# Oil Prices and Aggregate Economic Activity: A Study of Eight OECD Countries

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**Abstract**

This article uses impulse response functions based on vector autoregressive models for eight OECD countries to analyze how oil price shocks move through major channels of the economy to affect aggregate economic activity and inflation. For each country, the model represents the interactions between real oil prices, aggregate economic activity and monetary and financial variables. The results suggest that for energy-importing countries, an oil price shock presents a trade-off between an increased price level and a GDP loss. Although it does not appear that an energy-importing country can use its internal macroeconomic policies to eliminate the effect of oil price shocks on GDP, countries seem to be able to defer and reduce the effect by accepting higher rates of inflation.

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## 1. Introduction

Oil price shocks have major effects on world economies. Whether directly or indirectly, changes in oil prices have affected output and inflation (Hamilton 1983, 1988, 1996; Tatom 1988; Mork 1989, 1994; Kahn and Hampton 1990; and Huntington 1995). Oil price shocks have also been a source of economic fluctuation in the United States over the past three decades (Miller, Supel and Turner 1980; Kim and Loungani 1991; Finn 1991; and Raymond and Rich 1996). The preponderance of evidence suggests that rising oil prices contributed to falling output and increased inflation during the 1970s and early 1980s, and that falling oil prices boosted output and lessened inflation during the mid to late 1980s. In a departure from the remainder of the literature, Bohi (1989), argues that internal monetary policies account for the GDP losses resulting from oil price shocks.

Although there are many estimates of how sensitive output and inflation are to changes in the price of oil, little econometric research has been directed toward examining how a country's monetary policy response to an oil price shock can affect its output growth and inflation. In this article, we construct a vector autoregressive (VAR) model of eight OECD countries to examine how monetary variables affect the way oil price shocks are transmitted to aggregate economic activity. The model represents the interactions between oil prices, real GDP, a monetary aggregate, short-term interest rates, the spread between long-term and short-term interest rates, and the GDP deflator for the period 1973 through 1994.

Our approach adds to the existing research on the aggregate effects of oil price shocks in several ways. We sort through induced policy effects with a more complete model and compare across countries. Comparisons across the eight countries allow us to distill the trade-off between GDP loss and inflation that each country faces as oil prices rise. An examination of these trade-offs allows us to assess how internal monetary policies affect the GDP loss and inflation that a country experiences and to see how each country might have fared under a neutral monetary policy. The time periods we use for the analysis include periods in which oil prices fell sharply, as well as periods in which prices were rising.

Our analysis shows that for energy-importing countries, a real oil price shock yields a tradeoff between a loss of GDP and higher inflation. Policy can affect the timing of the GDP response and how much of the shock is experienced as a loss in GDP and how much as an increase in the price level. Our estimates suggest that a country cannot eliminate the GDP response, but it can cushion the effect by accepting higher inflation.

## 2. Analytical Framework and Estimation

To analyze the effects of oil price changes on inflation, we constructed a vector autoregressive (VAR) model to represent the relationships between oil prices, aggregate economic activity, financial variables and inflation. The model consists of six variables:

the real price of oil, real gross domestic product (GDP), a monetary aggregate, a short-term interest rate, the spread between long-term and short-term interest rates, and the GDP deflator.

*Economic Theory and Model Interpretation*

Although we impose no long-run structural priors on the model, it can be taken to represent several major relationships in aggregate economic activity. For example, the model contains variables that allow it to represent the monetary equation of exchange:

$$MV = PY \tag{1}$$

where $M$ is the monetary aggregate; $V$ is the velocity of the monetary aggregate; $P$ is the aggregate price level; and $Y$ is real GDP. Velocity is commonly represented as a function of interest rates because money demand is sensitive to the opportunity cost of holding money balances. With some money balances paying interest rates, the inclusion of a short-term interest rate and a spread variable allows for two major influences on velocity.

The model also has the potential to represent the relationship between energy (oil) price movements and aggregate economic activity (GDP). This relationship is one avenue through which real energy prices can have a permanent effect on the aggregate price level. Higher energy prices reflect the increased scarcity of this productive input and are expected to reduce real GDP. Under a neutral monetary stance (defined here as one in which $MV$ or nominal GDP is held constant), a reduction in real GDP must be accompanied by an equal percentage increase in the aggregate price level.

