

OIL AND UNEMPLOYMENT IN A NEW-KEYNESIAN MODEL

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Overview

In the two recession periods in the United States in the 1970s', oil prices reached a secular peak just prior to an economic contraction. However in the last oil shock of the 2000s', it seems that this typical characteristic vanished. Despite the huge increase of oil prices from the beginning of 2002 until mid 2008, the effects on inflation and economic growth were less striking than the one observed in the 1970s', but the effects on unemployment remain. The rate of unemployment rose by 6 per cent from the beginning of 2007 until mid 2010, which is comparable with the 4 and 5 per cent unemployment increase some quarters after the oil shocks in the 1970s'. While it cannot be denied the influence of the sub-prime crisis of 2008 for the high unemployment rate observed in 2010, we must not dismiss the effects of oil price shocks either, which have been behind the unemployment increase in the 1970s'.

The theme is not new: empirical literature has already studied the various transmission channels through which oil price shocks may have an impact on the economic activity: growth, inflation, unemployment. Just to name some, works from Hamilton (1983, 2009), Barsky & Kilian (2004), Löschel & Oberndorfer (2009), Doğrul & Soytas (2010), particularly state the strong correlation between oil shocks and unemployment rate increases. On the theoretical side, Hamilton (1988) constructs a general equilibrium model of unemployment and the business cycles and shows that oil price shock plays a role on unemployment rise. Davis & Hatwanger (2001) study the effects of oil price shocks on the creation and destruction of U.S. manufacturing jobs from 1972 to 1988, and find that oil shocks account for between 20 and 25 per cent of the variability in employment growth. Acurio Vasconez et al. (2013) and Acurio Vasconez (2014) construct Dynamic Stochastic General Equilibrium (DSGE) models that introduce oil in consumption and production. The Acurio Vasconez (2014) model recovers some of the well-known stylized facts after an oil shock in the latest years. However, no DSGE model that includes oil covers the issue of unemployment. Regarding the New-Keynesian model as a powerful tool for monetary policy analysis I believe that a model that includes both of these elements, oil and unemployment, is more than necessary.

With this in mind, this paper constructs a DSGE model that combines the recent modelization of unemployment dynamics developed by Mortensen & Pissarides (1994), with staggered multi-period wage contracting as in Gertler & Trigari (2009), staggered prices as in Gertler et al. (2009) and Blanchard & Galí (2010) and introduces oil in consumption and production as in Acurio Vasconez (2014). Within this framework, I analyze the impact of an oil shock.

Apart from displaying some of the well-known stylized facts after an oil price shock in the 2000s': a low level of inflation rate, a decrease on real wages, an inelastic price elasticity of oil demand, and a small decrease in GDP, the model also recovers an increase on unemployment that reaches its maximum some months after the shock.

Methods

The model relies on the unemployment dynamics à la Mortensen & Pissarides (1994) with staggered multi-period wage contracting as in Gertler & Trigari (2009). It also assumes a small open economy where oil is imported from a foreign country at an exogenous real price and used in consumption and production. As in Acurio Vasconez (2014), oil is assumed to be bad substitutable to others quantities. Finally the model also includes staggered prices.

The model consists of three sectors: Households, Firms and Government. The oil and capital markets are markets with exogenous price. The intermediate firm market will be considered as perfectly competitive. The retailers' market is however monopolistic, where as in Calvo (1983) just a fraction of the firms are able to renegotiate their prices. In contrast to models without unemployment, labor in this paper will be traded in a process that exhibits search externalities for individual households and vacancy openness for firms.

There exists a representative household with a continuum of members of measure unity, who put their income in a pool and let the head of the family self-insure their consumption path against unemployment risk. A fraction of them works for the intermediate firms and earn a salary. The remaining part searches for a job and receives unemployment benefits. Besides, the family has a diversified ownership stake in firms, which payout profits, pays

lump-sum taxes, consumes final domestic goods and oil, invests in government bonds, for what it receives a nominal interest rate and invest in capital, which is rent to firms at a real rental rate of capital.

There exist two kinds of firms. The intermediate good producers are price-takers and use labor, oil and capital to produce their goods that are sold to the retailers. It also posts vacancies in order to attract new workers for the next period. Posting vacancies has a quadratic cost. The representative intermediate firm maximizes its profit by choosing quantities of oil, capital and vacancies. Additional to that, a fraction of the intermediate firms can bargain with the households in order to fix a new wage. This negotiation will be done in a Nash bargaining framework. The retailers in the other hand are monopolistic firms and a fraction of them is able to re-optimize its price at each period.

Finally, there is a Government sector that has exogenous spending and a Central Bank that sets the nominal short-term interest rate by a monetary policy. The model is calibrated and its reaction analyzed, face to a shock on the real price of oil.

Results

The impulse response function analysis recovers most of the well-known stylized facts after an oil price shock in the 2000s: a weak GDP decrease coupled with a low level of inflation rate, a decrease on real wages, an inelastic price elasticity of oil demand, and which is particular in this model, an increase of unemployment. In this model, capital and labor are not perfectly substitutes for oil, then a real oil price shock provokes a decrease on the quantity of vacancies that the firm post in order to attract new workers, which in turn will provoke unemployment. A side effect of this phenomenon is the increase in the probability that a firm fills a vacancy, and the decrease in the probability that a worker finds a job. The reduction of real wages comes from the increasing of job searching, which arises because the unemployment generated after an oil shock.

Conclusions

Most of the oil shocks in US have been followed by a contraction of the economy: reduction of GDP, inflation and unemployment. While the latest oil shock of the 2000s' differs from previous ones in the reaction of growth and inflation, the consequences on unemployment remain, without disregarding the obvious effects of the sub-prime crisis of 2008. Some empirical papers have already studied this interaction, but at the time being, no DSGE has addressed this problem. Therefore, this paper constructs a New-Keynesian model that introduces a more realistic labor market with frictions as in Gertler & Trigari (2009) in a model where oil is used in production and consumption and is not easily substitutable to other quantities, as in Acurio Vásconez (2014). The reaction of such a model to an oil shock, recovers most of the stylized facts observed after the latest oil shock in the 2000s'.

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