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Do Energy-Price Shocks Affect Core-Price Measures?

by Owen Humpage and Eduard Pelz

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This paper investigates the relationship between energy-price shocks and three core measures of inflation in a vector autoregression model that incorporates measures of monetary policy and inflation expectations. The sample set includes data at monthly frequencies from 1980 through 2000. We find that that positive energy-price shocks have significant, though small, effects on all core price measures after a lag of 12 to 18 months, but that negative shocks have no discernable impact. The results suggest that relative energy-price changes do not distort the inflation signals that standard core-price measures provide.

JEL Classification: Q43, E52
Key Words: energy prices, vector autoregression, inflation, monetary policy

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1. Introduction

Standard price indexes are imperfect measures of inflation because they cannot distinguish between price movements resulting from excessive money growth and those stemming from relative price shocks or taxes. A central bank that does not correctly interpret movements in broad price indexes might undertake inappropriate policies and, thereby, convert a fairly innocuous relative price shock into a more profound and persistent economic adjustment. Since Bohi (1986), many economists have claimed that the depressing real macroeconomic effects of oil-price hikes prior to 1980 stemmed not from the direct impacts of higher oil prices, but from the monetary tightening that often accompanied them.

Standard core-price measures, which typically remove volatile food and energy components from headline price indexes, may provide only a limited remedy to this problem because changes in the relative price of non-core elements, like energy, might subsequently pass through to the core components. Other core-price measures, such as the Federal Reserve Bank of Cleveland's (FRBC) median consumer price index, attempt to minimize these pass-through problems but may not be totally immune from the pervasive effects of relative energy-price changes.

In this paper, we attempt to measure the impact of relative energy-price changes on three common core measures of inflation: 1) the methodologically consistent consumer price index (CPI) less food and energy, 2) the deflator for personal consumption expenditures (PCE) less food and energy, and 3) a methodologically consistent median CPI.[1] Although PCE and CPI use much of the same basic Bureau of Labor Statistics (BLS) price data, these indexes differ in their coverage and weighting schemes (e.g., Clark, 1999). Hence, energy shocks could affect the core CPI and core PCE differently. The median CPI is constructed by arraying the price changes for CPI components, repeating specific components according to their weight in the total index, and selecting the middle value (e.g., Bryan, Cecchetti, and Smiley, 1999). Because a relative price shock will have a smaller impact on the median price change than the mean, the median CPI conceptually offers a cleaner measure of inflation.

We find that energy-price shocks have asymmetric effects on core-price measures. Positive shocks have a significant, though small, effect on all of the core-price measures after a lag of 12 to 18 months, while negative shocks have no discernable impact on any of the core-price measures. Despite substantial methodological differences, our findings are similar to those of Hooker (1999). In section 2 of this paper, we review some ongoing controversies about the macroeconomic effects of energy-price shocks and explain how they influenced our modeling strategy. In section 3, we present a six-variable VAR model for each of the three core-price measures. These models directly incorporate inflation expectations and monetary policy. In section 4, we provide the standard model diagnostics and present impulse-response functions associated with 20-percentage-point, orthogonal, energy-price shocks. In section 5, we compare our results to Hooker (1999) and explain some broader implications of the model for ongoing debates about energy-price shocks and macroeconomic activity.

2. Oil Prices and the Macroeconomy

A voluminous literature analyzing macroeconomic effects of oil-price shocks has developed since the initial Organization of Petroleum Exporting Countries' (OPEC) embargo of 1973. Hamilton (2000) and Hamilton and Herrar (2000) contain fairly comprehensive sets of references. Almost all of these studies focus on the connection between oil prices and real economic variables. Although our study takes a different, narrower tack, persistent debates within the broader literature influenced our modeling strategy.

Central to most controversies is evidence of a structural break in the relationship between oil prices and macroeconomic variables in the early 1980s. Prior to this time, oil prices seemed to be exogenous and to Granger-cause output; after the break, oil prices appear to be endogenous, and their relationship to the real economy is ambiguous (e.g., Hamilton 1983, 1996, and Hooker 1996).

Since Morke (1989), many researchers have attributed the structural break to fundamental changes in the behavior of oil prices themselves. Before 1980, oil-price changes were by and large unidirectional. The Texas Railroad Commission and OPEC had cartelized much of the oil market, and as a consequence, oil prices rarely fell (e.g., Hamilton, 1983). By the middle of 1980, however, the price of West Texas Intermediate (WTI) crude oil began to decline. Between 1986 and 1997, WTI prices generally fluctuated between \$15 and \$22 per barrel, except for a brief spike in late 1990. Since 1998, oil prices have risen beyond \$22 per barrel, and they have demonstrated sharp swings.

The changing behavior of oil prices could create the early 1980s structural break in econometric estimates of their relationship with macroeconomic variables, if oil price increases and decreases have asymmetric economic effects. Many researchers have argued that the deleterious economic effects of oil-price hikes may be substantially stronger than the favorable economic effects of oil-price declines. All oil-price changes can induce sectoral reallocations and create uncertainties about the returns to irreversible investments, but oil price decreases, unlike increases, have positive real income (terms-of-trade) effects that offset these negative impacts. To deal with this phenomenon, many time-series modelers include nonlinear, asymmetric oil-price specifications (e.g., Hamilton, 2000, and references therein).

