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Energy in the World Economy, 1950–1992

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Trends in energy production, trade, and consumption during 1950–1992 are analyzed, using nine world regions to highlight both North-South energy trade and the regions' differing patterns of industrialization. Following price shocks in 1973 and 1979, and the price drop of the mid-1980s, the industrialized West adjusted its patterns of energy consumption and imports, and the Middle East changed its level of exports. These relationships suggest a cobweb-type model with an equilibrium price for Mideast oil around $30/barrel. This equilibrium could result in zero growth in energy consumption in the industrialized West but continued growth of GDP as energy efficiency increases. Energy prices that are "too high" reduce GDP growth in the short term—to the detriment of both energy importers and exporters—while prices that are "too low" lead in the long term to high dependency on Middle East oil exports, which, in turn, depends on an elusive and costly political stability in that region. The analysis highlights the central role of North-South energy trade in the world economy, and the close but changing relationship of energy with overall GDP growth.

The harnessing of nonrenewable energy sources (primarily coal, oil, and gas) has been fundamental to the process of world industrialization over the past two centuries. In global North-South relations, patterns of energy production and consumption reflect the underlying physical—that is, nonmonetary—structure of the world economy. Energy is by far the largest category of trade in natural resources globally, and a critical element in North-South trade generally. Energy flows

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therefore provide an excellent window for observing the relationships and trends embodied in global North-South relations.

North-South approaches to world politics divide the world into two blocs—the industrialized countries of the global North and the poor countries of the global South. Such an approach operates at a global level of analysis, distinct from the interstate, domestic, and individual levels traditionally favored by political scientists (Goldstein, 1996:16–23). Theories of North-South relations generally treat the North and South as core and periphery of a world economy in which the periphery's raw materials are exchanged (on unequal terms) for the core's manufactured goods. (World-system theories also posit a third semiperiphery zone inhabiting an intermediate position, with light manufacturing; it provides a buffer between core and periphery, and allows some upward and downward mobility. But scholars disagree on the criteria for the semiperiphery and on what real-world countries it should encompass.)

This study analyzes cross-national, time-series data on energy production, consumption, and trade, and GDP growth, from 1950 to 1992, aggregated by world regions. These energy data can illuminate three global-level phenomena. First, because of energy's central role in industrial development, energy data reflect the *differing levels and patterns of industrialization* in the global North and South. Second, the data allow us to describe the dynamics of *North-South trade* in oil—the most important "periphery" commodity. Third, the data embody the shifting patterns of energy use following the *price shocks* of the 1970s (after the price stability of 1950–1972). The reverberations from these "shocks" to the world system provide useful clues about the nature of the world political economy and the role of energy in it. The analysis suggests potential instability in current North-South energy relations, and suggests policies that might increase that stability.

Construction of Regions

If the general approach of North-South theories is correct, then the most important structures and relationships of the world system should be reflected in analyses using major contiguous world regions, constructed along North-South lines, as a unit of aggregation. Ideally, such regions should not be constructed on an ad hoc basis to test a particular hypothesis, but should have lasting validity.

This analysis uses nine world regions, shown in Figure 1, as the main units of analysis (for further discussion see Goldstein, 1996:19–22). The regions are of somewhat different sizes, and with different mixes of cultures, states, languages, and geography. But each represents a geographical "corner of the world." The regions are drawn so as to separate wherever possible the world's (present-day) rich countries from the poor ones. In addition, the regions are geographically contiguous and reasonably compact in shape. Countries with similar economic levels, cultures, and languages are kept together where possible, as are countries with a history of interaction, including historical empires or trading zones. The regions cannot be perfect with regard to these criteria; some states such as Mexico or Turkey are pulled toward two regions, and some states such as North Korea do not fit well with their immediate neighbors.

The global North includes the three regions of the "industrialized West," which is the core of the world system: *North America*, *Western Europe*, and *Japan/Pacific* (which includes Australia, New Zealand, and Korea). The North also includes *Russia/Eastern Europe* (the Cold War "East"). The South comprises *China* (including Hong Kong and Taiwan), the *Middle East* (from Northern Africa through Turkey and Iran), *Latin America*, *South Asia* (Pakistan through Indonesia and the Philippines), and subsaharan *Africa*.

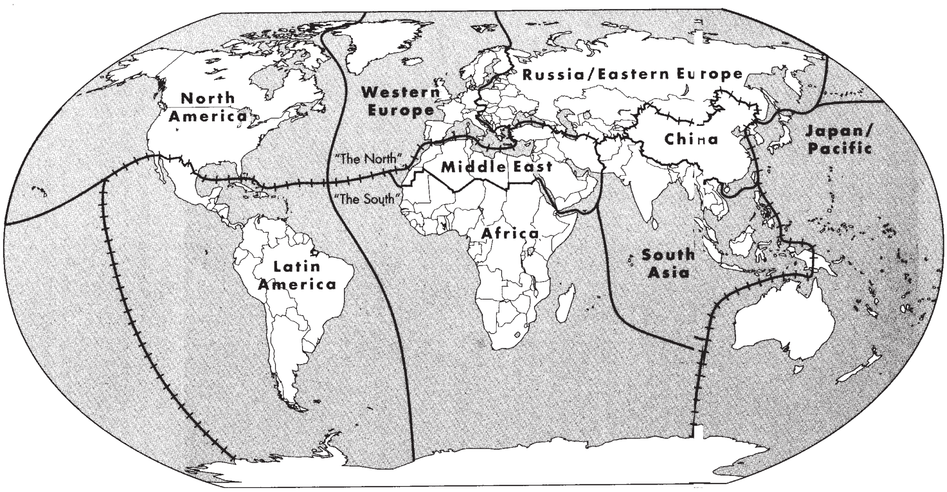

FIG. 1. Nine world regions.

Methods

Data Sources

Energy data are readily available from the U.N. in annual yearbooks (United Nations, 1976, 1981–92). We examine total energy production and consumption for each country; the difference of the two numbers is the level of net imports or exports. (In fact, because of fuels in transit, storage, and other technical factors—and misreporting—it diverges a bit from the official import-export figures in any particular year.) Data are expressed in a standard energy unit, metric tons of coal equivalent (MTCE)—the energy released by burning 2,200 pounds of coal (at a rate of 7,000 calories of energy per gram of coal). Since the U.N. does not maintain a historical database, several problems must be resolved in order to use the data appropriately in a cross-national, time-series study.

First, each yearbook typically lists the prior four years of data, which continue to be updated each year; generally the revisions are quite minor. For early years, the yearbooks were not updated annually. For later years, irregularly, the U.N. published revised data covering a ten-year period or several data points at five-year intervals. We used the latest year of publication available for each data point at the time of data collection.[1] This creates some minor discontinuities in some series. For example, data through 1969 come from the 1950–74 yearbook, 1970 data from the 1982 yearbook (which included 1970 and 1975), and 1971 data from the 1979 yearbook (which included annual data back to 1970). In our aggregate analyses, these minor discontinuities are insubstantial.

A second problem is that during the 1950–1992 period some countries came into existence, others split into multiple countries, and a few merged into a single country. Generally, colonial data are zero before independence, but since the early post-independence numbers are usually quite small, this is not a major problem. Since our main interest is in historical trends over the Cold War period, we have retained East Germany in the Eastern European region, and have estimated the

[1] Data years drawn from yearbooks as follows: 1950–69 (1950–74 yearbook), 1970 (1982 yearbook), 1971–72 (1979), 1973 (1981), 1974 (1979), 1975 (1982), 1976–77 (1980), 1978–79 (1981), 1980 (1983), 1981 (1984), 1982 (1985), 1983 (1986), 1984 (1987), 1985 (1988), 1986–89 (1989) [latest yearbook available at time of initial data collection], 1990 (1991), 1991–92 (1992). Energy data for China include Taiwan through 1966 but exclude Taiwan thereafter.

Eastern and Western German shares of Germany's energy consumption and production in 1991 and 1992. Likewise Yemen's data for 1991 and 1992 are split into estimated shares for North and South Yemen. We calculated totals for the former Soviet Union, Yugoslavia, and Czechoslovakia for 1991 and 1992.

Third, for countries with nuclear production the U.N. in 1990 changed its method of calculating Coal Equivalent for such production. We adjusted the pre-1990 energy production data to reflect the new method (long favored by many U.S. analysts), which basically compares nuclear production with an equivalent fossil-fuel power plant, rather than simply treating the nuclear electricity output as primary energy. The result is to roughly triple the apparent nuclear energy production, a substantial difference for national production in a few cases such as France. In the Western European region, the new method better reflects the effect of substituting nuclear power for imported oil, reducing somewhat Europe's import dependence. Since nuclear power is still a small part of total energy production even in Europe, the adjustment does not greatly affect the overall analysis.[2]

Data on oil prices, for the Middle East spot market and for U.S. domestic production, are from British Petroleum (1994) and U.S. Department of Energy (1994); we converted the data into 1995 constant dollars, and spliced the Mideast series at 1972 (with DOE data before, BP data after, and DOE adjusted slightly to make the 1972 value equal the BP value).

Measures of national economic activity such as Gross Domestic Product (GDP) are far more difficult than energy data to compare across national currencies and through time, since a corresponding universal measure is lacking. In recent years, however, data have been painstakingly constructed by the International Comparison Project (at the University of Pennsylvania) in order to facilitate such comparisons. Data points from different countries and years are expressed in terms of *purchasing power parity*—the equivalent ability to purchase a basket of goods through time or across countries. The data cover 1950 to 1992.[3] Again there are several problems.

Missing data in the early years, especially for countries in the global South, is a serious problem here (in contrast to the energy data). Many countries begin coverage in 1960, 1970, or later. Unfortunately, there is a systematic bias in that poorer countries are more likely to come "on line" later in the time series, so that one cannot simply add them into the pool as data become available (because of the potential to wrongly drag down the regional totals). Therefore, in analyses of energy use in relation to GDP, we use all available countries with data post-1970 (the interesting years).

