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### **Discussion of “Oil and the Macroeconomy: Lessons for Monetary Policy”<sup>1</sup>**

It’s a pleasure to discuss this thoughtful and comprehensive report on the macroeconomic implications of oil price movements.<sup>2</sup> Even though we are no longer faced with sky-high oil prices, the issues discussed here remain important and policy relevant. It is hard to believe that oil prices will not go up again sometime in the future, so it is vital that we learn from the last episode, both about how the economy is likely to be affected and how monetary policy should respond.

Perhaps not surprisingly, most of my discussion relates to the latter topic, namely the Fed’s policy response to the swings in oil prices over the last seven years. But I would like to start by commenting on the paper’s discussion of the relationship between the market price of oil and the value of oil in the ground. Thinking of this relationship in terms of Tobin’s  $q$  is an elegant and insightful contribution. As the authors point out, oil in the ground is like any other irreproducible asset, which should be described by Hotelling’s theory that the price of such an asset minus marginal cost increases at a rate equal to the prevailing interest rate. But oil above the ground has distinct characteristics. And a number of factors can cause its price to depart—for some time—from the value implied by Hotelling’s model. Thus,  $q$ —the ratio of the market

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<sup>1</sup> I would like to thank Bharat Trehan, John Fernald, John Judd, John Williams, and Sam Zuckerman for assistance in preparing these remarks.

<sup>2</sup> Harris, Kasman, Shapiro, and West (2009)

price of oil to its value in the ground—can and does deviate from unity. The authors provide an important and informative example of such a departure, which uses data on mergers and acquisitions to calculate the value of the oil in the ground and compare it to the market price of oil over the last few years. This exercise, together with one based on the stock prices of large oil companies, suggests that the market price of oil was temporarily high in 2007, and that the jump in the first part of 2008 represented a further departure from the long-term value. I will return to this topic later.

Let me now turn to the paper's discussion of oil prices and monetary policy, a topic that has sparked much debate among academic economists and policymakers during my two stints as a Fed policymaker. The authors have accurately summarized the main issues involved in the debate that took place during 2002–2008, both inside and outside the Fed. As is well known, an oil price shock typically poses a dilemma for policymakers: Higher oil prices depress output and raise inflation. While the reduction in output provides a reason for policy to ease, the uptick in inflation pushes policy in the opposite direction. It is rarely obvious which element deserves greater weight in policy decisions, and that leads to debate about the appropriate response. The oil shocks of the past several years were no exception.

I agree with the authors' assessment that the Fed focused primarily on core rather than headline inflation to gauge the extent of underlying inflationary pressures during this period. This strategy, as the authors note, can be justified on theoretical grounds. Since core inflation rose only slightly, the Fed's main inflation gauge did not signal a need to tighten policy dramatically. But as energy costs soared, the economy did experience an uncomfortable increase in headline inflation. The authors argue that the Fed should have paid more attention to the acceleration in headline inflation and raised interest rates by more than it did from 2004 to 2006.

Their argument is buttressed by two exercises, one of which examines some data on expected inflation while the other is based on model simulations. I will comment on each of these, in turn. Using a small vector autoregression model—where the price of oil is assumed to be exogenous—the authors show that changes in the price of oil help predict (or, more specifically, Granger cause) the Michigan survey’s measure of expected inflation and also one of two expectations measures based on Treasury yields. This result suggests to the authors that the Fed may have lost, or been on the verge of losing, at least some of its inflation-fighting credibility. Such a loss of credibility would obviously be problematic. For one thing, it would increase the amount by which the Fed would have to increase rates to offset any given inflationary shock.<sup>3</sup>

It’s not clear to me, however, that the Fed’s credibility was actually under such serious threat. Even taking the results at face value, the increase in expected inflation was small. Figure 5.3 in the paper reveals, in particular, that for three of their four measures, expected inflation in 2008 was only about one-tenth of a percentage point higher than what it would have been in the absence of any increase in the price of oil over this period.