A second explanation for the structural break in the relationship between oil prices and real macroeconomic variables focuses on changes in the Federal Reserve's reaction to energy-price shocks. According to this argument, energy-price changes exert a relatively small direct effect on the economy, but the Federal Reserve's response to these changes can appreciably magnify or dampen their propagation. In the 1970s, oil-price shocks occurred in an inflationary environment. The Federal Reserve either had already tightened (1972-1973) prior to the energy-price shock or tightened in response to the energy-price shock (1979). This correspondence accentuated the negative real economic impact of higher energy prices. In 1973, the Federal Reserve subsequently reversed policy as economic activity weakened, and over the next four years often accommodated higher oil prices with federal funds rate cuts. This policy generated an inflation, which the public associated higher oil prices. Inflation expectations became associated with oil-price shocks. After Volcker became chairman, policy quickly focused on eliminating inflation, and the Federal Reserve altered its operational procedure. Since that time, the Federal Reserve has credibly committed to long-term price stability, and it has not responded to oil-price shocks. Consequently, inflation expectations no longer track oil-price changes as closely as they did in the early 1980s.

Empirical studies disagree about the extent to which the Federal Reserve's policy responses explain the relationship between oil prices and real economic variables. The relevant literature includes: Bohi (1986), Dotsey and Reid (1997), Bernanke, Gertler and Watson (1997), Brown and Yucel (1999), and Hamilton and Herrera (2000).

Three aspects of our model stem from the debates on the nature of the structural break: First, we restrict our sample to the post-1980 period to avoid possible problems stemming from estimating a VAR across data containing a structural break. We are not interested in explaining this break. Second, we split our energy-price variable into positive and negative components to allow for possible asymmetries in the response to energy-price shocks. Third, we include the federal funds rate and variables to control directly for endogenous monetary-policy changes. The next section elaborates on the model.

3. The VAR Model Specification

To analyze the impacts of energy prices on each of the core-price measures, we estimate a recursive VAR using monthly data from 1980:1 to 2000:12. The model has the following standard form:

$$x_t = A_0 + T_t + \sum_{i=1}^{18} A_i x_{t-i} + e_t \,. \tag{1}$$

In equation 1, A_0 is a vector of intercept terms; T_t is a vector of exogenous time trends; A_i are matrices of coefficients; x_{t-i} are vectors of the lagged variables in the system, and e_t is a vector of contemporaneous disturbances. The error vector, e_t, is a linear combination of the underlying structural errors. Each element of e_t has a zero mean and a constant variance, and each is individually serially uncorrelated. The elements of e_t, however, are contemporaneously correlated. The vector x_t consists of the subsequent six terms in the following order:

1) Positive log changes in a measure of energy prices, either the CPI energy component or the PCE energy component
2) Negative log changes in the respective energy-price component
3) Log changes in a core measure of inflation, either the methodologically consistent CPI less food and energy, the methodologically consistent median CPI, or the PCE less food and energy
4) The log change in industrial production as a measure of economic activity generating a demand for energy
5) Expectations of inflation over the next 12 months as measured by the Michigan Survey of Consumer Sentiments
6) The federal funds rate as a measure of monetary policy.

We maintained this ordering in the Choleski decompositions. In each of the three estimated systems, we use the energy-price component that most closely corresponds to the core price measure.

We include a measure of inflation expectations because of their importance to the formulation of monetary policy and in the monetary transmission mechanism. (Inflation expectations consistently Granger-cause federal funds rate changes in our VARs.) Energy-price shocks in the 1970s and early 1980s allegedly heightened inflation expectations, but the positive relationship weakened in the 1980s and vanished in the 1990s. Consequently, to capture any possible direct monetary response to energy-price shocks, one must separately control for any independent relationship between monetary policy and inflation expectations. Moreover, if only real, unanticipated federal funds rate changes affect economic variables, allowing for the interaction of a nominal federal funds rate and inflation expectations within the system of equations seems especially important.[2]

We include an exogenous time trend to control for a steady pattern of energy conservation over our sample period. According to annual Department of Energy data, the energy needed to produce a unit of real GDP has steadily declined by nearly one-half since the early 1970s. The exogenous time trend is statistically significant at the 5% level or higher for the positive energy price equation in each of the three systems that we estimated. It is also weakly significant with a p-value of 6% in the core price equations of each system. Otherwise the exogenous time trend is not statistically significant.

The sample period runs from 1980:1 to 2000:12 with observations at a monthly frequency. Although, as is typical in VAR models, formal tests favored a shorter lag structure, we allow for 18 lags in the monthly data to stay consistent with the lag structures typically found in empirical studies that use quarterly data. Hamilton and Herrera (2000) emphasize the pivotal role that lag length can play in VAR analysis of oil shocks and point out shortcomings of lag-length tests.

4. Causality, Variance Decomposition, and Impulse Response Functions

4.1 Granger Causality, Block Exogeneity, and Variance Decomposition

Our objective is to estimate the standard form model and then to calculate impulse response functions showing the impact of exogenous energy-price shocks on core-price measures. To do so, we must first determine that each of the variables has a causal relationship with the others in the system and then check that the ordering of variables in Choleski decomposition does not affect our results.

Table 1 presents p-values from Granger-causality and block-exogeneity tests for each of the variables in all three VAR systems. The tests' likelihood-ratio statistics have χ^2 distributions, with 18 degrees of freedom for the Granger-causality tests and 90 degrees of freedom for the block-exogeneity tests. Although shown in table 1, Granger-causality tests are of limited usefulness in a VAR system. They describe bilateral relationships between independent and dependent variables in a single equation, holding all else constant, but even if a specific independent variable does not Granger cause a particular dependent variable, it may still influence that same dependent variable through its interaction with the other variables in the system. Block-exogeneity tests generalize Granger causality, indicating whether the lagged independent variables jointly affect a particular dependent variable. Neither test, however, considers contemporaneous interactions between variables.

