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THE AFTERMATH OF THE 1986 OIL PRICE CRASH: GROWING TRADE FRICTION

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The dramatic fall in the price of crude oil in the winter of 1985–86 resulted in relatively large "windfalls" for the United States and Japanese economies. While the size of the windfalls are roughly the same in both the U.S. and Japan, the differences in the economic structures of the two countries suggest that the distribution of this newly disposable income will not be the same.

Energy prices in the United States appear to move quickly to reflect changes in oil costs, thus the windfall due to lower crude oil prices will likely be passed on to final consumers. In Japan, energy prices appear to be somewhat *sticky*, and a portion of the windfall will be retained by the refining and electricity generating industries in the form of higher profits.

Higher disposable income in the hands of U.S. consumers is likely to result in larger imports and a worsening trade balance. Higher profits for Japanese firms are likely to be funneled into the financial sector and provide for an increase in the supply of loanable funds. Some portion of this increase in the domestic supply of funds will be invested overseas, thus increasing the flow of capital that helps maintain the bilateral trade imbalance between Japan and the United States.

Introduction

The winter of 1985–1986 brought a dramatic collapse in the price of crude oil. In the United States, prices for a barrel of oil fell from a bit under $27 to less than $15 by March. Accounting for inflation – in real terms – the recent plunge in the price of a barrel of oil has substantially erased the price increases of the two oil shocks of the 1970s. For oil importing countries such as Japan and the United States, lower oil prices mean an increased capacity to consume non-oil goods and services; a *windfall* of newly disposable wealth. In Japan, this windfall resulting from lower, dollar-denominated oil prices has been heightened by an equally dramatic surge in the value of the yen, reducing the costs of importing all goods.

Lower oil prices bring less inflation and higher rates of real economic activity – more employment and production. But there are problems as well, especially in the United States. Some of these problems have been well publicized; increased unemployment in the oil producing regions of Texas and Oklahoma, reduced orders for steel mills servicing the oil sector, and increased risks for banks which had been lending to these sectors.

An additional problem is likely to surface in international relations: the fall in

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oil prices is aggravating the unhealthy *symbiosis* developing between the economies of Japan and the United States. Both the trade imbalance and the associated capital flows between Japan and the United States are likely to grow as a result of the newly found windfall wealth that flows through both countries. In part, the reason for this is that the newly disposable wealth will flow in different channels in the two countries. In the United States, lower crude oil prices will quickly be transformed into higher discretionary income for consumers and likely higher spending on imported consumer goods. In Japan, the windfalls from lower oil prices and a higher yen will result in larger investment portfolios, which, finding their way to the United States, will support a higher level of trade imbalance.

The massive capital flows from Japan to the United States form one part of what we will refer to as an unhealthy symbiosis between the two economies. In the paper below the basic structure of this flow will be sketched out. In the next section the more obvious and better publicized trade balance will be discussed. The recent oil price crash forms the center piece of our argument and an examination of this phenomenon will be provided in the next section. The impact of the oil price fall on the bilateral trade between Japan and the United States can be discussed from a number of different standpoints. The first we touch on is from an *aggregate* modeling approach. Next, by examining the determination of retail energy prices in both the United States and Japan, we can examine in more detail the channels by which the new wealth will flow through the two economies.

The Unhealthy Symbiosis

By an unhealthy symbiosis we mean that institutions in both Japan and the United States reinforce behavior that leads over time to lower standards of living and increased risks of structural failure. The problems are more apparent in the United States, where increased borrowing from foreign sources for nonproductive consumption item purchases means simply that Americans are, as a whole, living beyond their means. By constrast, the Japanese people are, as a result of artificially maintained high prices, living poorer than need be.

Moreover, the system is not stable: the continuing trade imbalance leads to social and political pressure for change. Any short-term resolution of this disequilibrium, through protectionist legislation in the United States, or speculative attacks on the dollar, would have extremely severe reprecussions for the Japanese economy.

The U.S. as a Debtor Nation

According to official statistics, the United States has become a net debtor for the first time since World War I.[1)]

The United States is increasingly becoming a debtor nation. The appetite for borrowed funds has clearly increased during the 1980s. Recently the level of total debt (excluding the debts of financial institutions) has been increasing at roughly twice the rate of growth of nominal GNP.[2)]

Much of the increase in U.S. indebtedness has come with the expansion of borrowing by the federal government. U.S. government debt has increased sharply from the period of time of the second oil shock to the present. Estimates for 1986

show that the total governmental deficit (federal, state, and local) has been absorbing 3.8 percent of GNP, up from about 1 percent during 1980 and 1981.[3] The current political climate in the United States holds no promise that there will be any sharp reduction in the government's need to borrow.

Although much attention is rightfully focused on the borrowing by the federal government. American consumers have also played a major role in shaping the U.S. debt picture. During the last few years, U.S. households have generally been increasing their indebtedness with respect to assets or income. Because this has been a period in which both income and assets have been growing, increasing debt to income ratios and decreasing assets to debt ratios testify to a heightened use of debt.[4]

But although there has been increased demands for loanable funds from both the private and public sectors, the provision of funds has not kept pace. With domestic sources slender, foreign sources of loanable funds have filled the gap between domestic supply and demand. In the first half of 1986, foreign sources provided 15 to 16 percent of the domestic need for funds. (See Table 1.)

Table 1 U.S. Loanable Funds Demand Satisfied by Foreign Sources

Year	Demand	Supply	Ratio
	($ billion)		(%)
1983	630.9	33.5	5.3
1984	763.6	90.7	11.9
1985	797.4	115.2	14.4
1986-Q1	839.9	128.6	15.3
1986-Q2	861.7	137.7	16.0

Notes: Demand for loanable funds is the sum of government borrowing (both federal and state and local) and gross private domestic investment. Supply is the net foreign supply of funds. FRB, Federal Reserve Bulletin, Oct. 1986, p. A52.

Japan as a Creditor Nation

In contrast to the United States, the Japanese have what is becoming an international embarrassment of riches with respect to loanable funds. The most significant element in Japan's credit picture is the high level of household savings. Although the savings rate appears to be secularly declining since the mid-1970s, household savings in Japan appeared to be a bit over 18 percent of disposable income in 1984.[5] This was considerably more than two times times the figure for the United States and probably 50 percent greater than that found in comparable OECD nations.

Table 2 Japanese Long-Term Credit Flows

Year	Total ($ billion)	to U.S.
1979	12.98	
1980	−2.32	
1981	9.67	
1982	14.97	
1983	17.70	
1984	49.65	14.81
1985	64.54	33.16
1986-Q1	75.96	
1986-Q2	116.60	

Notes: Capital flow data from (Japan) Ministry of Finance, Monthly Finance Review, October 1986. Negative values indicate capital in-flow. Estimates of capital flows to the U.S. provided to the author by the Bank of America (San Francisco).

The position of Japan as an international creditor is reflected in Table 2 which provides a picture of long-term credit flows from Japan. We should note that the evolution of Japan's position as a net creditor is remarkably swift: moving, as it did, from a position of capital inflow during the second oil shock to exporting nearly 4 percent of GNP during 1986–Q1 and surely more in the second quarter.[6)]

Table 3 Composition of Net Long-Term Credit Flows from Japan

Year	Direct Investment	Trade Credits & Loans ($ billion)	Securities Purchases
1980	2.1	3.5	−8.2
1981	4.7	8.0	−6.3
1982	4.1	11.3	2.2
1983	3.2	11.0	7.5
1984	6.0	16.9	31.0
1985	5.8	13.3	55.9

Notes: Ministry of Finance, Financial Statistics of Japan Fiscal Year 1986, October 1986, p. 58. Net figures are assets minus liabilities.

