

Historical Causes of Postwar Oil Shocks and Recessions

James D. Hamilton*

INTRODUCTION

Turbulent petroleum markets and poor economic performance have been making headlines for the last decade. Three major oil shocks (1973–1974, 1979, and 1980–1981) have each been followed by major recessions. While the magnitude and violence of recent oil price changes are unique in postwar experience, the phenomenon of political instability producing disruptions in petroleum supply is not. Hamilton (1983a) observed that all but one of the recessions in the United States since World War II were preceded—typically by about nine months—by a dramatic increase in the price of crude petroleum (see Figure 1).

This earlier research considered three possible explanations for the correlation between oil price increases and subsequent recessions during the period 1947–1972:

Hypothesis 1: *The correlation is pure coincidence:* the true causes of oil shocks and recessions are totally unrelated, and just happened to occur at about the same time.

Hypothesis 2: *The correlation is systematic but not causal:* something about the nature of the business cycle tends to induce a sharp rise in oil prices just before a recession, though the recession is not itself caused by the oil shocks.

Hypothesis 3: *The correlation is causal:* the timing, magnitude, or duration of at least some of the recessions in the United States before 1973 would have been different had the oil shocks not occurred.

Consider the first hypothesis. Suppose we took the historical number of recessions and oil price episodes as given, but thought that whether or not either occurred in a particular year was a purely random event.

The Energy Journal, Vol. 6, No. 1

Copyright © 1985 by the International Association of Energy Economists. All rights reserved.

This paper is condensed from Chapter 1 of the author's Ph.D. thesis at the University of California, Berkeley, written under the supervision of James L. Pierce.

*Department of Economics, University of Virginia, Charlottesville, Va. 22901.

Then the number of years in which recessions and oil price increases appeared together would have a hypergeometric distribution, for which the probability of these two relatively rare events occurring together purely by chance turns out to be very small. Even if we ignored all the experience since 1973, and further ruled out the 1947-1948 evidence on the grounds that the recession followed the oil price increases by more than 12 months, a nonparametric test on postwar annual data based on the hypergeometric distribution would still call for rejection of hypothesis 1 at the 0.0335 significance level.¹

An even stronger conclusion emerges when more evidence is admitted and when more conventional econometric tests are used to investigate the timing of the relationship. Using time-series regressions Hamilton (1983a) documented an unambiguous rejection of the null hypothesis that oil prices were statistically uncorrelated with subsequent developments in a number of key macro series even before 1973, rejecting in some tests even at the 0.0005 significance level. The data leave little basis for claiming that the pattern in Figure 1 could have arisen from the interaction of two completely unrelated series.

Hypothesis 2 is less easily dismissed. Hamilton (1983a) relied on Granger-causality tests to see whether oil shocks could have been predicted statistically on the basis of key business cycle series. If so, that would offer evidence consistent with hypothesis 2. Instead, it was found that oil price increases could not have been predicted on the basis of such time series as U.S. output, unemployment, wages, various aggregate or commodity-specific price indexes, money supply, index of leading indicators, inventory changes, capacity utilization rates, interest rates, or stock prices. The three series that were most useful in predicting oil prices—import prices, coal prices, and an aggregate index of strike activity—were those least likely to be regarded as endogenous indicators of business cycle activity. Such results support the proposition that historical oil shocks arose from events exogenous to the U.S. business cycle and accordingly diminish the credibility of hypothesis 2.

For well-known reasons, an argument based solely on statistical predictability is an unconvincing demonstration of causality. It therefore seems useful to approach hypothesis 2 with a completely different methodology. This paper examines the institutional and historical details of postwar oil

1. During the period 1947-1972, there were oil price increases in five years (1947, 1953, 1957, 1969, and 1970) and in five years (1948, 1953, 1957, 1960, and 1969) a recession began, with the two appearing together in three years (1953, 1957, and 1969). Under the independence hypothesis, each of these 26 years is interpreted as an entry in a 2X2 contingency table. See Blalock (1972, pp. 287-291) for further explanation of the hypergeometric test statistic.

price shocks and attempts to identify the actual historical events responsible for each of the spikes in Figure 1.

Such an inquiry has three potential benefits. First, I will argue that the oil price increases resulted from events largely exogenous to the U.S. economy. If I am correct in this assertion (and in my claim that oil prices and output exhibit a systematic statistical correlation), a causal interpretation of the pattern in Figure 1 is plausible. Second, I will further claim that oil supply disruptions stemming from political instability in the Mideast, rather than being isolated incidents peculiar to the last decade, have been a recurrent fact of life ever since World War II. Given this historical record, there can be no doubt that further disruptions may be expected in the future; the only question is when. Third, I show how an institutionally motivated paradigm of oil price determination can make sense of actual postwar data—an achievement yet to be duplicated by the dominant theoretical models, which focus on resource exhaustion aspects of oil pricing or on optimizing cartel behavior on the part of OPEC.

OIL PRICES AND THE TEXAS RAILROAD COMMISSION

As striking as the abrupt spikes in oil prices in Figure 1 is the remarkable stability of nominal crude oil prices in the periods between these spikes. This stability can be attributed to state regulatory commissions' policy of defending posted prices whenever discounts threatened to produce a break.² Of these state agencies the most important was the Texas Railroad Commission (TRC), which was responsible for 42 percent of the nation's crude oil production in 1955. Each month the TRC would set allowable production levels for wells in the state. Its statutory mandate was to "prevent waste," which was defined to include, among other things, "the production of crude petroleum oil in excess of . . . reasonable market demand."³ The standard operating procedure of the commission was to forecast each month the demand for next month's production and use this forecast to prorate allowable production levels for each of the state's producing wells. As a result, gradual fluctuations in demand for petroleum were matched one-for-one by regulatory adjustments in supply, so that discounts or premiums were rarely allowed to continue long enough to lead to a change in posted prices.⁴

2. See Lovejoy and Homan (1967) or Adelman's (1972) careful treatment.

3. Title 102, Revised Civil Statutes of Texas, Article 6014, as cited by Lovejoy and Homan (1967), pp. 130–131.

4. Cassady (1954, p. 119), for example, claimed that typically only 1–2 percent of total crude would trade at premiums or discounts from prices posted domestically in the United States.