We can reject the null hypothesis of block exogeneity for all variables except positive energy-price changes in the median-CPI (p-value = 18.5%) and the core-PCE equations (p-value = 64.4%), which was not especially surprising, and for industrial production in the core-CPI (p-value = 5.9%) and the core-PCE equations (p-value = 14.5%). Although these exceptional cases suggest that the variable in question is exogenous to the system, we did not impose the restrictions on the sytem that block-exogeneity tests suggested. In the case of industrial production, the test results were only marginally insignificant in the core-CPI system (p-value = 5.9%). In the case of positive energy-price shocks, bilateral Granger causality test suggest that this variable is not exogenous in the median CPI system. We continued to estimate each of the three VARs using ordinary least squares even though the causality tests suggest that we lose efficiency from not imposing zero-restraints on the core-PCE equations and estimating that system with seeming-unrelated-regression techniques.

We did, however, ordered the variables in the system with positive energy shocks first in all cases. This is tantamount to restricting the system so that the other variables do not have a contemporaneous affect on positive oil shocks, but it still allows for lagged interactions. Some such restrictions are, of course, necessary for identification. We also experimented with the placement of industrial production (and other variables), but found that changing their order in the system, which potentially can affect the impulse-response functions (and the variance decompositions), had no noticeable affect on the results.[3]

Table 2 presents the 12-month variance decomposition for each of the three systems. Positive and negative energy prices, industrial production, and, to a lesser extent, core-price measures each explains most of its own forecast-error variance. Positive energy-price shocks account for a considerable amount of the forecast-error variation in the core CPI and the core PCE, but a substantially smaller proportion of the variation in the median CPI. Positive energy-price shocks also account for slightly more than 9% of the forecast-error variation in the negative energy price equation, but this is smaller that the standard deviation of the forecast-error. A similar, though smaller, relationship holds for negative energy-price shocks in the positive energy-price equation.

4.2 Impulse-Response Functions

Our impulse response functions indicate that none of the core-price measures are strongly affected by energy-price shocks. At most, energy-price shocks have small asymmetric effects on core-price measures follow a lag of at least one year. Energy-price shocks themselves exhibit a small amount of persistence with a small negative offset to positive shocks after a half-year lag.

We separately introduced positive and negative orthogonal energy-price shocks to each of the three core-price VAR systems for a total of six experiments. The magnitude of each shock was 20 percentage points, which approximately equals the mean plus 1½ standard deviations for changes in both the CPI and the PCE energy-price series. (The mean change in both energy-price series is approximately 7 percentage points.) We report only: 1) the impulse response functions characterizing the reaction of the three core-price measures to separate positive and negative orthogonal energy-price shocks; and 2) the impulse response functions showing the response of negative energy prices to positive energy-price shocks and positive energy prices to negative energy-price shocks.

Consistent with much of the broader macroeconomic literature on energy shocks, we find that energy-price shocks exert asymmetric effects. As reported in figure 1 (panels 3 through 6), a one-time, orthogonal, 20-percentage-point negative shock does not appear to have a significant effect on the methodologically consistent core CPI, the methodologically consistent median CPI or the PCE. (The solid lines in each of the six panels of figure 1 trace out the impulse response functions, while the dashed lines show plus or minus two standard deviations around that response). An orthogonal 20-percentage-point positive shock, however, increases the core CPI by approximately 0.4

percentage point after 12 months, and it increases the median CPI by approximately 0.2 percentage point after 15 months (figure 1, panels 1 through 3). The same shock increases the PCE deflator by approximately 0.6 percentage point after 17 months. Although significant, these effects are rather small and appear only after a substantial time lag. The substantially smaller impact on the median CPI probably reflects its different construction.

We also examined how each of the energy-price components—positive and negative—responds to its own orthogonal shock and to that of the other energy-price component. (Because interactions between the positive and negative PCE energy component were identical to those of the CPI energy component, we report only the impulse response functions, plus or minus two standard deviations in the four panels of figure 2.) The results show that both the positive and negative shocks persist for one month before dying out in the third month (panels 1 and 3). In addition, negative energy shocks show some evidence of an echo equal to 5 percentage points after a lag of five to six months (panel 4), suggesting that negative shocks followed negative shocks between 1980 and 2000.

We also find evidence of a negative offset to positive energy-price shocks. In panel 2 of figure 2, a 5.8 percentage point negative energy price response follows a 20-percentage-point orthogonal positive energy-price shock after 14 months in our sample. A similar positive offset does not follow a negative energy-price shock. In addition, each energy-price series demonstrates a small, but marginally significant, response two to three months immediately after a shock to the other series (panels 2 and 4). Since a shock to each series shows persistence for one month and because when one series takes a nonzero value the other is zero, we believe that any correlation in period two results because the associated zero value falls below a series' average. This would create the negative correlation in period two. The small significant response in the negative energy-price series in period three, however, may not reflect this phenomenon (panel 2).

