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Comment   Julio J. Rotemberg

Using a battery of compelling statistical methods, this chapter shows that the statistical effect of oil price shocks on output and inflation is more muted after 1984 than it was in the post-war period up to that point. As it happens, a small response of the economy to oil price increases is more consistent with standard macroeconomic models. There is thus a sense in which developments in the economy may lead this issue to lose its allure. In my opinion, however, it is precisely because we observed puzzling responses to what were arguably exogenous disturbances, that this topic is a great laboratory for understanding central features of the economy as a whole. Thus, I very much welcome this chapter's effort to disentangle the causes of this change in response.

The chapter offers three basic stories for the decline in the response to the price of oil. These are: (a) that "real wage rigidity" was more important in the past than it is today; (b) that "monetary policy credibility" was weaker in the past than it is today, and (c) that the share of energy in the economy was larger in the past than it is today. The message of this chapter is thus optimistic in that it suggests a transformation in U.S. institutions has inoculated the economy against the responses that we saw in the past.

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In this discussion, I articulate some concerns about all three mechanisms introduced by Blanchard and Galí. First, I see the "real wage rigidity" emphasized in this chapter as being of relatively limited use in explaining the large responses observed in the past. Moreover, I see very little evidence that such rigidities have become less prevalent more recently, as required for this story to explain the reduction in the importance of oil shocks. Second, the model of low credibility of central banks that the authors introduce has counterfactual implications for the response of real interest rates to oil price shocks, so it does not seem compelling as an explanation of past responses. Third, while I agree with Blanchard and Galí that the value of energy has fallen relative to gross domestic product (GDP), the importance of this phenomenon is not easy to quantify. After devoting three sections to spelling out my reactions to the three mechanisms emphasized by Blanchard and Galí, my comment closes with some alternative interpretations for the reduction in the measured effect of oil price increases on the economy.

The Importance of Reductions in Real Wage Rigidity

Blanchard and Galí suppose that, if there were no real wage rigidities, households would be indifferent between consuming one additional hour of leisure and working this extra hour in exchange for consuming the proceeds. With log utility for consumption and a Frisch labor supply of 1, this would imply that the log of real wages is equal to the sum of the log of employment plus the log of consumption. As a result, the wage should rise by considerably more than 1 percent every time that GDP rises by 1 percent. In practice, real wages are only slightly procyclical.[1]

It thus seems difficult to disagree with the notion that this model is inaccurate as a description of labor market equilibrium. Moreover, the equation that Blanchard and Galí propose to use instead is a paragon of simplicity. They suppose that

$$w_t - p_{c,t} = (1 - \gamma)(c_t + \phi n_t),$$

where w_t, $p_{c,t}$, c_t, and n_t represent, respectively, the nominal wage, the consumer price index, consumption, and employment at t. While this is a convenient simplification of labor markets, it fits far from perfectly, and this makes it difficult to estimate γ or its change. Nonetheless, Blanchard and Galí argue that the parameter γ that represents real wage rigidity has fallen in the United States. Blanchard and Galí defend this claim by noting that real wage declines after energy price increases were similar in the pre- and post-1984 period while the reductions in $(c_t + \phi n_t)$ were much larger in the earlier period. They interpret this as suggesting that wages are now more (procyclically) sensitive to employment and consumption so that γ is smaller.

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1. My interpretation of the relevant empirical findings can be found in Rotemberg (2006).

Unfortunately, we do not know that real wages respond only to $(c_t + \phi n_t)$ as opposed to responding also to other variables. And, since letting $\gamma \neq 0$ is an ad hoc emendation of a model that fits badly, there is no a priori reason to suppose that wages do indeed respond only to this variable. An alternative hypothesis, therefore, is that firms were, and remain, able to reduce consumption wages when oil prices rise for reasons having nothing to do with this model of wage determination while the response of wages to employment and consumption has remained unchanged. To see which of these alternatives is more valid one could look at other shocks that move consumption and employment and study whether these now have larger procyclical effects on wages.