In the post-1970 data, there are still numerous missing data points. Fortunately, the missing data are almost all either short in duration (a few years at most) or represent countries that play a minor role in the world economy and even in their own region (especially the smaller countries of the global South). We have interpolated, extrapolated, and estimated values for GDP per capita in such cases. The estimates are based wherever possible on applying GDP growth rates from the World Bank (1995) to fill gaps in the Penn World Tables. We believe that the accuracy of these estimates does not materially affect the overall regional trends reported here; whatever effect is present would be strongest in 1991–92.

In terms of statistical methods, we employ descriptive statistics since we are summarizing the overall trends in energy use (and economic growth) across the

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[2] Our energy database is available from the first author on request.

[3] See Summers and Heston (1991). Data reported are from Mark 5.6 (1995). Real GDP data are expressed in 1985 International Dollars (I$), which we have converted to 1995 dollars at an inflation factor of 1.4 (cumulative 10-year inflation of 40 percent). The Penn World Tables including these data are available via the internet from the National Bureau of Economic Research (gopher nber.harvard.edu).

universe of countries in the world—particularly since we are aggregating up to the regional level. (We believe that in analysis of world political-economic relationships, measurement and description deserve more attention than they have received, relative to methods of statistical inference.) We also hope to exemplify the potentials of data graphics as an analytical tool.

A 1973 Projection

We are fortunate to have a projection of world energy trends from twenty years ago—covering the decades of the 1970s and 1980s, using very similar regions to those used here—which one of us carried out just before the 1973 oil shock (Goldstein, 1975). This projection serves as a useful starting point in grounding our analysis of the two decades now that they have passed.

The 1973 study integrated various expert projections about world energy trends (conventional wisdom regarding particular fuels and regions) into a "macro" picture of world energy trends. In line with prevailing expectations of that time, energy prices were expected to remain stable as they had in the past, and the 1973 projections did not address prices or money.

The projections highlighted the expected rapid growth in U.S. energy imports and Middle East exports, in the 1970s and 1980s. Most experts held an assumption—rooted in the sustained prosperity of the 1950s and early 1960s—that both supply and demand for most energy sources would grow in the 1969–1989 period. As with many energy models of the pre-shock era, prices were assumed to be stable; indeed, they were not even included in the integrative projection. (Prices were a factor, but not a central one, in the various component predictions about supply and demand.)

Expected rates of consumption growth in the North *could* be largely realized, but only through a major shift in North-South energy trade. North America, with only slow production growth, would undergo a radical transition from self-sufficiency to import dependency. Meanwhile, energy exports from the Middle East would increase dramatically, the much smaller exports of Africa would grow tenfold, and Latin American exports would also increase. Flat to modest growth in European and Japanese imports would occur. Meanwhile, the Soviet Union's consumption and production would both grow strongly but self-sufficiently (with little import or export); China would follow a similar path from a lower starting position, becoming a major producer (but not exporter) by 1989. Thus, the most important trend expected was a strong and escalating dependency in North-South energy trade, specifically on Middle East exports.

Alternative projections based on increased domestic production of oil, coal, or nuclear power were all ineffective in reducing this dependency. The reduction of energy consumption via conservation was shown to be a much more effective option. Thus, the choice for the industrialized West would be sharply increasing dependency on the supply of energy from the South, or cutbacks in its own patterns of energy use.

The present analysis will show how these world energy trends actually developed over time. We analyzed actual world energy data for 1969–1992 in terms of the same fuels and similar regions as used in the above projection. This analysis showed how the vulnerabilities identified in the study of twenty years ago actually materialized, and how the world economy adjusted in response. Repeated price shocks triggered by political events suggest that the projected increase in Middle East energy exports was politically unstable. In line with the projection, this left only the option of sharply cutting back the growth in per capita energy consumption in the industrialized West, which is what happened. Energy prices were the main mechanism affecting energy consumption. In the short term, energy price shocks reduced economic growth and contributed to recessions. But in the long term, energy efficiency increased in the industrialized countries and GDP growth could be sustained with flat energy consumption.

Results

We will summarize the current overall North-South energy picture, then describe the historical path of North-South energy relations since 1970 with emphasis on oil prices, consumption levels in the industrialized West, and Middle East energy exports. Finally, we will explore the long-term "efficiency" relating a region's energy inputs to its output of goods and services (GDP).

Current North-South Energy Picture

The overall pattern of North-South energy relations is reflected in a "snapshot" comparing the nine regions at one point in time (the latest available data point, 1992). Two propositions suggested by North-South approaches receive strong support from this inter-regional comparison of energy consumption and trade.

First, levels of energy consumption (per capita) are markedly higher in the North than in the South. This difference is shown in Figure 2 (note, however, that there is a large difference *within* the North as well). Indeed, the global South with 76 percent of the world's population accounts for only 26 percent of the world's aggregate energy consumption. This reflects the sharp gap in levels of industrialization between North and South: on a per capita basis, the North uses nine times as much energy as the South.

Second, in the aggregate, the South exports, and the North imports, large quantities of energy. All but one of the world's regions follow this pattern of trade (North importing; South exporting), as shown in Figure 3. The exception is Russia/Eastern Europe, a net energy exporter. This is only one of several attributes distinguishing Russia/Eastern Europe from the industrialized West. Within the West itself, nearly half the net imports go to Western Europe, with the rest split between Japan/Pacific and North America. Within the South, the Middle East is by far the largest net exporter of energy.

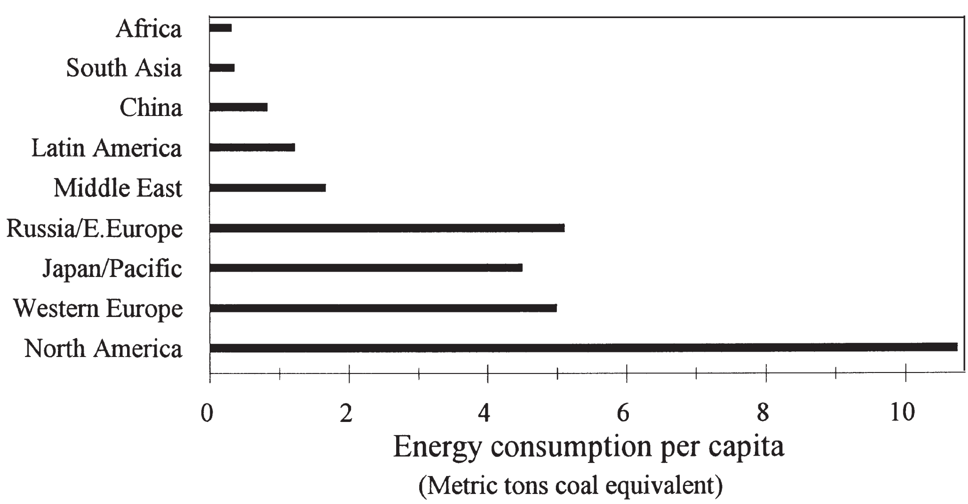

FIG. 2. Energy consumption by region, 1992.

Evolution of North-South Energy Trade

Total energy production by region is shown in Figure 4. As projected, North American production, which had grown robustly in the 1960s, leveled off in the 1970s. Western European production stagnated from the 1950s to the early 1970s, and production in Japan/Pacific never amounted to much. As a result, Middle East

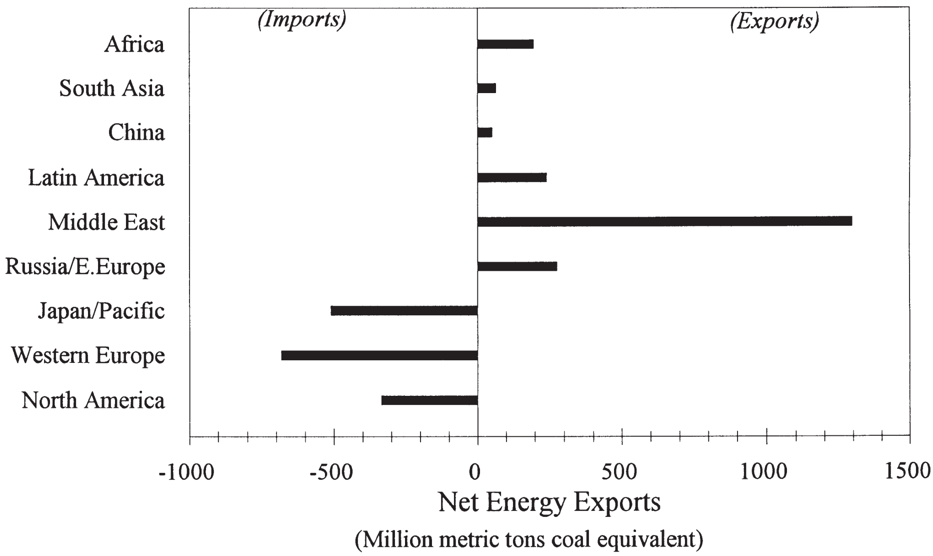

FIG. 3. Net energy exports by region, 1992.