But I think there are good reasons *not* to take these results at face value. Consider, first, the authors’ choice of survey measures. They argue that an increase in readings from the Michigan survey—following years of stability—reflects increasing inflation expectations. But they discount the stability of inflation expectations in the Survey of Professional Forecasters (SPF), arguing that it indicates “...forecast inertia rather than a super-credible central bank.” I find the authors’ preference for consumer surveys over those of professional forecasters surprising since it is usually argued that households pay less attention to the latest data than do

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<sup>3</sup> See, for example, Orphanides and Williams (2004, 2007).

the professionals who are paid to make these forecasts. Moreover, households probably update their forecasts of inflation less frequently than professionals. It's also worth pointing out that the lack of responsiveness of professional forecasts to *relative* price shocks appears to be a recent phenomenon, likely due, in my view, to increased Fed credibility and not some newly acquired inertia on the part of the forecasters. Research by my staff shows that while the SPF forecasts were sensitive to headline inflation data in the past, these forecasts have responded in recent years to core rather than headline inflation data.<sup>4</sup> This finding suggests that professional forecasters no longer expect relative price changes to have a persistent effect on inflation.

I would also take issue with the authors' assumption that oil prices are exogenous. For one thing, this assumption is at odds with the paper's extended discussion about how the price of oil is determined by economic developments in the U.S. and other countries. Moreover, the assumption is probably not innocuous: previous research has shown that treating oil as endogenous in such models can greatly reduce the estimated effects of oil shocks.<sup>5</sup>

Last, and certainly not least, I would question the authors' conclusion that inflation expectations have become unanchored based on their finding that oil prices help predict the Michigan survey measures of expected inflation. This finding does imply that a jump in the price of oil causes expected inflation to increase for a time. But it does not prove that the increase is permanent rather than transitory. A permanent response of expected inflation to a change in oil prices requires either that the expectations process be nonstationary or that oil prices be expected to continue rising forever. In other words, the authors' finding of a link between oil prices and survey measures of expected inflation is perfectly consistent with a

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<sup>4</sup> Trehan (2009).

<sup>5</sup> See Trehan (1986) and Barsky and Kilian (2004) for discussions of this issue.

*temporary* impact of oil price shocks on both inflation and inflation expectations. Importantly, these are precisely the responses that are consistent with well-anchored expectations—except, of course, if consumers believe that the Fed would absorb the hit of an oil shock entirely in the form of reduced output.

Let me turn now to the second exercise in the paper, which involves simulating a new Keynesian model to examine the effects of oil shocks. As the authors point out, their specification reproduces a standard feature of such models, which is that it is better for monetary policy to target core inflation than headline inflation. But the authors then proceed to conduct an unusual simulation. To mimic the pattern of oil price increases from 2002 to 2008, they subject the model to a sequence of 26 quarterly shocks in which the average increase in the price of oil is about 7½ percent. While they present results for several different parameter combinations, the typical outcome entails a core inflation rate that is about 2 to 4 percentage points higher than the assumed inflation target of around 1¾ percent. The authors argue that such a sequence of oil price and inflation increases could cause inflation expectations to become unanchored. The implication is that the Fed should have tightened policy more than it did to keep expectations from being cast adrift.

A key element of their simulation is the assumption of a long period of increasing oil prices. Was it reasonable to expect such an outcome on a priori grounds? We can use the authors' elegant framework to answer this question. The first factor that is relevant in forecasting oil prices in that framework is the price of oil in the ground, as determined by the Hotelling model. However, the authors do not argue that this price changed substantially over the last five years or so. The second relevant factor is the behavior of  $q$ . In the authors' framework,  $q$  should be expected to converge toward unity in the medium to long term. Thus,

the theory of the oil market presented in the paper suggests that forecasters during the 2002–2008 period should have expected oil prices to gradually revert to more “normal” levels over time, once  $q$  exceeded one. Of course, the model does not pin down precisely what might happen to the market price of oil for the next four, six or even eight quarters. Oil prices are notoriously hard to predict at these (and indeed at all) horizons, and there is plenty of room to argue about the role played by fundamentals, special factors, speculation, etc. But throughout most of this period, futures prices were predicting, even as oil prices rose, that oil prices would not rise further—and certainly not for six years running. And these were the most important real-time indicators of market expectations available to the Fed. Of course, futures-market forecasts proved wrong, *ex post*. But it seems to me now, as it did at the time, that there were neither strong empirical nor theoretical reasons to forecast that oil prices would continue rising for six years.