In addition, the model can be taken to represent the direct incorporation of energy prices into the aggregate price level. Nonetheless, the direct inclusion of energy prices into the aggregate price level would not be expected to yield a permanent change in the price level. Under the monetary equation of exchange, a change in energy prices cannot have a permanent effect on the price level unless real GDP, the monetary aggregate or velocity are altered.[1]

***Data***

For the United States, the oil price variable is real composite refiners' acquisition cost, and the monetary aggregate is represented by M2. The interest rate is the federal funds rate. The spread variable is the difference between rates on U.S. treasury bonds with a constant maturity of ten years and the federal funds rate. Our measure of inflation is the implicit GDP deflator. GDP is in constant 1987 dollars. All the variables are endogenous. We use quarterly data spanning the period from first quarter 1973 through fourth quarter 1994.[2]

For Canada, France, Germany, Italy, Japan, Norway and the United Kingdom, we use quarterly data from the International Financial Statistics (IFS) of the International Monetary Fund. The data used for France, Japan, Norway and the United Kingdom span first quarter 1973 through fourth quarter 1993. Data for Italy ran from fourth quarter 1974 through third quarter of 1993. The series for Canada include first quarter 1975 through fourth quarter of 1993. For Germany, real GDP data was available only from third quarter of 1978 through fourth quarter 1993.

For all countries, real oil prices are expressed in real own currency. The U.S. imported refiners' acquisition cost is converted to each country's own currency by the market exchange rate and then deflated by the appropriate deflator. The monetary aggregate, similar to M2 in the United States is "Money" (including demand deposits and currency outside banks) plus "Quasi-Money" (including time, savings, and foreign currency deposits), as defined by the IFS.

The short-term interest rate is the money market rate, which is the rate at which short-term lending between financial institutions occurs. The long-term rate is the government bond yield for France, Germany, Japan and Norway, and the long-term government bond yield for Canada, Italy and the United Kingdom. The spread variable is the difference between these short and long-term rates.

For Canada, France, Germany, Italy, Norway and the United Kingdom, GDP is measured in 1990 own currency. For Japan, GNP is measured in 1990 Yen. The deflator for all countries is an implicit deflator, very similar to the U.S. measure.

*Model Specification*

As an initial step in our econometric work, we performed several diagnostic checks to assess the correct specification for the various series. We tested for stationarity using augmented Dickey-Fuller and Phillips-Perron tests, and concluded that we could not reject the hypothesis that all of the series were integrated of order of one. Thus, the first differences of the series were stationary.

There are two approaches in using nonstationary data in a VAR model. One is to formulate an error-correction model in first differences with cointegrating terms. An alternative to the error-correction approach is to estimate the VAR in levels, without explicitly modeling the cointegrating relationships. Given the length of the data series and the number of variables, we selected a VAR model in log levels.

A good case exists for examining the model in levels. The low power of cointegration tests and the resulting uncertainty about the number of cointegrating vectors conditions the test results from an error-correction model. The levels model is a generalized version of an error-correction model, and its estimates are not conditional upon the estimated number of cointegrating relationships and their estimated values. Although some tests on a VAR model in levels do not have standard distributions, the tests presented in this paper do (Sims, Stock and Watson, 1990).

The lag lengths of the VAR models were determined by testing various lag lengths against the alternative of one less lag. The method of testing was the likelihood ratio test corrected for small samples using Sims' (1980) suggestion. The tests are valid because the null hypothesis can be represented by restrictions on stationary variables, as is required for the use of standard distributions with the levels model (Campbell and Perron, 1991). The resulting lag lengths were as follows: two for Canada, five for France, six for Germany, five for Italy, five for Japan, four for Norway, three for the U.K. and five for the U.S.

***Sensitivity Analysis***

To better understand the properties of the estimated VAR models and to see if they behaved in accordance with economic theory, we calculated impulse responses and confidence intervals for exogenous one-time shocks in the monetary aggregate and the short-term interest rate, in addition to the oil price shock, for all countries. The responses to monetary and interest rate shocks generally conform to economic theory.

Although we only report the results of our levels models, we examined different forms of the model. We ran the model in first differences within an error correction framework, and found little difference in the results. We tested for structural breaks in our 1973-1995 time-frame and found no significant break in that time horizon.

For the United States, we conducted sensitivity tests of the model by using alternate variables for the monetary aggregate, the short-term interest rate and the oil price. We used both bond-adjusted M2 and the Federal Reserve Bank of St. Louis' measure of the monetary base in place of M2, the rate of return on treasury bills of a three-month constant maturity in place of the federal funds rate and an aggregate energy price variable in place of oil prices. In addition, we considered the oil price as an exogenous variable. In all of these variants, we found the results to be substantially similar to those reported below.

*Impulse Responses*[3]

To examine the affect of oil price shocks on the various economies and inflation, we calculated impulse response functions. The impulse response function traces over time the effects on a variable of a given shock to the innovations from an equation in the VAR system. The persistence of a shock tells us how fast the system adjusts back to equilibrium. The faster a shock dampens, the faster the adjustment. We analyzed the effects of a one-time oil price shock (based on a Choleski decomposition of the covariance matrix) and traced the effects of this shock on each of the variables.