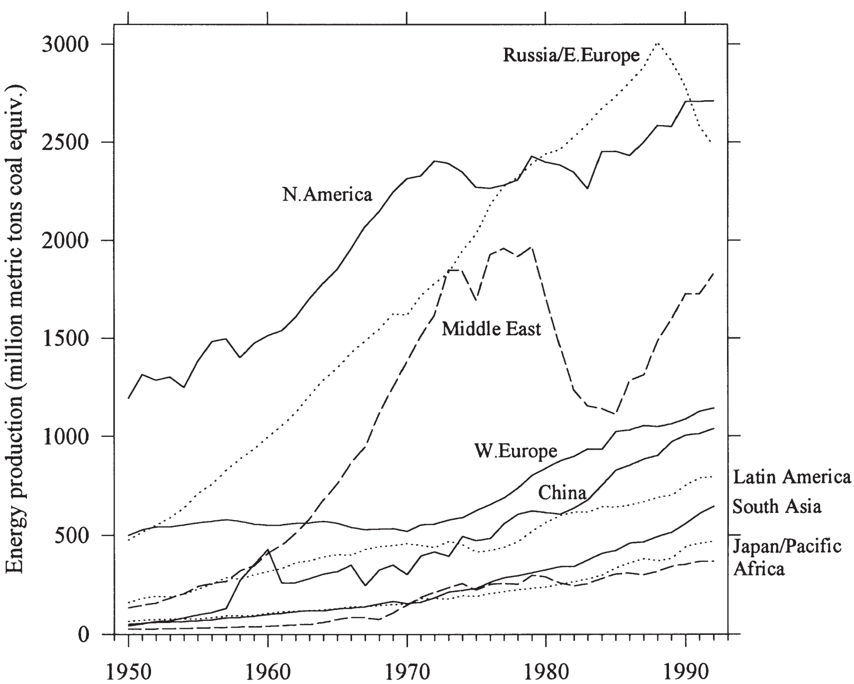

FIG. 4. Energy production, 1950–1992.

production increased dramatically up to 1973, after which production varied inversely with oil prices (more on that later). Russia/Eastern Europe increased production most dramatically of all, until the collapse of the Soviet Union starting in 1989. China, Latin America, South Asia, and Africa all increased energy production substantially in the 1970s and 1980s, but starting from much lower levels. Total world energy production grew rapidly from 1950 to 1970, from 2.7 billion metric tons of coal equivalent to over 7.1. Thereafter growth in world energy production continued but more slowly, reaching 9.4 BMTCE in 1980 and 11.5 in 1992. (Obviously the quadrupling of world energy use over forty years has profound implications for global warming and "sustainable development," but those long-term environmental issues fall outside the scope of this article.)

Russia/Eastern Europe, as an industrialized region, consumed most of the energy it produced, notwithstanding some growing energy exports over time. With North America and Western Europe consuming all their own production and more, and with China neither exporting nor importing on a major scale, only one region among the top energy producers could provide the very large imports needed to support the growth of consumption in the industrialized West—the Middle East.

This dominance of the Middle East in North-South energy trade is evident in Figure 5, showing each region's net energy trade from 1950 to 1992. By 1973 the Middle East was far and away the largest exporting region (note that the exports of Africa, South Asia, and China, not shown, are below those of Latin America). But in contrast to the projected tripling of Middle East production and exports in the base projection referred to earlier, actual Middle East production and exports leveled off sharply after the 1973 oil price shock, then declined substantially after the 1979 shock, and recovered partially only after the price of oil fell again in the late 1980s.

What materialized, then, was closer to the "limit consumption" projection than the base projection. Indeed, the actual Middle East energy production was well below the level projected in the "Middle East cutback" projections used to assess alternative policies. With cheap Middle East exports proving to be unreliable, and with no other major sources of cheap energy supply to replace them, the industrialized West "tightened its belt" and reduced its energy consumption in response to

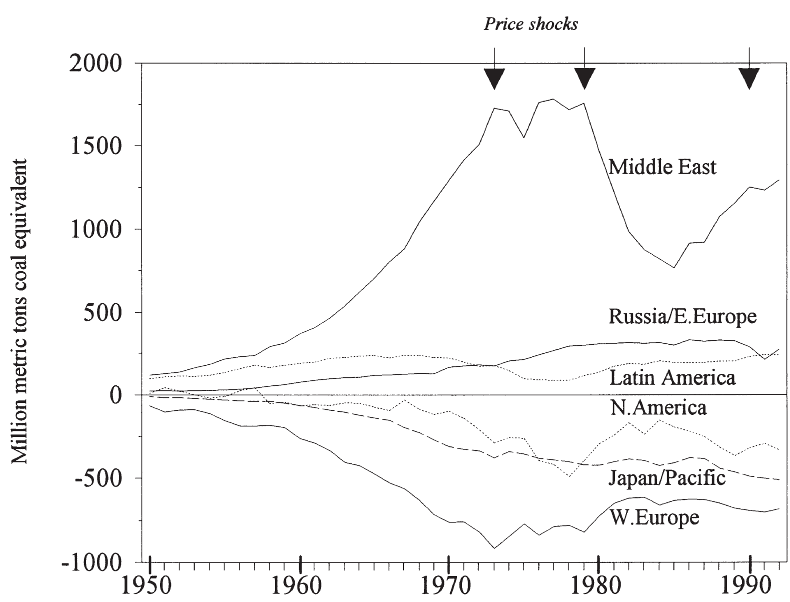

FIG. 5. Net energy exports, 1950–1992.

high oil prices. The development of alternative supplies such as Alaskan and North Sea oil, and nuclear power, also contributed to reduction in dependence on Middle East exports.

As a result, the imports of North America and Western Europe followed a pattern similar (but of course opposite) to that of Middle East exports, after 1973. Three times, energy prices jumped suddenly—in 1973, 1979, and 1990 (the third of these was only short-term, however). These years are marked with arrows at the top of Figure 5. Each time, both Middle East exports and American/European imports decreased. By contrast, in the late 1980s, when oil prices fell dramatically, Middle East exports increased again, as did North American and (to a lesser extent) Western European imports. Japan/Pacific reacted with much less sensitivity to the shocks of 1973 and 1979, and to the mini-shock of 1990; imports of Japan/Pacific continued to grow rather steadily.

Figure 6 shows the per capita energy consumption of the global North since 1950. Robust growth was interrupted in 1973, except in (self-sufficient) Russia/Eastern Europe, whose consumption fell only with the post-1989 economic collapse. Consumption in North America was both much higher than in the other regions of the North and more responsive to the price of energy. From 1973 to 1979, after the first energy shock, consumption flattened out in North America, Western Europe, and Japan/Pacific, and with the second shock in 1979 consumption per capita declined, especially in North America. Then as energy prices fell in the 1980s, consumption per capita rose again in the industrialized West, again most strongly in North America. And with the mini-shock of 1990, consumption declined slightly again in North America and Western Europe. As in Figure 5 (net trade), the adjustments in energy consumption here were less sharp in Japan/Pacific than in Western Europe or (especially) North America.

In short, the main trends of the projection materialized even more starkly in the real world than in the projection: energy production declined in the largest producing region (North America); and the two most economical ways to fill the gap were increased production of Middle East oil (no other region or fuel had a

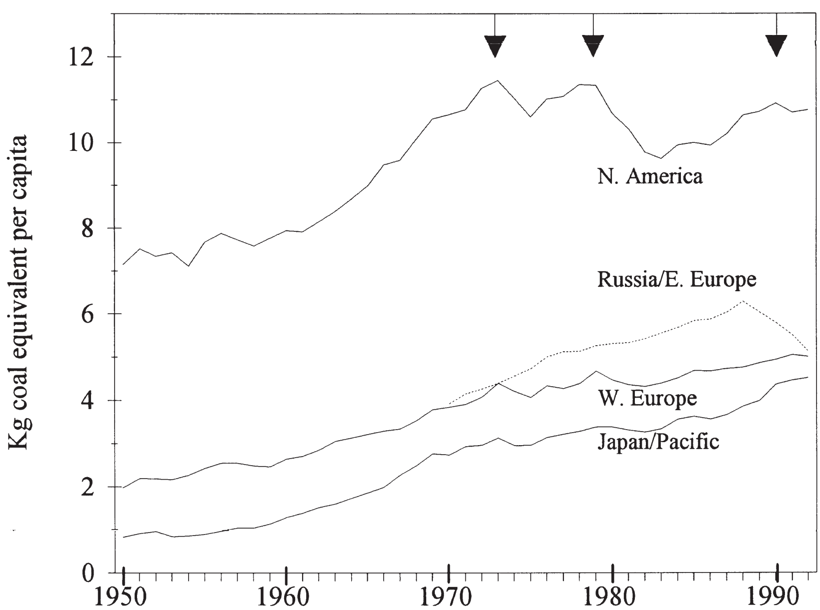

FIG. 6. Energy consumption per capita, 1950–1992.

comparable potential) and decreased consumption in the industrialized West, especially in North America with its high energy consumption. These realities meant that world energy dynamics in 1970–1992 were driven by energy consumption in the industrialized West (especially North America) and exports of Middle East oil. The mediating mechanism of this relationship was, of course, the price of oil.

Political events in the Middle East posed serious threats to stable energy exports from that region three times in twenty years: the 1973 Yom Kippur War, the 1979 Iranian revolution (followed by the start of the Iran-Iraq war), and the 1990 Iraqi invasion of Kuwait (for six months until it became clear that Saudi oil exports would not be affected). In each case the political catalyst opened the way for underlying economic realities to assert themselves. The threat to a stable future supply of Middle East oil exports in each case led to a sudden, large increase in the price of oil—staying high after 1973, then doubling again but declining back over several years after 1979, and jumping up for just part of one year in 1990 before resuming a gradual decline below the level of 1973–1978.

Figure 7 shows the price of U.S. and Middle East oil from 1960. The 1973 and 1979 price shocks, and the mini-shock of 1990, are noted. In 1990, prices peaked around $40/barrel, but remained high for only six months, leading to only a modest increase in the annual price (as shown on Fig. 7), followed by a price drop in 1991–92 (and since). Up until 1973, Middle East oil prices were well below U.S. oil prices (and both gradually declining); then Middle East prices were somewhat above U.S. prices for a decade, but the two converged by the late 1980s as world energy markets became more integrated.