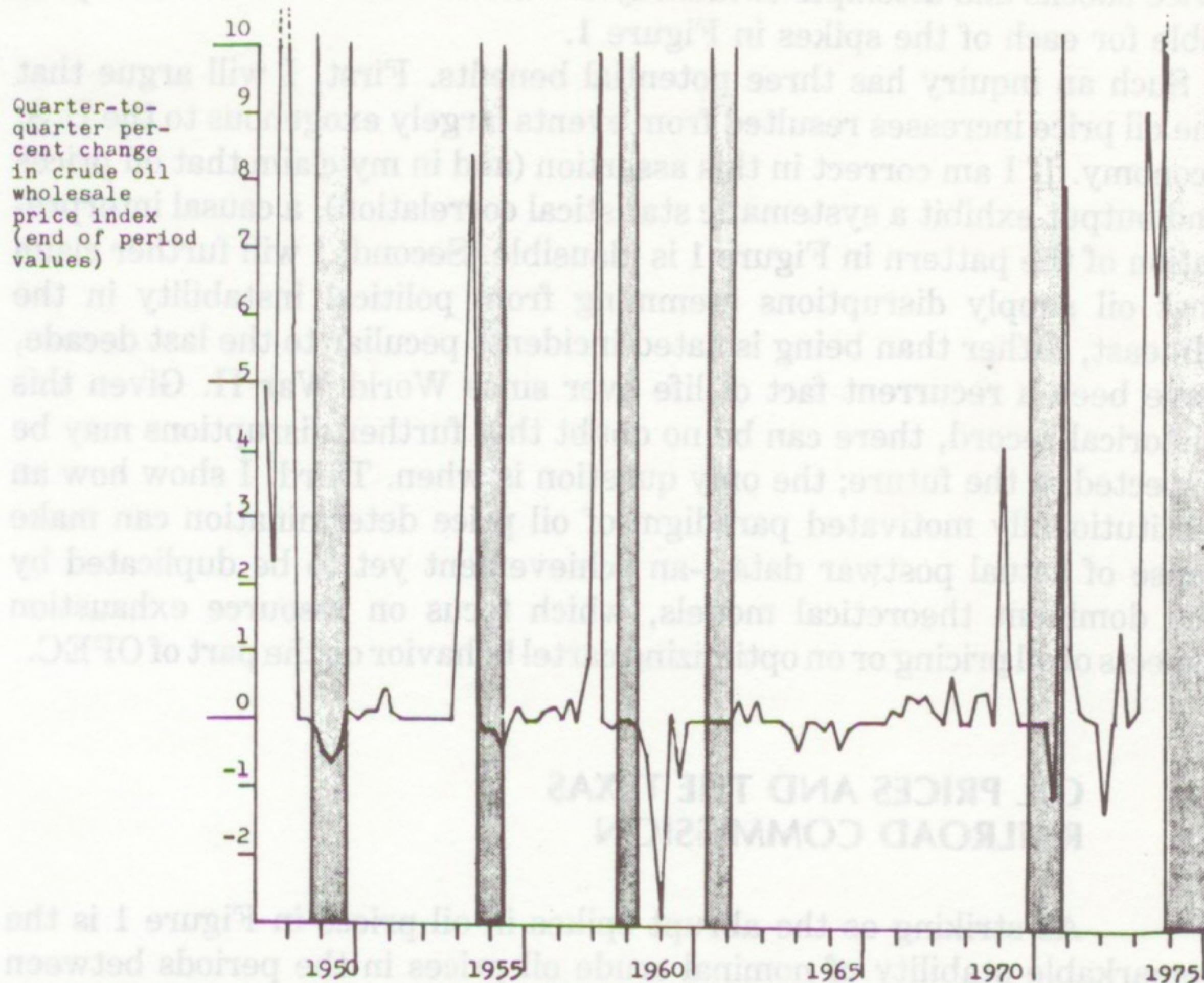


Figure 1. Crude oil prices (solid lines) and U.S. recessions (shaded areas), 1947–1975 (Source: Hamilton (1983a)).

The state commissions were largely successful in accommodating gradual adjustments in demand associated with cyclical economic factors and the secular trends of imports and new discoveries. However, I will argue below that they were generally unable or unwilling to accommodate sudden shocks of an essentially supply-based character, and therefore the crude oil price swings depicted in Figure 1 tracked developments largely unique to the petroleum industry. I conclude that a "regulatory filter" has been applied to the obvious endogenous economic factors responsible for changes in petroleum demand, so that only large exogenous shocks specific to the petroleum sector show up in the historical price series. For this reason, I argue that the nominal posted price of crude oil in the United States—as perhaps distinguished from other clearly related series such as the retail price of gasoline or the inflation-adjusted price of crude—uniquely tracked a series of exogenous historical shocks to the petroleum sector during the regulatory regime. The following analysis of the historical sources of crude oil price increases is substantially based on this view of the role played by the TRC.

THE HISTORICAL ORIGINS OF OIL PRICE SHOCKS

1947-1948

During World War II, like most other goods, the price of oil was subject to direct governmental control. With the price frozen at \$1.25 a barrel, petroleum demand nearly doubled, reflecting both a dramatic increase in the use of energy generally and an equally pronounced shift away from coal. However, inadequate incentives were provided for future supplies. Despite large price increases following decontrol, demand continued to swell after World War II because of (1) the enormous increase in petroleum demand associated with European reconstruction, and (2) a 15 percent reduction in U.S. coal production, largely caused by a shorter work week won by U.S. miners.⁵ Given the long lead times associated with petroleum investment, wartime controls left the oil industry in 1947 facing a chronic undercapacity in both drilled wells and transportation facilities.

On June 24, 1947, Indiana Standard led the major oil companies in announcing rationing for certain midwestern filling station operators. By August, spot shortages of gasoline were being reported in Detroit, Cleveland, and other cities, with the problem growing to major proportions by winter. In late November, the National Congress of Petroleum Retailers asked its members nationwide to close on Sundays and holidays, and not to operate past 7:00 P.M. on weekdays. At this time fuel oil retailers in New York and New Jersey complained that they were getting only half of their 1946 allotments.⁶ The following winter (1948-1949) brought the first of the major postwar recessions.

