

## ***John A. Tatom***

*John A. Tatom is an assistant vice president at the Federal Reserve Bank of St. Louis. James P. Kelley provided research assistance.*

# **The 1990 Oil Price Hike in Perspective**

**T**HE ECONOMIC EFFECTS of the sharp rise in oil prices in 1990 were, for a while, the central issue in discussions of the economic outlook for 1990 and 1991. Iraq's maneuvers to raise the world price of oil late in July 1990 and their invasion of Kuwait less than a week later led to a doubling of oil prices. As a result, oil price shocks and the appropriate economic policy response to such shocks became subjects of renewed speculation.

One of the most popular hypotheses to emerge at the time was that, since the economy was different in 1990 than it had been when previous large oil price increases occurred, the 1990 price rise should not affect the economy to the same extent.<sup>1</sup> It still was widely believed, however, that the principal and most immediate effect would be the onset of a recession. In response, many analysts believed that the Federal Reserve would ease monetary policy because they thought it had done so at the outset of previous oil shocks.

This article outlines the potential channels of influence of a rise in the price of oil and the extent to which the purported differences in eco-

nomie conditions in 1990 could account for differences between the economic effects of the 1990 oil price surge and those in earlier, comparable episodes.

## **WHY DO OIL PRICES MATTER?**

One usually encounters two principal arguments in assessing how oil and energy price changes affect the economy. First, since energy resources are used to produce other goods and services, a change in their price affects how much of the goods are produced as well as the mix of resources that will be used to produce them. This argument focuses on the supply side of the markets for goods and services. It suggests that the output losses associated with higher energy prices are permanent, so that changing economic policies or shifting market prices cannot replace the loss.

A second argument focuses on the effects on the demand for a country's output. It suggests that output losses are cyclical or transitory, so that adjustments in wages and prices, or in economic policy, can reverse the loss in output.

---

<sup>1</sup>Fieleke (1990) was one of the first to develop this argument. Among the reasons he cites are differences in the size of the shock, the sensitivity of oil consumers to oil price changes, the state of the economy before the oil shock and differences in available policy options. The Council of Economic Advisers (1991) provides a more extensive discussion consistent with this view.

Each argument suggests which characteristics of the economy determine the effects of an energy price shock, as well as how changes in these characteristics would alter these effects. Each also provides a different conclusion about the potential for economic policy to ameliorate the adverse influences of energy price shocks.

### ***Energy Prices and Economic Capacity: The Permanent Effects of an Energy Price Shock***

Energy resources are used to produce most goods or services. As such, a rise in their price will (1) raise the total cost of an efficient producer's output, (2) alter the most efficient means for producing output, (3) lower the profit-maximizing level of output, (4) raise the long-run equilibrium price of output and (5) reduce the capacity output of each firm's existing stock of capital.<sup>2</sup> Capacity output declines when energy prices rise because firms reduce their use of energy and energy-using capital, some capital becomes obsolete, and firms use labor and capital to economize on energy costs—that is, they generally switch to less energy-intensive production methods. The shaded insert on pages 6 and 7 briefly explains the microeconomic foundations of this capacity effect.

The economy's aggregate supply is the sum of the supply decisions of the nation's firms. Thus, the effect of energy prices on the typical firm's economic capacity determines the effect on the economy's natural output and its aggregate supply. The influence of a rise in the price of energy on aggregate supply is shown in figure 1. The aggregate supply curve indicates the output that producers will supply at various levels of the aggregate price level, given other factors influencing this decision. The supply curve typically is derived from a given production function, which relates output to the employment of resources such as labor and capital. An initial level of nominal wages, the supplies of labor

and capital goods and the relative price of energy resources are assumed to be given in deriving a particular aggregate supply curve.

Suppose that the price level,  $P_0$  in figure 1, results in a real wage (nominal wage deflated by the price level) at which a given supply of labor resources is fully employed. At this level of employment, which often is referred to as natural employment, the economy produces its capacity or natural output level,  $X_n^0$ . Given the nominal wage level, the real wage is lower when prices are higher than  $P_0$ , so firms would desire to produce more output and demand more employment. Workers would be unwilling to work more at a lower real wage, however, so neither output nor employment could rise. Indeed, to maintain output and employment, the nominal wage must rise proportionately with the price level to keep the real wage unchanged. Thus, the aggregate supply curve is vertical at  $X_n^0$  for prices above  $P_0$ . At a lower price level than  $P_0$ , the real wage is too high for firms to employ as much labor or produce as much output as at  $X_n^0$ ; output and employment are below their natural counterparts along this upward-sloping portion of the aggregate supply curve.

A rise in the relative price of energy, given the short-run supply of capital and labor resources, will reduce capacity output from  $X_n^0$  to  $X_n^1$  and raise the aggregate level of prices associated with this output from  $P^0$  to  $P^1$ . The percentage decline in capacity output and the rise in price level associated with each 1 percent rise in the relative price of energy generally are equal and proportional to the share of energy in the cost of output.<sup>3</sup> In this case, although real output has fallen, the level of nominal spending on output at point B in figure 1 will be the same as at point A. Thus, if output is measured by the nation's real GNP, then real GNP is lower at point B than at point A, but nominal GNP is the same.

Aggregate output and the price level are determined by the interaction of aggregate supply

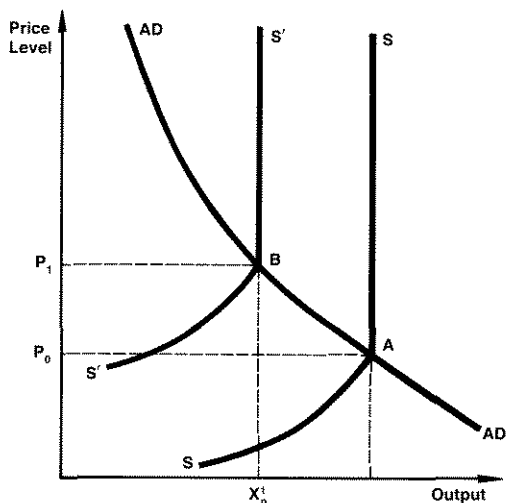
<sup>2</sup>This discussion draws upon Rasche and Tatom (1977a) and (1981); Karnosky (1976) was one of the first to argue that a rise in the price of energy reduces capacity and raises the price level. Hickman, Huntington and Sweeney (1987) summarize the similarities and differences of empirical estimates of the effects of energy price shocks in 14 prominent macroeconomic models. All of these models show a permanent output loss due to an oil price increase; in six of these models, this loss is explicitly cited as a decline in potential output.

The Council of Economic Advisers (1991) suggests that any effect on capacity is transitory. Others who have been

critical of the significance of the capacity effect include Berndt (1980), Berndt and Wood (1987), Denison (1979) and (1985), Darby (1984) and Olson (1988).

<sup>3</sup>The conditions required to obtain the equality of these outcomes are discussed in Rasche and Tatom (1977a) and derived in Rasche and Tatom (1981). The shaded insert to this article provides a summary of the analysis.

**Figure 1**  
**The Effect of a Higher Price of Energy on Output and the Price Level**



and demand. Aggregate demand indicates the quantity of output demanded at various price levels and is inversely related to the general price level. The aggregate demand curve in figure 1 passes through both points A and B. At these points, nominal GNP (the product of the price level and output) is the same, indicating that a rise in the price level is associated with an equal proportionate decline in real output. Thus, the nominal value of aggregate demand is unaffected by the price level.

This assumption simplifies the analysis without reducing its generality. The higher price level reflects the permanent decline in natural output, with no cyclical loss of output or employment; the smaller natural output level is produced by an unchanged level of natural employment. Only a further reduction in output would fit the notion of a cyclical loss associated with cyclical unemployment.