The energy-price measures considered in this paper are themselves composites of different types of energy prices, including gasoline and piped gas and electricity. The components are all positively correlated with each other and with the overall energy-price index, but the correlation coefficients between some components can be low. Because core measures of inflation could respond differently to shocks in the more basic energy-price components, we also considered the effects of orthogonal shocks to these sub-indexes.[4] We found that positive and negative shocks to individual components generally had no effect on the core-price measures. (We do not present these results). This is not surprising, given that the overall effect of an energy-price shock is small. We also found, however, that shocks to individual components exhibited stronger offset effects, particularly positive to negative, than the overall energy-price measures.

Energy-price shocks do not appear to affect industrial production or the federal funds rate in our model, but they do have an asymmetric impact on inflation expectations in each of the models. Positive energy-price shocks do not seem to affect expectations, but negative energy-price shocks consistently lower inflation expectations by 0.1 to 0.2 percentage point with a lag of one month. (In the CPI model only, negative energy-price shocks also lower inflation expectations by 0.2 percentage point with lags of three and four months.) We offer an interpretation of these events in the next section.

5. A Conclusion, a Comparison, an Interpretation

Our VAR analysis finds that since 1980, changes in energy prices do not seriously distort the inflation signals that standard core-price measures provide. Positive impulses have had only a small pass-through effect after a lag of approximately 12 to 18 months. Negative energy-price shocks have had no apparent effect on core-price measures. These results are similar to those of Hooker (1999), who concludes that after 1980, energy-price shocks exerted a negligible effect on core prices and influenced headline price measures primarily in accordance with their weight in the overall index.[5] We found a small amount of persistence (two months) in energy-price shocks, which could compound their impact on headline price measures.

Hooker (1999) investigates the effects of energy-price shocks on the core CPI, core PCE, and the GDP deflator using quarterly data and a Phillips curve approach. We find that his results are robust to variation in our estimation technique, dissimilarities in the other independent variables contained in the core-price equations, and differences in the frequency of our observations. We differ from Hooker in that we find somewhat more evidence of asymmetric pass-through effects from positive and negative energy-price shocks than he does.[6] Although we have not tested it, we suspect that positive and negative energy-price shocks affect mark-up strategies differently: Positive energy-price shocks initiate mark-ups, but negative energy shocks do not prompt discounting.

We did not intend to investigate ongoing debates about the broader connections between energy prices and real macroeconomic variables, but our finding offers an interpretation of the relationships. We find that orthogonal positive (and negative) energy-price shocks do not affect the federal funds rate in our equation systems, even though the impulse response functions allow energy-price shocks to affect monetary policy indirectly through their interactions with inflation expectations and industrial production. We find that positive energy-price impulses have no direct effect on inflation expectations, while negative price shocks tend to lower inflationary expectations very slightly in all three of the equation systems. We find that energy-price shocks—positive and negative—had no discernable effect on industrial production between 1980 and 2000. These results suggest: 1) that absent a monetary-policy response, the business-cycle effects of energy-price shocks are fairly benign (e.g., Hooker 1996 and Hamilton, 1996); and 2) that because energy price have not seriously affected output or inflation, the Federal Reserve has not responded to them since 1980. Understanding the Federal Reserve's reaction function may be the key to understanding how energy prices impact the economy.

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Table 1: Pairwise Granger Causality and Block Exogeneity Tests
(P-values for appropriate tests)

A. Core Price Measure: Consumer Price Index less Food and Energy

	Energy +	Energy -	Core prices	Ind. Prod.	Expectations	Fed funds
Energy +		0.0003	0.0229	0.4754	0.8332	0.9348
Energy **-**	0.0404		0.4097	0.8849	0.0100	0.0392
Core prices	0.3429	0.2324		0.3507	0.1480	0.6157
Ind. prod.	0.2349	0.0141	0.6004		0.9056	0.0131
Expectations	0.0652	0.0132	0.2226	0.8679		0.0037
Fed funds	0.0474	0.0476	0.2104	0.5183	0.5943	
Block Exog.	**0.0343**	**0.0000**	**0.0085**	**0.0590**	**0.0002**	**0.0000**

B. Core Price Measure: Median Consumer Price Index

	Energy +	Energy **-**	Core prices	Ind. Prod.	Expectations	Fed funds
Energy +		0.0002	0.0671	0.7055	0.6247	0.8653
Energy **-**	0.0689		0.3152	0.9339	0.0117	0.0438
Core prices	0.8845	0.3589		0.9010	0.0388	0.5178
Ind. prod.	0.3341	0.1493	0.3055		0.8665	0.0007
Expectations	0.0722	0.0019	0.2509	0.7947		0.0004
Fed funds	0.0046	0.0594	0.4018	0.6532	0.1842	
Block Exog.	**0.1850**	**0.0000**	**0.0085**	**0.0000**	**0.0000**	**0.0000**

C. Core Price Measure: Personal Consumption Expenditures Deflator

	Energy +	Energy **-**	Core prices	Ind. Prod.	Expectations	Fed funds
Energy +		0.0000	0.0153	0.4433	0.4652	0.8185
Energy **-**	0.2976		0.4944	0.9659	0.1052	0.1016
Core prices	0.9603	0.2424		0.7224	0.0200	0.7540
Ind. prod.	0.3552	0.1083	0.2016		0.9665	0.0004
Expectations	0.3072	0.0492	0.6959	0.5530		0.0008
Fed funds	0.4629	0.2900	0.2373	0.2343	0.7508	
Block Exog.	**0.6436**	**0.0002**	**0.0024**	**0.1445**	**0.0000**	**0.0000**