Long-term capital flows have several main components: direct investment, trade credits, loans, and purchases of securities. (See Table 3.) Direct investment expenditures have been steadily rising since the second oil shock with investments in the

United States taking the *lion's* share of the money. In fiscal 1985, Japanese investment in the United States had absorbed approximately 44 percent of all overseas investment reported to and approved by the Ministry of Finance. This is considerably larger than the 33 percent share in 1984 and well above the postwar historical share of approximately 30 percent.[7)]

Japanese direct foreign investment in the United States stems from a number of factors. Many of which will be part of the economic scene for a number of years. Not the least of these is protectionism. For example, the inter-governmental agreement to limit sales of Japanese-made cars in the United States has spurred Japanese auto manufacturers to invest in overseas assembly and production facilities[8)]

Most recently, the drastic revaluation of the yen with respect to the dollar has accelerated Japanese investment in the United States.[9)] The yen revaluation affects the decision to invest in the United States in a number of different ways. Not the least of which is that the absolute level of wages in the two countries has moved closer together; erasing much of the previous cost advantage held by Japanese firms. Further, the present value of the dollar reduces the costs of buying existing facilities in the United States, as well as lowering the construction costs of new facilities. Finally, a point we will expand on below, the revaluation of the yen (and the decline in the price of crude oil) has increased corporate profits.[10)]

Recently, the most important component of long-term capital flows has been the purchase of securities. These purchases have risen to nearly $56 billion in 1985 or more than 4 percent of Japanese GNP. By the middle of 1986, net acquisitions of foreign stocks and bonds were running at an annual rate of over $100 billion. Overwhelmingly, these purchases were of bonds and not corporate equities.[11)] A very large portion of these purchases were of U.S. Treasury securities. In 1985, Japanese net purchases of securities accounted for over 80 percent of foreign purchases of U.S. treasury securities.[12)]

The Trade Imbalance

The massive capital flows into the United States have helped maintain a complementary disparity in the flow of trade goods and services. The United States trade picture since 1982 shows a steady increase in the value of nearly all categories of imports: petroleum imports are the only exception.[13)] By contrast, total U.S. exports have shown either general stability or slight declines. As a result, the United States has been showing an increasing trade deficit. The bilateral trade figures show that the trade deficit with Japan accounts for about one-third of the overall deficit. (See Table 4.)

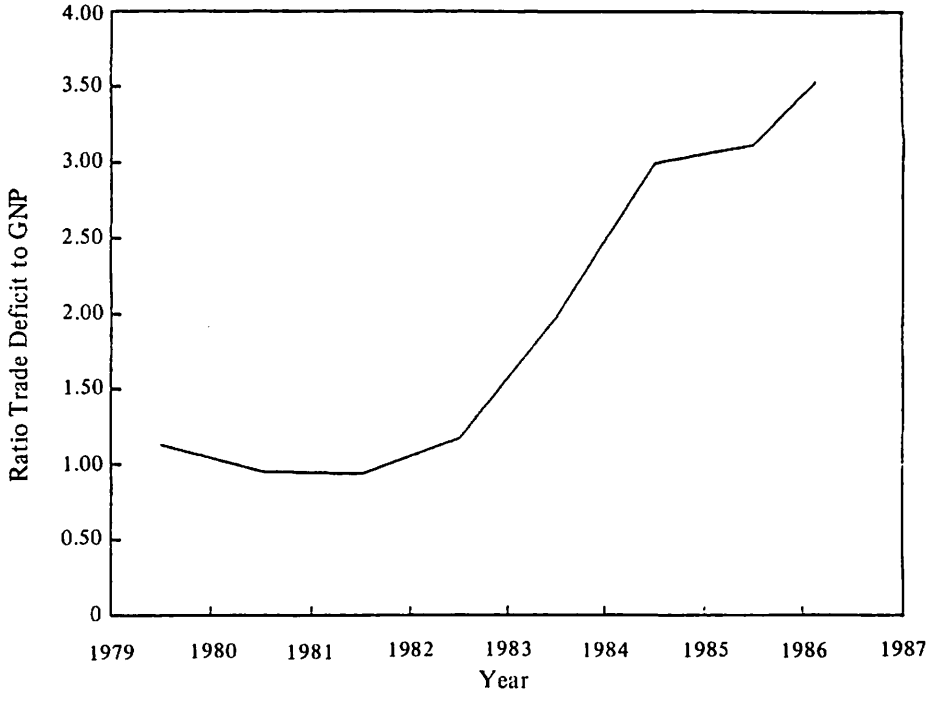
The importance of the bilateral trade with Japan is obvious from the series in Table 4. (By the same token, the U.S. is Japan's most important export market. In 1985, the United States was the target for more than one-third of Japan's external sales.[14)]) The extent of the trade deficit is easy to see; the ratio of the merchandise trade deficit to GNP, which had been falling after the second oil shock, rose abruptly after the 1981–1982 recession. (See Figure 1.)

Table 4 United States Current Account Balance

Year	Total	With Japan
	($ billion)	
1983	57.6	19.6
1984	107.9	37.0
1985	132.1	43.4
1986-Q1	156.9	
1986-Q2	145.3	

Notes: Overall trade balance (merchandise), FRB, Federal Reserve Bulletin, October 1986, p. A54. Bilateral trade figures from Keizai Koho Center (Japan Institute for Social and Economic Affairs), Japan 1986. p. 38.

Figure 1. U.S. Trade Deficit vs. GNP



Notes: Data 1979 to 1982, Keizai Koho Center, Japan 1986, pp. 12 and 49. Data 1983 to 1986-Q1 FRB, Federal Reserve Bulletin, Oct. 1986, pp. A51 and A53. Note that the definitions of the trade series used here may be slightly different than those used elsewhere.

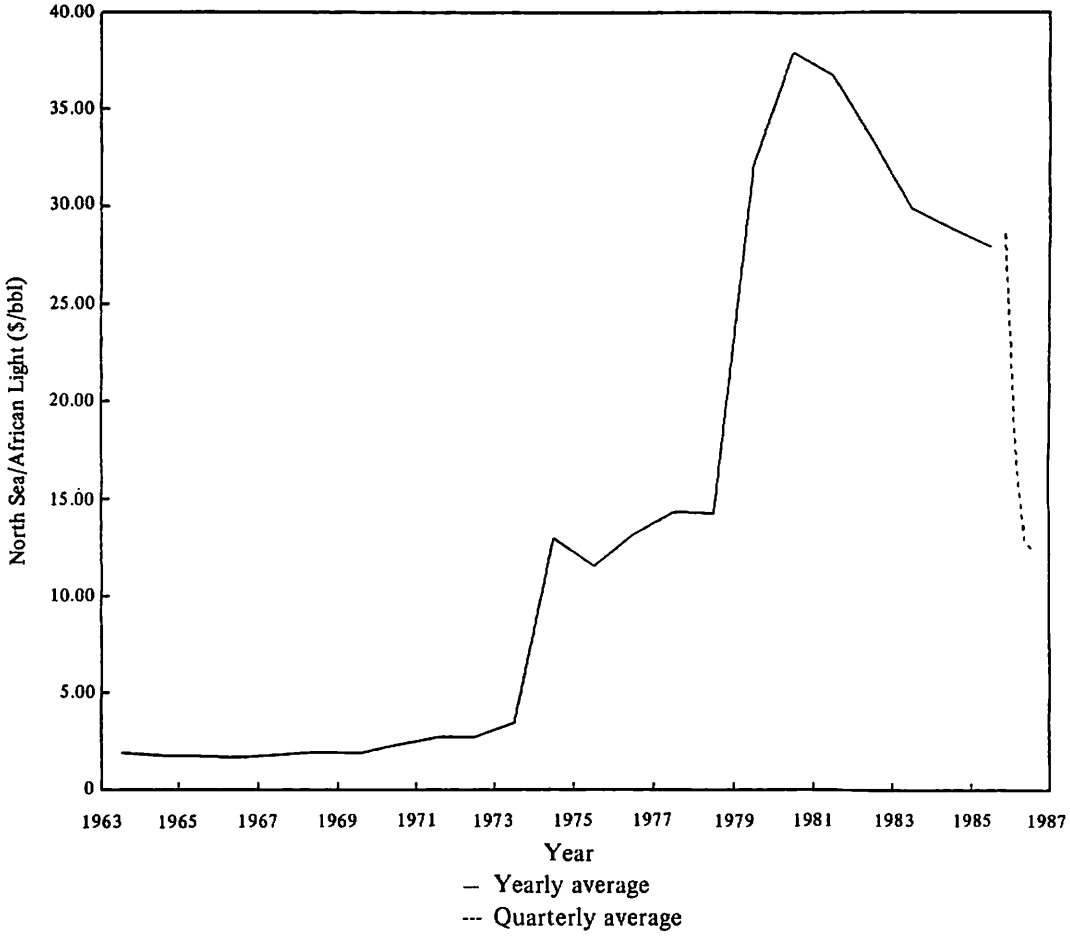
The massive trade deficits have resulted in a severe drag on the economy. Thus, although the U.S. economy has shown generally stronger growth than most other industrialized countries, the growing trade imbalance has resulted in a growing gap

between final sales and domestic production.[15] Measures of U.S. production and capacity utilization show less growth than the economy as a whole (measured for instance by final sales), reflecting markets lost to imports.[16]