For cyclical output and employment losses to arise from an energy price increase, either (1)

aggregate demand must be more responsive to a rise in the price level (flatter than that drawn in figure 1), (2) an increase in the relative price of energy must cause the aggregate demand to shift to the left, or (3) there is some short-run dynamics of price and output adjustment not shown in the movement from A to B. For example, if the price level adjusts upward slowly because of temporary rigidities in the prices of goods and services, then a rise in energy prices will lead producers to reduce employment temporarily, reducing output by more than the decline in natural output. When output prices rise sufficiently to reduce real wages by the extent of the permanent decline in labor productivity, employment will be restored to its natural level and output will have fallen only to the extent of the capacity loss.<sup>4</sup> Thus, even if the principal effects of an energy price rise are a permanent decline in capacity and a rise in the price level, some transitory recessionary declines in output and employment are likely to occur.

### ***Energy Prices and Aggregate Demand***

The second channel of influence above indicates that a rise in the relative price of energy would shift aggregate demand to the left, reducing output and/or the level of prices. These effects are transitory, or cyclical, however, in contrast to the permanent output loss arising from reduced capacity. When output is less than its natural level, employment is as well. Thus, wages and rental prices of capital goods will tend to fall, shifting the upward-sloping portion of the aggregate supply curve and the price level down until output is restored to its natural level.

Aggregate demand will fall if a rise in oil prices raises expenditures on oil and total imports and thereby lowers net exports. In effect, the rise in the oil import bill acts like a tax on domestic income, reducing aggregate demand. For such a shift in aggregate demand, the decline in output and employment are propor-

<sup>4</sup>Tatom (1981) indicates that temporary cyclical effects occur for the third reason above; that is, they are short-run dynamic variations as the economy moves from point A to point B. In this analysis, sticky prices keep the price level from rising instantaneously. Inventories and increased employment initially are used to meet unchanged sales and partially offset the productivity loss. Within a short time, however, firms begin to reduce output because sales fall

more as prices begin to rise; cyclical losses in output and employment occur. Empirical evidence indicates that, after about a year, the price level has adjusted fully (to  $P_1$  in figure 1), so producers step up production and employment to their natural levels (point B).

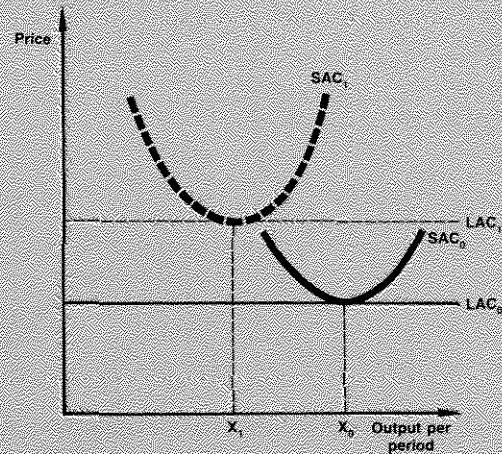
## The Effect of a Higher Price of Energy on Economic Capacity

The effect of a rise in the price of energy on a firm's cost structure is illustrated in the accompanying figure, which shows the long- and short-run average cost of output and how they are affected by a rise in the price of energy. The long-run average cost curve ( $LAC_0$ ) indicates the minimum cost per unit of output for the firm. This curve is derived from the least-cost combination of resources that produces the indicated quantity of output, given available technology and the prices of the resources used to produce the firm's output. The long run refers to a period over which the firm is free to vary the quantity of all resources used in production.

In the figure, the long-run average cost curve is horizontal, or unaffected by the level of output. The long-run average cost could decline over some range of output, indicating what are called "economies of scale," or it could rise over some range indicating "diseconomies of scale." When the curve is horizontal, as in the figure, the firm's production exhibits constant returns to scale so that, for any initial output level, proportional increases or decreases in output can be obtained from equiproportional changes in the employment of each resource. In this case, long-run cost varies equiproportionately with output, so that the long-run average cost is unaffected by the output level the firm chooses to produce. With constant returns to scale, the long-run average cost also indicates the long-run marginal cost, the minimum additional total cost of producing an additional unit of output.<sup>1</sup>

The short run is characterized by the inability to vary the use of some resources. In particular, firms have difficulty in varying their capital stock—their plant and equipment—to produce more or less output in the short run. Thus, a given size of capital stock would be freely chosen to allow least-cost production at only one level of output. At a larger

The Effect of a Higher Price of Energy on a Firm's Cost, Capacity and Price



(smaller) output, more (less) capital would be used to minimize the cost of production. The output level at which the existing stock of capital would be selected is called the economic capacity of the firm's capital stock. At this output, the long-run and short-run total and average cost of output are the same.

Should the firm desire to produce more or less output, it could not do so as cheaply in the short run as it could in the long run because the capital stock cannot be varied in the short run. Higher-cost methods of production, which use relatively more labor or other variable resources, must be used until the capital stock can be altered. Since the total cost of producing any level of output other than the capacity level ( $X_0$ ) is higher in the short run than the long run, the short-run average cost ( $SAC_0$ ) is also higher.

When the price of energy rises, the long-run and the short-run average cost of output rise ( $LAC_1$  and  $SAC_1$ , respectively). The size of

<sup>1</sup>The most general case is often illustrated with a U-shaped long-run average cost curve, which exhibits increasing returns to scale over the range of relatively low output levels and decreasing returns to scale at

relatively high levels of output. At the minimum long-run average cost, there are constant returns to scale.

the rise depends, in part, on the size of the increase in energy prices and the share of energy resources in total cost. The effect on the firm's economic capacity depends on how the optimal long-run mix of resource employment changes. The higher price of energy will cause the firm to reduce its use of energy to produce a given level of output (say  $X_0$ ) and increase the use of some resources whose prices have not changed. The use of some other resources could also be reduced along with energy.<sup>2</sup> As drawn in the figure, the capacity output of the firm falls to  $X_1$ , since the short-run average cost rises more than the long-run average cost at output  $X_0$ .

<sup>2</sup>The effect of a rise in the price of one resource on the efficient level of employment of another is assessed by the "elasticity of substitution" between the two resources, which measures the percentage change in one resource associated with each 1 percentage-point rise in the price of the other, holding output constant. If the elasticity of substitution between energy and some other resource is positive, a rise in the price of energy raises the employment of the other resource. In this case, energy and the other resource are said to be substitutes. When this elasticity of substitution is negative, energy and the other resource are "complements."

<sup>3</sup>Some analysts describe production as "putty-clay," meaning that, in the short run, the capital stock requires fixed proportions of other resources. In this case, the elasticity of substitution between energy and capital is zero in the short run, so that capacity is unaffected. Over time, a capacity loss would be realized as obsolete capital is replaced with capital that uses

Whether capacity output falls, rises or is unaffected by a rise in the price of energy depends on the relationship between capital and energy resources in production. When these resources are substitutes, a rise in energy prices would lead the firms to substitute capital for energy in producing  $X_0$ . Thus, the existing capital stock would be chosen to produce a smaller output level ( $X_1$ ).<sup>3</sup> If capital and energy are independent or complements, the higher short-run and long-run average cost level will be identical at the same or higher level of output, respectively. Energy and capital are substitutes, however, which implies that economic capacity will fall when energy prices rise.<sup>4</sup>

less energy. See Corcoran (1990), for example. Evidence cited in the text suggests that putty-clay considerations are not dominant in the short run.