We used the estimated coefficients of the VAR system of equations and Monte-Carlo integration with 1,000 replications to compute confidence bands for the impulse response functions. The methodology follows Kloek and Van Dijk (1978) with the coefficient draws directly from the estimated posterior distribution of the coefficients. This methodology yields 80-percent confidence bands for the impulse response functions of the variables in the model. These bands can be used to distinguish where the impulse response functions differ significantly from zero.

## 3. The United States

For the United States, the impulse responses indicate that an oil price shock affects all other variables in the model significantly, as shown in figure 1. Some of the effects are transitory, some are long lived, and some are permanent. We analyze and report the U.S. response in detail, as a blueprint for the other countries.

***GDP Response***

Real GDP initially responds to a one-standard deviation shock in the real oil price with a barely significant uptick that lasts four quarters and reaches a maximum of 0.5 percent in the fourth quarter. The effect on GDP is insignificant in quarters five through ten, after which to GDP becomes negative. GDP falls a maximum of 2.9 percent below its pre-shock value by quarter 29. Thereafter, the impulse to GDP weakens, and it is no longer significant by quarter 34.

Our findings are similar to those of Hamilton (1983), Tatom (1988), Mork (1989 and 1994), and Huntington (1995) who all find decreases in real gross national product after an oil price shock. Like Tatom, we find only temporary decline in output results from an oil price shock. If the maximum decline in GDP is normalized by the maximum increase in the price of oil, the resulting oil price elasticity of GDP is -0.031.[4] This elasticity is near the average of -0.05--and well within the range of estimates of -0.02 to -0.076--found in a 1987 Energy Modeling Forum study (Hickman et al, 1987).

*Interest Rates and Monetary Responses*

On the financial side, the oil-price shock leads to a transitory increase in short-term interest rates, a transitory decline in the spread between long-term and short-term interest rates, and a delayed response in M2. The federal funds rate rises 15 percent above its pre-shock value by the fourth quarter, 30 percent by the eighth quarter, and 37 percent by the eleventh quarter. Impulses to the federal funds rate lose significance in the twelfth quarter.

The interest-rate spread falls 5.3 percent below its pre-shock value by the fourth quarter and 10.6 percent by the eighth quarter. The difference between the decline in the spread and the increase in the federal funds rate may be taken to imply that long-term rates also rise, but not as much as short-term rates. Impulses to the spread lose significance in the ninth quarter, implying there is no difference between the response of long and short rates after two years.

The increase in oil prices yields a delayed response in M2. The oil price shock has no significant effect on M2 until quarter 41. After becoming significant, the M2 response increases steadily throughout the time horizon, with M2 rising 27 percent above its pre-shock value in quarter 60.

*Inflationary Response*

A shock to oil prices leads to a permanent increase in the price level. In addition, the price level rises throughout the 60-quarter time horizon.[5] During the first 11 quarters, the price level rises at an increasing rate. At four quarters, the price level is 0.7 percent higher than its pre-shock value; at eight quarters, it is 2.5 percent higher; and at eleven quarters, it is 4.3 percent higher.

After the eleventh quarter the impetus to inflation moderates. Nonetheless, inflation persists and the price level rises throughout the 60-quarter time horizon and remains significant. At the end of the period, the price level is 24.8 percent higher than its pre-shock value, and the elasticity of the price level with respect to the same period real price of oil is 0.26.

***Inflation, GDP and Monetary Policy***

Throughout the 60-quarter time horizon, we find that an oil price shock yields a greater percentage increase in the GDP deflator than the percentage decline in real GDP. In other words, an oil price shock results in an expansion of nominal GDP, a finding that is inconsistent with a neutral monetary policy. The expansion of nominal GDP implies that accommodative monetary policy validates the inflationary impact of oil price shocks, which is consistent with Trehan's (1990) analysis.[6]

The response of real GDP and the price level are consistent with a supply-side response to an oil price shock. The shift in aggregate supply lowers output and increases prices. The Federal Reserve tries to offset the rise in prices by increasing the federal funds rate to slow the rate of money growth. In the medium term, however, the policy is neither strong enough nor persistent enough to prevent a rise in nominal GDP, as the velocity of money increases. At 16 quarters after the oil price shock, M2 is unchanged from its pre-shock level, but nominal GDP is 4.9 percent higher than its pre-shock level. Over the longer run, velocity returns to its pre-shock levels, but the money supply is increased. At 60 quarters, M2 is 27 percent higher than its pre-shock value and nominal GDP is 28 percent higher.

## 4. THE RESPONSE TO OIL PRICE SHOCKS

The estimated responses show that oil price shocks play an important role in the evolution of real and financial variables in the eight countries. Each of the countries respond somewhat differently to a shock in the real price of oil. Differences in policy, as well as the energy consumption-to-GDP ratios account for differing responses across the countries. Table 1 summarizes the impulse responses to an oil price shock for the eight countries.