Thus, the world energy economy has experienced several adjustments since 1970, in response to the underlying vulnerabilities identified in the original projections. In the first two adjustments (1973 and 1979) heavy dependence on Middle East oil made possible large price increases, which in turn dampened—and then reduced—energy consumption in the industrialized West (especially North America). These adjustments, along with some interfuel substitution and oil supply diversification, reduced dependence on Middle East oil and led to lower oil prices. The third adjustment, brought on by these declining oil prices in the 1980s, was in the opposite direction—energy consumption picked up and Middle East oil exports began

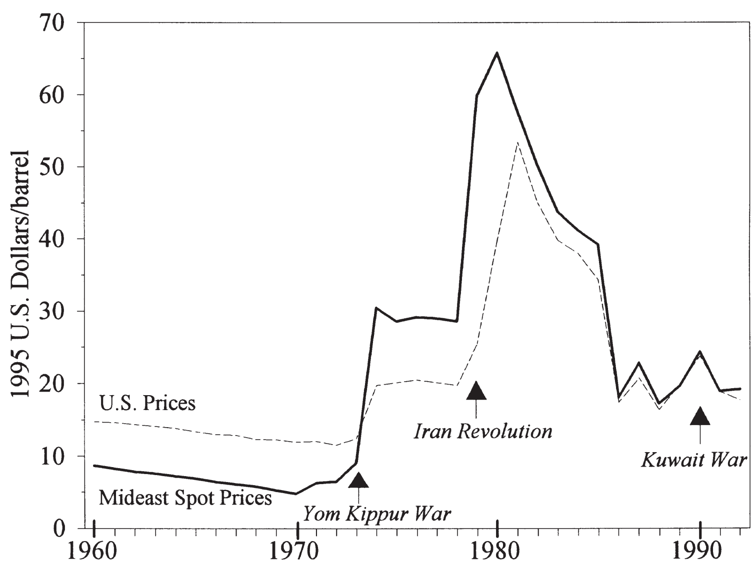

FIG. 7. Real oil prices, 1960–1993.

growing again. Then the short-lived energy shock of 1990 brought a minor version of the earlier energy shocks, with a slight reduction in Western consumption and imports and in Middle East exports.

Overall, the adjustments in energy consumption have been dramatic over the past twenty years. Per capita consumption in North America was lower in 1992 than in 1973, and that of Western Europe and Japan/Pacific was only modestly higher, far below earlier projections. More dramatically, Middle East energy exports at bottom in 1983–1987 were roughly half the level of 1973–1979 (see Figure 5), and the 1992 level was still below that of 1970. Diversification of energy sources away from the Middle East is also apparent: the Middle East accounted for about 75 percent of world energy flows into the three regions of the industrialized West in the 1970s, but only about 50 percent by the late 1980s.[4]

An Equilibrium Price for Oil?

The industrialized economies responded to energy vulnerabilities by adjusting per capita energy consumption. The timing of these adjustments coincides with energy price changes, especially in the highly volatile price of oil. Price increases following 1973 and 1979 sharply altered the growth rate of consumption (first to zero, then to negative growth), while the price decreases of the 1980s again altered the consumption growth rate (resuming positive growth). In turn, these changes in demand for energy drove the export levels of Middle East energy. Figures 8, 9A, and 9B examine these relationships, using the same data on prices, Mideast exports, and Western consumption just described.

Figure 8 illustrates the theoretical relationship of price and demand that underlies a "cobweb model" (Boulding, 1966:229–30), although with somewhat different causal dynamics than in the classical example of agricultural supply. To start at the bottom, when energy prices are low, demand for energy rises in industrialized countries. When demand is high, prices are driven upward (right-hand side). When prices are high, demand is dampened (top), and when demand is low, prices are driven down (left side). With time lags in the responses of these variables—and in our case with "shocks" that suddenly change the trajectory—the system follows a circular path, either converging toward some equilibrium near the center, or diverging away from it.

In Figures 9A and 9B the vertical axis shows the real price of Middle East oil. The highest *monthly* prices reached in late 1990—equivalent to about $38/barrel in 1995 dollars—are shown with an asterisk and dotted line from the 1990 full-year data point. The horizontal axis in Figure 9A represents the level of net energy exports

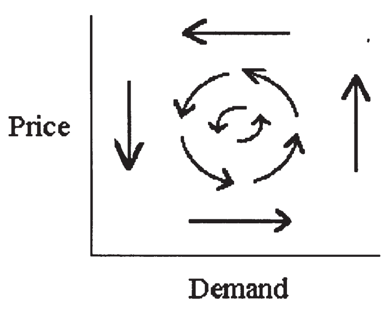

FIG. 8. Phase diagram for cobweb model.

[4] Lin (1984) summarizes global adjustments to the 1973 price shock, emphasizing energy conservation in the industrialized countries.

from the Middle East, while in Figure 9B it represents the per capita consumption of energy in the industrialized West. Thus, the historical path followed by the world system is represented by a line in the space defined by prices and quantities (exports or consumption).

Both figures resemble a convergent cobweb model. The historical paths in Figures 9A and 9B are consistent with a dynamic system in which a counterclockwise cycle results from the following chain of causation: when prices are low, demand increases and both Western consumption and Middle East exports rise. When Middle East exports are high, prices tend to rise (triggered sometimes by politically

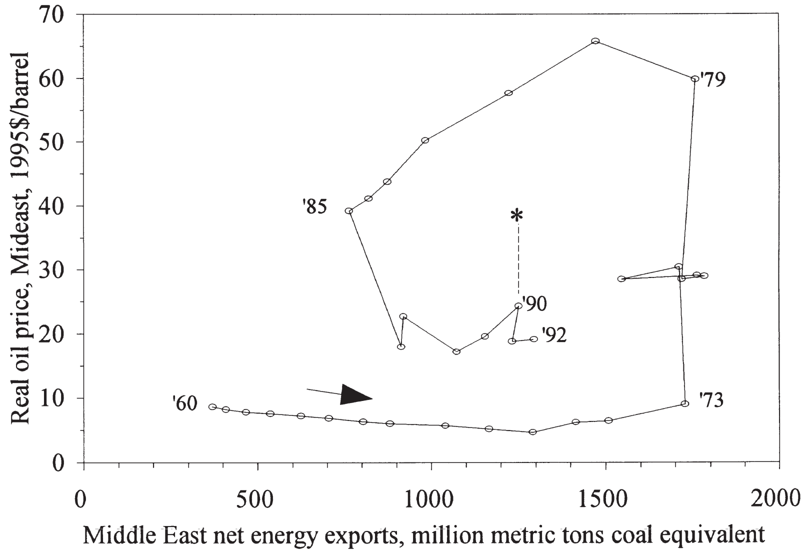

FIG. 9A. Mideast exports and oil prices, 1960–1992.

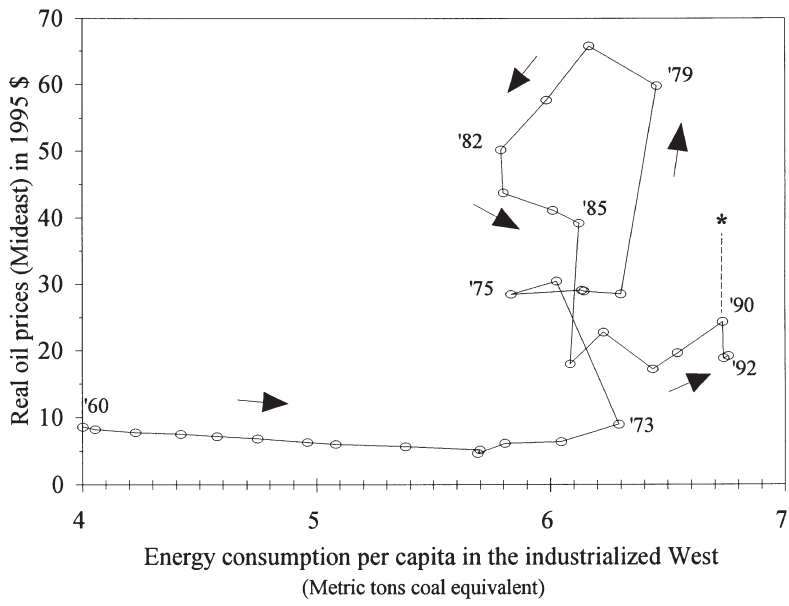

FIG. 9B. Western energy consumption and real oil prices, 1960–1992.

induced shocks). When prices are high, demand decreases (and non-Middle East supply increases), so Middle East exports drop, as does Western consumption. When consumption and Middle East exports are low, prices tend to fall. And when prices are low, consumption and exports rise. Convergence is suggested by the inward-spiraling path (e.g., oil prices higher in 1986–1992 than in 1967–1970 in Figure 9A). The growth of futures and derivatives markets for world oil in recent years should in theory also contribute toward a convergence toward equilibrium, dampening any "shocks" as compared to 1973 and 1979.

Figure 9A suggests an equilibrium for real oil prices and Middle East exports, in the range of perhaps $35/barrel (in 1995 dollars) for oil. (Exports would be around 1 to 1.5 billion MTCE.) In Figure 9B, the equilibrium oil price around $35/barrel would correspond with energy consumption of around 6–7 MTCE per capita in the industrialized West (modestly lower than current levels). To be conservative, and since U.S. prices tend to be slightly below Middle East prices,[5] we will refer to an equilibrium around $30/barrel—which is only a rough estimate.

At the equilibrium, presumably, the political-economic instability of North-South energy trade would be mitigated, and the growth of energy demand in the North would be curtailed at sustainable levels (politically and economically sustainable if not environmentally), with slow growth if any of energy consumption. Prices much below the equilibrium level would lead to sustained consumption growth, trade dependency on the Middle East, and the potential for sudden jumps in price as political events alter supply expectations. Conversely, prices much *above* the equilibrium level would lead to negative consumption growth, slackened demand (including, as we shall see, recessions), and price decreases. The data are, of course, only suggestive; Adelman (1991:145) argues *against* applying a (different) cobweb model, based on lags in capacity, to world oil (partly because Gulf oil production differs so much from U.S. production).

Energy and Stable Economic Growth

So far we have discussed only energy consumption, and not economic growth per se. But higher oil prices might dampen the growth of energy consumption for either of *two* reasons. First, high energy prices might drive the industrialized economies into recession, arresting economic growth itself as well as energy growth. Or, second, high energy prices might stimulate greater efficiency in energy use, arresting energy growth but not economic growth.[6] The ideal price to maintain stable economic growth depends on which of these effects predominates.