This apparent reluctance of oil firms, in the absence of explicit government controls, to set market-clearing prices in 1947-1948 seems to have been a recurrent feature in many historical oil supply disruptions.⁷ One motive behind such behavior may be the oil companies' views of social

5. Other factors contributing to lost coal production include wildcat strikes and a shortage of railroad freight cars (*U.S. News*, Sept. 12, 1947, pp. 32-35). Nonetheless, the unauthorized walkouts following passage of the Taft-Hartley Act on June 23, 1947, mostly took place during the normally scheduled vacation period, so that the actual number of man-days lost was fairly trivial. Moreover, the shorter work week resulting from settlement of the strike is itself a sufficient explanation—the workday was reduced from 8¾ hours to 7½, while employment in the coal industry was virtually unchanged. See *Monthly Labor Review*, various issues.

6. *New York Times*, June 25, 1947, 1:6; August 12, 46:1; August 22, 9:2; November 25, 59:8; and November 30, 27:2.

7. In addition to the other postwar evidence discussed below, Olmstead and Rhode (1982) provided an intriguing study of a gasoline famine in 1920 on the west coast of the United States. They too documented in considerable detail the extent of consumer rationing that occurred in the absence of any government price controls.

responsibility—few want to be the person selling buckets of water at a fire.⁸ An alternative interpretation might point to the implicit threat of extensive controls on the industry if the companies were perceived to be profiteering from the nation's hardships. In the case of the reported oil shortages of 1947–1948, the painful experience of World War II controls was still fresh in the minds of oil men, (along with the Congressional inquiries into the resultant shortages of 1943–1944). In the winter of 1947–1948, the National Petroleum Council agreed under Public Law 395 to a voluntary allocation scheme. This agreement appears to have been specifically stimulated by widespread demands for direct controls (Goodwin 1981:93–95). Indeed, in February 1948 the attorney general explicitly excluded from antitrust prosecution cooperation among the oil companies so long as this cooperation attempted to alleviate shortages by any mechanism other than raising prices.⁹

Max Ball, director of the Oil and Gas Division of the Department of Interior, asserted in October 1947 that the tight fuel supply situation would persist at least another five years.¹⁰ Such forecasts of a long-term energy crisis, however, turned out to be geologically premature by several decades. Completion of the Trans-Arabian pipeline in 1949, together with offshore production and exploitation of other major new U.S. fields, ushered in a new era of cheap and abundant energy supply. Gordon (1980) regarded as a key postwar mystery the fact that real gross national product in the United States grew some 18 percent between the second quarter of 1948 and the second quarter of 1951. This was a phenomenal record of growth, given that the period was interrupted by a significant cyclical downturn and that total employment grew only 3 percent over this same period. It is worth noting that U.S. production of crude grew some 22 percent between 1947 and 1951, while petroleum imports virtually doubled.¹¹ These tremendous increases in petroleum use and economic growth in the United States, which were substantially exceeded in Europe, coincided with the gradual elimination of petroleum shortages as a physically constraining factor in economic activity. The last reports of petroleum rationing in the United States came in February 1948—though accounts of spot shortages of aviation gasoline in the United States continued through the early 1950s. Gasoline rationing was not abandoned in France and Germany until the end of 1949, in England until May 1950,

8. See Akerlof (1980) for a neoclassical model in which adherence to social norms (in this case, eschewal of price gouging) could be utility maximizing even though such adherence reduces total profits.

9. *New York Times*, February 1, 1948, IV-9:1.

10. *New York Times*, October 8, 1947, 40:4.

11. American Petroleum Institute, *Basic Petroleum Data Book*, IV:1 and IX:1.

in Ireland until early 1952, and in Japan until July 1952.¹² If energy supplies indeed imposed a binding constraint on economic activity during this period, the exogenous increase in petroleum supply during 1948–1951 occasioned by exploitation of new geologic discoveries merits consideration as a factor in the worldwide economic growth of this era.

1952–1953

The phenomenal growth in world petroleum supply was interrupted in the summer of 1951 with Mossadegh's nationalization of the Iranian oil industry. This move in itself might not have affected the world petroleum situation had not the U.S. Petroleum Administration for Defense set up a Foreign Petroleum Supply Committee (composed entirely of U.S. oil company representatives) with the mandate to design a response to the Iranian "crisis." The committee determined that new supplies should be provided for all former purchasers of Iranian oil, thus ensuring an effective world boycott of the Iranians (Goodwin 1981:115–116). Crude oil production in Iran fell from 19 million barrels in June 1951 to zero by the following September, with about half of this shortfall matched by increased production in the United States.¹³

For a variety of reasons these higher production levels were not sustained as the boycott wore on during 1952. U.S. production of crude, which had been growing faster than 5 percent annually since 1947, was virtually constant in 1952. One factor was a major strike by U.S. oil refinery workers on April 30, 1952, which shut down a third of the nation's refineries, with lost production estimated at some 65 million barrels. The resulting worldwide shortage of aviation fuel led the governments of the United States and Britain to order 30 percent cuts in the delivery of jet fuel, while the Canadian Air Transport Board suspended private flying altogether.¹⁴ Perhaps as many as 20 percent of the commercial airline flights normally scheduled through New York's La Guardia Field were cancelled as a result of the shortage.¹⁵ Rationing of motor gasoline was instituted in several midwestern cities.¹⁶

Pronounced materials shortages also affected several other energy-related areas in 1952. An October strike by the United Mine Workers

12. *New York Times*, December 4, 1949, 32:1; January 20, 1950, 7:7; May 27, 1950, 1:4; November 30, 1951, 20:4; and July 2, 1952, 3:6.

13. *International Petroleum Trade*, Bureau of Mines, U.S. Department of Interior, May 1952, p. 52.

14. *Wall Street Journal*, May 5, 1952, 3:1; May 7, 2:2; May 12, 2:2; June 6, 1:2.

15. *New York Times*, May 10, 1952, 1:8; May 12, 1:1.