The Oil Price Crash of 1985–1986

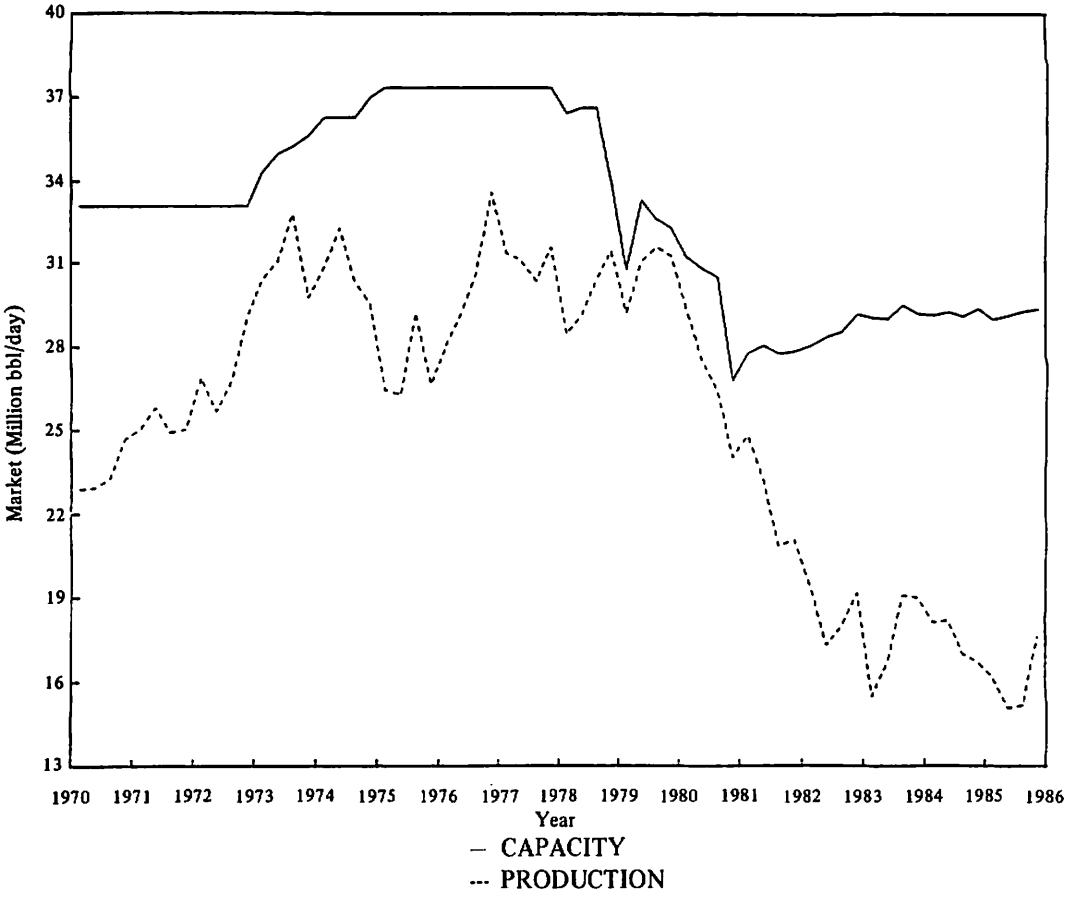
The figure below provides a stark picture of the change in the price of crude oil on the world market during the last two decades. (See Figure 2.) The two positive oil shocks of 1973–1974 and 1979–1980 came as dramatic interruptions to the otherwise smooth change in prices. Since the second oil shock prices have generally trended downward until the beginning of 1986.

Figure 2. Spot Price for Crude Oil



Notes: Annual Data, U.S. Department of Energy (DOE), Annual Energy Review 1985, (DOE/EIA-0384 (85)), p. 257. Generally North African crude oil pricings. Quarterly data, Petroleum Intelligence Weekly, Sept. 8, 1986 p. 4. 1986-Q3 value is the average of monthly reports for North Sea-Brent oil.

Figure 3. OPEC's Market



Source: See the author's 1986 paper "The Determination of Crude Oil Prices using Non-Constant Stochastic Processes," for an expanded discussion of the pricing of crude oil. (Green (1986b))

The next figure (Figure 3) shows that the two oil shocks have come during periods of time in which the market for crude oil has been in severe disequilibrium. This disequilibrium can be measured roughly by the difference between the oil producing capacity of the Organization of Petroleum Exporting Nations (OPEC) and the actual production by OPEC.[17)]

The recent fall in oil prices also was precipitated by growing disequilibrium, in this case growing excess capacity. It was an adjustment to actual market conditions. Although the price is not likely to remain fixed, especially with respect to the inflation in any particular nation, it is unlikely to soon return to 1979 levels. (This is barring any drastic political upheavals in the major crude oil exporting nations.) This being the case, we can ask the question. "What are the implications for Japanese-United States economic relations of this fall in the price of oil?"

Energy Prices and the United States and Japanese Economics

The magnitude of the oil shock can be seen in relation to the importance of oil

in the economies of the United States and Japan. In 1985, the United States imported an average of 3.0 million barrels per day of crude oil and a further 1.3 million barrels per day of refined petroleum products.[18] At $26 to $27 per barrel of crude oil this implies an import bill for 1985 in excess of $40 billion (crude oil costs of total oil imports). In the same year, Japanese imports of crude oil ran at about 3.4 million barrels per day at a similar cost. Making allowances for imports of refined petroleum products and natural gas, the imported oil and gas bill for Japan for 1985 was approximately $49 billion.[19]

For the United States, a cut in oil prices by 50 percent, to $13 per barrel, would reduce the crude oil-import bill by half, providing a windfall of about $20 billion. For Japan, the situation is roughly similar; the oil bill, denominated in U.S. dollars would fall by one half. If the reduction in crude oil prices were matched by a fall in the prices of imported refined products and a proportional fall in the price of imported natural gas, the Japanese windfall would amount to about $23 billion.

However, the yen cost of the Japanese oil and gas bill would fall even further. The yen cost of a $49 billion imported oil and gas bill was roughly ¥11.7 trillion (at ¥239 = $1). In 1986, the yen cost of a $25 billion imported oil and gas bill would be only ¥4.3 trillion (at ¥170 = $1). The Japanese oil and gas bill in 1986 could drop by 50 percent in dollar terms, but in yen terms in could drop closer to two-thirds.

For the United States, the oil import savings represents about 0.5 percent of estimated 1986 GNP. For Japan, the larger oil bill and smaller GNP means a bigger impact: the fall in oil prices could result in a windfall equivalent to more than one percent of estimated GNP in 1986. As a matter of perspective, we note that the oil windfalls represent roughly one-half of the U.S.-Japanese, bilateral trade imbalance.