***Canada***

For Canada, an energy-exporting country, real GDP shows no response to a real oil price shock, hence the oil-price elasticity of real GDP is zero. Although higher energy prices increase the value of Canadian exports, which increase Canadian income, Canadian output remains unchanged.

Nonetheless, short-term interest rates are pushed permanently higher in Canada. Increased interest rates increase the velocity of money, and even without a significant change in the money supply, the price level is significantly higher through the first 30 quarters. The rise in nominal GDP is indicative of expansionary monetary policy that often results from improved terms of trade. After a lag of 30 quarters, the money supply is reduced, and inflation is eliminated. Normalizing the maximum gain in the price level by the maximum gain in the real Canadian dollar price of oil the yields an estimated oil-price elasticity of the price level equal to 0.081.

*France*

The oil price shock leads to an immediate and persistent loss of real GDP for France. By quarter 42, French GDP falls by a maximum of 4.8 percent. Thereafter, the loss in real GDP moderates. Normalizing the maximum loss in GDP by the maximum gain in the real French franc price of oil yields an estimated oil-price elasticity of real GDP equal to -0.069.

The monetary aggregate is not affected significantly in response to an oil price shock, while short-term interest rates rise temporarily. The oil price shock gives rise to an increase in the price level, but the increase is transitory, becoming insignificant after the 16th quarter. For the maximum significant increase in the French price level, the corresponding oil-price elasticity of the price level is 0.031.

In the 16 quarters in which the price level is significant, the price level rises by less than the decline in GDP, reducing nominal GDP. This response suggests a restrictive monetary policy following an oil price shock for France.

*Germany*

For Germany, the oil price shock leads to a persistent loss of real GDP. By quarter 60, real GDP is reduced 12.3 percent. Short-term interest rates rise temporarily in Germany and are significant only through the first five quarters. The monetary aggregate shows a continuous decline throughout the 60-quarter time horizon. The GDP deflator also declines continuously throughout the 60-quarter time horizon. The declines in the monetary aggregate, real GDP, and the deflator are indicative of a contractionary monetary policy. For the maximum change in the price level, the oil-price elasticity of the price level is -0.186.

*Italy*

For Italy, the oil price shock initially leads to a slight rise in real GDP that is significant through the first four quarters. By the twelfth quarter real GDP begins a significant decline, reaching a minimum of 3.5 percent by quarter 21. The effect on GDP is transitory, becoming insignificant after the 29th quarter. For the maximum loss in real GDP, the oil-price elasticity of real Italian GDP is -0.048.

The Italian monetary aggregate shows a transitory reduction in response to an oil price shock, from quarter five through quarter 13, but becomes insignificant thereafter. Short-term interest rates rise sharply for 12 quarters before moderating and becoming insignificant around quarter 40. They also begin rising toward the end of the forecast horizon, regaining significance at quarter 56. With higher interest rates increasing the velocity of money, the brief period of monetary contraction does not prevent nominal GDP from rising. Consequently, the GDP deflator increases by more than GDP falls. The deflator reaches a maximum value of 9.0 percent higher in quarter 21, becoming insignificant at quarter 39. For the maximum values of the oil price and price level shocks, the oil-price elasticity of the Italian price level is 0.117.

*Japan*

For Japan, like Italy and the United States, the oil-price shock initially leads to a slight rise in real *GNP* that is significant for the first four quarters.[7] By the 14th quarter, real GNP begins a significant decline. By quarter 29, real Japanese GNP falls by its maximum significant value of 5.2 percent. By quarter 32 the real Japanese GNP is no longer significantly different than its initial value. Using the maximum significant values, the oil-price elasticity of real Japanese GNP is -0.043.

For Japan, the monetary aggregate is not significantly different from its pre-shock values in quarters two through 15, then exhibits a temporary decline until quarter 28. Japanese short-term interest rates are increased following an oil price shock. The confidence bands also reveal two periods (Q19 through Q27 and Q44 through Q56) in which short-term interest rates are not significantly different from the pre-shock value.

With the rise in interest rates and no initial contraction in the money supply, the oil price shock leads to a rise in nominal GNP - the increase in the Japanese price level is greater than the loss in real GNP. The increase in the price level reaches a maximum of 2 percent in quarter 18 and then becomes insignificant after quarter 24. Using the maximum values, the oil-price elasticity of the Japanese price level is 0.016.

*Norway*

For Norway, an energy-exporting country like Canada, real GDP shows no response to a real oil price shock, hence the oil-price elasticity of real GDP is zero. Although higher energy prices increase the value of Norwegian exports, which increase Norwegian income, Norwegian output remains unchanged.