<sup>4</sup>The size of the fall in economic capacity is proportional to the share of energy in factor cost and the elasticity of substitution and inversely proportional to the expenditure elasticity of the capital stock (or fixed resources generally). The elasticity of capacity equals  $(-\sigma_{KE}/\eta_K)$   $s_e$ , which reduces to  $-s_e$ , the share of energy in total cost, if the expenditure elasticity of capital,  $\eta_K$ , and the elasticity of substitution,  $\sigma_{KE}$ , are one; these elasticities are each one for a broad class of functions used in empirical analysis. The former elasticity is the response of desired capital use to an increase in expenditures on all resources. For increases in the relative price of energy, instead of the nominal price, the share of energy in the expressions here and above is replaced by  $(s_e/1 - s_e)$ .

tional to the rise in the oil price and the share of oil imports in GNP. In this case, the net oil import status of a country determines the effects of an energy price shock.<sup>5</sup> Countries that export oil face larger aggregate demand when oil prices rise; world aggregate demand and output are redistributed from oil importers to exporters when oil prices rise, and conversely when oil prices fall.<sup>6</sup>

<sup>5</sup>Feldstein (1990) and the Council of Economic Advisers (1991) provide recent restatements of this shift in aggregate demand and the price-level-induced movement along the aggregate demand curve as the central channels of influence of an oil price hike. The Council of Economic Advisers also emphasizes a decline in real consumption expenditures as a result of an oil price hike. Perry (1991) argues that the oil price hike had little effect on the economy in 1990, because it did not reduce real income much (operating through the aggregate demand channel above), nor did it induce the Fed "to raise interest

## Monetary Policy and Oil Price Shocks

The appropriate monetary policy response to a rise in the relative price of energy depends on its dominant channel of influence. If the higher energy price only lowered aggregate demand, policymakers could take offsetting actions to neutralize this shift by increasing the money

rates to fight inflation" as, he argues, it had in the past.

<sup>6</sup>A change in the relative price of energy could also affect aggregate demand by altering investment in plant, equipment and housing. Such an effect can account for a decline in the real interest rate, which is incompatible with a conventional model of aggregate demand. Reinhardt (1991) discusses the effects of energy price shocks on interest rates.

supply, which would shift the aggregate demand curve back to the right.

If an energy price increase affects aggregate supply, however, both raising the price level *and* reducing natural output, policymakers could attempt to offset the price level rise by reducing the money stock to reduce aggregate demand. This would result in a cyclical loss in output and employment as the economy's output fell short of its lower natural output level until the price level declined sufficiently.

Alternatively, policymakers could attempt to offset the reduction in output by raising aggregate demand. Raising demand could not restore the economy's natural output, however; it would not replace the energy and capital resources that firms can no longer afford to purchase or use. Instead, it would further raise the aggregate level of prices associated with the smaller level of capacity output.<sup>7</sup>

Thus, there is no real policy dilemma posed by oil price increases. Raising the money stock cannot offset a loss in natural output, while reducing the money stock can only offset a price level increase at the cost of a further loss in output and a cyclical rise in unemployment. Moreover, it is virtually impossible to alter monetary policy enough to fully offset the price level surge because of the time it takes for a change in the money stock to affect the price level and because of the relatively small size of the initial price response to changes in monetary policy.<sup>8</sup> An unchanged growth rate for the money stock is a policy that accepts the permanent output and price level consequences described above without compounding one or the other loss.

### **HAVE THE ECONOMIC EFFECTS OF OIL PRICE SHOCKS CHANGED?**

Many analysts argued that the rise of oil prices in 1990 would have substantially less im-

pact on the U.S. economy than earlier oil price hikes. There were two versions of this argument. The first was that the adverse effects of an oil price rise are proportional to the share of oil imports in the economy and that this share had fallen since the earlier oil price shocks. The second argument was that the effects of an oil price rise are proportional to the use of energy per unit of output and that this dependence on energy also had fallen.<sup>9</sup>

### ***Does a Smaller Import Share Reduce the Adverse Effects of an Oil Price Hike?***

If the share of oil imports in GNP has fallen, then the first argument above implies that the economy's aggregate demand and output have become less sensitive to a rise in oil prices. Figure 2 shows expenditures on petroleum imports as a percent of nominal GNP since 1970. In mid-1990, this share was about 1 percent, less than half its level in early 1979, but above its 0.6 percent share in 1973. Thus, the share had fallen below its level preceding only one of the previous two oil price shocks.

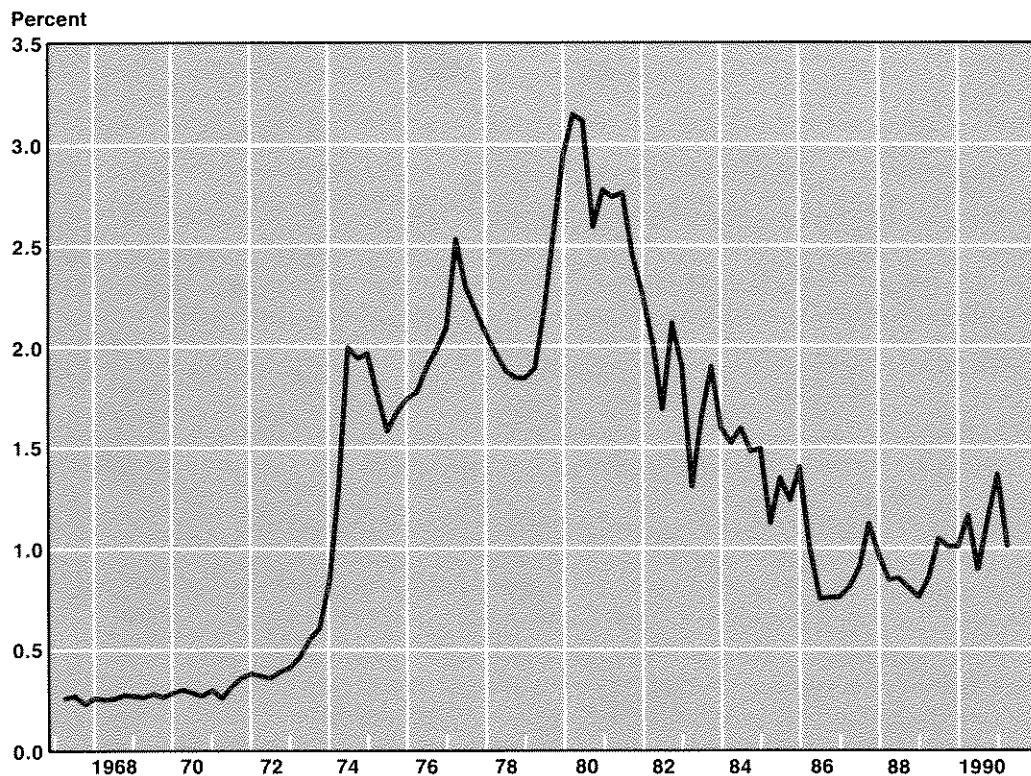
The import share argument has other shortcomings. First, it suggests that oil-exporting countries, including Canada in 1974 or the United Kingdom in 1979, should gain when oil prices rise, because net exports and aggregate demand should rise. In each instance, however, output did not rise nor was there other evidence of a cyclical expansion following the previous oil price shocks. The argument also suggests that countries that import a relatively small share of their oil, like the United States, will be less affected than countries that import relatively more of their oil, like Germany or Japan. The earlier experience with oil price shocks indicates that, especially in 1973-74, both the temporary rise in inflation and the permanent loss in output were larger in Japan than in

<sup>7</sup>Kahn and Hampton (1990) contrast three monetary policy options, which include tightening to offset the price level effect, easing to offset the cyclical effects and a neutral policy which "maintains constant monetary or nominal GNP growth." Feldstein (1990) endorses the third option, nominal GNP targeting, and he also equates this with unchanged money stock growth.

<sup>8</sup>See Tatom (1981) and (1988a), for example, for evidence on the relative size and lag lengths for energy price and monetary policy effects on prices and output.

<sup>9</sup>See Council of Economic Advisers (1991), Kahn and Hampton (1990), Anderson, Bryan and Pike (1990), Brinner (1990), "How Big An Oil Shock" (1990), "Shocked Again" (1990), May (1990), Yanchar (1990) and Fieleke (1990) for analyses that emphasize one or both of these arguments. Fieleke, Kahn and Hampton, May and Yanchar emphasize, to varying degrees, that the expected effects also are smaller because of a smaller expected rise in the price of oil.