Energy Prices and United States-Japanese Trade

In summary, the fall in oil prices is likely to mean increases in disposable income in both countries that are large in relation to the trade imbalance or the capital flows between the two nations. The impact on the trade imbalance or capital flows will depend on a large number of factors. However, even a simplistic analysis suggests that, as a result of the fall in crude oil prices, the bilateral trade imbalance will tend to grow. This is because the oil price decline can be considered an increase in income for both countries, and historically, such increases in income have meant that Japanese exports to the United States have expanded faster that imports.

Models of trade tend to use econometric equations that explain exports and imports as a function of variables such as real GNP and the prices of traded goods. For example, we can use the following equation to examine Japanese exports to the United States:

$$X = \alpha + \beta Y + \gamma P + e.$$

Here, X represents the real level of exports from Japan to the United States, Y is real U.S. GNP, P is the dollar value of the unit price of all Japanese exports, adjusted for U.S. inflation, and e represents the random component unavoidably present in any econometric relation. The terms α, β, and γ are the constants whose values we seek to find through econometric techniques.

In this type of model we are tacitly making a large number of assumptions. We are assuming that exports are *homogeneous* goods; that we do not have to use more disaggregated sectoral data.[20] In addition, we are assuming that the structure of the model is unchanged over the period of time used; that the historical data is useful as a guide to the present or to future circumstances. By estimating the equation by itself, and not as part of a system of equations, we are implicitly assuming that the explanatory variables on the right-hand side of the equation are not themselves dependent upon the level of exports.

Using quarterly data from 1964–Q1 to 1985–Q1 to fit an equation, ordinary least squares estimators can be found.[21] These are displayed below. (Note that all data has been transformed to logarithmic form.)

$$X = \underset{(-48.4)}{-26.9} + \underset{(50.8)}{3.7Y} - \underset{(-8.7)}{1.0P}.$$

$R^2 adjusted = .97$, *Durbin-Watson statistic* $= .96$.

Since the above variables are all in log terms, the coefficients can be interpreted as long-run elasticities. Thus the model suggests that a one percent rise in import prices (either through exchange rate changes or changes in Japanese sales' prices) would decrease exports to the U.S. by one percent. But a one percent rise in the U.S. GNP would increase imports by 3.7 percent.

This powerful "kick" to Japanese exports from a growing United States economy is reflected in many econometric models of trade. By the same token, of course, studies suggest that a growing Japanese economy will increase U.S. exports to Japan. However, in general, U.S. exports to Japan are found to be less sensitive to changes in Japanese income than are changes in Japanese exports to the U.S. as a result of growth in the U.S. economy. Vincent Reinhart concludes:

> On the basis of the estimated model, U.S. imports from Japan are almost three times as sensitive to income as U.S. exports to Japan. This differential sensitivity to income implies that Japan's real income must grow at nearly three times the U.S. rate to maintain balanced increases in export and import volume ... .[22]

Reinhart's study allows us to estimate the simple impact on the trade imbalance from an increase in disposable income due to a fall in the oil import bill. We make the following assumptions:

> 1. The change in the oil import bill results in a change in real income of comparable magnitude. Real income in the U.S. grows 0.5 percent, in Japan, 1.2 percent.
> 2. The prices of traded goods are not affected, including the exchange rate. (Thus we are considering only the wealth or income effects of the recent changes.)
> 3. The elasticity of imports from Japan to the U.S. with respect to a change in real U.S. income is 3.2 percent. In Japan, the comparable elasticity is 1.2 percent.[23]

Under these assumptions, exports to the U.S. from Japan would grow slightly faster (1.6 percent) than exports from the U.S. to Japan (1.4 percent). Since exports to the U.S. from Japan are nearly twice as large as the reverse flow, this would increase the trade gap by about two-thirds of a billion dollars. This figure is relatively small by international trade standards, however, we argue below that this estimate, based on simple econometric evidence, is likely to be an underestimate.

The estimate above is likely to be an underestimate of the impact of the oil price fall on trade and credit flows between Japan and the United States due to the particular channels through which the windfalls flow. In the United States, much of the increased income flows directly to consumers who appear to have a high propersity to purchase imported consumer goods, many of which will be produced in Japan. The windfall from declining oil prices in Japan will, however, flow into corporate profits, much of which will be invested in the United States.

The Channels of Flow (I): Gasoline Prices

A decline in crude oil prices creates a windfall of more than $20 billion in both the United States and Japan. Who will receive this windfall? What is the distribution of this income? One factor in determining this question is the degree to which refined petroleum product prices change to reflect the now lower price of crude oil.

The relationship between the prices of refined petroleum products such as gasoline and heating fuel, and the price of crude oil is very direct. The primary raw material in refinery operations is crude oil. While not strictly a one-to-one relationship (other crude materials such as natural gas are used), the rule-of-thumb that one barrel of refined petroleum required one barrel of crude oil is reasonable for our level of abstraction. In addition, the refining of crude oil is a very capital intensive industry. This means that the short-run, marginal costs are largely those of crude oil, not labor.

For these reasons, we often think of the pricing of refined petroleum products as a mark-up over the cost of crude.

$$P^{refined\ products} = P^{crude\ oil} + F(X).$$

Here, the mark-up (F) can usefully be thought of as a function of other variables (X). One of these variables could even be the costs of crude oil. This is because changes in the price of crude often act as important signals for the future course of demand or supply factors – crude oil price changes can act as proxies for expectations of changes in the market.

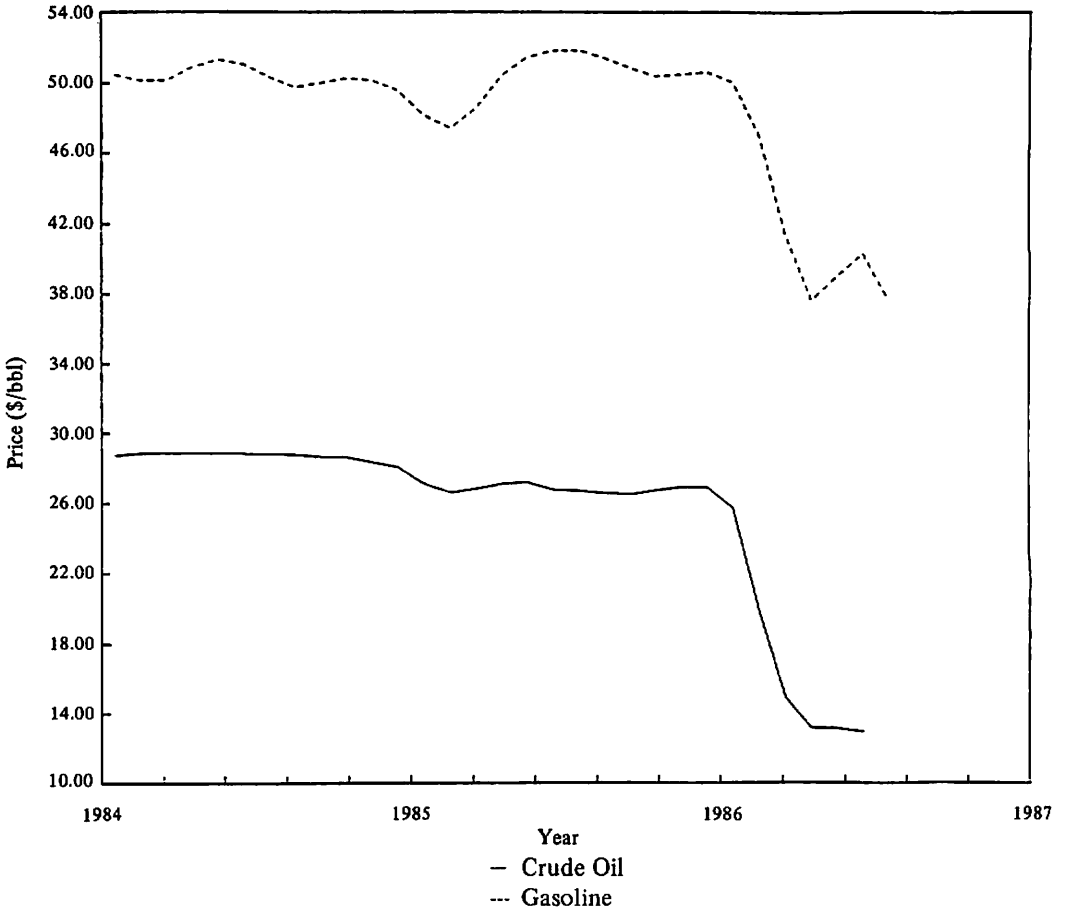
Other arguments in the mark-up equation for refined petroleum prices would be government taxes. This is an especially important factor for gasoline, particularly in Japan, where average gasoline taxes were 41 percent of the retail price in 1986–Q2. This compares with an average of over 50 percent in most other industrialized nations and 29 percent in the United States.[24)]