A crude way of doing this is to run a regression of $(w_t - p_{c,t} - c_t - n_t)$ on $(c_t + n_t)$. According to the Blanchard-Galí interpretation, this coefficient should be more negative in the earlier period when wages were unresponsive to $(c_t + n_t)$, while it should be closer to zero in the more recent one. Using that data that Blanchard and Galí have graciously provided, the earlier period yields a coefficient of $-.917$ while the latter yields -1.057. Thus, by this metric, real wages have become slightly less procyclical and γ has risen over time. This is precisely contrary to the Blanchard-Galí conclusion that "the response of the consumption wage to the marginal rate of substitution [. . .] appears to have increased over time."

In any event, real wage rigidity (and its changes) cannot be the whole story even though the idea that the failure of wages to adjust played an important role in the recessions induced by oil price increases has a distinguished history. As Bruno and Sachs (1985) pointed out, oil price increases necessitate a reduction in real wages because they lead workers to produce a lower value of "net output." Thus, an unwillingness of workers to reduce their wages would lead firms to curtail their employment. As Rotemberg and Woodford (1996) have stressed, however, the amount by which wages must fall for firms to keep their employment unchanged is extremely small.

To see this, follow Rotemberg and Woodford and consider a general constant returns to scale production function that relates output Y_t to value added $V(H_t)$ and energy inputs E_t, where H_t is the volume of employment

$$Y_t = Q(V(H_t), E_t).$$

Constant returns then implies that

$$Y = Q_{Vt}V_t + Q_{Et}E_t.$$

The first-order conditions for profit maximization are

$$Q_{Et} = \mu_t p_{Et} \quad \text{and} \quad Q_{Vt}V_H(H_t) = \mu_t W_t,$$

where μ_t is the markup of price over marginal cost, p_{Et} is the price of energy relative to the price of final output, and W_t is the real wage in terms of final output. The left-hand side of the second of these equations falls with

employment. Thus, this equation says that employment will fall if either the real wage or the markup rise.

These equations can be used to study the extent to which the real wage W_t needs to fall to keep employment constant. One way of demonstrating that this change is quite small is to focus on the wage deflated by the value-added deflator defined as

$$P_{Vt} \equiv \frac{Y_t - P_{Et}E_t}{V(H_t)}.$$

With perfect competition, $\mu_t = 1$ so the previous equations imply that $P_{Vt} = Q_{Vt}$. Thus, the second equation in (1) becomes

$$V_H(H_t) = \frac{W_t}{P_{Vt}}.$$

This says that employment would stay constant as long as the wage deflated by the value-added deflator stayed constant as well. The wage deflated by the price of total output does indeed have to decline. However, the required percentage drop in wages equals the percent increase in the price of energy times the share of the value of energy in the value of output. Since this share is about 3 percent, the amount by which the wage must decline is trivial.

What is more, both the impulse responses in Rotemberg and Woodford (1996) and those in the current chapter show that the wage deflated by the value-added deflator actually fell after the pre-1984 energy price increases. Thus, the resulting decline in employment and output is inexplicable unless markups rose. While Blanchard and Galí do not explicitly grant markup variations a large role, such variations stand behind the power of monetary policy in their model. As in all new-Keynesian models with sticky prices, increases in interest rates lower output because price rigidity prevents firms from cutting prices right away, and this raises markups.

A second reason to worry about the role of real wages in the pre-1984 recessions is that this does not seem to explain international differences in responses. French wages, for example, seem to have increased in the impulse response functions reported in this chapter. Yet the output decline in France does not appear to have been significantly larger than the output decline in the United States.

Blanchard and Galí's Model of Markup Increases: Noncredible Monetary Policy

As discussed previously, an explanation of why output fell more after the pre-1984 oil price increases is likely to be incomplete without a theory of why these earlier shocks led to larger increases in markups. This chapter's theory exacerbates the effect of sticky prices on markup variation through an ingenious model of monetary policy failure.