Figure 2  
**Petroleum Imports as a Percent of GNP**



the United States, but that these effects were smallest in Germany.<sup>10</sup>

There are three other major difficulties with the import share argument. First, it is difficult to reconcile the relatively large economic effects of oil price hikes with the relatively small size of the petroleum import share. Second, an aggregate demand reduction in the face of an oil price hike implies only a cyclical decline in output, not a permanent one. The failure of real GNP per worker and real wages to return to their previous growth trends in virtually all nations after the two previous OPEC price hikes is not consistent with the pattern expected for a purely cyclical loss. Third, the trade-based ag-

gregate demand story predicts a decline in net exports and the currency value of a large oil importer after an oil price shock. At least for the United States, however, exports rose relative to imports so that both net exports and the exchange rate rose after each earlier oil price shock. Indeed, the only periods of positive net exports since 1970 occurred in 1974-75 and 1979-82, following the earlier oil price hikes.<sup>11</sup>

### *Does Increased Energy Efficiency Reduce the Adverse Effects of an Oil Price Hike?*

The second argument for less adverse effects of the 1990 price hike is based on a decline in

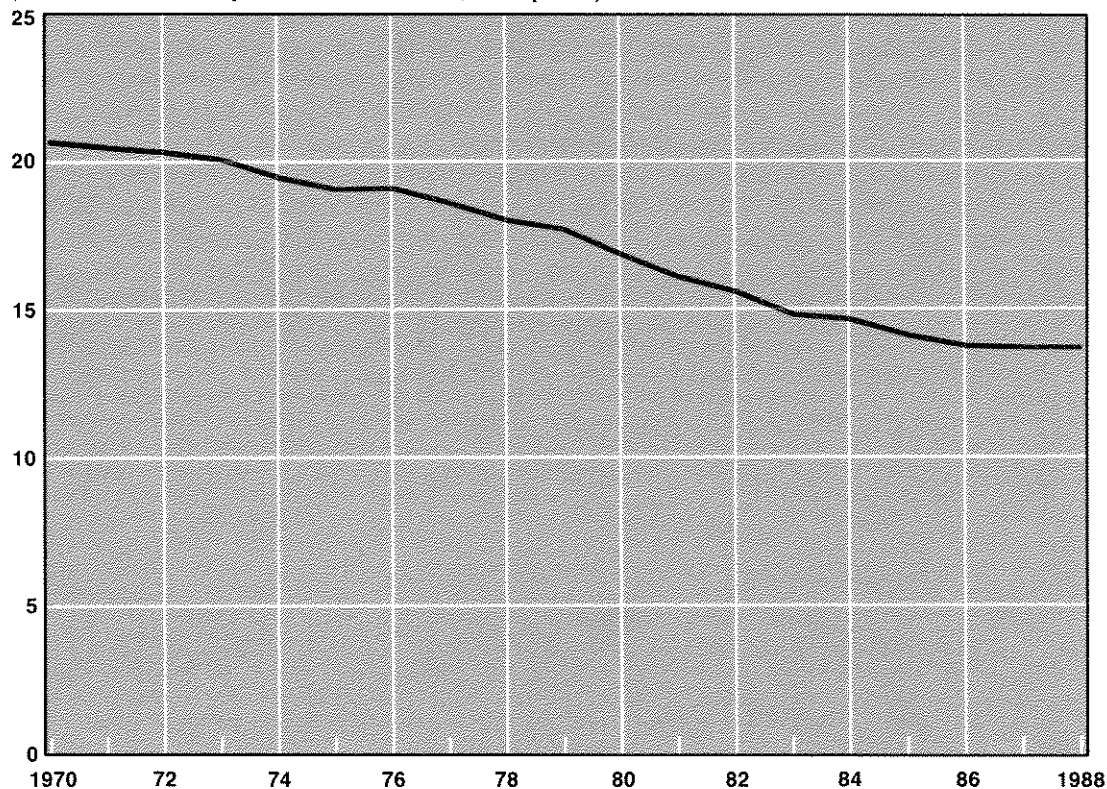
<sup>10</sup>See Rasche and Tatom (1981), Tatom (1987) and Tatom (1988a) for reviews of this international evidence. In 1973, the share of petroleum imports in GNP equaled 1.7 percent in Germany and 1.6 percent in Japan, much more than the 0.6 percent in the United States. Similarly, in 1978, this share was 2.7 percent in Japan, 2.5 percent in Germany and 1.9 percent in the United States.

<sup>11</sup>See Tatom (1988b) for a discussion of the theory and evidence supporting such contrary effects. Consistent with

this rise in net demand for U.S. goods, the trade-weighted value of the dollar rose in IV/1973 and I/1974, and was higher over the rest of 1974 than it had been in the two quarters preceding the oil price rise. In the second quarter of 1979, the value of the dollar also rose slightly. Over the next four quarters, the value of the dollar was only 0.6 percent lower than in the two quarters before the oil price hike.

## Figure 3 Energy Use per Unit of Real GNP

(Thousands of BTUs per dollar of real GNP, 1982 prices)



energy use per unit of output. According to this argument, energy is less important to a firm's production than in the past, so a rise in oil prices is expected to have a smaller effect on prices and production today than in the past.

Figure 3 shows total U.S. energy use per unit of output (measured in BTUs per unit of real GNP) from 1970 to 1988, the latest year available on this basis.<sup>12</sup> Energy use per unit of output has fallen sharply since 1973: BTUs used per unit of real GNP were about 31 percent lower in 1988 than in 1973 and about 22 percent lower than in 1979. This rise in output per unit of energy is not surprising given the rise in the relative price of energy since 1973, but it is not relevant in assessing the importance of energy as a resource or in assessing whether

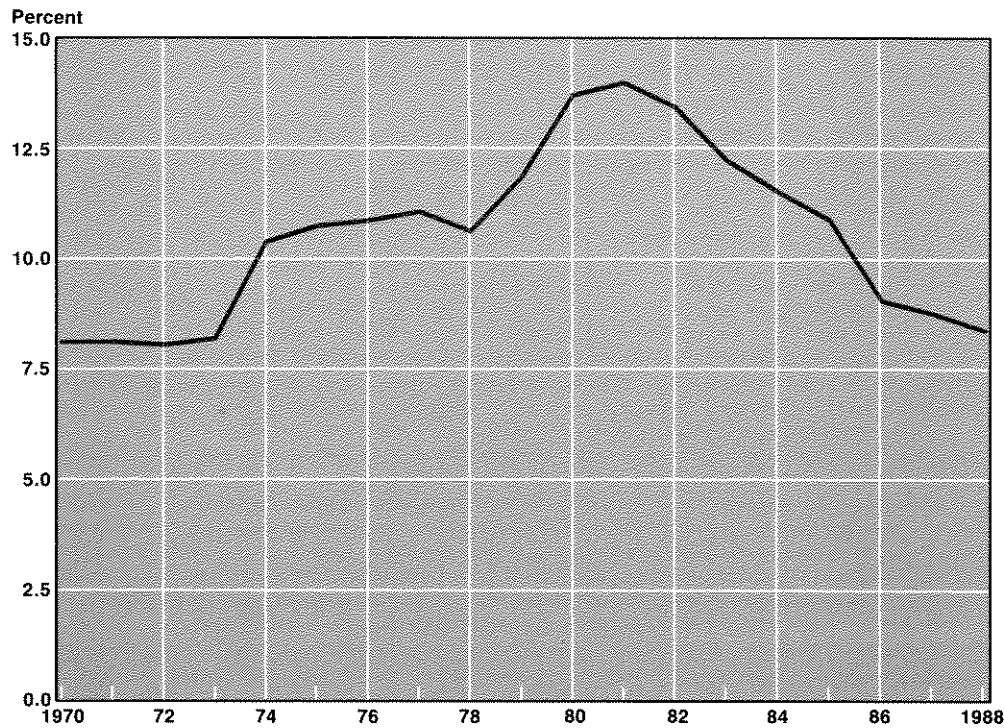
the effects of an energy price boost have declined in magnitude.