In the United States, for products such as residual fuel oil, the price of imported fuel oil is very important. An earlier study suggested that the mark-up of residual fuel in the United States was very sensitive to the corresponding mark-up in price for imported, European-priced residual fuel oil. Any change in the mark-up would be matched, within one or two quarters, by a change in the mark-up of domestically produced fuel (See the author's paper on residual fuel oil, Green (1986a).) In Japan, the importing of refined products has been severely controlled and the prices of domestic products are likely to be very insensitive to changes in foreign pricing patterns.[25)]

Of course, an over-riding concern in understanding the mark-up pricing of refined petroleum products is the market structure of the petroleum industry; the

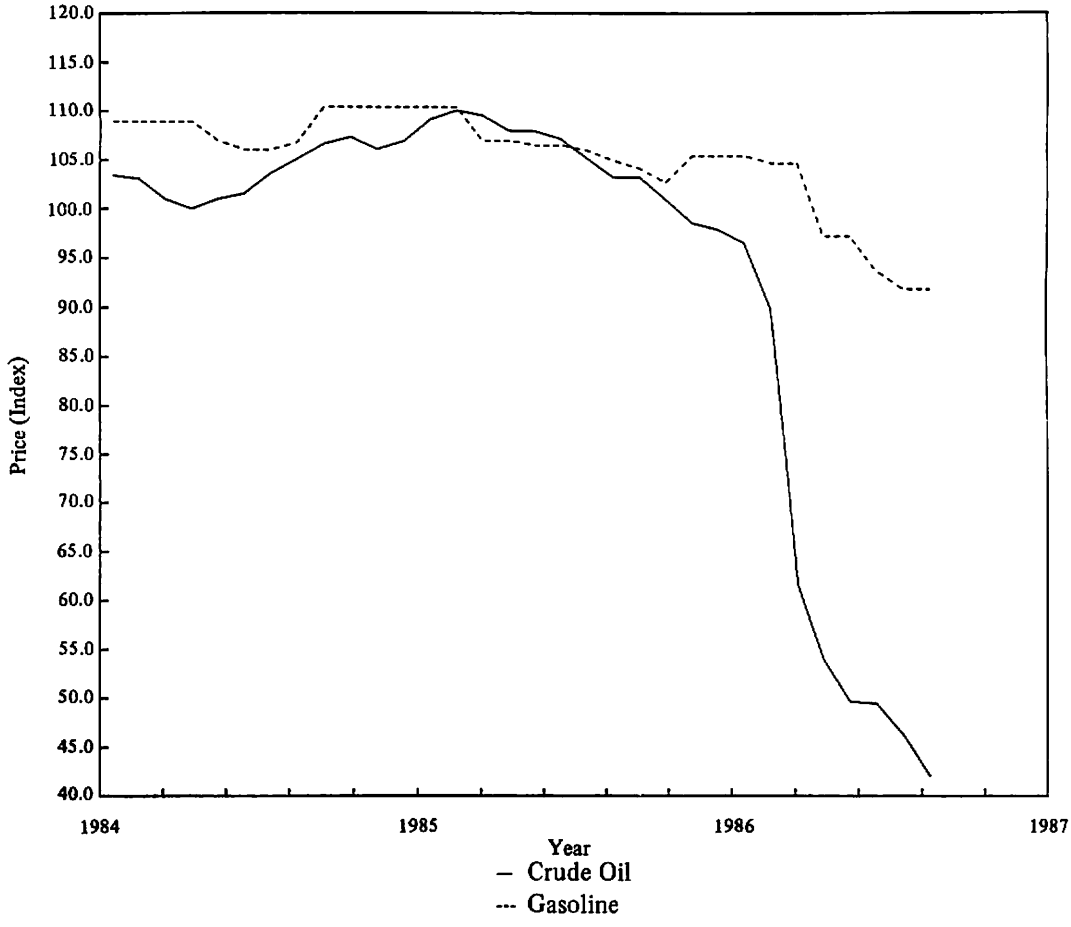
importing of crude and refined products, the refining of crude oil, and the distribution of products. At one extreme, a very competitive industry would determine prices in a manner that would be very responsive to changes in the underlying supply and demand variables. At the other extreme, an industry organized by an oligopoly might be very insensitive to changes in market conditions – preferring a price stability that aids in the control of the market to a more efficient, competitive pricing behavior. (See the discussion in Green (1986b) for an elaboration of this issue as it relates to the determination of crude oil prices in the world oil market.)

Figure 4. U.S. Crude Oil and Gasoline Prices



Notes: Crude oil prices are refiners acquisition costs. Gasoline prices are retail. DOE Monthly Energy Review, June 1986.

Figure 5. Japanese Crude Oil and Gasoline Prices



Notes: Crude oil prices are an index of imported goods prices. Gasoline prices are from a wholesale price index. Bank of Japan. Price Indexes Monthly, various issues.

The two figures (Figures 4 and 5) illustrate the recent charges in both crude and gasoline prices in the United States and in Japan. In both countries, the measures of crude oil prices show sharp and decisive declines during the winter of 1985–1986. In the United States, the price of gasoline shows a corresponding fall. But in Japan, the price of gasoline held steady through March, falling only slowly during the summer.

By August, on a yen per kiloliter basis, the price of gasoline in Japan had dropped enough so that the major portion of the decline in the yen-based crude costs had been passed on at the wholesale level. However, the response of the Japanese gasoline prices appears to be a full quarter or so slower than in the United States. Thus, at least one-quarter of the windfall gains in the importing of crude oil for the refining of gasoline (during the past year) appear to have been captured by the refining industry. By contrast, the decline in crude oil costs appears to have been quickly passed on to consumers of gasoline in the United States.[26)]

The apparent "stickiness" of gasoline prices is evident in the recent increase in profits for petroleum refining and distributing companies. Reported profits are, of

course, a very tricky variable to use in economic analysis: tax laws and accounting conventions utilize concepts that differ substantially from those we would like to have for economic market analysis. However, if we look at the figures for 10 firms reporting profits for the year ending March 31, 1986, we see profits of ¥30.4 billion against losses of ¥57.0 million during the comparable pervious 12 month period.[27]

In summary, in the United States, lower crude oil prices were translated into lower gasoline prices and higher disposable income for consumers. Much of this income is likely to be spent on more imported goods from Japan.[28] In Japan, the "stickiness" of gasoline prices resulted in increased profits for refiners. Especially in the short-run, these profits are likely to be channeled to the financial sector in the form of an increased supply of loanable funds – fueling the capital flows that sustain the trade imbalance.