16. *Monthly Labor Review*, July 1952, p. 66; *Wall Street Journal*, May 6, 1952, 3:1; *New York Times*, May 9, 1952, 16:7.

shut down 95 percent of the country's soft coal production. Consumption of hydroelectric power in the Pacific Northwest was also cut 10 percent by the Defense Electric Power Administration because of drought conditions. But by far the most dramatic materials shortages in 1952 resulted from the 56-day strike by steel workers. Shortages of steel led to substantial layoffs in the automobile, electrical appliance, machinery, railroad, and heavy equipment industries. An important secondary effect fed back into petroleum supplies. The Petroleum Administration for Defense estimated that the country lost 5,000 new oil wells in 1952 and more than 10 percent of its active rigs because of a shortage of steel casing and pipe.¹⁷

Despite these developments, there is no doubt that overall substantial excess capacity existed in U.S. petroleum-producing facilities at the time. It was primarily a deliberate policy choice on the part of state regulatory commissions that kept production from filling any supply gaps. The TRC, instead of trying to accommodate any supply dislocations associated with these developments, made the most of the situation and in January 1953 began a campaign to stifle U.S. imports of petroleum. Adelman (1972) concluded that it was this policy more than anything else that emboldened the U.S. domestic oil industry to seek higher prices.

The effects on oil prices of the Iranian boycott, the strikes by oil, coal, and steel workers, and the TRC's import campaign were all of necessity postponed. The price of domestic crude had been restricted by a ceiling set by the Office of Price Stabilization (OPS) on January 25, 1951, which would not be removed until February 13, 1953.¹⁸ While price controls for a number of other goods were also removed in early 1953, the prevailing market prices of many of these goods turned out to be substantially below the officially allowable ceilings. The principal inflationary concern of Joseph Freehill (director of the OPS at the time) lay with decontrol of petroleum,¹⁹ and indeed half of the total increase in the wholesale price index in the first six months of 1953 came solely from the increase in petroleum prices. These oil price increases and earlier accounts of shortages were followed by the second postwar recession, which began in July 1953.

1956-1957

On October 29, 1956, Israel, followed by French and British troops, invaded Egypt. The ensuing crisis cut off 1.5 million barrels a day of oil flow

17. *Wall Street Journal*, June 24, 1952, 1:2; July 10, 1:2; July 11, 1:2; July 23, 1:2; September 4, 1:2; October 21, 1:2; and November 17, 1:2.

18. *New York Times*, May 8, 1951, 45:1.

19. *Wall Street Journal*, February 13, 1953, 2:2.

through the Suez Canal, prevented a further 500,000 barrels a day of Iranian production from reaching eastern Mediterranean ports, and cut off Persian Gulf access to 300,000 barrels a day from Saudi fields.²⁰ The direct effects on the United States were relatively minor, with only a 10 percent drop in total imports.²¹ The problems encountered in Europe, which was much more dependent on Middle East oil, were far more serious.

Again, the TRC's response was hardly helpful. Production from Texas fields was nearly 4 million barrels less in the fourth quarter of 1956 than in the three months preceding the Suez Crisis.²² The large integrated oil companies had argued strongly for relaxation of Texas allowables—as of course did European officials who understood the consequences of the TRC's policy.²³ But in the end it was lobbying by the small Texas producers and fears that pipeline and tanker facilities were inadequate to the task that determined the course of events in Texas. Not until March did Congressional pressure finally force the Texas commissioners to relax production constraints, five months into the crisis, and just two months before the Suez Canal would be reopened.²⁴

In the meantime, serious measures had been adopted in Europe to cope with petroleum shortages. Rationing was used to enforce a 20 percent cut in gasoline consumption in Denmark and a 30 percent cut in England, while French drivers were limited to only five gallons a month. The governments of Belgium, Luxembourg, the Netherlands, Switzerland, and Sweden banned Sunday driving. Continental hotel and restaurant owners complained of losing the better part of their business, and many of the automobile and steel industries throughout Europe were forced into layoffs and shorter work weeks.²⁵ The recession of 1957–1958 was the first of the postwar downswings that was clearly worldwide, with the business cycle peak in the United States following the oil price increases by a little over seven months.

The 1960s

The year 1960 saw the only recession in postwar history that was not preceded by an increase in the price of oil. Oil shortages and price increases

20. *Oil and Gas Journal*, November 12, 1956, pp. 122–125.

21. *Minerals Yearbook*, 1957, U.S. Bureau of Mines, Department of Interior.

22. *Minerals Yearbook*, 1957, U.S. Bureau of Mines, Department of Interior.

23. *Oil and Gas Journal*, December 24, 1956, p. 38; January 7, 1957, p. 25; *New York Times*, January 5, 1957, 7:1.

24. *Oil and Gas Journal*, February 25, 1957, p. 78.

25. *New York Times*, November 17, 1956, 6:4; November 21, 8:2; November 28, 15:4; December 2, 1956, 1:5; December 9, 1956, II-33:3; January 3, 1957, 57:5.

are of course not the *only* cause of recessions, and the 1960 experience is a case in point. It is nevertheless worth remarking that Moore (1973:18) regarded the 1960 and the 1969–1970 recessions as the two mildest postwar downswings, while Sachs (1980:81) concluded that the 1960 recession was less than half as severe as any other postwar downturn.

The remainder of the 1960s represents the longest period in postwar history of uninterrupted growth in both petroleum supply and real economic activity. There had been some concern that the second closing of the Suez Canal, in June 1967, would lead to a recurrence of the events of ten years earlier. However, the aggressive and positive response of the Texas Railroad Commission was in sharp contrast to 1956–1957 (see Figure 2). The TRC raised production allowables from 33.8 percent of maximum efficient rates in May 1967 to 54.0 percent by August, adding 700,000 barrels a day to world supplies. As a consequence, the oil price increases associated with the second Suez closing were quite minor (see Figure 1). It is presumably just a coincidence that this disruption occurred in the middle of a U.S. growth cycle downturn (a classification indicating a deceleration of output less severe than a full-scale recession), which Mintz (1972) considers to have lasted from September 1966 to October 1967. Certainly by the standards of the decade to follow, the continuous decline in real oil prices and increase in real GNP, which were never interrupted for more than one quarter throughout the sixties, look quite enviable.

1969

Toward the end of the decade, the long-term energy supply and demand situation for the United States began to change. As Figure 2 shows, the market demand factor for Texas production, which had receded from the Suez II high to a level of 41 percent by late 1968, rose again sharply to 64 percent by June 1969 and would reach 100 percent by April 1972. Geology thus accomplished what Congress had never attempted—the effective elimination of market demand prorationing. Data on proved petroleum reserves, though subject to considerable uncertainty due to a variety of economic and engineering considerations, confirm that the late sixties marked a major turning point in the country's long-term energy outlook. Figure 3 illustrates the generally upward trend in U.S. reserves until the discovery of Prudhoe Bay in 1968 and the uninterrupted decline

26. The precise date of this downturn depends on when one allocates the reserves ultimately proved for Prudhoe Bay. In Figure 3 I have credited these to 1968, the year of discovery. Data are from the American Petroleum Institute, *Basic Petroleum Data Book*, Table II:1.