While energy use per unit of output is lower than earlier, the responsiveness of prices or output to a change in a resource's price are proportional to the share of the resource's cost in total cost, not to the share of its quantity in output. Consider the familiar case of labor productivity. Labor employment per unit of output in the business sector declined by nearly one-third from 1955 to 1973, as output per worker rose from \$21,084 to \$31,142 (1982 prices). Thus, the economy became less dependent on labor over these 18 years—in exactly the same sense and to nearly the same extent as some have suggested about energy resources over the past 18 years. Nevertheless, the share of labor in total

<sup>12</sup>The energy expenditures and quantity data used for figures 2 and 3 are from the Energy Information Administration, *State Energy Price and Expenditure Report, 1988* (September 1990).



**Figure 4**  
**Energy Expenditures as a Percent of GNP**



cost was about the same: 65.3 percent in 1973 and 64.8 percent in 1955. For a given share of labor in cost, a percentage point rise in the wage rate will raise the cost of an additional unit of output and price in proportion to this share.<sup>13</sup>

Analysts who emphasized the increased productivity of energy are unlikely to espouse the equivalent view that a 10 percent rise in wages has a smaller effect on unit costs or product prices today than in 1973 or 1955. As discussed previously, the response of capacity and price to changes in a resource's price depends on the share of the resource in cost, not on its productivity or output per unit.

Figure 4 shows how the share of energy expenditures as a percent of GNP has changed from 1970 to 1988. Following each energy price hike, expenditures rose sharply relative to GNP; as energy prices fell beginning in 1982 (on an

annual basis), the share fell. By 1988, the share nearly had returned to its 1970-73 level. These data suggest that the share of energy in the cost of the economy's output has not fallen below its level before the earlier oil price changes, especially the 1973-74 rise. Thus, these data do not support the view that a doubling of the price of oil should be expected to have smaller effects in 1990 than it had earlier, especially in 1973-74, because the share of energy in total cost has not declined.

### **RECENT OIL AND ENERGY PRICE DEVELOPMENTS**

The economic effects of an energy price shock depend on the size of the price change as much as they depend on the responsiveness of measures of economic performance to a given

<sup>13</sup>A typical discussion of the relationship between wages, productivity and prices can be found in Fischer, Dornbusch and Schmalensee (1988), pp. 566-67. Shin (1991)

discusses other shortcomings of using the energy-output ratio for analytical or policy purposes.

change in energy prices. Table 1 shows the monthly average price of oil purchased by refiners since June 1990. Following the Iraqi invasion of Kuwait and the subsequent U.N. embargo of crude oil exports from both countries, the price of oil doubled within three months. The 1990 oil price rise was comparable in magnitude to the two earlier OPEC price hikes in 1973-74 and 1979-80. In each of these previous cases, oil prices nearly doubled. In the second instance, oil prices rose again sharply in the first quarter of 1981.

A rise in the price of oil is likely to raise the cost of production of competing energy sources and raise the demand for competing forms of energy, as consumers substitute other fuels for oil. For both reasons, the prices of competing sources of energy change along with the price of oil. Thus, an oil price shock can be considered more generally an energy price shock.

Figure 5 shows the relative price of crude petroleum—measured by the producer price index for crude petroleum deflated by the business sector implicit price deflator—and the relative price of energy—the producer price of fuel, power and related products relative to the same deflator.<sup>14</sup> The relative price affects economic performance because producers of goods and services assess the cost of energy relative to the goods and services produced using it. From the third quarter of 1973 to the third quarter of 1974, the relative price of crude oil nearly doubled. Measured in 1990 prices, the composite refiner acquisition cost of crude oil rose from \$10.67 per barrel in 1973 to \$21.28 in 1974, or 99.4 percent.<sup>15</sup> In the second OPEC oil price shock, from early 1979 to the second quarter of 1980, this relative price of oil nearly doubled

**Table 1**  
**The Composite Refiners Acquisition Cost of Crude Oil (dollars per barrel)**

Date	Price	Date	Price
June 1990	\$14.98	January 1991	\$22.90
July	16.15	February	19.02
August	23.57	March	17.89
September	30.01	April	18.43
October	33.18	May	18.60
November	30.61	June	17.98
December	26.21		

again, rising from \$22.35 per barrel to \$41.82 per barrel. A further surge in early 1981 put the price up to \$50.75 per barrel.

From the second quarter of 1990 to the fourth quarter of 1990, the price of oil rose from \$16.10 per barrel to \$30.00 per barrel, an 86.3 percent rise that is almost as large as the near-doubling in the previous two oil shocks.<sup>16</sup> If the effects of oil price hikes are proportional to their size, then the effects of the 1990 increase should be about the same as in the two previous instances. The relative price of energy rose about 50 percent during the previous two energy price shocks. From the second quarter of 1990 to the fourth quarter of 1990, however, the relative price of energy rose 29.6 percent, about 60 percent of the earlier magnitudes.<sup>17</sup> Thus, on this basis, the recent energy price shock is somewhat smaller.

<sup>14</sup>A logarithmic scale is used because differences in logarithms show percentage changes; an equal-sized increase or decrease in figure 5 reflects equal *percentage* changes. For example, a rise from 50 to 100, or 100 to 200 represents a doubling of the relative price and the respective distance in each case is the same in figure 5.

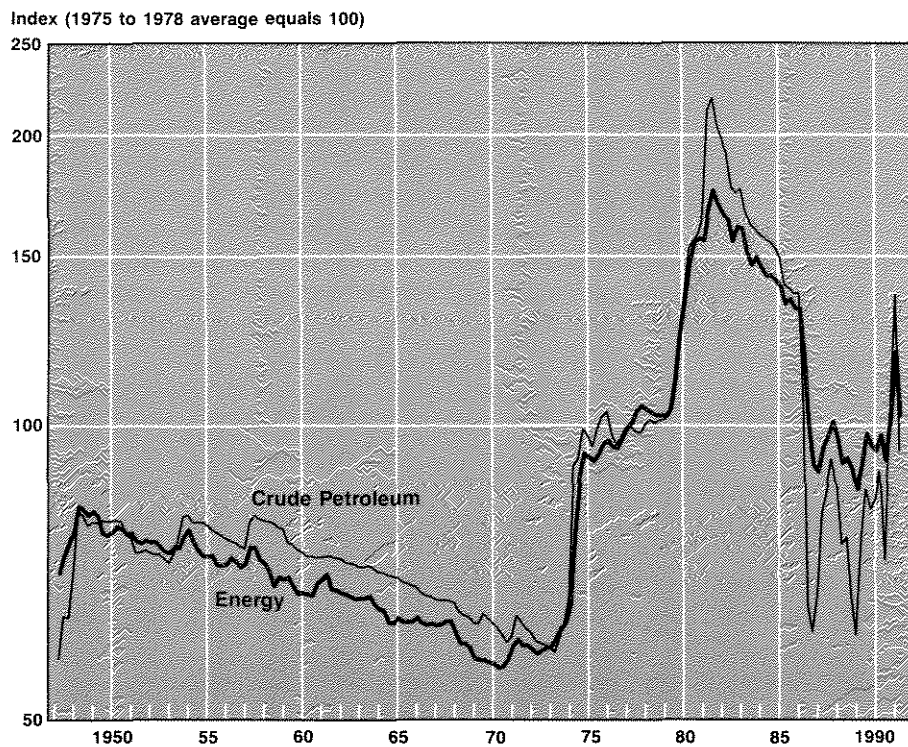
<sup>15</sup>The rise in the relative price of oil shown in the figure actually begins in early 1973, but this earlier increase largely reflects partial and temporary relaxation of U.S. price controls on domestic crude oil prices. The much larger OPEC price increases followed the Yom Kippur War in October 1973. The 1947 oil price shock is not discussed here. The producer price for crude petroleum measures prices paid to domestic producers, which were controlled from 1971 to early 1981. Over most of this period, the composite refiner acquisition cost was higher, but was representative of oil prices paid by domestic purchasers.