The Channels of Flow (II): Electricity Pricing

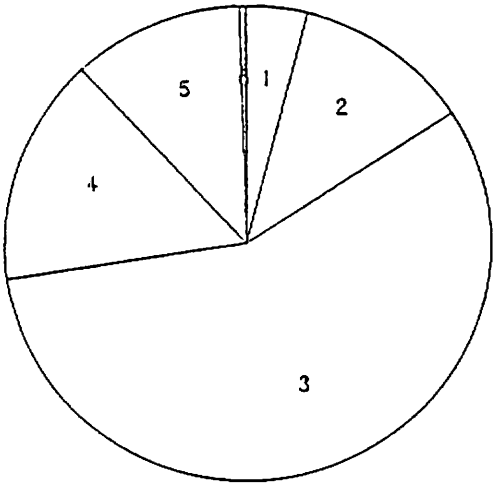
The proceeding discussion has concentrated on the impact of the change in crude oil prices on the price of refined product prices. Implied in the analysis was that the changes in crude prices could either be passed on to consumers, in the form of lower product prices, or held by producers in the form of higher mark-ups (and profits). Consumers, as a class, are not homogeneous. They include households, buying fuel for heating and cooking, and gasoline for transportation. Industrial firms are also large purchasers of oil products, using them for heating and transportation, and as a direct input into many manufacturing processes. Finally, electric utility companies purchase large quantities of petroleum.

As a specific class of consumers, electric utility companies are interesting because of the extreme differences between government policy in Japan and in the United States. We will see that, in the United States, government policy has been for electricity prices to change quickly to reflect any change in fuel costs – the recent crude oil price decline will be passed on to electricity consumers. In Japan, an explicit decision on the distribution of the oil and yen windfall has been made by the Ministry of International Trade and Industry (MITI), in consultation with the nation's utilities. This decision will likely result in less than two-thirds of the expected windfall being passed on to final purchasers of electricity.

As a fuel for electricity generation, oil is much more crucial to Japan than to the United States. The *pie* charts (Figure 6) shows that, in the United States, petroleum is little used to generate electricity: coal is much more important. The comparison with 1978 shows that, following the second oil shock, petroleum has been used less. This was in line with the expectation that oil would be the most expensive fuel. By 1985, electric utilities accounted for only about 3 percent of all domestic oil consumption.[29] The most commonly used petroleum fuel was *residual* or heavy fuel oil. By contrast, Japan relies considerably on petroleum. Consumption by the nine major private utilities in Japan accounted for about 17 percent of total national consumption in 1985.[30] As in the United States, the most commonly utilized petroleum product is heavy fuel oil (type C) although significant amounts of crude oil are also burned as fuel.

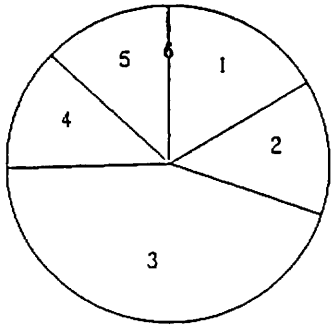
Although oil itself plays only a minor role as a fuel for generating electricity in the United States, the price of crude oil has a disproportionate impact on the total

Figures 6a-6c: Electricity Generation by Fuel Type



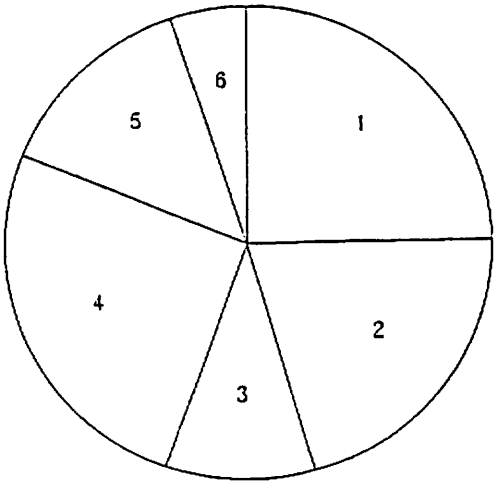
1	Petroleum	4%
2	Natural Gas	12
3	Coal	57
4	Nuclear	16
5	Hydro	11
6	Other	0

Fig. 6a. United States, 1985



1	Petroleum	17%
2	Natural Gas	14
3	Coal	44
4	Nuclear	13
5	Hydro	13
6	Other	0

Fig. 6b. United States, 1978



1	Petroleum	25%
2	Natural Gas/LNG	21
3	Coal	10
4	Nuclear	26
5	Hydo	14
6	Other	5

Fig. 6c. Japan, 1985

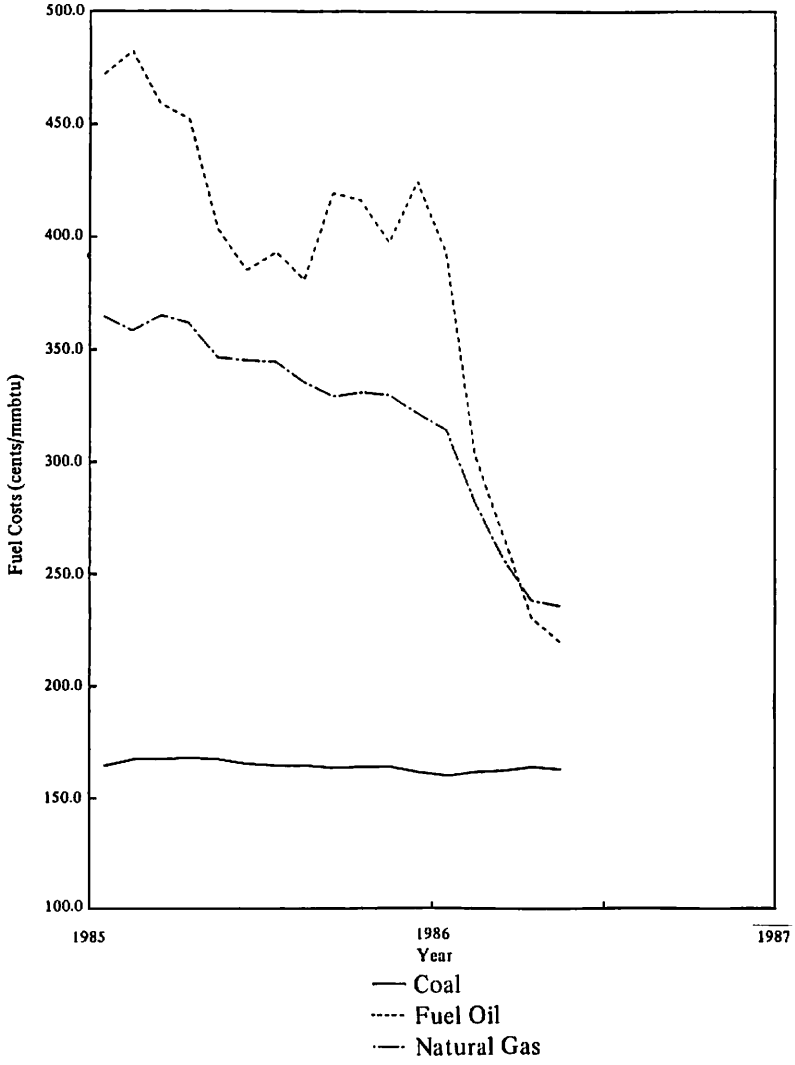
Notes: Data for U.S., DOE, Monthly Energy Review, June 1986. Data for Japan, Japan Petroleum & Energy Weekly, April 14, 1986.

fuel costs for a utility company. First, because the price of residual fuel oil in the United States reacts quickly and fully to changes in crude oil prices. As before, we look at the price of "resid" as a mark-up ($F(X)$) over the cost of crude oil:

$$P^{resid} = P^{crude\ oil} + F(X).$$

The mark-up, during the 1970s was small (often negative) in relation to the price of crude oil, so the market price of "resid" responded quickly to changes in the price of crude oil. (Even the mark-up, which reflects a complex variety of market conditions, responds within one or two quarters to changes in the price of crude oil or to competitive pressures from imported residual fuel oil. See Green (1986a).)

Figure 7. United States Fossil Fuel Costs



Notes: U.S. Department of Energy (DOE), Monthly Energy Review, June 1986.

Figure 7 shows the change in fossil fuel prices paid by electric utility companies during the recent period in the United States. The sharp decline in residual fuel oil prices clearly reflects the decline in crude oil prices. By May 1986, residual fuel oil prices had fallen roughly 89 percent of the per barrel drop in crude oil prices.