Nonetheless, after five quarters without a significant response, short-term interest rates are pushed higher in Norway. The increase in short rates remains significant through quarter 50. In addition, there is a delayed monetary aggregate response as the Norwegian monetary aggregate rises in quarters 18 through 52.

With increased income, higher short-term interest rates, and eventually an increase in the monetary aggregate, the Norwegian price level rises throughout the 60-quarter time horizon. The rise in nominal GDP is indicative of the expansionary monetary policy that often results from improved terms of trade. Normalizing the maximum gain in the price level by the maximum gain in the real Norwegian price of oil the yields an estimated oil-price elasticity of the price level equal to 0.308.

***The United Kingdom***

For the United Kingdom, like Germany, the oil price shock leads to a persistent loss of real GDP. By quarter 60, real GDP is reduced 18.4 percent, the oil-price elasticity of real GDP is -0.121.

Short-term interest rates rise temporarily in the U.K. and are significant only in quarters five through 12. As is the case for Germany, the U.K. monetary aggregate and nominal GDP show a continuous decline throughout the 60-quarter time horizon. These declines are clearly indicative of a contractionary monetary policy.

After showing a small, but significant rise for the first five quarters, the GDP deflator becomes insignificant and remains so for the duration of the 60 quarter time horizon. For the maximum significant change in the U.K. price level, the corresponding oil-price elasticity of the price level is positive at 0.007.

*A Tradeoff: GDP Loss or Inflation*

A comparison of the response to oil price shocks across the eight OECD countries shows evidence of a tradeoff between GDP loss and a higher price level. As shown in Table 2, rank ordering the eight countries by the magnitude of their GDP loss and the increase in the price level is nearly perfectly inverse.

Use of the oil price elasticities of GDP loss and the price level permits a closer examination of the tradeoff between GDP loss and a higher price level. As shown in figure 2, countries deferring the GDP loss through accommodative monetary policy in which nominal GDP rises (Italy, Japan and the United States), generally end up with a greater increase in the price level and a smaller GDP loss than those countries accepting an immediate GDP loss through a restrictive monetary policy in which nominal GDP falls (France, Germany and the United Kingdom).[8]

We further analyze the tradeoff by ranking countries according to their energy-consumption-to-GDP ratios. For each of the energy-importing countries, figure 3 shows a hypothetical tradeoff between increases in the price level and GDP loss that could result from an oil price shock. For any pair of countries in figure 3, the curve representing the country with the lower energy-consumption-to-GDP ratio is closer to the origin. The result is a well-behaved family of curves. For each country, given a level of energy consumption, the curves illustrate a continuous tradeoff between inflation and GDP, a set of iso-energy-intensity curves, so to speak.[9]

Under a neutral monetary policy in which nominal GDP is held constant these curves imply that for any pair of energy-importing countries, the country with the higher energy-consumption-to-GDP ratio experiences a greater GDP loss and a greater increase in the price level. Deviations from a neutral policy can yield a smaller loss in GDP at the expense of a higher price level or vice versa.

## 5. SUMMARY AND CONCLUSION

We use impulse responses from a VAR model to assess how oil price shocks move through major channels of an economy to affect aggregate economic activity and inflation in eight OECD countries--Canada, France, Germany, Italy, Japan, Norway, the United Kingdom and the United States. For each country, the model represents the interactions between six variables: the real oil price, real GDP, a monetary aggregate, short-term interest rates, the spread between long and short-term rates, and a deflator.

Taken together, the responses of GDP and inflation across the eight countries present a consistent picture. For energy-exporting countries, such as Canada and Norway, an oil-price shock yields more favorable terms of trade, and higher income, but no increase in output. The improved terms of trade result in a classical increase in the monetary aggregate and a higher price level.

For energy-importing countries, an oil price shock presents a trade-off between an increased price level and a GDP loss. The higher is a country's energy-consumption-to-GDP ratio (or net-energy-imports-to-GDP ratio), the less attractive is the tradeoff. Given the tradeoff it faces, each country's internal policies determine how much of the shock will be experienced as a GDP loss and how much will be experienced as an increase in the price level. Although it does not appear that an energy-importing country can use its internal macroeconomic policies to eliminate the effect of oil price shocks on GDP, countries seem to be able to defer and reduce the effect by accepting higher rates of inflation.

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## Notes

1. Although real oil prices are somewhat more volatile than real energy prices, changes in real oil prices may represent changes in energy prices. Yücel and Guo (1994) have shown that oil prices and other energy prices generally move together in the long run.

2. Data for some series are available for a longer span of time. We restricted the estimation period to one in which oil prices showed volatility.

3. The VAR approach also enables one to calculate the variance decomposition of the system. The information provided by the impulse response functions and variance decompositions is the same, but presented in an alternate form.