<sup>16</sup>The total output of Kuwait and Iraq fell about 4 million barrels per day in August 1990 from its May-July 1990 aver-

age; by November and December 1990, it was down 4.6 million from the earlier average. The latter reduction equaled 7.6 percent of world production and 19 percent of OPEC output. In comparison, the reductions in the total of Iran and Iraq production from 1978 to its lowest annual average level in 1981 was somewhat larger, 5.4 million barrels per day, but this was 18.2 percent of OPEC's 1978 production.

<sup>17</sup>Empirical estimates suggest that the relative price of energy adjusts contemporaneously and with a one-quarter lag to changes in the relative price of oil; thus, one reason for the relatively smaller rise in the energy price is the fact that the relative price of crude oil fell 20.6 percent in the second quarter of 1990. When expressed in logarithms, each 1 percentage-point rise in the relative price of crude oil is estimated to result in about a one-half percent rise in the relative price of energy. See Tatom (1987b).

**Figure 5**  
**Relative Price of Energy and Crude Petroleum**



There were two other important differences between the recent rise and the previous two. First, the recent rise occurred much more quickly—in two quarters instead of four or six. Second, the recent increase did not persist. Nevertheless, producers did not know at the time whether, or by how much, oil prices might decline in the future. This article assumes that producers treat price changes as permanent, in the sense that the expected price they use for economic decisions is the current price. It also focuses only on the effects of the recent price increase. To the extent that producers did not anticipate having to face the price increase, the effects of the price shock should be smaller.

### THE EXPERIENCE IN PREVIOUS OIL PRICE SHOCKS

The previous discussion of energy price effects indicates that the 1990 oil price hike should be associated with a lower level of natural output and productivity and a rise in the price level. These changes were likely to be revealed

as a temporary acceleration in inflation and a temporary reduction in output growth. Moreover, temporary rigidities in nominal prices and lags in the adjustments that firms and consumers make in response to large price changes were likely to give rise to temporary movements in employment, including a recessionary decline in employment, although past experience suggests that such a change occurs with a delay of about one year. These effects should be expected to have been somewhat smaller than those following previous oil shocks, because the rise in the relative price of energy in the 1990 episode was only about 60 percent as large as the previous increases.

Following the sharp rise in the relative price of energy in 1973-74 and 1979-80, the loss in capacity and adjustment to a higher price level, as discussed earlier in reference to figure 1, were reflected in a temporary acceleration in the inflation rate. In each case, output growth slowed, reflecting both the permanent decline in natural output and a transitory loss in output. Produc-

tivity (and real wages) fell.<sup>18</sup> Generally, the permanent loss in output and productivity and the rise in prices were experienced first, with the temporary surge in inflation (as measured by the GNP deflator) delayed about two quarters.<sup>19</sup> Employment declined much later and for only a few quarters. Cyclical unemployment associated with an oil price rise peaked about six quarters later, before quickly dissipating.

Table 2 shows these developments for the three most recent large energy price hikes. For periods surrounding each oil price hike, the table provides real GNP growth, productivity (business sector output per hour) growth, the rate of increase in the GNP deflator, civilian employment growth, the average unemployment rate for the civilian labor force and money stock (M1) growth. Each measure is provided for the year before and the first four consecutive two-quarter periods following the shock. Two-quarter periods are used to simplify the data presentation, although the timing of energy price effects facilitates the usefulness of this procedure. OPEC1 refers to the first oil price shock which began in IV/1973. OPEC2 begins in II/1979 and IRAQ begins in III/1990.

As table 2 indicates, real GNP growth slowed following the two previous oil price hikes, but did not become negative on a two-quarter basis until after the first two quarters (OPEC1) or after a year (OPEC2). The slowing in output growth reflects both the decline in natural output and, principally later, a temporary cyclical loss in output. Table 2 also shows that the expected productivity decline (negative growth) occurred more quickly than the decline in real GNP in the previous two cases; it began in the first two quarters of the energy price shock in

each case. Both productivity and output growth show a sharp cyclical acceleration in the last two-quarter period.

The most recent energy price shock, like the earlier two, was accompanied by an immediate decline in productivity and a slowing in output growth.<sup>20</sup> Output growth became negative earlier than in the previous two cases. Since the recent energy price hike occurred over only two quarters, the period of decline in productivity and output growth should be correspondingly shorter than in the previous two instances. The slight rise in productivity growth in the second two-quarter period is consistent with this expectation.

In the previous two instances, the decline in productivity and natural output was reflected, with about a two-quarter lag, in a sharp and temporary acceleration in the rate of price increase as measured by the GNP deflator. Thus, in the second two-quarter period in OPEC1, inflation accelerated sharply and only temporarily, reflecting the one-time adjustment in the price level. The same acceleration occurs in OPEC2, but with a one-quarter lag; the data for the two-quarter period ending one quarter later are shown in parentheses. As table 2 shows, however, in the first two-quarter period, the rate of increase in the GNP deflator rose (OPEC1) or was unchanged (OPEC2); in the latest instance, it declined.<sup>21</sup>

In the previous two cases, the delayed acceleration in the rate of price increase persisted for about four quarters (five quarters for OPEC2), about as long as the period of sharp increases in energy prices. There is also an acceleration in the recent second two-quarter period (I/1991 and II/1991). Since the latest price hike occurred over half as many quarters as in the previous

<sup>18</sup>These developments were observed in nearly all countries. The notable exception was that income policies impeded the reductions in real wages (and, therefore, in labor productivity) in some countries, especially in 1973-74, so that the effective supply of natural employment fell, further reducing natural output. See Rasche and Tatom (1977a), (1977b) and (1981), Tatom (1988a) and (1987). Hamilton (1983) also provides empirical evidence supporting the permanent effect on U.S. real GNP. Helliwell, Sturm, Jarrett and Salou (1986) provide international evidence on the effect on natural output.

<sup>19</sup>See, for example, Tatom (1981) and (1988a). The lag for the PCE deflator and CPI is shorter (one quarter) and the magnitude is larger for these consumer price series, because the share of energy cost in expenditures is larger for consumer expenditures than for GNP as a whole. Thus, the effect of a given rise in oil prices is larger for consumer price inflation measures. The effects on producer prices occur even faster and are even larger.

<sup>20</sup>Productivity growth had declined more rapidly in the year before the recent oil price shock than it did in the initial two-quarter period, so productivity growth did not actually slow in the second half of 1990.

<sup>21</sup>The initial decline in the rate of price increase in the first two-quarter period is not out of line. In each of the previous initial two-quarter periods, this rate was much lower in at least one of the two quarters. In particular, in the first quarter of 1974, the rate of increase of the deflator fell to a 5.6 percent rate; in 1979, it fell from 9.5 percent in the first quarter to a 9.2 percent rate in the second quarter and to 8.5 percent in the third quarter of 1979.