Figure 2. Texas production allowables as a percentage of maximum efficient rates (Source: Oil and Gas Division, Railroad Commission of Texas, Annual Reports).

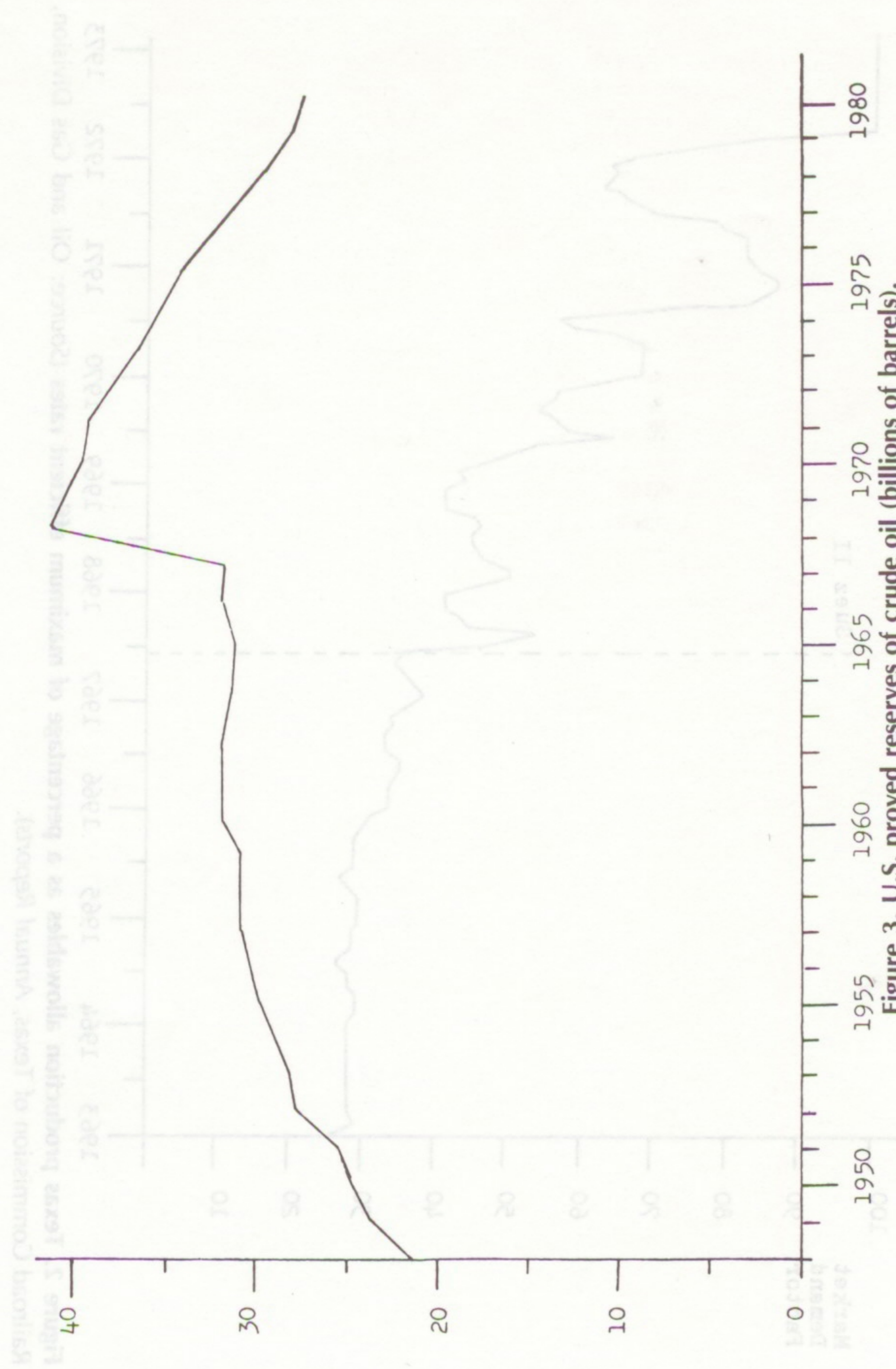


Figure 3. U.S. proved reserves of crude oil (billions of barrels).

ever since.²⁶ Hall and Cleveland (1981) also show that this decline in proved reserves took place during a period of intensified drilling of both exploratory and developmental wells, thus marking the late sixties as an even more dramatic geologic turning point in terms of yield per drilling effort. Meanwhile oil imports' share of total U.S. petroleum demand nearly doubled from 20 percent in the later sixties to 36 percent by 1973.²⁷ U.S. natural gas reserves also began to decline in 1969, even as heightened environmental concern was generating new doubts about the ability of nuclear power and coal to fill the projected energy gap of the years ahead.

Within this long-term context of diminishing energy availability, the immediate cause behind the crude oil price increases in early 1969 was a strike by fuel oil deliverers on the east coast in December 1968. This was associated with local accounts of consumer shortages,²⁸ and was followed on January 4 by a nationwide strike by the Oil, Chemical, and Atomic Workers Union. When the latter strike was settled, Texaco initiated a relatively modest round of crude oil price increases on February 24, 1969, citing higher labor costs as the justification for price hikes. These oil price increases were the mildest of any of the six episodes discussed here, and the recession that began the following winter was likewise the mildest of any of the postwar recessions, with the single exception of 1960.

1970

A clearer harbinger of 1973–1974 came in May 1970, when a tractor in Syria poked a hole in the Trans-Arabian pipeline—allegedly by accident. The Syrians would not allow the rupture to be repaired, preventing 500,000 barrels a day of Saudi crude from reaching Mediterranean ports. Deliberate production cutbacks by Libya and Algeria were then successful in producing a sharp increase in world oil prices by the end of 1970.²⁹

An even larger increase in coal prices took place in late 1969 and 1970. As the Japanese steel industry boomed, U.S. bituminous coal exports rose 40 percent from 1968 to 1970. Despite this increase in demand, production was nearly stagnant. Industry cited the Coal Mine Health and Safety Act, signed into law in December 1969, along with sympathy wildcat strikes by miners, spawned by the union-related murder of Joseph Yablonski (who had accused United Mine Workers president Tony Boyle of election fraud).³⁰

26. The precise date of this downturn depends on when one allocates the reserves ultimately proved for Prudhoe Bay. In Figure 3 I have credited these to 1968, the year of discovery. Data are from the American Petroleum Institute, *Basic Petroleum Data Book*, Table II:1.