4. The reported value is calculated on a constant elasticity basis.

5. Kahn and Hampton (1990) find an oil price shock is likely to lead to a persistent pick-up in the inflation rate because cost-of-living adjustment clauses and other contracts raise input prices and inflationary expectations are increased.

6. Darby (1982) notes that additional factors, such as the final breakdown of pegged exchange rates and the dismantling of price controls, may have augmented the inflationary effects of oil price shocks.

7. For Japan, statistics on GDP are not generally available, hence, data on GNP is used.

8. In figures 2 and 3, the 45 degree line represents neutral monetary policy, that is one in which nominal GDP is constant and the GDP loss equals the increase in the price level.

9. We also experimented by ranking countries by their energy import to GDP ratios. Again the result is a well-behaved family of curves. For each country, the curves illustrate a tradeoff between inflation and GDP after an oil price shock.

TABLE 1. RESPONSES TO AN OIL PRICE SHOCK

| | Price Level | GDP | Money | Short Rate | Spread |
|---|---|---|---|---|---|
| Canada | transitory increase | no significant effect | lag, permanent decline | permanent increase | transitory decline |
| France | transitory increase | permanent decline | no significant effect | transitory increase | lag, transitory increase |
| Germany | permanent decline | permanent decline | permanent decline | transitory increase | transitory increase |
| Italy | transitory increase | short-term decline | short-term decline | transitory increase | transitory decrease |
| Japan | transitory increase | lag, transitory decline | lag, transitory decline | cycling increase | transitory increase |
| Norway | long-term increase | no significant effect | lag, transitory increase | transitory increase | transitory increase |
| U.K. | transitory increase | permanent decline | permanent decline | permanent increase | permanent decrease |
| U.S. | permanent increase | lag, transitory decline | lag, permanent increase | transitory increase | transitory decrease |

Table 2. GDP - Inflation Tradeoff

| Strength of GDP Response | Strength of Price Level Response |
| --- | --- |
| U.K. | Norway |
| Germany | U.S. |
| Japan | Canada |
| France | Italy |
| Italy | France |
| U.S. | Japan |
| Canada | U.K. |
| Norway | Germany (-) |