Since the improbable did in fact come to pass and the Fed tightened less than the authors consider optimal, it seems entirely appropriate to consider the costs of the Fed’s policy judgment. The authors note that the onset of the recession makes it all but impossible to get an unambiguous answer, and I agree. But I still think we can form some judgments based on the behavior of inflation during the more-than-five-year period, ending in mid-2008, during which oil prices kept moving higher. In 2001—the year before oil prices began to rise—core PCE price inflation was 1.9 percent. It averaged 2.2 percent over 2005–2007 and registered 2.2 percent during the first half of 2008. So, core inflation did rise somewhat. We can debate just how much of that increase should be attributed to oil shocks, rising capacity utilization levels, and the wearing-off of the unusual sequence of productivity shocks of the late 1990s, which had helped to push inflation to an unusually low level for a time. The important point, though, is that the

actual increase in core inflation fell far short of the increase predicted by the model simulations presented in the paper.

During the period of rising oil prices and high headline inflation, policymakers paid close attention to the behavior of wages for possible signs that higher inflationary expectations might be spilling over into wage bargains. Reassuringly, there was little evidence of any increase in the rate of wage growth, a linkage that I consider necessary for a sustained increase in the inflation rate. For instance, after increasing at a 4.3 percent pace in 2001—the year before oil prices began their sustained increase—the Employment Cost Index rose by an average of a little over 3.2 percent per year over 2005–2007 and at an annual rate of 2.8 percent in the first half of 2008. Other compensation measures also reveal relatively steady wage growth during this period.<sup>6</sup> So, data on wages, like those on core inflation, reveal little evidence of any impact resulting from the long sequence of large oil price shocks.

The authors attribute the lack of any sizable run-up in core inflation to other shocks that may have hit the economy at the same time. But it is important to emphasize that a significant body of recent research instead suggests that the measured effect of oil price shocks has diminished over the last several decades. Over a decade ago, Hooker (1996) showed that the effect of oil price shocks had diminished since the early 1980s and subsequent research has verified this finding. In fact, this influential research has shifted the academic debate concerning oil shocks, with some authors now questioning whether such shocks were ever actually as important as was believed in the 1970s (Barsky and Kilian, 2004, Bernanke, Gertler, Watson,

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<sup>6</sup> Other wage and compensation measures reveal the same general behavior. Total compensation per hour in the nonfarm business sector rose by 4.1 percent in 2001, an average of 4 percent over 2005–2007, and by 2.4 percent at an annual rate in the first half of 2008. Average hourly earnings rose by 3.8 percent in 2001, an average of 3.6 percent per year over 2005–2007, and at a 3.8 percent rate in the first half of 2008.

1997) and others investigating what structural changes in the economy may have diminished the impact of such shocks (Blanchard and Gali, 2007).

It seems to me that a change in the conduct of monetary policy following the experience of the 1970s has probably caused inflation expectations to become better anchored, explaining why recent oil shocks have inflicted relatively little damage on the economy. This hypothesis could at least partly explain why the huge run-up in energy prices through the middle of last year was not accompanied by rising wage demands. That in turn enabled the Fed to follow an easier monetary policy that gave greater weight to the output effect of rising oil prices than would have otherwise been possible.

Since mid-2008, oil prices have, of course, plummeted. But the extraordinary weakness in the economy means that the usual trade-offs associated with such supply shocks are absent right now. Any boost to spending from falling oil prices will be more than welcome in the current circumstances. And with inflation now below desirable levels, a decline in inflationary expectations that could push core inflation down over time would be most unwelcome. I argued earlier that the Fed's inflation credibility helped over a number of years to keep inflationary expectations anchored in the face of rising oil prices and high headline inflation. My hope is that inflationary expectations will remain similarly well-anchored now, serving to stabilize core inflation. The FOMC's recently released longer-run inflation projections should be useful in this regard, helping to reinforce inflation expectations of around 2 percent.

To conclude, let me emphasize that I enjoyed reading the paper and found the discussion of recent developments quite informative. But, the arguments in this paper did not persuade me to change my opinion of recent Fed policy. As I noted, during the period of rising oil prices, there was little evidence that policy was inappropriate: labor compensation growth remained well

contained and inflation persistence appeared to be low, most likely because of increased Fed credibility. The Fed must always be vigilant in guarding its inflation credibility. But I did not think then, and I do not think now with the benefit of hindsight, that expectations became or were close to becoming unanchored at any point. Nor do I think that the Fed should have taken out substantial insurance against the possible consequences of a highly unlikely sequence of shocks, especially when a growing body of research suggested that the impact of oil shocks had declined substantially since the 1970s.

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