More importantly, the price of crude oil has a disproportionate impact on the total fuel bill of an electric company because other fuel prices often move in sympathy with oil prices. This is particularly true with respect to natural gas. The delivered price of natural gas to electric utilities will generally change, with a lag, to maintain its market share with respect to oil. (See the author's discussion of the United States natural gas markets. Green (1984).) Coal prices too, will likely react to lower oil prices, but here the competition is more limited.

Thus changes in the price of crude oil can have a large impact on total fuel costs. Moreover, in the United States, these declining fuel costs will be passed on rather completely to the consumer of electricity. This is due to the institutional framework for determining the price of electricity in the United States.

In the United States, electric companies are considered public utilities. Their price, conditions of service, and profits are regulated by a government body. Typically, regulation is carried out by a state government agency called a public service commission (PSC). Of course, the actions of any particular PSC will vary between states depending on the laws and political climate. However, with respect to the pricing of electricity, the vast majority of states use *fuel adjustment clauses.*[31)]

Fuel adjustment clauses, in essence, divide the price of electricity into two parts:

$$P^{electricity} = P^{base} + (Cost\ of\ Fuel).$$

The first part is the base price, reflecting the utility companies need for revenue to recover capital investment and to pay the wage bill. This base is typically changed only after a formal public hearing before the PSC. These hearings can be contentious, costly, and time consuming. The second part of the regulated price of electricity is simply the sum of the bills for the various fossil fuels; coal, natural gas, and oil. Typically, at the end of every month, consumer bills are calculated with the actual fuel costs entered into the price.

By automatically adjusting electricity prices to reflect contemporary changes in fuel costs, the utility companies bear none of the risks resulting from sudden changes in the price of fuels. Fuel adjustment clauses became popular in the 1970s when rapid and unpredictable increases in oil or natural gas prices were common. In the absence of fuel adjustment clauses, utility companies often had to wait for the outcome of lengthy and infrequent formal hearings from the PSC's to readjust their prices to reflect changing fuel costs.

In summary, the institutional structure of decision-making in the United States insures that changes in the costs of fuels will be rapidly passed on to consumers of electricity in the form of lower electricity prices.

In Japan, we will find, as in the United States, that changes in the price of crude oil will be *translated* into lower fuel oil prices; albeit somewhat more slowly. However, we will see that the impact of lower fuel prices on final electricity prices is considerably different in Japan than in the United States. As a result, a substantial part of the crude oil price and "stronger-yen" windfall will be retained by the electricity utilities and not passed on to consumers.

Table 5: Fuel Oil and Crude Oil Prices in Japan

Year	Fuel Oil	Crude Oil (¥/kiloliter)	Mark-up
1985-Q4	49,900	36,050	13,850
1986-Q1	44,550	31,407	13,143
1986-Q2	34,050	15,060	18,990
1986-Q3	19,550	11,136	8,414

Notes: Generally, Japan Petroleum & Energy Weekly, Monthly Price Report, various issues, esp. Sept. 1986, p. 2. 1986-Q3 figure for crude oil is July-August data.

Concerning the prices of fuel oil, the next table (Table 5) provides a picture of the relationships between fuel oil and crude oil prices. We note that the mark-up between fuel oil and crude oil jumped sharply in the second quarter of 1986 as the price of crude oil fell further and faster than the price of fuel oil. However, by the third quarter, the price of fuel oil had fallen so that the mark-up over crude oil had actually declined in nominal terms.

The nature of price determination in the heavy fuel market in Japan appears, currently, to ensure that changes in crude oil prices will be rather fully accomodated in heavy fuel oil prices. This is because, unlike the United States where residual fuel oil prices are established in an open if imperfectly competitive market, the price of heavy fuel in Japan is determined by *negotiations*. These negotiations are conducted between representatives of the consuming industries (particularly the nine major electric utility companies) and representatives of the refining industry.[32] The most recent agreement reafirmed that crude oil costs were to be the basis of the calculation for the price of heavy fuel delivered to large users. Thus as crude oil prices fall, the electric utility industry can be expected to see significantly lower generating costs.

Table 6: Reduction in Electricity Generating Costs in Japan

Fuel	Consumption (million)	Price Decline	Mark-up (¥-billion)
Coal	12.0 tons	¥6,900-ton	82.8
Fuel Oil	17.0 kl	¥34,300-kl	583.1
Crude Oil	12.8 kl	¥31,000-kl	396.8
LNG	21.1 tons	¥33,800-ton	713.2
			1775.9

Notes: Consumption figures are those for fiscal year (fy) 1985.

For coal, crude oil, and liquified natural gas (LNG), the price declines are the changes from fy-1985, average import prices to the comparable average for July and August 1986. Japan Petroleum & Energy Weekly, Monthly Price Report (JPEW-MPR), various issues, and Japan Petroleum & Energy Weekly, April 14, 1986, p. 5.

Fuel oil price declines are changes from 1985-Q3 in the negotiated price for sales to utilities. JPEW-MPR, Sept. 1986, p. 2. To avoid the appearance of undue precision, the price decline estimates have been presented in "rounded" terms.

Falling oil prices and a stronger yen have meant that generating costs are substantially lower in 1986 than in 1985. Rough calculations suggest that these savings, at the end of the summer in 1986, are running in excess of ¥1,700 billion per year. The calculations are given in Table 6. Generally they use, for each of the primary four fossil fuels, the quantity consumed in 1985 and the price change from 1985 to 1986-Q3.

Estimates such as these include considerable uncertainty. The estimated volumes consumed for each fuel could be considerably different. For instance, the amount of fuel oil consumed by electric utility companies in Japan fell 17.6 percent in 1985 relative to the previous fiscal year, while the consumption of coal rose 13.1 percent.[33] On this note, our calculations are likely to be conservative since we would expect fuel companies to shift toward those fuels exhibiting the larger price declines. A shift in weight towards those fuels showing greater fuel price declines would inflate our estimate of decreased fuel costs.

However, the more crucial assumptions are those regarding the size of the estimated fuel price declines. By using prices as of 1986-Q3 as a base, we are implicitly assuming that prices will continue to decline as they have since the beginning of the fiscal year. We assume either that the yen continues to strengthen or that the dollar price of imported oil and gas continues to decline. While this assumption may be subject to argument, it will serve as an illustrative assumption for our purposes.[34]

Given our estimates of the fuel cost savings, what will be the part that is passed on to consumers? As of early winter 1986, it appears that ¥971.4 billion will be turned over to consumers in the form of lower electricity prices.[35] (Gas utility customers will be "refunded" an additional ¥114.5 billion.) This is considerably lower than our estimate of the fuel cost windfall. Thus it appears that about 45 percent of the estimated windfall will be retained by the utility companies. This figure of 45 percent is open to dispute, depending as it does on our calculations of the total windfall. However, it is clear that the process of decision-making concerning the price of electricity is such that a substantial part of the windfall of lower crude oil prices and a stronger yen will be retained by the electric utility companies.

The degree to which electricity prices will be lowered to reflect the reduced generating costs was determined by the Ministry of International Trade and Industry in consultation with utility companies. The plan approved by MITI estimated that the electric utility companies would benefit from a ¥1,340.2 billion windfall. This differs from our estimate above, in large part, due to MITI's assumption that the average price for oil would be $19 per barrel during 1986 (against a July-August figure of about $11 per barrel) and that the exchange rate would be ¥178 per dollar (against a July-August value more than 10 percent below this).[36]

MITI's plan then is based on the principle that somewhat under 30 percent of any windfall should be retained by the electric utility companies. Thus compared to the United States, a substantial portion of the crude oil price windfall will not be passed on to consumers in the form of higher disposable income. The substantial windfall retained by the electric utility companies is to be utilized for investment purposes. However, it seems likely that, especially in the short-run, large portions will be funneled to the financial sector serving to increase the supply of loanable funds in Japan. This could be accomplished either by a reduction in borrowing by these companies or by an increase in their financial assets.

