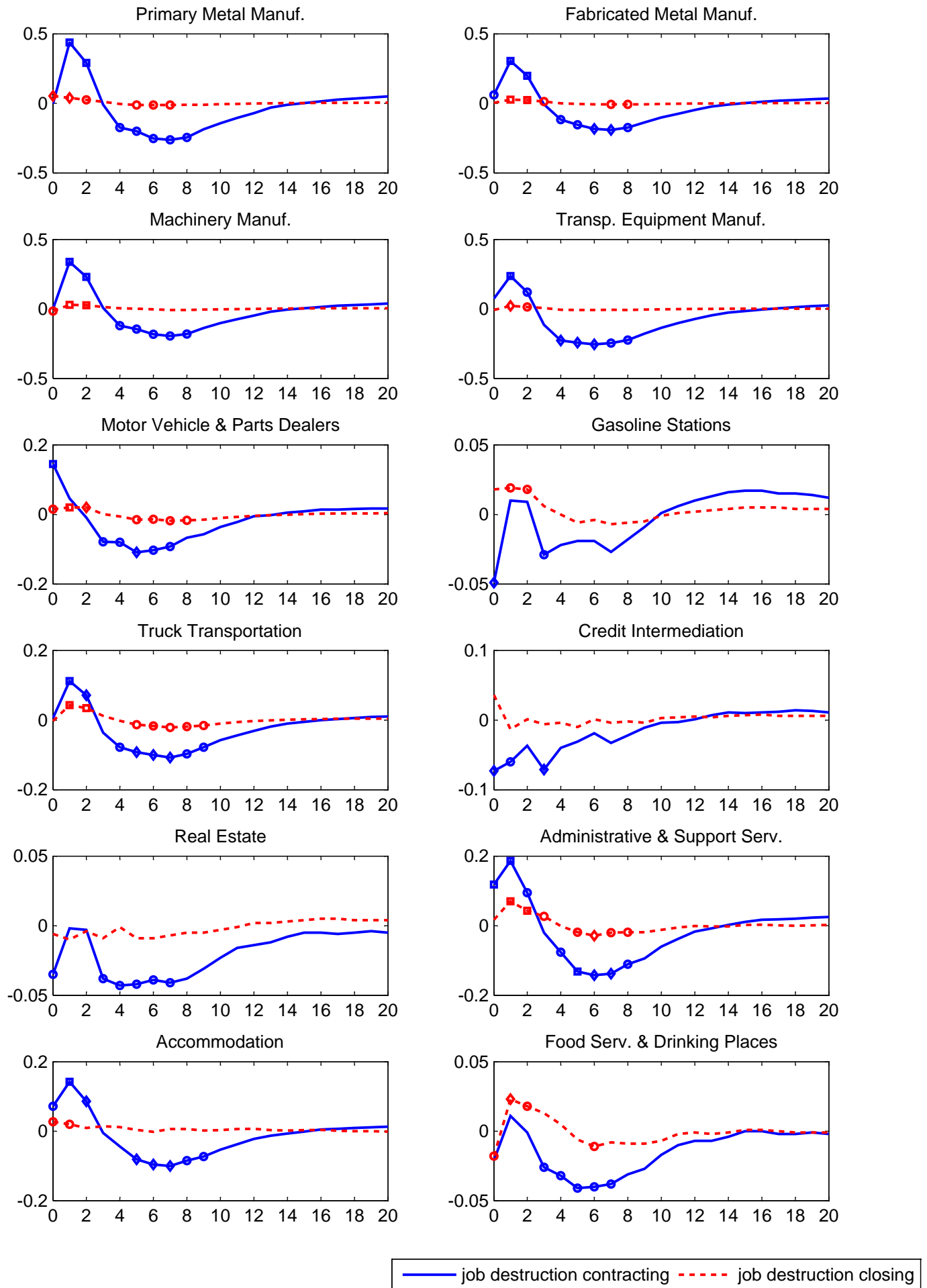
Notes: Squares, diamonds and circles represent significance at the 5%, 10% and 32%, respectively

Figure 4a: Responses of job destruction from contracting and closing establishments to a negative oil price shock of 1 s.d.



Notes: Squares, diamonds and circles represent significance at the 5%, 10% and 32%, respectively

Figure 4b: Responses of job destruction from contracting and closing establishments to a negative oil price shock of 1 s.d.