Figure 1
U.S. RESPONSE TO AN OIL PRICE SHOCK
with 80 percent confidence bands

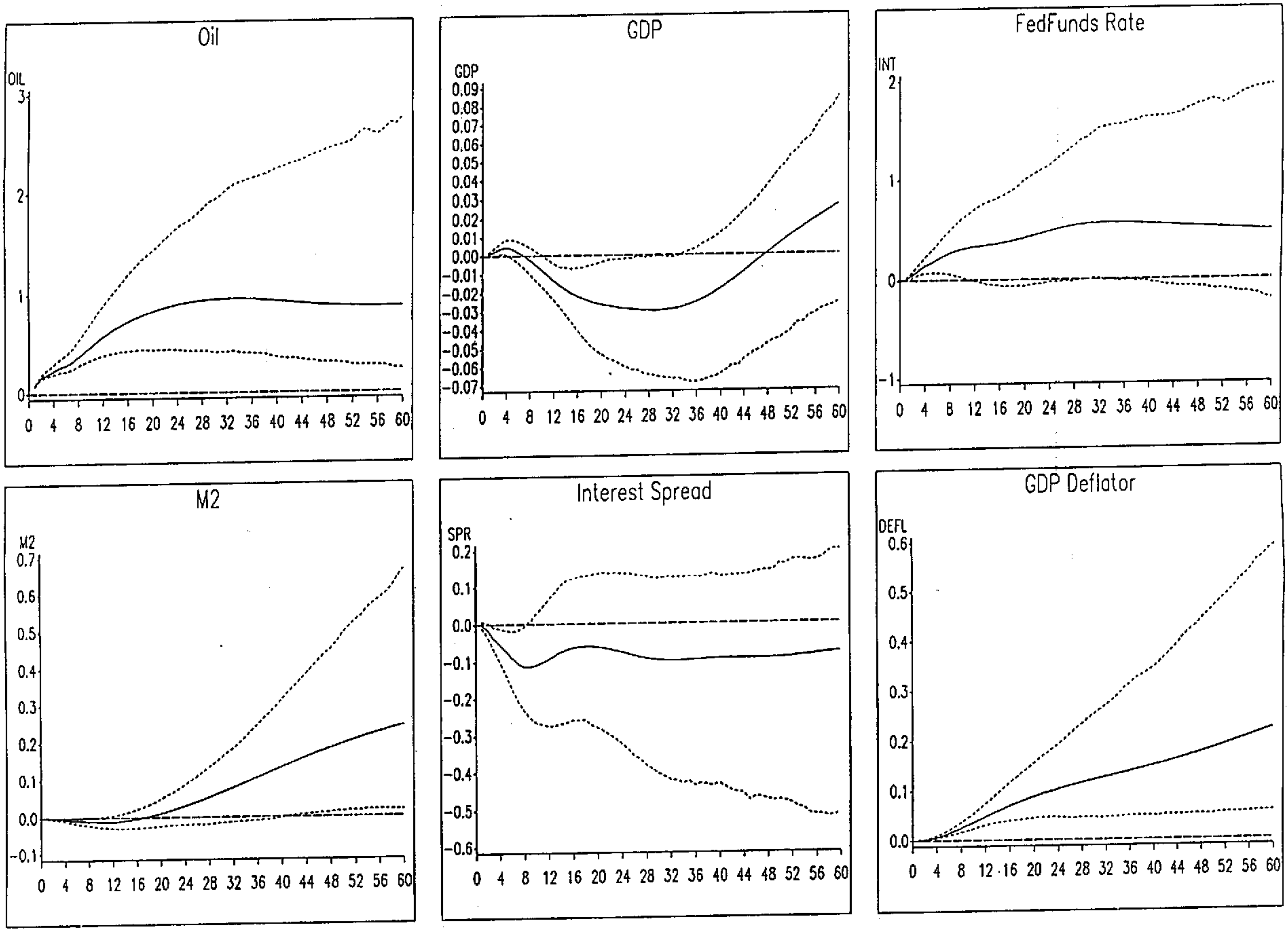


Figure 2
OIL-PRICE ELASTICITIES OF GDP LOSS AND THE PRICE LEVEL
for eight OECD countries

