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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. Following an unexpected oil price drop in the first year, we find that in 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 an increase in the net employment change. An unexpected decline in the real oil price slows down the pace of gross job reallocation. We demonstrate that the increase (decrease) in private job destruction (creation) observed during the first year is primarily driven by the response of closing (expanding) firms in services and manufacturing.

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 were experiencing large declines since July of 2014,[1] the question that arises is where do jobs go when oil prices drop?

Some journalists and stock market commentators have argued that "the U.S. economy and stock market as a whole won't even notice" the decline in oil prices (Ro, 2014). They would argue that even though the energy sector's share in U.S. investment has increased significantly since the shale boom (e.g., the oil and gas sector accounted for about 31% of capital expenditures of Compustat firms in 2014), energy represents only a small fraction of aggregate GDP (e.g., gas and oil extraction accounted for about 1.3% of GDP in 2014). Nevertheless, as we will show, oil price shocks exert a disproportionate effect not only on job flow in the energy sector but also in manufacturing and services. Indeed, lower oil prices are good news for sectors that use energy intensively in production or consumption.

This paper employs data on U.S. job flows to investigate the effect of unexpected oil price decreases on the labor market. We build on the work of Davis and Haltiwanger (2001) and Herrera and Karaki (2015) who explore the effect of oil price shocks on job reallocation, motivated by the theoretical analysis in Hamilton (1988). 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. Our paper differs from previous studies in four dimensions. 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

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[1] See Baumeister and Kilian (2015) for an excellent analysis on the sources of this decline in oil prices.

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U.S. manufacturing.[2] Hence, these studies have largely ignored the impact on labor flows in the services and mining. Given the secular increase in the share of employment accounted for by services, the fast expansion of U.S. shale oil production since 2013 (see, Kilian (in press)), and the role that both oil and gas industries have played in generating jobs after the Great Recession, it is important to include these sectors in any analysis aimed at understanding the response of job flows to oil price shocks. Second, we re-examine the degree of job reallocation generated by oil price shocks using sectoral job creation and destruction data that extend beyond the 1990s. Exploiting disaggregated data on job flows for this period is important given that both labor and crude oil markets have experienced important changes. In particular, recent work by Davis and Haltiwanger (2014) reveals a decrease in the fluidity of U.S. labor markets since the 1990s and work by Kilian (2009) uncovers a greater role for demand shocks in driving real oil prices. Third, the methodology employed here differs from previous studies. Both Davis and Haltiwanger (2001) and Herrera and Karaki (2015) estimate vector autoregressive models where oil prices can have a nonlinear effect on job flows. Here, motivated by the lack of evidence in favor of asymmetry (see Herrera and Karaki (2015)), we restrict the effect of oil prices to be linear. Finally, we investigate whether the response of job reallocation to oil price shock stems from the impact on expanding/contracting firms or entering/exiting firms. This question has not been addressed by previous studies.

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 aggregate variables and on some unobserved common 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. One year after the unexpected oil price decrease, the cumulative change in job creation ranges from −0.744 percentage points in other information services to 0.965 percentage points in scenic and sightseeing transportation, whereas the corresponding change in job destruction ranges from −0.478 percentage points in scenic and sightseeing transportation to 0.820 percentage points in funds, trusts and other financial variables. On the one hand, oil and gas extraction and support activities for mining exhibit a decrease of 0.175 and 0.919 percentage points in the rate of change in net employment during the first year following an unexpected oil price decline. On the other hand, construction, manufacturing and services respond to the decline in oil prices by expanding employment via higher job creation (e.g. the cumulative one-year changes for construction of buildings, wood manufacturing and funds, trusts and other financial vehicles equal 0.128, 0.100, and 0.761 percentage points, respectively) and by slightly lowering job destruction. In particular, industries that are more energy intensive in production experience larger job gains. As a result, the pace of job reallocation, measured by excess job reallocation, declines by 0.162 percentage points in the private sector. This result is consistent with Herrera and Karaki (2015) who – using and earlier sample – find that job reallocation increases in manufacturing after a positive oil price innovation, especially in transportation equipment, textiles, petroleum and coal, and rubber and plastics. Yet, this paper reveals that the positive relationship between oil price changes and job reallocation extends beyond manufacturing. Furthermore, we find evidence that during this period of lower job market fluidity and higher domestic oil production, employment in the private sector declines a year after an unexpected drop in oil prices but it recovers by the second year.

[2] See for instance Kilian and Vigfusson (2011), Davis and Haltiwanger (2001), Herrera and Karaki (2015).

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. Focusing on total private sector, the one year cumulative change in net employment is −0.183 percentage points. Yet two years after the shock, the cumulative change in net employment is 0.058 percentage points. The short-run effects on private net employment are mainly driven by the response of expanding and closing firms in services and manufacturing. Yet, as time goes by, entering firms in all sectors generate more jobs and less jobs are destroyed by exiting establishments.

Finally, we investigate what proportion of the historical variation in the job creation and destruction rates is accounted by oil price shocks during the shale oil boom. We find that of the 0.5 percentage points of cumulative increase in net employment growth between 2004:I and 2014:IV, 0.08 percentage points are attributed to oil price shocks. Thus, oil price shocks accounted only for a small proportion of the cumulative change in the net employment. This finding is robust to splitting the sample in the period of the rapid shale oil expansion (2004:I–2014:II) and the collapse of oil prices (2014:II–2014:IV).

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. In Section 6 we investigate the role of oil price shocks in explaining the historical changes in net employment during the shale oil boom. We set forth our main conclusions in Section 7.

2. Data

The aggregate data comprise the log growth of the real oil price, the interest rate quality spread, and the total job creation and job destruction rates for the private sector (hereafter total job creation and total job destruction) computed as follows. The real oil price is calculated by deflating the imported U.S. crude oil refiners acquisition cost reported by the Energy Information Agency by the U.S. consumer price index (CPI). The interest rate quality spread – hereafter 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. Including the spread in the aggregate block allows us to control for changes in credit conditions over the period under analysis.

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

$$POS_{i,t} = POS_{\exp anding,i,t} + POS_{opening,i,t}, \tag{1}$$

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

$$NEG_{i,t} = NEG_{contracting,i,t} + NEG_{closing,i,t}, \tag{2}$$