The idea is that monetary policy was set by having

$$i_t = \phi_\pi \pi_t,$$

where i_t and π_t represent the nominal interest rate and inflation at t, respectively, and where $\phi_\pi > 1$. Price setters, on the other hand, believed that the interest rate was set according to

$$i_t = \phi_\pi (1 - \delta)\pi_t + v_t,$$

where $\delta > 0$ and v_t was believed to be i.i.d. Since price setters correctly perceived both current interest rates and current inflation, they used their beliefs regarding $\phi_\pi(1 - \delta)$ to compute v_t, with the result that this always turned out to equal $\phi_\pi \delta \pi_t$.

For the parameters used in this chapter the effect of $\delta > 0$ is to make firms raise their prices too much in response to oil price increases. Firms do so because they attribute the contemporaneous rise in interest rates to a monetary policy disturbance that will soon be corrected so that they expect the monetary authority to conduct a fairly loose monetary policy in the future. Markups are high, resulting in a recession, because of false expectation that the currently high interest rates will quickly be rescinded.

While providing a very elegant theory of stagflation, this model seems counterfactual both regarding the behavior of the ex-ante real rate and of the "real rate" one obtains by subtracting the current inflation rate from the current interest rate. Because $\phi_\pi > 1$, the model predicts that this latter "real rate" should have been very high after an inflationary episode induced by an oil price increase. However, while pre-1984 oil shocks did raise inflation and lower output, they were associated with low rather than high values of $i_t - \pi_t$.

Blanchard and Galí point out that surveys of expectations show that these shocks were associated with increases in expected inflation. This is consistent with the idea that people expected monetary policy to be relatively loose. The difficulty for the model is that monetary policy was in fact loose as well. Moreover, people seem to have noticed this in the sense that ex-ante real rates constructed with their own inflation expectations were low. This seems impossible to square with the reductions in output that are observed (because aggregate demand should not have been low). Not being consistent with output declines, this behavior of ex-ante rates is not consistent with markup increases either. Rotemberg and Woodford's (1996) theory, by contrast, is designed to offer an alternative reason that markups should have increased and thereby reduced output.

My view remains, as in Rotemberg (1983), that implicating tight monetary policy for the output declines that followed oil price increases is difficult. The reason is that oil price increases led to rises in inflation, and these rises in inflation suggest that monetary policy was too loose rather than too tight. The idea that monetary policy was to blame for these recessions is not unique

to Blanchard and Galí's work, however. Barsky and Kilian (2002) also proposed a model that seeks to explain post-oil shock recessions in this way, though their model of price setting involves more inertial elements than those found in the current chapter. Even so, the Barsky and Kilian (2002) model also has trouble explaining how output declines could have been so large in a period of negative real rates.

Changes in the Share of Energy

As a final factor, Blanchard and Galí note that energy's importance in the economy has waned. There is good prima facie evidence for this decline, with the U.S. Energy Information Administration reporting a drop in the "energy intensity" of GDP from an index value of 100 in 1980 to a value of about 62 in 2000.[2] I am thus inclined to believe that this structural transformation could be an important factor. It turns out, however, that measuring the importance of this factor is nontrivial.

To see this, recall that the Blanchard and Galí model supposes that utility depends on the log of consumption, which is in turn given by

$$c_t = (1 - \chi)c_{q,t} + \chi c_{m,t},$$

where c_t, $c_{q,t}$ and $c_{m,t}$ represent, respectively, the logarithms of total consumption, consumption of domestically produced goods, and consumption of energy at t. The share parameter χ is then literally the ratio of the value of energy consumption over the value of total consumption. With these preferences, this share is constant and independent of the price of energy.

Similarly, Blanchard and Galí suppose that the production function for domestic output takes the Cobb-Douglas form

$$q_t = a_t + \alpha_n n_t + \alpha_m m_t,$$

where q_t, n_t, and m_t represent, respectively, the logarithm of domestically produced output of employment and of the energy input at t. Here too, the technological parameter α_m ought to equal the ratio of the value of energy inputs to the value of domestic output and this ratio ought to be independent of the real price of energy.