Table 2: Variance Decomposition
(Percentage of 12-month error variance)

A. Core Inflation: Consumer Price Index less Food and Energy

	Energy +	Energy -	Core prices	Ind. Prod.	Expectations	Fed funds
Energy +	65.9	9.29	12.0	7.0	9.8	1.6
Energy **-**	7.6	63.6	5.7	2.9	21.2	1.3
Core prices	5.0	1.5	69.3	10.6	9.0	2.7
Ind. prod.	5.8	14.0	4.0	72.0	12.5	63.0
Expectations	7.8	6.8	6.3	2.4	43.7	7.0
Fed funds	7.8	4.8	2.7	5.2	3.7	24.4
Std. Error	15.5	14.7	1.5	8.1	0.5	1.4

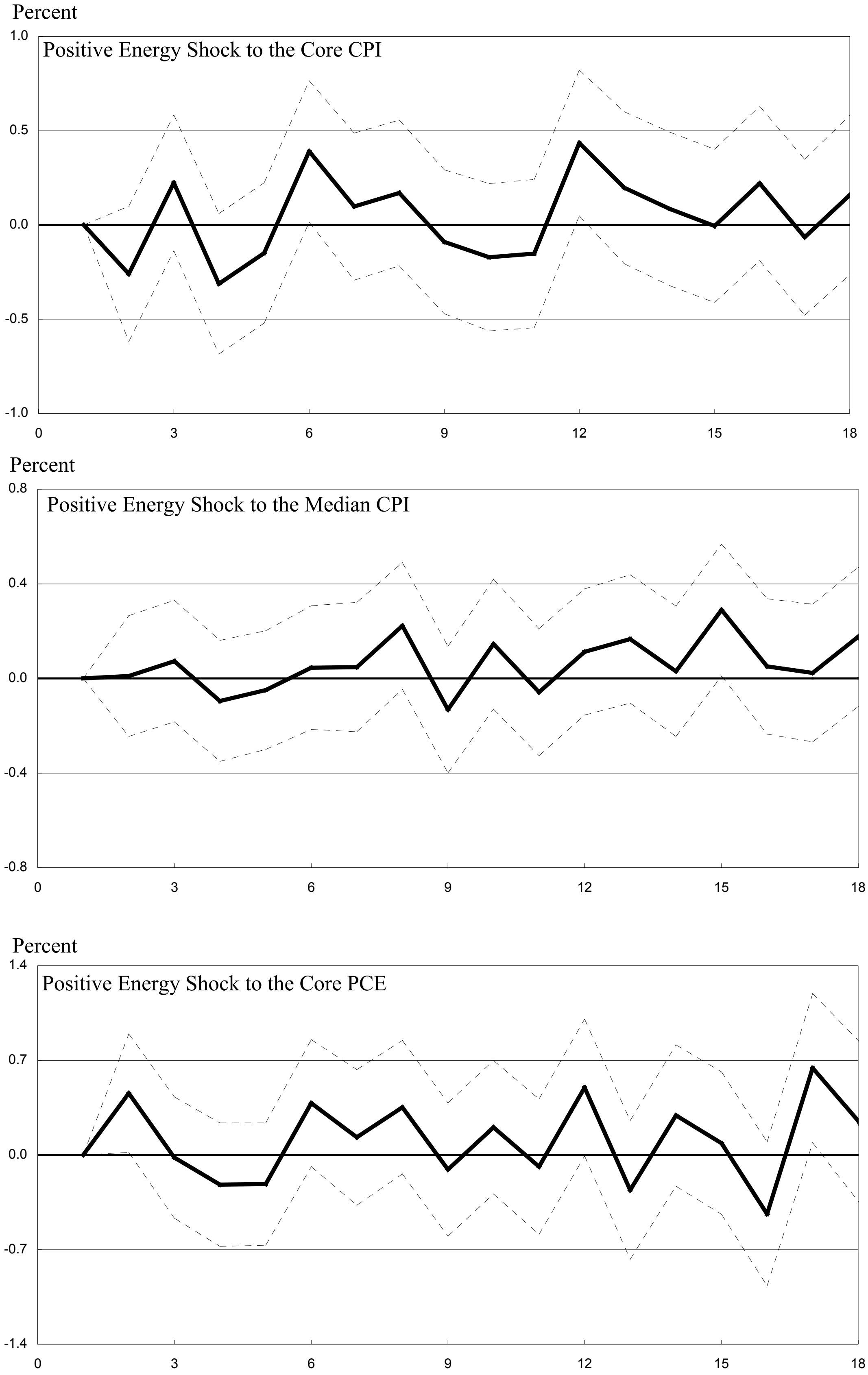
B. Core Inflation: Median Consumer Price Index