Notes: Squares, diamonds and circles represent significance at the 5%, 10% and 32%, respectively

7 Appendix

Table A.1a List of industries and their employment share of total private sector expressed in percentage

Code	Industry	Employment share
111	Crop Production	0.49
112	Animal Production	0.20
113	Forestry and Logging	0.06
114	Hunting, Fishing, and Trapping	0.01
115	Support Activities for Agriculture and Forestry	0.30
211	Oil and Gas Extraction	0.14
212	Mining (except Oil and Gas)	0.19
213	Support Activities for Mining	0.26
221	Utilities	0.51
236	Construction of Buildings	1.35
237	Heavy and Civil Engineering Construction	0.82
238	Specialty Trade Contractors	3.73
311	Food Manufacturing	1.35
312	Beverage and Tobacco Product Manufacturing	0.18
313	Textile Mills	0.17
314	Textile Product Mills	0.14
315	Apparel Manufacturing	0.21
316	Leather and Allied Product Manufacturing	0.03
321	Wood Product Manufacturing	0.41
322	Paper Manufacturing	0.41
323	Printing and Related Support Activities	0.53
324	Petroleum and Coal Products Manufacturing	0.10
325	Chemical Manufacturing	0.77
326	Plastics and Rubber Products Manufacturing	0.67
327	Nonmetallic Mineral Product Manufacturing	0.41
331	Primary Metal Manufacturing	0.40
332	Fabricated Metal Product Manufacturing	1.33
333	Machinery Manufacturing	1.03
334	Computer and Electronic Product Manufacturing	1.14
335	Electrical Equipment, Appliance, and Component Manufacturing	0.38
336	Transportation Equipment Manufacturing	1.47
337	Furniture and Related Product Manufacturing	0.43
339	Miscellaneous Manufacturing	0.57
423	Merchant Wholesalers, Durable Goods	2.66
424	Merchant Wholesalers, Nondurable Goods	1.81
425	Wholesale Electronic Markets and Agents and Brokers	0.71
441	Motor Vehicle and Parts Dealers	1.65
442	Furniture and Home Furnishings Stores	0.46
443	Electronics and Appliance Stores	0.47
444	Building Material and Garden Equipment and Supplies Dealers	1.10
445	Food and Beverage Stores	2.60
446	Health and Personal Care Stores	0.88

Table A1b: List of industries and their employment share of total private sector expressed in percentage

Code	Series ID	Employment share
447	Gasoline Stations	0.78
448	Clothing and Clothing Accessories Stores	1.26
451	Sporting Goods, Hobby, Musical Instrument, and Book Stores	0.57
452	General Merchandise Stores	2.70
453	Miscellaneous Store Retailers	0.78
454	Nonstore Retailers	0.40
481	Air Transportation	0.45
483	Water Transportation	0.05
484	Truck Transportation	1.23
485	Transit and Ground Passenger Transportation	0.37
486	Pipeline Transportation	0.04
487	Scenic and Sightseeing Transportation	0.03
488	Support Activities for Transportation	0.51
492	Couriers and Messengers	0.50
493	Warehousing and Storage	0.56
511	Publishing Industries (except Internet)	0.77
512	Movie Picture and Sound Recording Industries	0.34
515	Broadcasting (except Internet)	0.28
517	Telecommunications	0.90
518	Data Processing, Hosting, and Related Services	0.29
519	Other Information Services	0.10
522	Credit Intermediation and Related Activities	2.44
523	Securities, Commodity Contracts, and Other Financial Investments	0.74
524	Insurance Carriers and Related Activities	1.92
525	Funds, Trusts, and Other Financial Vehicles	0.07
531	Real Estate	1.29
532	Rental and Leasing Services	0.53
533	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	0.02
541	Professional, Scientific, and Technical Services	6.72
551	Management of Companies and Enterprises	1.68
561	Administrative and Support Services	6.84
562	Waste Management and Remediation Services	0.32
611	Educational Services	2.09
621	Ambulatory Health Care Services	5.02
622	Hospitals	4.05
623	Nursing and Residential Care Facilities	2.70
624	Social Assistance	2.14
711	Performing Arts, Spectator Sports, and Related Industries	0.36
712	Museums, Historical Sites, and Similar Institutions	0.11
713	Amusement, Gambling, and Recreation Industries	1.26
721	Accommodation	1.64
722	Food Services and Drinking Places	8.46
811	Repair and Maintenance	1.10
812	Personal and Laundry Services	1.17
813	Religious, Grantmaking, Civic, Professional, and Similar Organizations	1.19