As is well known and as the Blanchard-Galí calculations in appendix B make clear, increases in the price of energy raise the ratio of energy expenditures of households over total expenditures as well as raising the ratio of the value of energy inputs over the value of produced output. This suggests that the elasticity of demand for energy is less than one and that the constant share models are not ideal. If, as is done in Blanchard and Galí, one calibrates the "constant shares" χ and α_n on the basis of particular yearly observations (they choose 1973 for the pre-1984 period and 1997 for the post-1984 period), the year that is chosen for this calibration is important.

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2. See http://www.eia.doe.gov/oiaf/1605/gg05rpt/stopics.html.

It seems possible that one might be able to obtain more robust estimates by considering explicitly a model with less substitutability between energy and other goods.

Alternatives

Blanchard and Galí's question of why the output response to oil price increases dampened after 1984 is important, and is only made more urgent if one does not find all the explanations offered in this chapter entirely convincing. One possible alternative explanation, stressed in Rotemberg and Woodford (1996), is that the earlier movements in the price of oil were exogenous to the behavior of the U.S. economy (and induced either by the Texas Railroad Commission or by developments in the Middle East), while the more recent ones were endogenous.

Blanchard and Galí argue that they are considering exogenous changes in the price of oil because they are letting oil be influenced contemporaneously by other variables in their VAR and treating the residuals as the oil price shock. Unfortunately, this technique is not compelling in the case of the price of a durable commodity such as oil. In a free market, the price of such commodities is strongly affected not only by variables that affect current GDP but also by expectations of future demand. Thus, the expectation that China will demand a great deal of oil in the future would drive up the price of oil today. Blanchard and Galí assert that, from the point of view of the United States, an oil price increase fueled by Chinese demand is equivalent to one fueled by a supply disruption. This is questionable, however. Increases in Chinese demand can also lead to increases in the demand for U.S. output in a way that oil supply disruptions need not. This expansionary effect of Chinese demand may then counteract the negative effect of oil price increases. This point is perhaps best understood at the world level, where an increase in the price of oil that is due to factors that raise world output is much less likely to lead to output reductions than an exogenous increase in the price of oil.

While separation of exogenous from endogenous oil price changes seems essential for progress on this issue, the task appears to be a difficult one. Kilian (2008) proposes a method for detecting the exogenous changes in the quantity of oil sold by Organization of the Petroleum Exporting Countries (OPEC) members by comparing the output of countries subject to shocks to the output of other countries that he deems immune to these shocks. These exogenous changes turn out to be associated with only small subsequent movements in output and inflation both in the early period and in the Kuwait-Iraq War of 1990. While very attractive methodologically, this approach creates puzzles of its own. Consider, for example, the well known 1973 to 1974 "OPEC shock." From September 1973 to January 1974, the official price of Saudi crude went from $2.59 per barrel to $11.65 per barrel and then remained high for a long time. In Kilian's (2008) narrative, quantity

supplied did decline in the last quarter of 1973, but rose so much thereafter that OPEC output was back to normal by March 1974 (so that a favorable supply shock in the first quarter of 1974 fully offset the unfavorable one of the last quarter of 1973).

In addition to being much more likely to be endogenous, recent changes in the price of oil seem more likely to have been seen as transitory. It is apparent from figure 7.1 in their chapter that the price of oil experienced several transitory up-and-down movements between 1995 and 2001, and that these movements are of a different character than those that came before. Of course, it is still an open question whether a coherent model can be developed where transitory endogenous movements in the price of oil are less correlated with subsequent movements in output and inflation than are more permanent exogenous movements in the price of oil. Given the importance of making sense of the pre-1984 correlations between oil prices and the economy, such an effort would seem very worthwhile.

Lastly, Blanchard and Galí may well be right when they think that the markup variations due to repeated oligopolistic interactions that are discussed in Rotemberg and Woodford (1996) do not help explain why oil shocks now seem to matter less. It is worth noting, however, that the period since 1982 has been one where many firms have faced renewed international competition. This may have destabilized, perhaps only temporarily, the oligopolistic arrangements studied in that paper.

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