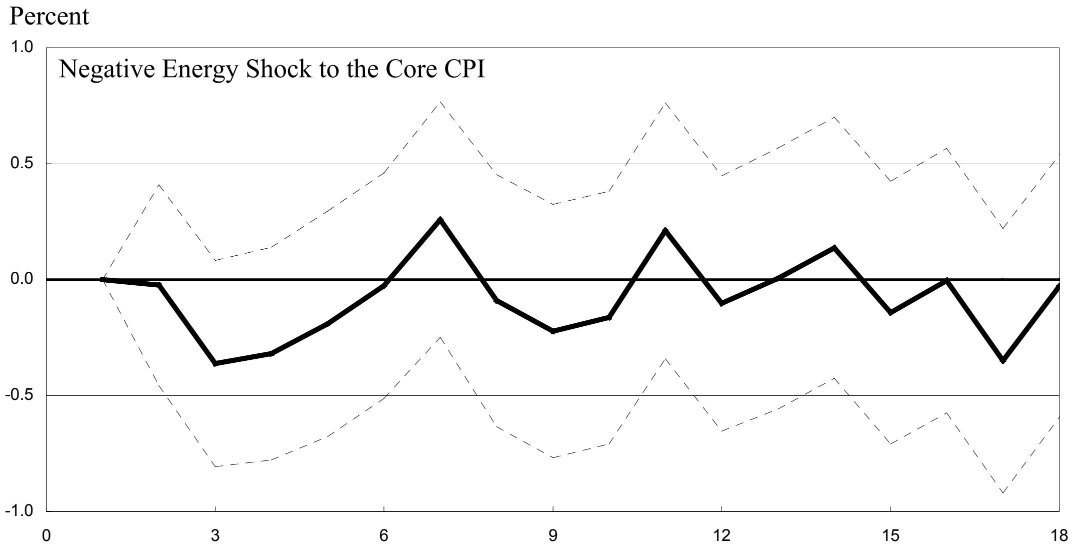
	Energy +	Energy -	Core prices	Ind. Prod.	Expectations	Fed funds
Energy +	66.6	9.8	4.5	6.4	12.9	4.5
Energy **-**	7.8	61.7	5.6	2.8	20.8	2.2
Core prices	3.5	8.1	69.8	3.7	4.4	0.1
Ind. prod.	5.1	10.3	5.9	76.1	13.1	68.9
Expectations	7.6	4.9	5.7	4.0	42.0	0.2
Fed funds	9.3	5.1	8.6	6.9	6.9	24.0
Std. Error	15.8	14.9	1.0	8.2	0.5	1.3

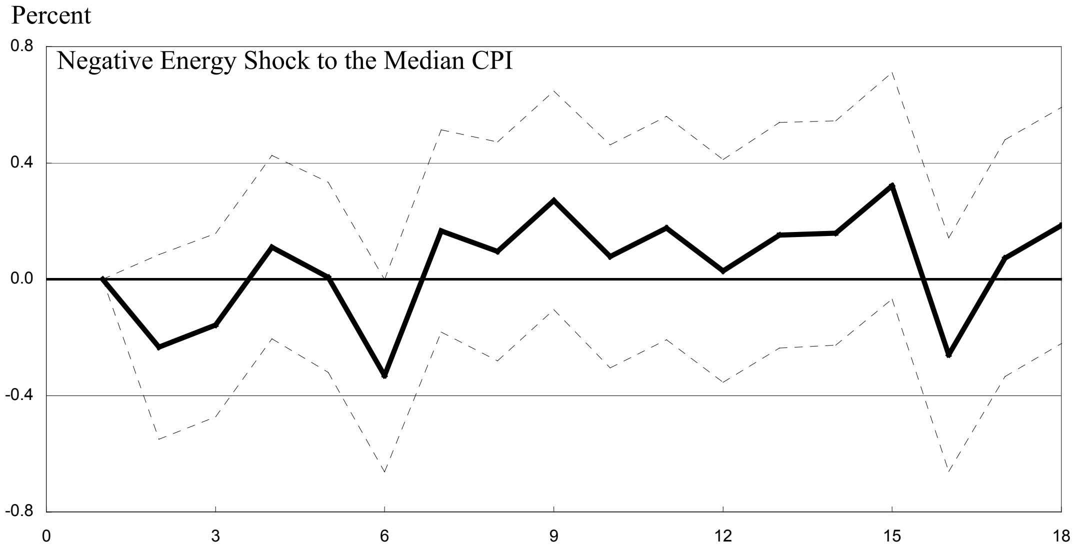
C. Core Inflaiton: Consumer Price Index less Food and Energy

	Energy +	Energy -	Core prices	Ind. Prod.	Expectations	Fed funds
Energy +	70.9	9.1	12.8	8.2	10.9	3.4
Energy **-**	6.5	59.4	4.1	3.1	3.6	1.2
Core prices	5.8	12.0	67.3	5.4	34.5	10.7
Ind. prod.	4.7	8.3	3.1	72.1	10.3	56.3
Expectations	6.9	8.3	3.9	3.8	33.8	1.3
Fed funds	5.1	3.0	8.8	7.4	6.9	27.0
Std. Error	16.0	14.8	1.9	8.1	0.6	1.3

Figure 1: Core Price Impulse Response Functions to Energy-price shocks




Percent
Negative Energy Shock to the Core CPI
1.0
0.5
0.0
-0.5
-1.0
0
3
6
9
12
15
18


Percent
Negative Energy Shock to the Median CPI
0.8
0.4
0.0
-0.4
-0.8
0
3
6
9
12
15
18