Past studies have found both effects. The effect of energy price on aggregate economic growth is deeper than would be expected from the relatively small part of GNP represented by the energy sector (Hogan and Manne, 1977).[7] Fourteen different models of the energy-economy interaction, collected from different re-

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[5] A similar circular path results if one plots North American energy consumption alone, against *U.S.* domestic oil prices (the figure is available from the first author on request). In this North American version, the equilibrium (U.S., not Middle East) oil price would seem to be slightly lower, around, say, $30/barrel—consistent with slightly lower historical prices for U.S. oil as compared with Middle East oil.

[6] While the effect of nonmarket forces is hard to determine, "at least 80 percent and probably much more of the demand reductions can be attributed to price and economic activity changes" (Sweeney, 1984:35).

[7] "The relationships between energy and the economy are complex and multifaceted. Sudden changes in energy price or availability can lead to structural and aggregate unemployment, to sharp increases in inflation, and to major changes in the distribution of wealth, both among nations and within a given country. In the longer run, when transitional impacts subside and after compensating monetary and fiscal policies are implemented, changes in the price or availability of energy may influence the long-run growth prospects of a nation" (Sweeney, 1978:115). Economists have not always agreed on some basic issues such as whether energy and capital are substitutable or complementary (see Pindyck and Rotemberg, 1983; Berndt and Wood, 1987; Heal and Chichilnisky, 1991:xvi, 35).

search groups by the Energy Modeling Forum (Hickman, Huntington, and Sweeney, 1987:22, 24), converge around a fairly consensual view of the effect of energy price increases on economic growth: in the median model, two years after a 50 percent oil price increase, real output had fallen 2.9 percent, unemployment had increased 1.2 percent, and prices had increased 2.0 percent.[8] These effects were mostly temporary, with recovery beginning after a few years (pp. 31, 33). The models also treated oil price reductions as being essentially similar to increases but with reverse effects; for instance, a 20 percent price reduction would raise GNP by 1.2 percent in the median model, by the second year (pp. 44–5). This relationship is illustrated in Figure 10. But neither price increases nor decreases have much effect on the *long-term* rate of GNP growth, according to these models. The short-term disruption of economic growth, then, results more from the shock of a sudden price increase than from the actual price level itself.[9]

Figure 11A shows the actual path since 1970 (each dot representing one year), in the same conceptual space as Figure 10—with oil prices now on the horizontal axis, in contrast to Figures 9A and 9B. (Because GDP data are not comprehensive before 1970, the GDP analyses are confined to the post-1970 period.) If Figure 10 is correct, one would expect the figure to be oriented from upper left to lower right, with sudden movements to the right (price increases) driving the path downward (reduced rate of economic growth)—and leftward movements driving the path upward. This is largely true in Figure 11A, especially regarding the paths followed in 1973–1975, 1978–1982, and 1988–1991. Note, however, that in 1975–1978 and 1991–1992 earlier rates of GDP growth were resumed without change in oil prices.

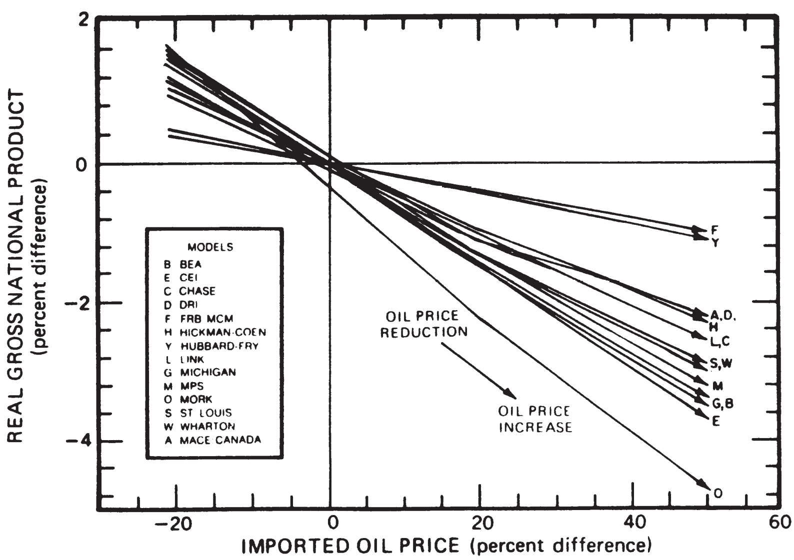


FIG. 10. Effect of oil price change on GNP growth in 14 researchers' models. (*Source:* Hickman, Huntington, and Sweeney [1987:45])

[8] The effects on real potential GNP ranged across the models from 2.0 to 3.5 percent for the second year. In most models, the mechanism for these effects entails reductions in money supply and higher interest rates, with a consequent dampening of investment, consumer durables purchases, real income, and overall consumption. In addition, U.S. domestic income is eroded by the shift of income out of the U.S., the reductions in industrialized trading partners' GNPs and hence in U.S. exports, and (potentially) by government policies such as income tax "bracket creep" (Hickman, Huntington, and Sweeney, 1987:22, 30–31).

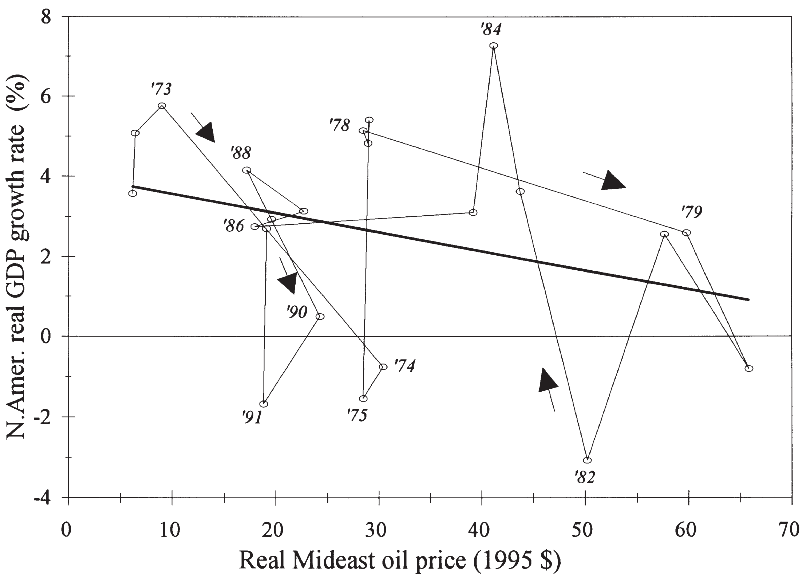
[9] Daly and Mayor (1983) argue that consumers responded rationally to the two energy price shocks of the 1970s, in forming expectations of the future.

Only after the recession of 1982 did *falling* oil prices accompany resumed GDP growth. Thus, the short-term impact of oil prices on GDP growth may differ from long-term impacts (see Heal and Chichilnisky, 1991:27).

If oil price increases represented mainly a North-to-South transfer of income, as was suggested by some advocates of a New International Economic Order, then the effect of oil prices in the OPEC countries should be opposite to that in the industrialized, energy-importing regions such as North America. Then, in a figure like Figure 11A, the path followed should run mainly from lower left to upper right. But, as Figure 11B shows, such is not the case for OPEC countries. Their path runs top-left to bottom-right just as the North American one does. Although OPEC GDPs grew robustly after the 1973 price increase, after 1979 they remain low until after 1986, when the price of oil falls and OPEC's GDP growth increases again. Thus, contrary to intuition, high oil prices did not help OPEC's economic growth.

Indeed, as shown in Figure 12A, the OPEC growth rate after 1979 was consistently below that of energy-*importing* countries of the South. Even the non-OPEC energy exporters of the South[10]—which enjoyed many of the benefits of OPEC without some of the costs (Heal and Chichilnisky, 1991:49–52)—did no better than the energy importers overall. They did better briefly in 1979–1981 but much worse in 1982–1985 even while oil prices remained quite high.

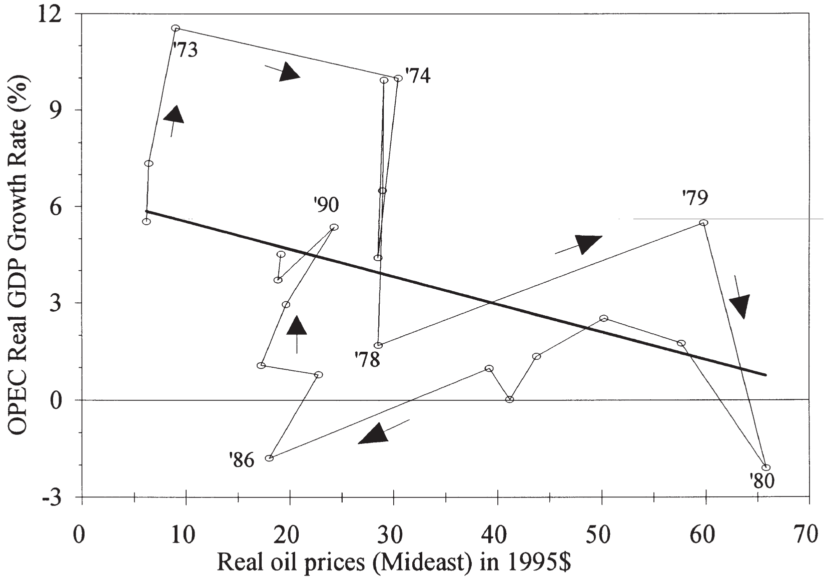
These data provide strong support for the arguments of Heal and Chichilnisky (1991:84–94) that oil exports created economic problems for the exporters. (They present only partial data to confirm their theoretical model, but here the fuller and more-up-to-date data confirm the result.) "Dutch disease" refers to the paradoxical



Note: Heavy line shows least-squares fit to data points.