27. American Petroleum Institute, *Basic Petroleum Data Book*, Table IX:1.

28. *New York Times*, December 25, 1968, 1:3; December 27, 1:5.

29. *New York Times*, October 4, 1970, IV-8:1.

30. *New York Times*, September 6, 1970, III-1:1.

Though the press often described these developments in petroleum and coal as "shortages," it is difficult to find actual instances of consumer rationing traceable to these events. To the extent that there were any shortages in the sense that economists use the term, the only minor accounts that I have found stem from a second strike by New York fuel oil deliverers in December 1970.³¹

The crude oil price increases of late 1970 mark the only oil price episode during the period 1948–1975 that was not followed by a U.S. recession. Nevertheless, the 1971 unemployment rate of 5.4 percent was higher than that reached during the recession of 1954, even while inflation stayed at the highest levels since the Korean War. The terms *energy crisis* and *stagflation* were introduced simultaneously into the American lexicon, as the United States began what would (in retrospect) be seen as the first of several violent rightward spirals off the historical Phillips relation between inflation and unemployment.

1973–1974

Excellent analyses of the events behind the dramatic oil price increases of 1973–1974 have been provided by Darmstadter and Landsberg (1975), McKie (1975), and Johnson (1975). Several conclusions merit repeating here. The proximate cause of the OPEC embargo announced on October 17, 1973, was the outbreak of Arab-Israeli hostilities on October 6. Energy problems were nevertheless emerging long before the Arabs cut back production. U.S. shortages of heating fuel and natural gas in January 1973 were followed in the spring by allegations that the major oil companies had concocted a further shortage of gasoline in order to drive the independent retailers out of business.³² These shortages presumably had more to do with the geologic decline in U.S. reserves and the effects of environmental legislation, aggravated by an economic boom confronting the Nixon price controls and long-standing ceilings on natural gas prices. In addition to these factors behind the 1973–1974 price increases, Johany (1980) emphasized that title to Middle East oil passed from the international oil companies (who had recognized that their ownership was fleeting and therefore had every incentive to pump the oil out quickly) to the host governments, who according to competitive theory would seek a scarcity rent on an exhaustible resource. By contrast, Pindyck (1978) interpreted the increases sought by the new owners as optimizing cartel behavior. Presumably there is some merit in all these perspectives. The overall view that emerges places a primary emphasis on exogenous political

31. *New York Times*, December 18, 1970, 1:2; December 23, 1:4.

32. *Time*, "And Now the Chillout," January 22, 1973, p. 68; "The Growing Gasoline Gap," April 16, 1973, p. 88.

events, such as the decline in U.S. reserves, the Arab-Israeli war, environmental legislation, and change in property rights.

The shortages and price increases in early 1973 were followed with the usual three-quarter lag by the business cycle peak dated at November by the National Bureau of Economic Research (NBER). The tremendous output collapse in the first quarter of 1975 likewise followed by a year the violent price increases of January 1974 associated with the Arab embargo.

1979-1981

Pindyck's (1978) model of OPEC as an optimizing cartel has been unable to account for the turbulent behavior of oil prices after 1978. Better predictions have come from Adelman's (1980) view that the cartel is somewhat clumsy in identifying the revenue-maximizing price and bases its short-run behavior on inflexible response to particular crises. Danielson and Selby (1980) likewise observed that OPEC ratcheted the nominal price up during short-term disruptions and tried to defend this nominal price through subsequent supply contractions, much as the TRC did from 1948 to 1972. Indeed, the expressed policy of Kuwait and Saudi Arabia has been that the nominal price "should be frozen so that the real price (adjusted for inflation) . . . would fall for two or three years."³³ For this reason, under OPEC as well as the TRC, short-run changes in nominal posted crude oil prices have their immediate origin in events largely exogenous to the U.S. economy.

One such development was the Iranian revolution in October 1978. Iranian production fell from 6.0 million barrels a day in September 1978 to 0.4 million barrels a day in January 1979, a loss of 9.1 percent of total world production.³⁴ While two-thirds of the shortfall was made up by increased production elsewhere, these extramarginal supply increases were accompanied by substantial increases in prices and the return of gasoline queues in early 1979.³⁵ These were in turn followed three quarters later by recession, dated by the NBER as beginning in the first quarter of 1980.

Even as Iranian production remained depressed, the Iran-Iraq war knocked out an additional 2.4 million barrels a day of production from Iraq between September 1980 and January 1981. With Reagan's decontrol of crude in February, the attendant speculative run-up in world oil prices

33. Kuwait's Oil Minister al-Sabah, quoted in *Wall St. Journal*, March 9, 1982, p. 2.

34. Data are taken from various issues of *Monthly Energy Review*.

35. Other researchers have suggested that inventory hoarding by oil companies (Danielson and Selby 1980) and final consumers (Bohi 1983) aggravated the price increases, though there is general agreement that the Iranian revolution was the proximate cause of such speculation.

produced the second major spike in crude oil prices in as many years. These price increases were again followed with the typical three-quarter lag by the recession beginning in the third quarter of 1981—just as the recovery of the first quarter of 1983 lagged the crude oil price reductions of early 1982.

CONCLUSIONS

I now return to the conjecture raised in the introduction that oil price increases represent systematic, endogenous outcomes associated with business cycle peaks. Table 1 summarizes the principal historical forces behind each of the oil price episodes. Most of these influences would surely be recognized as arising from outside the U.S. macroeconomy. Indeed, some of the developments, such as the Iranian nationalization, Suez Crisis, secular decline in U.S. reserves, rupture of the Trans-Arabian pipeline, OPEC embargo, Iranian revolution, and Iran-Iraq war are as exogenous as economically relevant developments are ever going to get. Even for the other events identified in Table 1, it is clear that if one is to account for oil price increases as a systematic outcome of U.S. business cycle dynamics, the mechanism is by no means straightforward. Moreover, I have argued that the defense of posted prices, whether by OPEC or the TRC, institutionally guaranteed that movements in crude oil prices would be dominated by precisely these kinds of exogenous events.