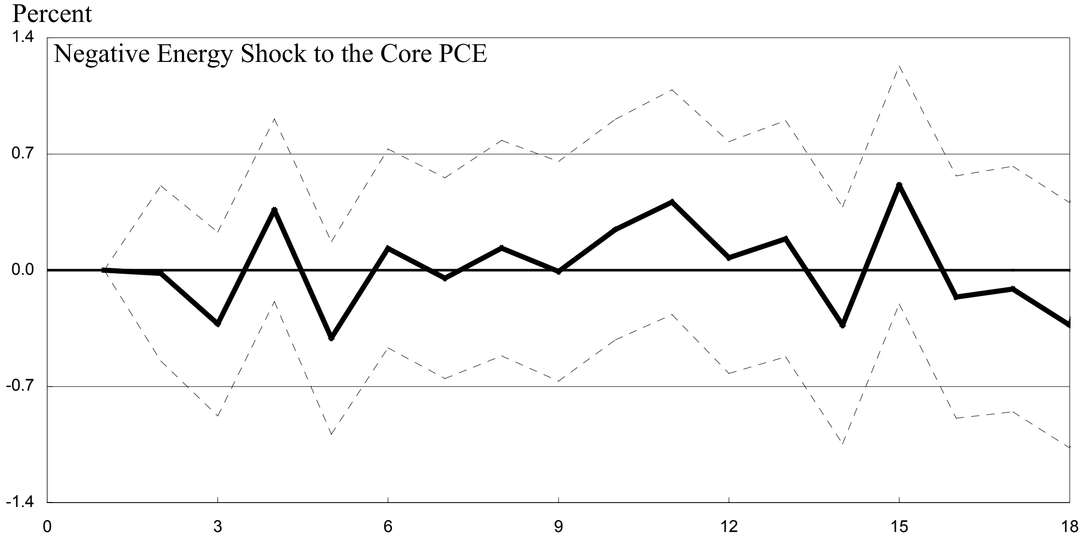
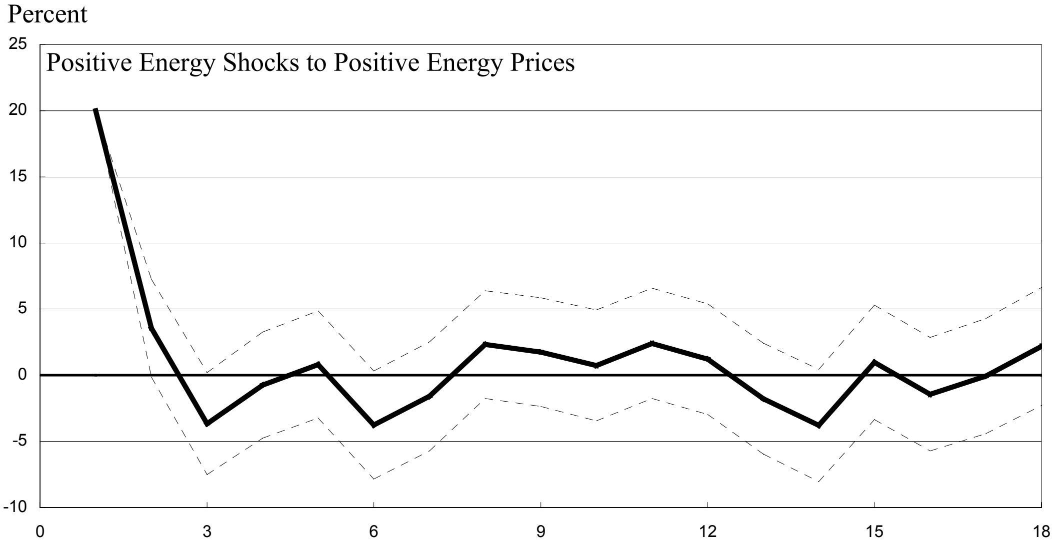
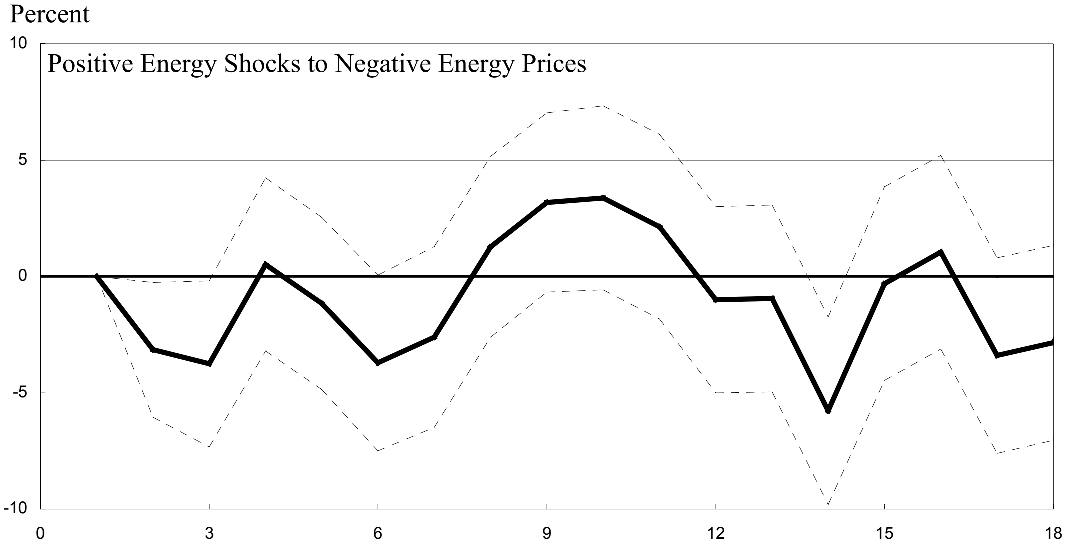
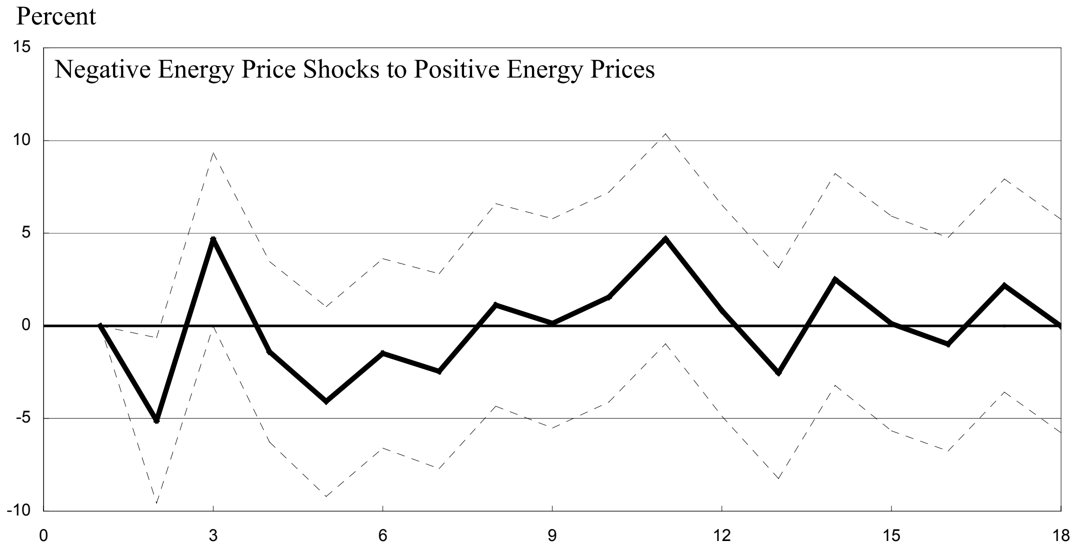