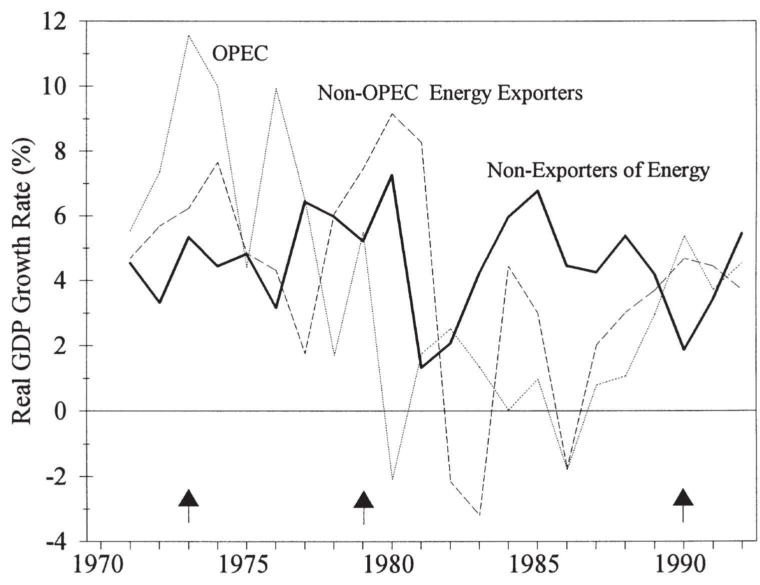
FIG. 11A. Oil price and GDP growth, North America, 1971–1992.

[10] We define these as countries of the South whose 1982 net energy exports were at least 20 percent of energy production (thus excluding those whose minor energy exports do not greatly affect their economies). They are Bahrain, Egypt, Oman, Syria, Tunisia, Bolivia, Mexico, Peru, Trinidad and Tobago, Afghanistan, Brunei, Burma, Malaysia, Angola, Benin, Cameroon, Congo, South Africa, and Zaire. The OPEC members (all of whom also meet the 20 percent criterion) are Algeria, Iran, Iraq, Kuwait, Libya, Qatar, Saudi Arabia, United Arab Emirates, Ecuador (until 1992), Venezuela, Indonesia, Gabon, and Nigeria.



Note: Heavy line shows least-squares fit.

FIG. 11B. OPEC GDP growth and real oil prices, 1971–1992.



Note: Arrows indicate oil "shocks."

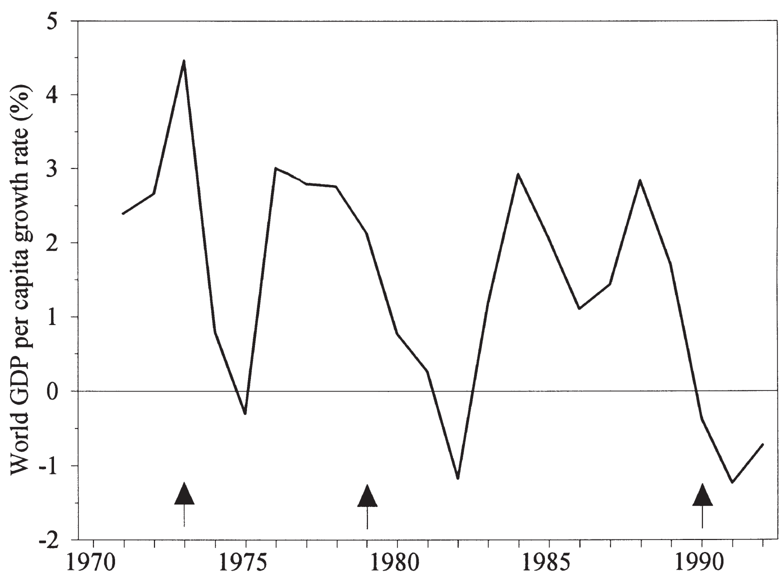
FIG. 12A. GDP growth rates of global south energy groups, 1971–1992.

effects by which booming exports of North Sea gas seemingly contributed to rising Dutch unemployment (Fardmanesh, 1991; Heal and Chichilnisky, 1991:84; Looney, 1992; Peng and Martin, 1994). The boom in mineral exports leads to an appreciation of currency exchange rates so that nonmineral export and import-competing sectors (in manufacturing and agriculture) suffer. More importantly, in the case of oil-exporting developing countries, oil price increases led both to reduced demand for oil in the industrialized countries and to inflation in those countries, which raised the price of manufactured goods being imported by the oil producers. Furthermore, the expansion of oil export quantities led to a reduction in price, with a net loss of income (Heal and Chichilnisky, 1991:39, 89).

For nonexporters of energy in the global South, of course, oil price increases also affect growth negatively (Tsai, 1989:67–79), but apparently only in the short term. In Figure 12A, short-term drops in GDP growth for these countries after price shocks do not appear to impede overall long-term growth. Again the results support Heal and Chichilnisky's (1991:95) claim that "oil importing developing countries did not suffer a significant loss of growth or welfare due to higher oil prices," and that oil importers did at least as well as exporters even during the period of high oil prices.

On a global level, the effect of the oil shocks on aggregate worldwide GDP growth (per capita) is shown in Figure 12B. (When broken out, the pattern of GDP growth is substantially similar through time for the North and South.) The three periods of negative growth in the overall world economy (centered on 1975, 1982, and 1991) follow each of the three energy shocks (see arrows). Looking at the per capita GDP growth of the industrialized West, illustrated in Figure 13, the three interruptions to growth were in 1973–1975, 1979–1982, and 1990–1991 (shaded areas). As Figure 13 shows, each of these three periods saw falling Middle East energy exports—presumably because slackened economic growth meant less demand for energy. (Here the results do not support Heal and Chichilnisky's (1991:74–83) claim that high oil prices had little effect on growth and inflation in the industrialized countries). Thus, Figures 12B and 13 both support the idea that short-term influences of price on energy consumption operate by way of the general economic growth rate. Energy shocks precede and contribute to recessions, which in turn contribute to lower energy prices.

In the long term, however, the Western economies are increasing their energy efficiency—the ratio of the production of goods and services to primary energy consumption. (Efficiency here is the inverse of what is sometimes called energy "intensity.") Thus, in theory economic growth could continue, even under higher energy prices, because a certain rate

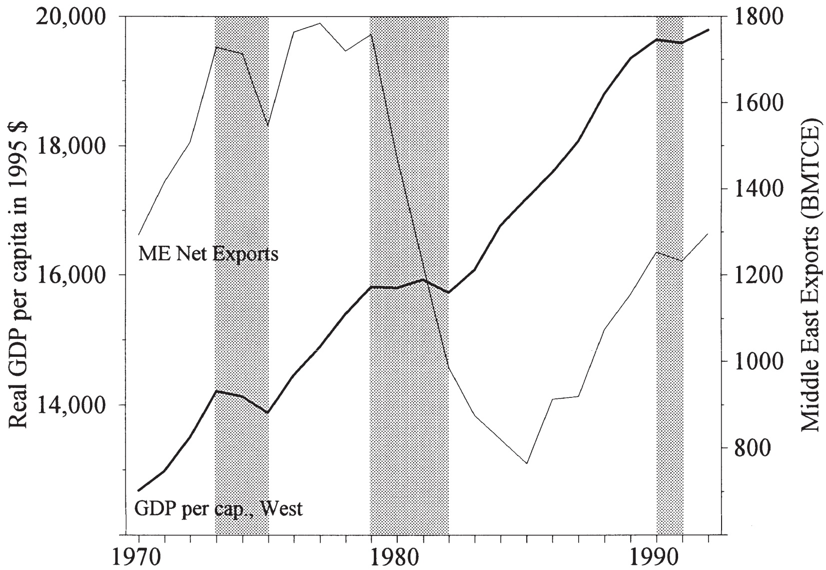


Note: Arrows indicate oil "shocks."

FIG. 12B. Growth rate of world GDP per capita, 1971–1992.

of economic growth could occur without increase in energy demand, as efficiency increased.

As shown in Figure 14, the ratio of real GDP to energy consumption in fact did increase substantially between 1970 and 1992 in North America (albeit from a low



Note: Shaded areas are interruptions of GDP growth, and reductions in M.E. exports.

FIG. 13. Western GDP per capita and Middle East energy exports, 1970–1992.

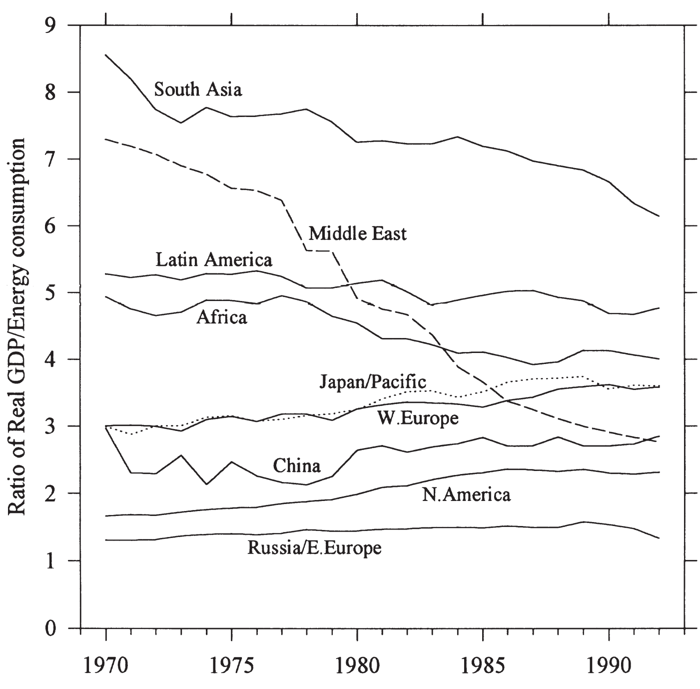


FIG. 14. GDP / energy ratio, 1970–1992.

starting point), as well as in Western Europe and Japan/Pacific more modestly. However, Russia/Eastern Europe lagged far behind in energy efficiency (see also Dobozi, 1991). Japan appears to have been more successful than the United States in absorbing the price shocks of 1973 and (especially) 1979 by promoting energy efficiency (Weatherford and Fukui, 1989; on failures of U.S. policy see Tugwell, 1988). In Japan, MITI developed industrial policy based on expectations of fairly high future energy prices, rather than reacting only to short-term prices (Ikenberry, 1986; Lesbirel, 1988; for a nonbureaucratic interpretation see Samuels, 1987). Energy efficiency is also easier to achieve in a growth economy with high investment in new capital equipment (such as Japan) than in a sluggish economy with less new investment (Sweeney, 1984:32, 34).