**Table 2**  
**Economic Performance Surrounding Three Energy Price Shocks**

	Previous Year	First Two-Quarter Period	Second Two-Quarter Period	Third Two-Quarter Period	Fourth Two-Quarter Period
<b>Real GNP growth rate</b>					
OPEC1	4.4%	0.7%	-2.0%	-5.6%	5.5%
OPEC2	5.3	1.6	1.6	-4.5	6.6
IRAQ	1.0	-0.1	-1.7		
<b>Productivity growth rate</b>					
OPEC1	1.5	-1.3	-2.1	0.9	6.8
OPEC2	0.6	-2.6	0.4	-0.4	3.7
IRAQ	-0.6	-0.2	0.2		
<b>Rate of price increase</b>					
OPEC1	7.1	7.7	11.5	10.9	7.8
OPEC2 <sup>1</sup>	8.9	8.9 (8.4)	8.5 (9.1)	9.4 (10.7)	11.4 (8.7)
IRAQ	4.0	3.2	4.9		
<b>Civilian employment growth rate</b>					
OPEC1	3.5	3.3	0.9	-3.9	1.8
OPEC2	3.9	1.6	1.7	-1.9	2.7
IRAQ	0.9	-1.1	-1.0		
<b>Average unemployment rate</b>					
OPEC1	5.0	5.0	5.4	7.4	8.7
OPEC2	5.9	5.8	6.1	7.5	7.4
IRAQ	5.3	5.7	6.7		
<b>M1 growth rate</b>					
OPEC1	7.0	6.0	3.7	3.7	6.9
OPEC2	7.4	10.3	5.1 (1.5) <sup>1</sup>	5.8	8.0
IRAQ	4.0	3.6	6.8		
<b>Period</b>					
OPEC1	III/1972 to III/1973	IV/1973; I/1974	II and III/1974	IV/1974; I/1975	II and III/1975
OPEC2	I/1978 to I/1979	II and III/1979	IV/1979; I/1980	II and III/1980	IV/1980; I/1981
IRAQ	II/1989 to II/1990	III and IV/1990	I and II/1991		

<sup>1</sup>Data in parentheses are for the two quarters ending one quarter later.

two, the acceleration would be expected to be reversed in the third two-quarter period, even without any effect from the decline in energy prices in I/1991 and II/1991. It remains to be seen whether inflation will decline as abruptly as it did following earlier oil price shocks.<sup>22</sup>

The delayed cyclical response to an energy price hike is seen most clearly by looking at the

growth of civilian employment. In the two previous instances, employment growth slowed, but did not become negative until a year after the energy price shock began. Moreover, this decline occurred in only one two-quarter period (the third one), when employment fell at a relatively rapid pace. Thus, the typical recessionary characteristic of falling employment did not oc-

<sup>22</sup>The rate of increase in the CPI rose from a 3.8 percent rate in the second quarter of 1990 to about a 7 percent rate in the third and fourth quarters of 1990. Similarly, the rate of increase of the producer price index rose from a 0.3 percent rate in the second quarter of 1990 to a 6.6 percent rate and a 10.8 percent rate in the third quarter

and fourth quarters of 1990, respectively. The rate of increase of the latter two price measures fell sharply in the first half of 1991, reflecting the quicker response of these measures to a rise in energy prices as well as to their subsequent decline.

cur until a year after the onset of the two previous energy price hikes.

The unemployment rate also did not rise immediately after the two previous adverse energy price shocks. In 1973-74, it fell slightly in the fourth quarter of 1973, rose only 0.8 percentage points by the third quarter of 1974, then peaked 3.3 percentage points higher three quarters later.<sup>23</sup> The unemployment rate peaked six quarters after the initial surge in energy prices, in the last period shown in the table. In the second quarter of 1979, the initial quarter of OPEC2, the unemployment rate also fell slightly, then rose gradually for the next three quarters so that it was only 0.4 percentage points higher in I/1980 than it was before the energy price shock. The unemployment rate then rose 1.4 percentage points to a peak in III/1980, six quarters after the initial energy price surge.<sup>24</sup>

In the most recent case, the unemployment rate rose immediately, climbing from 5.5 percent in July 1990 to 7 percent in June 1991. Such a rise is substantially different from the pattern in the initial stages of the previous energy price shocks.

Its behavior might better be understood in the context of the slowing in U.S. economic activity that began in 1988. For example, civilian employment actually began declining sharply in March 1990, five months before the energy price hike; civilian employment fell at a 0.9 percent rate from March to July 1990 and declined further at a 0.5 percent rate from July to October 1990, when energy prices peaked; from October 1990 to August 1991, such employment fell at a 1.3 percent rate. Thus, the path of economic activity downward into recession had begun well before energy prices rose.<sup>25</sup>

### *A Comparison of Changes in Monetary Policy Actions*

Each of the two previous oil shocks were followed by changes in monetary policy actions. There is no clear initial pattern, as money growth slowed in the initial two quarters in 1973-74 but accelerated in 1979. As shown at the bottom of table 2, however, in each case, M1 growth then slowed sharply during the second two-quarter period, at the same time that the rate of price increase temporarily accelerated.<sup>26</sup> Then, in each instance, M1 growth accelerated sharply in the fourth two-quarter period following the sharp rise in the unemployment rate.

The expectation that the economy would quickly experience a recessionary rise in unemployment because of the 1990 oil price rise was widespread. There were equally widespread warnings against repeating the "typical" policy response of easing monetary policy to combat this unemployment.<sup>27</sup> While there is evidence of rising unemployment and subsequent accelerations in M1 growth following previous oil price surges, these changes came more than a year after the initial oil price rise. These changes also occurred after the substantial slowing of M1 growth and the transitory inflation rate hike that are more closely associated with the oil price increases.

In the most recent case, money (M1) growth slowed from a 4.8 percent rate from IV/1989 to II/1990 to a 3.7 percent rate in III/1990 and to a 3.5 percent rate in IV/1990. Money growth quickly reversed course, however, accelerating to a 6.8 percent rate, as the unemployment rate continued to rise in the first half of 1991. This

<sup>23</sup>One explanation for the initial decline in the unemployment rate when oil prices rise relies on the capacity loss and "sticky" prices. The initial fall in productivity and initial absence of a price-related decline in aggregate demand when oil prices rise require that producers raise employment to offset some of the output loss and avoid larger-than-desired depletion of inventory. See Tatom (1981) and Ott and Tatom (1986) for discussions of this effect. Rasche and Tatom (1977a) show that employment rose during the first three quarters of the 1973-74 oil shock and did not fall until five quarters later.

<sup>24</sup>In this second instance, a further rise in energy prices late in 1980 and early in 1981 contributed to a further rise in the unemployment rate about a year later, from IV/1981 to II/1982.

<sup>25</sup>Other analysts have emphasized this point. See Weidenbaum (1990) and Erceg and Leovic (1990), for example.

<sup>26</sup>After late 1982, monetary policymakers placed relatively more emphasis on M2 instead of M1. Another measure,

the adjusted monetary base, is often a convenient summary measure of monetary policy actions. Higher energy prices significantly raise relative currency demand one quarter later, reducing monetary aggregates relative to the adjusted monetary base; see Tatom (1990). Thus, monetary base growth is less useful as an indicator of monetary policy during energy price shocks. Bullard (1991) discusses these and other indicators of monetary policy and the potentially conflicting signals they offer.

<sup>27</sup>For example, according to Trehan (1990), "Researchers have generally concluded that the Fed eased policy to overcome the reduction in output caused by the oil embargo" and "... the Fed's initial response to the second oil shock also was similar to its response to the first oil shock." See also, Council of Economic Advisers (1991), which indicates that policy was excessively stimulative prior to the previous oil shocks so that it lacked credibility, making efforts to ease ineffective. The Council of Economic Advisers (p. 80) suggests such temporary actions would be appropriate and effective today.

acceleration in M1 growth occurred earlier than it had following the previous oil price hikes, although it did follow both a previous slowing in M1 growth and a recessionary rise in the unemployment rate, just as had similar accelerations in M1 following the two previous energy price increases.<sup>28</sup>

## CONCLUSION

The rise in oil prices from August to October 1990 set in motion renewed concern and confusion over both the effects of oil price hikes and the appropriate monetary policy response. Three views achieved widespread acceptance. First, the economy was believed to be less sensitive to oil price hikes than it had been earlier. Second, it was widely believed that the principal and most immediate effect would be a cyclical decline in output and employment. Third, analysts believed that the Fed would ease policy, as it had when faced with this problem in the past.

These views are at odds with previous experience. In 1990, the share of oil imports in GNP and energy per unit of GNP had not fallen to the level before the first oil price shock in 1973. Moreover, the relevant parameter, the share of energy in cost, had not fallen below its 1973 level either. Thus, U.S. economic performance should not have become less sensitive to oil price shocks than it was before. In addition, negative employment growth and an acceleration in money growth had not characterized the initial year of previous energy price shocks.