As a standard for interpreting the events in Table 1, I have searched the *New York Times Index* from 1947 to 1972, examining the references under "Oil (Petroleum) and Gasoline" to developments in the United States, Canada, and Western Europe. I made a note each time the word *shortage* or *ration* appeared, disallowing any references that announced the end of rationing programs, stated that there might be a need for rationing in the indefinite future, or denied the existence of current shortages. The number of such references for each quarter during the period 1947–1972 is plotted (solid line) against NBER dates for postwar recessions (shaded areas) in Figure 4. Headlines and selected excerpts from the *New York Times* articles that are counted in this index are provided in Hamilton (1983b). This *New York Times*-derived index shows exactly the same pattern of six spikes over the 1947–1975 period as the crude oil price series in Figure 1. The contemporary accounts of shortages generally precede the price increases by about a quarter of a year and therefore on average lead the business cycle peak by almost a full year. The notable exceptions to this pattern are: (1) 1952–1953, when the accounts of shortages came during a period of crude oil price ceilings and

Table 1. Principal Causes of Crude Oil Price Increases, 1947–1981

<i>Oil Price Episode</i>	<i>Principal Factors</i>
1947–1948	Previous investment in production and transportation capacity inadequate to meet postwar needs Decreased coal production resulting from shorter work week European reconstruction
1952–1953	Iranian nationalization Strikes by oil, coal, and steel workers Import posture of Texas Railroad Commission
1956–1957	Suez Crisis
1969	Secular decline in U.S. reserves Strikes by oil workers
1970	Rupture of Trans-Arabian pipeline Libyan production cutbacks Coal price increases (strikes by coal workers; increased coal exports; environmental legislation)
1973–1974	Stagnating U.S. production Arab-Israeli war Change in property rights
1978–1979	Iranian revolution
1980–1981	Iran-Iraq war Removal of U.S. price controls

so preceded the actual price increases by nearly a full year (though the lag between the shortage accounts and the eventual recession is close to the usual interval), and (2) 1970, when most of the discussion of shortages came *after* prices had already gone up. Figure 4 also affords a qualitative ranking of the oil shocks by the amount of media attention they received, led by 1973–1974, followed by the disruptions of 1947–1948 and 1956–1957, with the disruptions of 1952, 1969, and 1970 receiving the least media coverage. It is worth noting that this ranking exactly coincides with Sach's (1980) categorization of 1973–1975 as a strong contraction, 1948–1949 and 1957–1958 as moderate contractions, and 1953–1954 and 1969–1970 as mild contractions.

A further check on the accuracy of Table 1 is provided by the statistical tests reported in Hamilton (1983a). There I show that while standard business cycle series are of little use in predicting oil price increases, there is a statistically significant relation between oil prices, coal prices, and the aggregate incidence of strike activity—the same factors identified in Table 1. Moreover, these statistical tests confirm that the coal price increases and strikes also represent largely exogenous events, as our historical analysis concludes.

To summarize, any interpretation of the oil price–output relation portrayed in Figure 1 must also account for the following phenomena:

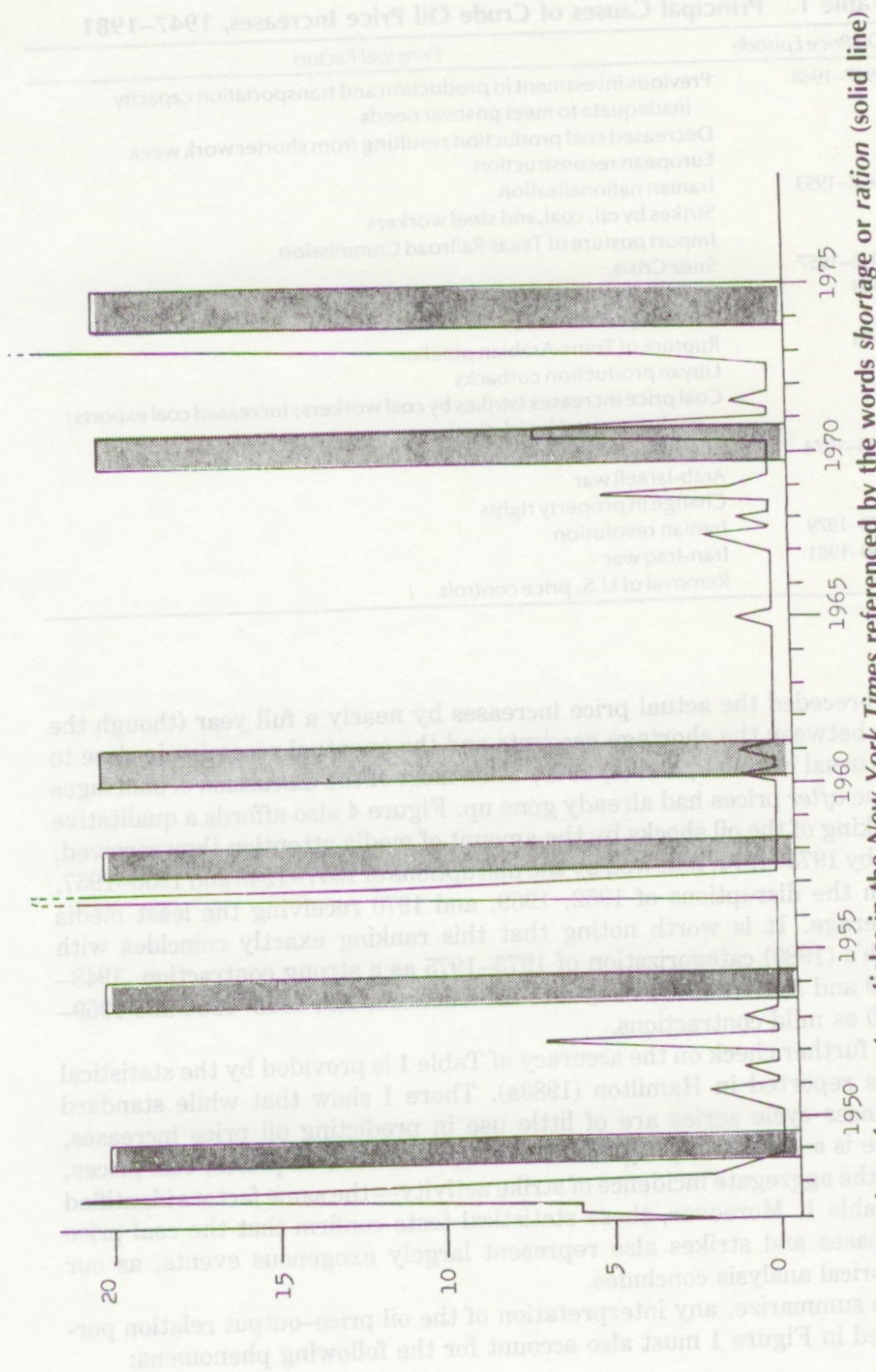


Figure 4. Number of separate articles in the New York Times referenced by the words shortage or ration (solid line) and U.S. recessions (shaded areas), 1947-1972.

1. During most of this period the price of crude oil was quite stable; price increases had a discrete, dramatic character.
2. These oil price increases were each preceded by media reports of shortages of petroleum products; such reports do not appear in significant numbers at other times during this period.
3. These shortage accounts coincided with dramatic historical events affecting petroleum supply, which would have to be described for the most part as exogenous to the U.S. economy.

My own interpretation of these facts has focused on the role of market-demand prorationing by the Texas Railroad Commission for the period before 1972 and on price-ratcheting supply behavior by OPEC since 1972. I have argued that these institutions assured that gradual, endogenous changes in petroleum demand were matched by a regulatory adjustment of supply. Most of the time this kept crude oil prices from changing much. During abrupt shocks to supply, however, there was usually little accommodation, so that the historical behavior of crude oil prices over this period was dominated by events exogenous to the U.S. economy (specifically by those events detailed in Table 1). If this assessment is correct, it casts considerable doubt on the proposition that oil price increases have represented a systematic, endogenous development associated with business cycle peaks. If we indeed rule out this possibility, and likewise are convinced that the oil price-output relation represents something other than a random coincidence, we must give a causal interpretation to the correlation between oil prices and output.

Despite the current glut on world oil markets (or conceivably even because of it), the political history of the Middle East makes it almost inevitable that sometime within the next decade economists will be granted some more data with which to assess the economic effects of oil supply disruptions.

REFERENCES

- Adelman, Morris A. (1972). *The World Petroleum Market*. Baltimore: Johns Hopkins University Press for Resources for the Future.
- (1980). "The Clumsy Cartel." *Energy Journal* 1 (January): 43-53.
- Akerlof, George A. (1980). "A Theory of Social Custom, of Which Unemployment May Be One Consequence." *Quarterly Journal of Economics* 95 (June): 749-75.
- Blalock, Hubert M., Jr. (1972). *Social Statistics*, 2nd ed. New York: McGraw-Hill.
- Bohi, Douglas R., Jr. (1983). "What Causes Oil Price Shocks?" Discussion Paper D-825, Energy and National Security Issues. Washington, D.C.: Resources for the Future (January).
- Bohi, Douglas R., Jr., and Milton Russell (1978). *Limiting Oil Imports: An Economic History and Analysis*. Baltimore: Johns Hopkins University Press for Resources for the Future.

- Cassady, Ralph, Jr. (1954). *Price Making and Price Behavior in the Petroleum Industry*. Petroleum Monograph Series, vol. 1. New Haven: Yale University Press.
- Danielson, Albert L., and Edward B. Selby, Jr. (1980). "World Oil Price Increases: Sources and Solutions." *Energy Journal* 1 (October): 59-74.
- Darmstadter, Joel, and Hans H. Landsberg (1975). "Oil Crisis in Perspective: The Economic Background." *Daedalus* 104 (Fall): 15-37.
- Goodwin, Craufurd D. (1981). "Truman Administration Policies toward Particular Energy Sources." In C. D. Goodwin (ed.), *Energy Policy in Perspective: Today's Problems, Yesterday's Solutions*. Washington, D.C.: Brookings.
- Gordon, Robert J. (1980). "Postwar Macroeconomics: The Evolution of Events and Ideas." In Martin Feldstein (ed.), *The American Economy in Transition*. Chicago: University of Chicago Press for the National Bureau of Economic Research.
- Hall, Charles A. S., and Cutler J. Cleveland (1981). "Petroleum Drilling and Production in the United States: Yield per Effort and Net Energy Analysis." *Science* 211 (6 February): 576-79.
- Hamilton, James D. (1983a). "Oil and the Macroeconomy Since World War II." *Journal of Political Economy* 91 (April): 228-48.
- (1983b). "The Macroeconomic Effects of Petroleum Supply Disruptions." Ph.D. Thesis, University of California, Berkeley.
- Johany, Ali D. (1980). *The Myth of the OPEC Cartel: The Role of Saudi Arabia*. New York: Wiley.
- Johnson, William A. "The Impact of Price Controls on the Oil Industry: How to Worsen an Energy Crisis." In Gary D. Eppen (ed.), *Energy: The Policy Issues*. Chicago: University of Chicago Press, 1975.
- Lovejoy, Wallace F., and Paul T. Homan (1967). *Economic Aspects of Oil Conservation Regulation*. Baltimore: Johns Hopkins University Press for Resources for the Future.
- McKie, James W. (1975). "Oil Crisis in Perspective: The United States." *Daedalus* 104 (Fall): 73-90.
- Mintz, Ilse (1972). "Dating American Growth Cycles." In Victor Zarnowitz (ed.), *The Business Cycle Today*. National Bureau of Economic Research, General Series 96. New York: Columbia University Press.
- Moore, Geoffrey H. (1973). "New Work on Business Cycles." In annual report, National Bureau of Economic Research.
- Olmstead, Alan L., and Paul Rhode (1982). "The Gasoline Famine of 1920." Mimeographed. Department of Economics, University of California, Davis (May).
- Pindyck, Robert S. (1978). "Gains to Producers from the Cartelization of Exhaustible Resources." *Review of Economics and Statistics* 60 (May): 238-51.
- Sachs, Jeffrey (1980). "The Changing Cyclical Behavior of Wages and Prices: 1890-1976." *American Economic Review* 70 (March): 78-90.