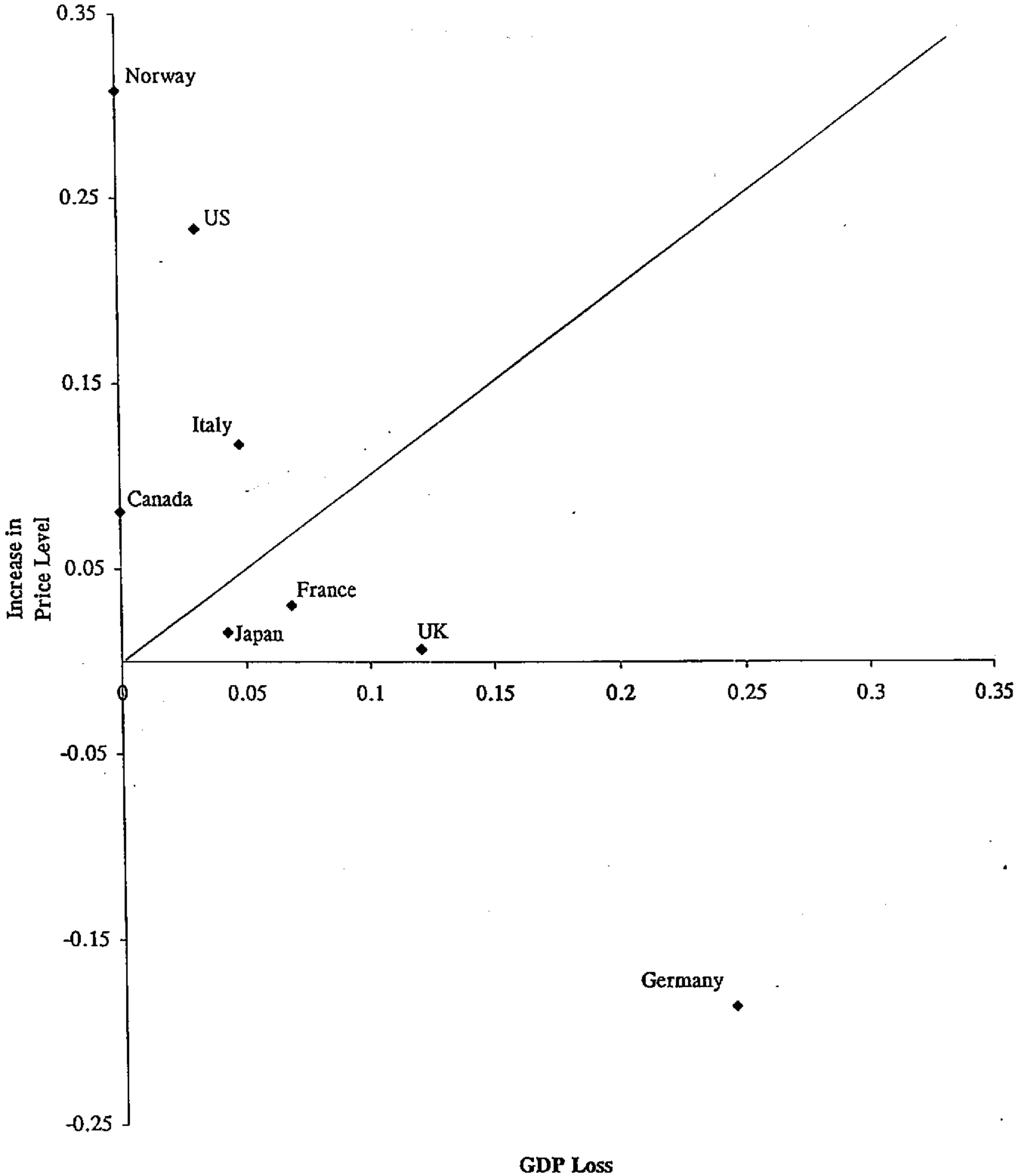
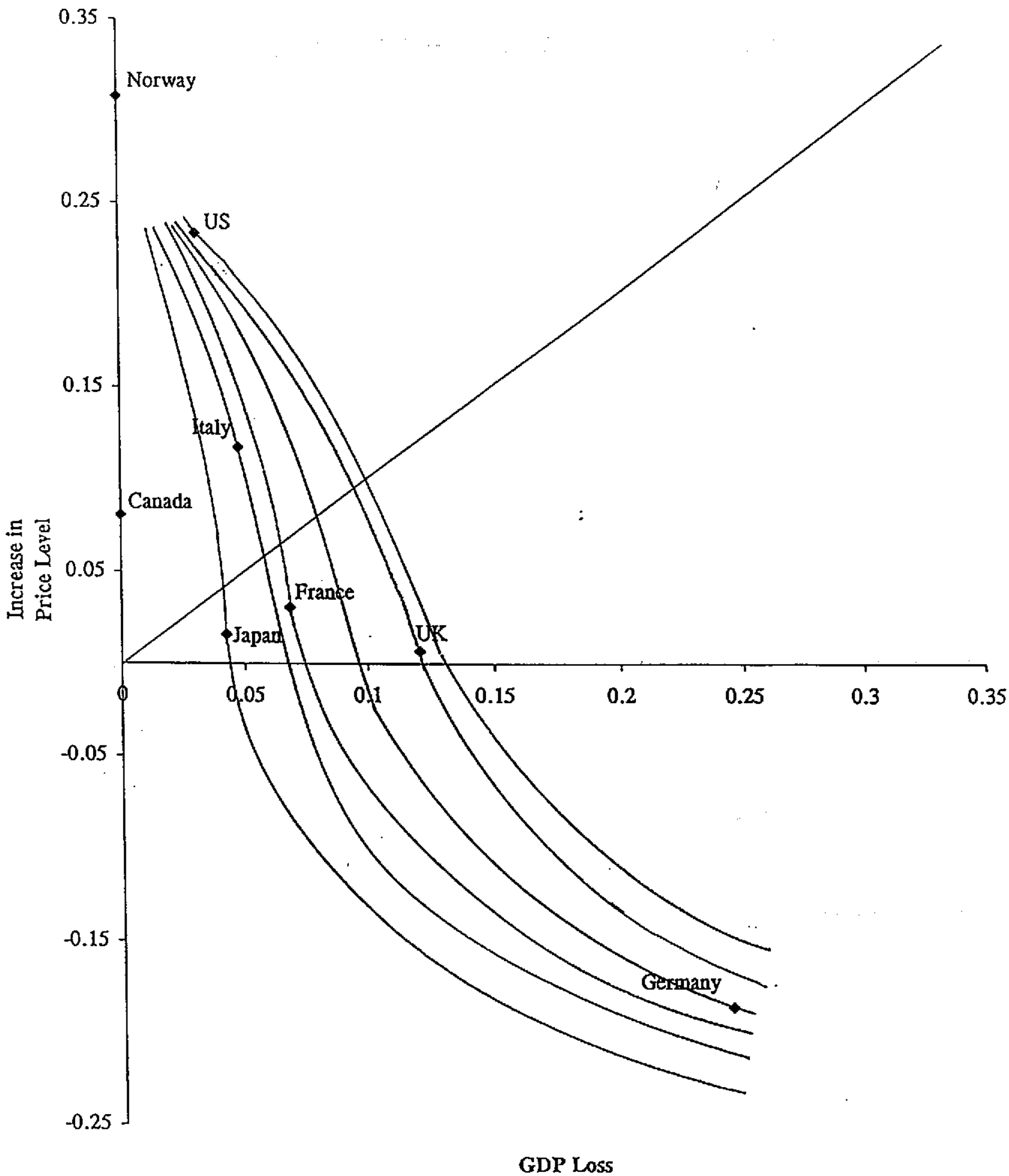


Figure 3
OIL-PRICE ELASTICITIES OF GDP LOSS AND THE PRICE LEVEL
with hypothetical tradeoffs for eight OECD countries



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