Earlier evidence suggests that the principal cost of an energy price hike is the loss in capacity output and productivity. A counterpart of this loss is a one-time surge in the general level of prices, which follows the energy price hike relatively closely. The adverse cyclical consequences of past shocks occurred later. The principal policy response following previous oil price hikes was a slowing in money growth. Later, when inflation declined and the unemployment rate rose sharply, money growth accelerated.

The 1990 oil price rise occurred against the backdrop of a slowing in money and output

growth that had been under way since late in 1988. Thus, the expected productivity decline and temporary surge in inflation were accompanied by a continuing decline in employment and cyclical output loss. While these developments were uncharacteristic of the initial effects of previous oil price hikes, monetary growth slowed in the second half of 1990 anyway.

There were other distinguishing features associated with the 1990 oil price hike. Foremost among them was its brevity: it occurred over a three-month period and was nearly reversed in another five months. Thus, while the response of output, productivity and prices appears consistent with the capacity-loss-induced effects associated with previous oil price doublings, the subsequent decline in oil prices from October 1990 to March 1991 can be expected to result in offsetting price, output and employment movements.

## REFERENCES

- Anderson, Gerald H., Michael F. Bryan, and Christopher J. Pike. "Oil, the Economy and Monetary Policy," Federal Reserve Bank of Cleveland *Economic Commentary* (November 1, 1990).
- Berndt, Ernst. "Energy Price Increases and the Productivity Slowdown in United States Manufacturing," *The Decline in Productivity Growth*, Federal Reserve Bank of Boston Conference Series, no. 22 (1980), pp. 60-89.
- Berndt, Ernst R., and David O. Wood. "Energy Price Shocks and Productivity Growth: A Survey," in Robert C. Gordan, et. al., eds., *Energy: Markets and Regulation, Essays in Honor of M.A. Adelman* (MIT Press, 1987), pp. 305-67.
- Brinner, Roger E. "Finding Keys to Turn," *U.S. Forecast Summary* (DRI/McGraw Hill, October 1990).
- Bullard, James B. "The FOMC in 1990: Onset of Recession," this *Review* (May/June 1991), pp. 31-53.
- Corcoran, Patrick J. "'Putty' and 'Clay'—A Parable for Potential GNP," *Prudential Economics*, The Prudential (February 15, 1990), pp. 6-9.
- Council of Economic Advisers. "Oil Price Shocks and Economic Policy," chapter 3 in *Economic Report of the President* (1991), pp. 79-110.
- Darby, Michael R. "The U.S. Productivity Slowdown: A Case of Statistical Myopia," *American Economic Review* (June 1984), pp. 301-22.
- Denison, Edward F. *Trends in American Economic Growth, 1929-1982* (The Brookings Institution, 1985).
- \_\_\_\_\_. "Explanations of Declining Productivity Growth," *Survey of Current Business* (August 1979, Part II), pp. 1-24.
- Erceg, John J., and Lydia K. Leovic. "The Outlook After the Oil Shock: Between Iraq and a Soft Place," Federal Reserve Bank of Cleveland *Economic Commentary* (October 15, 1990).

<sup>28</sup>M2 shows the same pattern. It grew at a 2.5 percent rate from II/1990 to IV/1990, down from a 4 percent rate in II/1990 or the 5.1 percent rise in the two-quarter period ending in II/1990. In the first half of 1991, M2 growth also rose, but only to a 4.2 percent rate. Bullard (1991) indicates that Fed decisionmakers were keenly aware of the policy dilemma and chose to pursue a course of neither

easing nor tightening. He indicates that there was a concern for *actual* inflationary pressures late in 1990, but concern for the cyclical consequences of the oil price hike was framed only in terms of the potential risk.

- Feldstein, Martin. "The Fed Must Not Accommodate Iraq," *Wall Street Journal*, August 13, 1990.
- Fieleke, Norman S. "Oil Shock III?" *New England Economic Review* (September/October 1990), pp. 3-10.
- Fischer, Stanley, Rudiger Dornbusch, and Richard Schmalensee. *Economics*, 2nd ed. (McGraw Hill Book Company, 1988).
- Hamilton, James D. "Oil and the Macroeconomy since World War II," *Journal of Political Economy* (April 1983), pp. 228-48.
- Helliwell, John, Peter Sturm, Peter Jarrett, and Gerard Salou. "The Supply Side in the OECD's Macroeconomic Model," *OECD Economic Studies* (Spring 1986), pp. 75-131.
- Hickman, Bert, Hillard G. Huntington, and James L. Sweeney. *Macroeconomic Impacts of Energy Shocks* (North Holland Press, 1987).
- "How Big An Oil Shock," *The Economist* (August 11, 1990), pp. 12-13.
- Kahn, George A., and Robert Hampton, Jr. "Possible Monetary Policy Responses to the Iraqi Oil Shock," Federal Reserve Bank of Kansas City *Economic Review* (November/December 1990), pp. 19-32.
- Karnosky, Denis S. "The Link Between Money and Prices—1971-76," this *Review* (June 1976), pp. 17-23.
- May, Todd Jr. "Oil Prices Won't Bring a Recession," Fortune Forecast/Special Report, *Fortune* (September 10, 1990), pp. 51-52.
- Olson, Mancur. "The Productivity Slowdown, The Oil Shocks and The Real Cycle," *Journal of Economic Perspectives* (Fall 1988), pp. 43-69.
- Ott, Mack, and John A. Tatom. "Are Energy Prices Cyclical?" *Energy Economics* (October 1986), pp. 227-36.
- Perry, George L. "The Anomalous Recession," *The Brookings Review* (Spring 1991), p. 51.
- Rasche, Robert H., and John A. Tatom. "Energy Price Shocks, Aggregate Supply and Monetary Policy: The Theory and the International Evidence," in Karl Brunner and Allan H. Meltzer, eds., *Supply Shocks, Incentives and National Wealth*, Carnegie-Rochester Conference Series on Public Policy (North Holland, 1981), pp. 9-93.
- \_\_\_\_\_. "The Effects of the New Energy Price Regime on Economic Capacity, Production and Prices," this *Review* (May 1977a), pp. 2-12.
- \_\_\_\_\_. "Energy Resources and Potential GNP," this *Review* (June 1977b), pp.10-24.
- Reinhart, Vincent. "Reading the Effects of an Energy Shock in Financial Markets," *Journal of Economics and Business* (1991), pp. 115-32.
- Shin, David. "International Comparisons of Energy-Gross National Product Ratios," American Petroleum Institute Discussion Paper 68 (June 1991).
- "Shocked Again," *The Economist* (August 11, 1990), p. 23.
- Tatom, John A. "The Effects of Financial Innovations on Checkable Deposits, M1 and M2," this *Review* (July/August 1990), pp. 37-57.
- \_\_\_\_\_. "Are The Macroeconomic Effects of Oil Price Changes Symmetric?" in Karl Brunner and Allan H. Meltzer, eds., *Stabilization Policies and Labor Markets*, Carnegie-Rochester Conference Series in Public Policy (North Holland, 1988a), pp. 325-68.
- \_\_\_\_\_. "Macroeconomic Effects of the 1986 Oil Price Decline," *Contemporary Policy Issues* (July 1988b), pp. 69-82.
- \_\_\_\_\_. "The Macroeconomic Effects of the Recent Fall in Oil Prices," this *Review* (June/July 1987), pp. 34-45.
- \_\_\_\_\_. "Energy Prices and Short-Run Economic Performance," this *Review* (January 1981), pp. 3-17.
- Trehan, Bharat. "Lessons from the Oil Shocks of the 1970s," Federal Reserve Bank of San Francisco *Weekly Letter* (November 9, 1990).
- Weidenbaum, Murray. "Recessionary Signs Were Evident Even Before Oil Crisis," *Christian Science Monitor*, October 16, 1990.
- Yanchar, Joyce. "A Look at Oil Market Fundamentals," Special Study, *DRI/McGraw-Hill U.S. Review* (August 1990), pp. 25-31.