Percent
Negative Energy Shock to the Core PCE
1.4
0.7
0.0
-0.7
-1.4
0
3
6
9
12
15
18

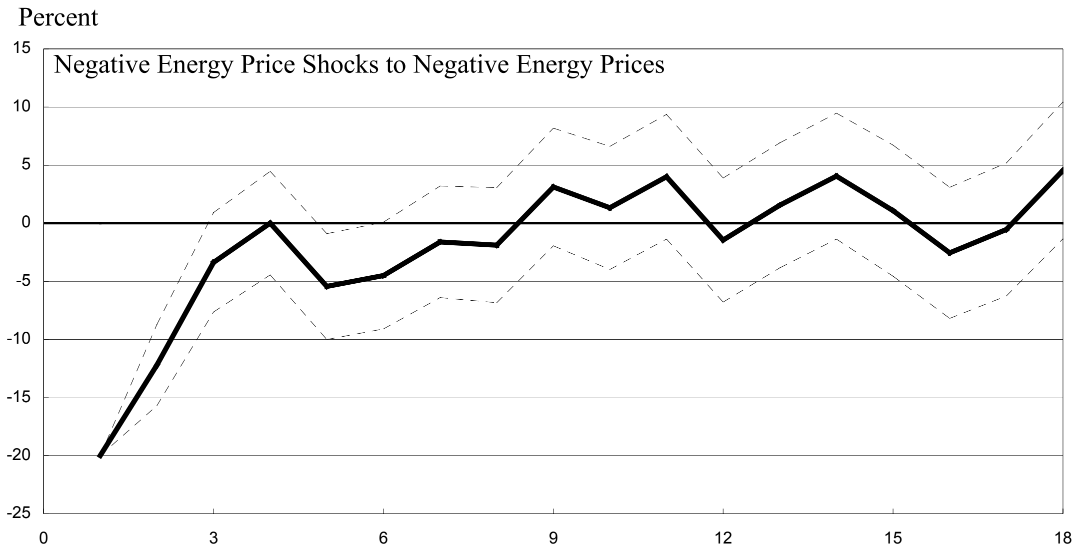
Figure 2: CPI Energy Price Impulse Response Functions to Energy Price Shocks







Negative Energy Price Shocks to Positive Energy Prices



Negative Energy Price Shocks to Negative Energy Prices

End Notes

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[1] The methodologically consistent CPI and median CPI avoid discontinuities in the price series resulting from changes in the Bureau of Labor Statistics' (BLS) techniques for constructing the CPI. Because such changes could affect existing contracts, the BLS does not alter previously published CPI values to conform to revised methodology. The BLS, however, maintains a methodologically consistent CPI series. The choice of these alternative series could affect empirical work.

[2] Controlling for expectations might also solve the Sims (1992) price puzzle in monetary VAR models because expectations could capture information about future inflations not revealed elsewhere in the model.

[3] The contemporaneous cross-correlations among the error terms were generally low. We altered the ordering of variables with cross correlation coefficient greater than 0.2, but we found no appreciable effect on the results.

[4] We looked at the following subindexes of the CPI (their correlations with the CPI research energy component are in parentheses): Fuels and utilities (0.54), fuels (0.59), fuel oil and other fuels (0.59), piped gas and electricity (0.38), motor fuel (0.95), and gasoline (0.95). The components of the energy-price measures were not available on a methodologically consistent basis.

[5] Hooker (1999) found that prior to 1980, energy-price shocks affected core-price measures. He attributes this to the response of monetary policy at the time.

[6] Hooker (1999) concludes that a structural break in 1980:QII better fits the data than do asymmetric specifications of energy prices.

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