Conclusions

This paper has examined the impact of the recent decline in crude oil prices and rise in the value of the yen, on the pattern of trade and capital flows between the United States and Japan. The two countries are experiencing a severe trade imbalance that is matched and sustained by massive capital flows from Japan to the United States. Lower oil prices in both countries, and a stronger yen in Japan, have meant lower imported energy costs. The savings —a *windfall* — imply higher standards of living in both Japan and the United States. However, because the income or wealth increase is roughly equal in both countries, the historical statistical relations imply that imports into the United States from Japan are likely to grow larger than the reverse flow. The simple analysis suggests that the oil price decline will hinder any reduction in the trade imbalance that is occurring due to the appreciation of the yen or government market-opening programs in Japan.

Further, the distribution of the windfall gains is very different in both countries. By examining both gasoline and electricity prices, we find that changes in oil prices, in the United States, are likely to be quickly and completely translated into lower retail energy prices. Lower retail energy prices probably mean increased disposable income for households and higher spending on imported goods. By contrast, in Japan, retail gasoline prices and electricity prices move slower to accomodate changes in crude oil prices. In the case of electricity prices, clear government policy exists to retain substantial portions of the windfall gains in the hands of the utility companies. The retention of these windfalls by the refining industry and the electric utilities is likely to mean an increase in the supply of loanable funds and an increased outflow of capital from Japan to the United States.

Notes

1) U.S. Federal Reserve Board (FRB), *Federal Reserve Bulletin*, May 1986, p. 294.
2) Federal Reserve Bank of Cleveland, *Economic Trends*, September 1986, p. 17.
3) Organization for Economic Co-operation and Development (OECD), *United States 1985*, Nov. 1985, p. 24.
4) "The rate of growth of household debt slowed each year from 1979 to 1982, but it has outpaced GNP growth each year since, surging to more than 14 percent in 1985 .... In addition, household debt growth exceeded that of disposable personal income over the past five years." FRB, *Federal Reserve Bulletin*, August 1986, p. 513.
   Periods of economic recovery tend to be times in which households increase their use of debt as employment, income, and consumer confidence tend to rise. However, consumer credit, borrowing on credit cards, has expanded much faster in recent years than during other comparable recoveries. See Federal Reserve Bank of Cleveland, *Economic Trends*, August 1986, p. 7.
5) Keizai Koho Center (Japan Institute for Social and Economic Affairs), *Japan 1986*, p. 87.
6) See Table 2 for capital flow figures for 1986-Q1 and Q2. The GNP estimate for 1986-Q1 is from the Ministry of Finance, *Monthly Finance Review*, October 1986. The GNP figure in yen is converted into dollars using the monthly values for the yen/dollar exchange rate, FRB, *Federal Reserve Bulletin*, June 1986, p. A68.
7) Ministry of Finance, *Financial Statistics of Japan Fiscal Year 1986*, October 1986, p. 73.

8) Federal Reserve Bank of Cleveland, *Economic Commentary*, "American Automobile Manufacturing: It's Turning Japanese," by Michael F. Bryan and Michael W. Dvorak, March 1, 1986.
9) *Asahi Evening News*, May 20 and 21, 1986.
10) "US prices are at bargain-basement levels for yen-rich Japanese corporations, and the wage gap has nearly closed between Japanese and US blue-collar workers" *Far Eastern Economic Review*, Sept. 4, 1986, p. 61. (Punctuation as in the original.)
11) Ministry of Finance, *Monthly Financial Review*, October 1986, p. 44.
12) FRB, *Federal Reserve Bulletin*, May 1986, p. 295.
13) Federal Reserve Bank of Cleveland, *Economic Trneds*, June 1986, p. 13.
14) Ministry of Finance, *Monthly Financial Review*, October 1986.
15) Federal Reserve Bank of Cleveland, *Economic Trends*, Sept. 1986, p. 3.
16) Federal Reserve Bank of Cleveland, *Economic Trends*, p. 4. Measures of industrial production have shown almost no growth since mid-1985. Capacity utilization figures have been trending downward since mid-1984.
17) See the author's 1986 paper for an expanded discussion of the pricing of crude oil. (Green (1986b))
18) (U.S.) Department of Energy, *Monthly Energy Review*, Jan. 1986, p. 37.
19) *Japan Petroleum and Energy Weekly*, April 14, 1986, p. 5.
20) For a very comprehensive, multi-sectoral study of the trade picture the reader is directed to Petri (1984). We should note that the emphasis in this paper on *bilateral* trade between Japan and the United States may be misleading. In particular, Japan's need for raw materials imports, especially fuels, from developing nations, means that a completely balanced trade between Japan and other industrialized nations is undesirable. (The author is indebted to Prof. Sasaki for this reminder.) Of course the level of trade surplus called for from this "triangular" trade is much smaller than currently existing between Japan and the United States.
21) Data on exports and the exchange rate is from Nihon Keizai Shimbum, Inc. Data on the U.S. economy, inflation rates and GNP is from the (U.S.) Council of Economic Advisors, *Economic Report of the President* and FRB. *Federal Reserve Bulletin.*
22) Reinhart, Vincent, "Macroeconomic Influences on the U.S.-Japan Trade Imbalance," Federal Reserve Bank of New York, *Quarterly Review*, Spring 1986, p. 9.
23) Reinhart, Vincent, op. cit., p. 8.
24) *The Economist*, August 30, 1986, p. 52.
25) For a discussion of Japanese government policy towards petroleum imports, the reader is directed to the interesting story surrounding the attempt by Lions Petroleum, a small distributing firm, to import a small amount of gasoline.
Though not technically illegal, the shipment violated industry custom. The importing attempt was finally stopped by what would appear to American eyes as extra-legal financial pressure. (See the coverage by *The Japan Times*: during January 1985, especially on the 14th, p. 5; the editorial on the 18th; and on the 28th, p. 8.)
Recent changes in government policy will apparently allow for some imports of petroleum products but solely by petroleum refiners. (*Asahi Evening News*, Nov. 12, 1985, p. 3.)
26) We should note that calculations of this sort are subject to considerable uncertainty. One problem is that data on crude oil costs is not always reliable and different sources report inconsistent data. However, other estimates of the pass-through of the crude oil windfall appear to be lower than our estimates above. See for instance the (Japan) Economic Planning Agency calculations referred to in the *Asahi Evening News*, Oct. 15, 1986, p. 1. *The Economist* suggests that the fall in Japanese gasoline prices has been lower than in other major industrial countries. Concluding that this is part of an overall package by which the Japanese government subsidizes "its inefficient refining industry ... ." August 30, 1986, p. 52.
27) *Japan Petroleum and Energy Weekly*, June 2, 1986, pp. 2-3.

28) How exactly consumers will use their new found wealth is a tricky question. It will depend, among other things, on how consumers view the change in income; as permanent or as a purely transitory. In addition, it will depend on the propensity to consume imported consumer items, something that is likely to shift with fashion and the introduction of new products such as video cameras. One bit of statistical evidence comes from a study by Nolle and Pigott (1986) who suggest that consumer goods tend to be a part of Japanese imports that are very sensitive to changes in U.S. aggregate demand. We should note, however, that the authors stress the importance of capital goods in current imports from Japan to the United States.
29) (U.S.) Department of Energy, *Monthly Energy Review*, June 1986. We should note that recently, the decline in oil prices has stimulated utility companies to rely more heavily on oil as a fuel.
30) *Japan Petroleum and Energy Weekly*, May 5, 1986.
31) Scott (1986) p. 117.
32) *Japan Petroleum and Energy Weekly*, Oct. 6, 1986, p. 4.
33) *Japan Petroleum and Energy Weekly*, May 5, 1986, p. 5.
34) We note that our estimates are of a similar magnitude to those of at least one other analysis. See the *Financial Times, Energy Economist*, June 1986.
35) See, *Tokyo Business Today*, Oct. 1986, p. 46, and *Financial Times, Energy Economist*, June 1986.
36) MITI appears to be weighing an additional cut in utility charges in line with less conservative assumptions concerning the price of oil and the exchange rate. See *The Japan Times*, Nov. 15, 1986, p. 8.

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