Among the regions of the South energy efficiency was much higher than in the North, reflecting the greater energy efficiency of the less industrialized economies. China was an exception, however, with low energy efficiency closer to its fellow, centrally planned economy (Russia/Eastern Europe) than to its fellow, less developed economies in the South.[11] Apparently industrialization in China followed an energy-inefficient pattern, especially in the 1960s and 1970s when GDP growth lagged. With faster economic growth in the 1980s, Chinese energy efficiency improved somewhat; in the last decade China's energy consumption reportedly has grown at less than half the rate of economic growth (*China News Digest*, 1995). However, energy shortages have resulted (Geng, 1993).

In the rest of the South, efficiency, although higher, has decreased steadily since 1970 (as economies began industrializing). This declining efficiency was most dramatic in the Middle East, where energy consumption grew rapidly as oil-rich states built energy-intensive industry. Overall, the North-South differences in energy efficiency are diminishing over time, while inter-regional differences not based on North-South position are increasing. The lowest energy efficiencies appear to characterize regions with large territories and rich energy resources (Russia, North America, China) or the rapid expansion of cheap energy resources (Middle East).

In the industrialized regions, the year-to-year changes in energy efficiency (the GDP/energy ratio) show that greater energy efficiency in the industrialized West was a long-term response, not much affected in the short term by price fluctuations (see Sweeney, 1984:33). Heal and Chichilnisky (1991:26–30, 68) emphasize the long lags in adapting industrialized societies to higher energy prices. In the early 1980s, some changes made in response to the 1973 price shock were still coming into effect. This may help explain why prices "overshot" in 1979 and went into a sharp decline by the mid-1980s. By then, as a result of a decade of response, non-OPEC production was expanding substantially and energy efficiency was rising in the industrialized West.

Thus, *both* mechanisms mentioned above seem to operate in response to energy price changes, but on different time scales. In the long term, higher energy prices stimulate greater energy *efficiency*, so that GDP continues to grow while energy consumption remains more level. In the short term, sudden changes in energy prices are more likely to affect energy consumption by speeding up or slowing (or reversing) *economic growth* itself in the industrialized regions. In this regard, the 1973 and 1979 price shocks must be distinguished. While both shocks disrupted growth in the short term, the 1973 shock reached what might have been a stable and sustainable price, had long-term forces had time to catch up. As illustrated in Figures

[11] The PWT estimates of China's real GDP are considerably above those of the World Bank; the low GDP/energy ratio for China compared with other Third World regions is in spite of this. With the World Bank GNP estimates, the ratio would be considerably lower still, highlighting China's remarkably energy-intensity development style.

11A–13, the 1976–1978 period saw annual real GDP growth rates on the order of 5 percent in North America, all categories of the global South, and the overall world economy (which registered nearly 3 percent *per capita* growth)—despite "high" oil prices of around $30/barrel in today's terms. By contrast, the prices after the 1979 shock were not sustainable.

Figure 15A (and the enlargement in Figure 15B) illustrate the relationship between real GDP and energy consumption by tracing each region's path in the space defined by those two variables. Traditional economic growth, which prevailed before the starting point of 1970 and until 1973, moves toward the upper right. Economic recession or collapse (decrease in both energy consumption and GDP per capita) moves toward the lower left. Examples include Russia/Eastern Europe after 1989 and Latin America and Africa after 1980. A direction toward the right or lower right indicates growing energy consumption that is not translating into economic growth; the Middle East shows this pattern after 1979. A path moving straight up or up and left indicates a region that is curtailing energy growth but maintaining economic growth. This is the overall direction of North America since 1970, to a lesser extent Western Europe, and (still less) Japan/Pacific (where energy growth continued). China also seems to have made an adjustment in this direction around 1979.

As indicated by North America's path in Figure 15A, the energy shocks knocked the North American economy off of its previous growth path and forced it toward greater energy efficiency, but with GDP growth continuing overall.

Conclusions

Three main conclusions can be drawn from the results. First, the overall pattern of inter-regional energy production, trade, and consumption fits broadly the model of North-South relations sketched at the outset—especially if one considers Russia/Eastern Europe to be a semiperiphery. There is a large gap in energy consumption levels between the industrialized North and the less developed South. Furthermore, the regions of the South all export energy while the regions of the industrialized West all import it. However, the various regions also have distinctive patterns that do not appear to be captured by existing theoretical models. In the North, these regional differences include North America's high energy consumption and high price sensitivity, compared with Japan/Pacific's lower consumption and lower price sensitivity, and, of course, Russia/Eastern Europe's hugely inefficient consumption and growing exports. In the South, notable characteristics unique to particular regions include the size and variability of Middle East exports, the inefficiency of Chinese and (over time) Middle East energy use, the nongrowth of Africa, and the reversal of Latin American economic energy growth in the 1980s versus rapid growth in China.

Second, the results demonstrate the central role that energy, and energy trade, play in the world economy. Oil price movements not only link directly to shifts in consumption in the industrialized regions, and to exports from the Middle East, but also correlate with changes in GDP growth—the entire pace of world economic activity. Furthermore, the role of North-South energy trade—especially from the Middle East—is central to the world energy economy overall. Over the 1950s and 1960s, North-South energy trade grew exponentially; in the 1970s and 1980s it fluctuated in a complex pattern relating to both economics (supply, demand, expectations) and politics (wars and revolutions).

Third, the cobweb-type path followed by the North-South world energy trade (Middle East exports and Western consumption) over the 1970–1992 period suggests the possibility of equilibrium levels (or paths) of price, consumption, and trade. At such an equilibrium, future "energy shocks" such as perturbed the world economy

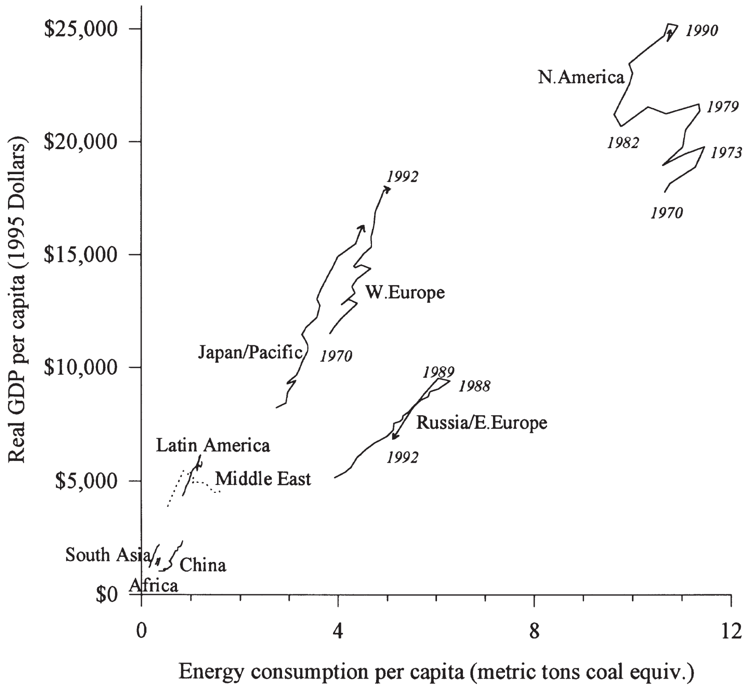


FIG. 15A. Paths in GDP / energy space, 1970–1992.

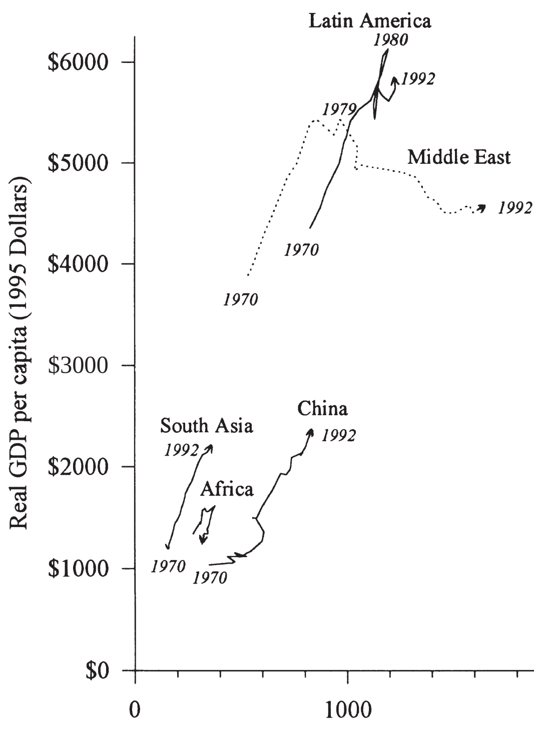


FIG. 15B. Paths in GDP / energy space, 1970–1992. (Enlargement from FIG. 15A) in 1973–1990 could theoretically be minimized in the future. Although we cannot say with much accuracy what the equilibrium oil price level would be, it appears from the "cobweb" model (Figures 9A and 9B) to be in the vicinity of $30. Certainly the equilibrium would be well above the 1995 oil price of below $20/barrel. It is also higher than the $20/barrel range that some energy economists have recommended as ideal for U.S. economic growth (Uchitelle, 1991) and for stable producer-consumer relations (Kuttner, 1991; Yamani, 1991). But the equilibrium price presumably would not exceed the rather stable price of energy sources *other* than Middle East oil, which Lynch (1987) puts at a level equivalent in 1995 dollars to about $40/barrel.

If such an equilibrium is meaningful (and we admit that it is just a first-order approximation based on a relatively short history), then the path being followed by the world system after the Gulf War (the 1991 and 1992 data points, and the subsequent low oil prices not included in our data set) moves away from equilibrium. Certainly, the low post–Gulf War oil prices came as a relief for the economies of the United States and other countries suffering from recession. But these low prices may, as before 1973 and 1990, stimulate consumption growth in the industrialized countries and renew their dependence on Middle East oil.

In such a case, today's low oil prices may be setting up the industrialized world for future energy shocks (see Lee, 1991; Wald, 1991). Heal and Chichilnisky (1991:72) note "major political disruption in the Middle East" as one of the few factors that could push oil prices back up. Indeed, political events in the Middle East (the breakdown of talks that were expected to lead to resumed Iraqi oil exports) in early 1996 contributed to a sudden jump in world oil prices of more than 25 percent. That price jump in turn contributed to rising U.S. gasoline prices, which quickly became a presidential campaign issue. Although the oil price jump was expected (as of this writing in May 1996) to be temporary, the point is that "low" oil prices since the Gulf War come at a cost in terms of both volatility and sensitivity to political events in the Middle East.

In the late 1980s, the system moved in a similar direction as post-1991 (falling energy prices; rising Northern consumption and Middle East exports), and this may have played a role in establishing the conditions for a new price shock in 1990. But the sharp temporary price increase of 1990 was reversed by successful military intervention to protect the flow of Saudi oil (which in turn could expand quickly to fill the supply gap left by Kuwait's occupation and sanctions on Iraq). If the war had widened and interrupted regional exports, oil prices might have remained high for much longer. But the Gulf War seemingly allowed the system to reverse the mini-shock of 1990 and continue its path of low prices and rising consumption and exports.

We may speculate, then, that there may be two "equilibrium" prices—one under conditions of stable access to Middle East oil at world-market prices, and one under conditions of restricted or unstable access to that oil. (Presumably, actual prices reflect some probabilistic expectation of risk regarding future access to Middle East oil.) It is possible to estimate crudely the difference between these two levels, based on the historical change in oil prices during periods of stable access to Middle East oil supplies versus periods when such access was threatened by political developments such as war or revolution. The difference in price level can be estimated at, say, $15 per barrel.

In this way of thinking, we can ask whether the Gulf War (or future actions that may ensure stable access to Gulf oil) was "worthwhile." The value to the industrialized West of stable access to Middle East oil would be roughly $15 times the Middle East export level of around 6 billion barrels annually—a total of nearly $100 billion per year. This is only an order-of-magnitude estimate. But clearly the Gulf War—costing on the order of less than $100 billion total—more than paid for itself if it gained at least a few years of stable access to Gulf oil. On the other hand, Telhami and O'Hanlon (1995) put current and ongoing U.S. military expenditures related to the Gulf region at about $50 billion annually, which is less of a bargain.

These calculations, although simplistic, illustrate the continuing importance of Middle East oil exports in the world political economy—and the cost that rational policy makers in the West might be willing to pay to assure continued stable access at world-market prices (protected from political instabilities). In one interpretation, we might estimate the value of the Middle East peace process, showing that a large investment (of diplomatic effort, economic aid, etc.) in that effort by the industrialized regions would be rational. Whether political stability is to be sought by war or peace, however, a host of questions arise regarding the distribution of costs among the industrialized regions—among countries in the case of war and peace costs, and also among consumers and taxpayers in the case of oil costs. These questions are largely beyond the scope of the present study, but we may note two points.

First, the globalization of oil markets has made the question of who sells and buys a particular barrel of oil less and less relevant. Specifically, although North America imports less Middle Eastern oil than oil from other regions, as compared to Europe and Japan, any shortage or surplus of Middle Eastern oil directly affects global oil prices, including those paid by North America for non–Middle Eastern oil imports. In this context, it is understandable that all the industrialized regions share the costs of maintaining the political stability in the Middle East, whether through actions such as the Gulf War, or through peace initiatives or economic development programs.

Second, collective goods problems are endemic to such a cost-sharing. World oil prices affect those who contribute to stable Middle East exports and those who do not contribute. For example, Telhami and O'Hanlon (1995) argue that the United States carries far too great a burden for maintaining military security in the Gulf region, relative to European states. A dramatic event such as the Gulf War may mobilize the political will to allocate costs among allies on a one-time basis, but doing so on an ongoing basis is far more difficult. A dilemma for the industrialized regions results, because the value of stable access to Middle Eastern oil is greater than (any reasonable estimate of) the costs of providing such stability—if only those costs could be shared to everyone's satisfaction. Presently, there is no mechanism for doing so (other than a series of phone calls from President Bush on a one-shot basis).

Looking to the longer-term future, the idea of an equilibrium price of oil suggests an evolving relationship between economic growth (GDP) and energy use. If, indeed, robust rates of consumption growth (with consequent increases in North-South energy dependence) cannot be sustained at stable low prices in future years, then a national strategy of energy conservation makes more sense than one of ongoing growth in per capita energy consumption in the industrialized West. (The latter approach dominated the U.S. national energy strategy developed in 1991.) The desirability of curtailing energy consumption growth in North America and (to a lesser extent) Europe and Japan/Pacific is reinforced by the problem of global warming, which is affected in the long run by global rates of energy consumption (see Wald, 1992). Certainly the indefinite continuation of the past growth rates of world energy use, from less than three billion MTCE in 1950 to around twelve billion now, would be problematical. Conservation, then, would seem to continue to be the most promising avenue for national energy strategies in North America (especially) as well as Western Europe and Japan/Pacific (see Cherfas [1991] on new energy conservation technologies). Brown, Flavin, and Postel (1991:35–47) suggest energy efficiency measures as a central pillar of global efforts for environmentally sustainable development. This conclusion is consistent with the Ford Foundation's (1974) call for zero energy growth but continued economic growth, at a time when we were at roughly the same point in the "cobweb" as we are now (see also OECD, 1974).

Energy conservation is, of course, closely connected with energy prices, which in turn are connected with overall economic growth. As we have seen, oil price increases in the short term dampen GDP growth. But over the long term a different outlook emerges: GDP growth can continue without growth in energy consumption. This is due to the rising energy efficiency in the industrialized West. Indeed, over the period from 1970 to 1992 North America increased its per capita GDP by 40 percent, while increasing its per capita energy consumption by only 1 percent. As new technologies continue to develop, as "silicon" replaces "steel" in the post-industrial economies, and as long-lived capital turns over, energy efficiency is likely to continue to increase and GDP growth without energy growth should be sustainable in the industrialized West. (The global South will face greater problems, however, in industrializing along energy-efficient lines.) From this perspective, it is not high energy prices per se, but the short-term fluctuations in energy prices, that most damage stable economic growth. Indeed, somewhat higher prices that provided greater price stability might be optimal.

Stable and somewhat higher world energy prices might emerge in any of several ways, all related to politics; but all are problematical. First, OPEC or some enlarged international arrangement could control production to achieve target prices well above the current price levels. This seems unlikely, for the same reasons that have plagued OPEC for the last decade (see Moran [1987] on the theory and history of oligopoly in world oil; Clark [1990:352–5] on the breakdown of OPEC influence post-1979). Incidentally, even if production and price targets were met, the revenues generated by higher prices under this policy would flow only to producers. As we learned in the 1970s, it would be naive to think that this would bring about a sensible North-South income transfer for the benefit of developing countries.

Conversely, industrialized governments could extend the present use of taxes to raise energy prices while generating revenue. Here the revenues would go to the governments of the industrialized countries, perhaps helping sustain stable economic growth in those countries (but again doing nothing for poor countries in the South). This strategy would be especially appropriate in North America as the least efficient of the Western regions and the one with the lowest energy taxes by far (and even more appropriate in Russia/Eastern Europe). However, past proposals for sharply higher energy taxes in the United States, such as President Clinton's of 1993, have failed to generate sufficient political support to overcome the evident short-term economic benefits (to individuals, companies, and society) of low energy prices.

Presumably, international coordination of energy taxation and price policies would also contribute to stability. However, such coordination is also politically problematical. For example, one obvious proposal to achieve price stability would be for Western governments to put variable tariffs on imported oil, rising when world prices were low and falling when prices were higher. Such a tax policy is proposed, for example, by MacNeill, Winsemius, and Yakushiji (1991:38) as part of a package of "environmental taxes." But as Lynch (1987) points out, such a system would signal to oil-exporting countries what price the West would ultimately pay, inviting the exporters to raise prices, drive down the tariffs, and pocket the price gains themselves. So fixed tariffs, such as on imported oil, or more generalized energy taxes such as the BTU tax, would seem more promising.

An international energy regime of producers and consumers is another possibility. Target prices could be maintained, and revenues thus generated could be split in some manner between producers, industrialized consumers, and poor (consuming) Third World countries. But again, from a realistic political point of view, such a regime would be a daunting task for an international system that can barely manage its trade and monetary relations.

Nonetheless, the long-term benefits of stable and somewhat higher energy prices appear to be substantial: a transition from the past cyclical instability of world energy trade to a future stability in North-South energy relations with consequent stability in economic growth.

Despite the many political problems associated with managing the transitions in world energy trade over the past twenty years, many successes have been achieved. North America has already achieved—though with some cyclical instability—a general path of zero energy growth with positive economic growth. Western Europe and Japan have continued to increase energy efficiency, and Russia/Eastern Europe will surely develop a more energy-efficient economy in the post-collapse era than the musclebound Soviet economy that preceded the collapse and proved unsustainable. Dependence on Middle East energy exports is lower now than in 1973, contrary to a popular view at the time of the Gulf War that the West had become ever more dependent on Middle East oil.

The energy shocks of 1973–1990 created waves that rippled through the world system, and in some ways jolted the system away from equilibrium. But the system adapted rather quickly and efficiently, when viewed from a global perspective. What is unclear now is whether the waves are dying down as the world system settles into a new stable path, or whether dysfunctional dynamics in the system (as in the conflict of political and economic objectives, or of long- and short-term benefits) will lead to a continuing series of painful shocks and adjustments in the coming years.

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