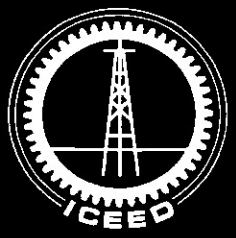
THE JOURNAL OF ENERGY AND DEVELOPMENT



STRONG DOLLAR, LOW INFLATION, AND OPEC'S TERMS OF TRADE

*Mohammad Shaaf**

The real price of OPEC oil in the international market is subject to two major factors: the value of the dollar in relation to other major international currencies and worldwide inflation. Since OPEC oil prices are denominated in terms of the U.S. dollar, a strong dollar increases the purchasing power of OPEC members when they import from other countries and a weak dollar decreases that purchasing power. For example, a strong dollar relative to the Japanese yen makes the terms of trade better for those OPEC members who are Japan's trading partners by letting them enjoy a reduction in import prices relative to the price of oil. Worldwide inflation results in a loss of the purchasing power of oil revenues.

In the early 1970s when the U.S. dollar was weak and OPEC members were united, the multinational oil companies agreed to adjust the price of oil based on the relative weakness of the dollar against a composite of currencies. The first currency composite agreed upon was the Geneva I basket, which consisted of nine currencies: the Belgian, Swiss and French francs, the German mark, the Italian lira, the Japanese yen, the Netherlands guilder, the Swedish kroner, and the British pound.

In 1973 OPEC members decided "to negotiate with the oil companies with a view to amending the Geneva I agreement to offset the devaluation of the United States dollar and avoid further loopholes."[1] By this accord, both parties agreed to use the arithmetical average of 11 currencies against the exchange rate of the dollar for the adjustment of the price of oil. This new Geneva II basket consisted of the nine currencies of Geneva I, plus the Canadian and Australian dollars.

---

*Mohammad B. Shaaf, Assistant Professor of Economics at Central State University, Edmond, Oklahoma, holds M.A. and Ph.D. degrees in economics, with specialization in monetary economic, public finance, and labor and manpower. The author's doctoral dissertation deals with a currency composite approach to the pricing of the Organization of the Petroleum Exporting Countries' oil.

[1]Organization of the Petroleum Exporting Countries (OPEC), *OPEC Information Booklet* (Vienna: OPEC, 1980).

The Journal of Energy and Development, Vol. 10, No. 1

OPEC officials occasionally mentioned that they might substitute the Special Drawing Right (SDR) of the International Monetary Fund (IMF) for the U.S. dollar.[2] Originally designed in 1974 as a basket of 16 currencies, as of 1981 the SDR basket consisted of five currencies: the U.S. dollar weighted at 42 percent, the German mark weighted at 19 percent, and the French franc, Japanese yen, and British pound, each with a weight of 13 percent.

The purpose of this article is to measure the impact of a strong or weak dollar on the purchasing power of OPEC from 1970 to 1983. Five different currency baskets have been used for measurement and comparisons. These include Geneva I, Geneva II, SDR, trade, and Dailami baskets.

The trade basket consists of nine currencies: the U.S. dollar, the Japanese yen, and the currencies of the European Common Market countries (Belgium, Germany, France, Italy, the Netherlands, Great Britain, and Denmark).[3] The selection and their corresponding weights are based on OPEC members' imports of goods and services from these countries.

Mansor Dailami suggested a basket, similar to the trade basket, for the measurement of the impact of the dollar's fluctuation on OPEC.[4] His basket consists of nine currencies: the Belgian franc, the Japanese yen, the German mark, the French franc, the Italian lira, the Dutch guilder, the Swiss franc, the British pound, and the U.S. dollar. Since Dailami's study was for 1971 to 1977, in this article the values in his basket have been adjusted to reflect the time period 1970 to 1983.

A composite inflationary index, based on the export price indices of the countries whose currencies are in the trade basket, will be measured. Combining this inflationary index with changes in the price of oil by OPEC with the impact of the strength or weakness of the dollar on each of those five baskets, the terms of trade for OPEC as a whole for 1970 to 1983 are measured.[5] A summary of the characteristics of these five currency baskets is shown in table 1.[6]

---

[2]See, for example, "OPEC Might Switch to SDRs if Dollar Plummets," *New York Times,* August 4, 1977 and the interview with the Secretary General of the Organization of the Petroleum Exporting Countries in *Worldview*, March 1979, p. 43.

[3]The other members of the European Common Market and other nations are excluded because their individual sizes of trade are relatively small.

[4]Mansor Dailami, "Inflation, Dollar Depreciation and OPEC's Purchasing Power," *Journal of Energy and Development,* spring 1979, pp. 336-43 and "The Choice of an Optimal Currency for Denominating the Price of Oil," MIT Energy Laboratory, working paper no. MIT-EL78-02WP, October 1978 (revised February, 1979).

[5]Changes in terms of trade among countries reflect the impact of changes in price and exchange rates on imports and export revenues. There are several alternatives for the concept of terms of trade. The most widely used is called "net barter" terms of trade. If trade between two countries is balanced, then by definition

Table 1

CHARACTERISTICS OF FIVE CURRENCY BASKETS

Baskets	Number of Currencies	Dollar Inclusion	Weights	Origin
Geneva I	9	Not included	Equal	Agreement between OPEC and oil companies
Geneva II	11	Not included	Equal	Agreement between OPEC and oil companies
Trade	9	Included	Not equal: Based on Exports to OPEC	Author
Dailami	9	Included	Not equal: Based on exports to OPEC	Mansor Dailami
SDR	16 (1974-80) 5 (since 1980)	Included	Not equal: Based on world trade	International Monetary Fund (IMF)

Source: Mohammad Shaaf and James Jonish, "International Pricing of OPEC Oil: Is the Dollar Preferable to Currency Baskets?" *Central State Business Review,* spring 1984, pp. 30-6.

$$Px \cdot Qx = Pm \cdot Qm$$

or

$$Px/Pm = Qm/Qx,$$

where Px and Pm are the prices of exports and imports and Qx and Qm are the quantities of exports and imports, respectively. The ratio Px/Pm is called the "net barter" terms of trade; the ratio Qm/Qx is called the "gross barter" terms of trade. The higher either of the ratios is for a country, the more that country is able to import for any quantity of exports. If for the same quantity of exports, Qx, a country can import more or less commodities, its terms of trade improve or depreciate, other things being constant.

[6]For more details of these baskets, see Mohammad Shaaf and James Jonish, "International Pricing of OPEC Oil: Is the Dollar Preferable to Currency Baskets?" *Central State Business Review,* spring 1984, pp. 30-8.

Methodology and Model of the Measurements

Assuming the weight of each currency in a basket to be Wi, and the annual percentage changes in the exchange rate of each currency in the basket to be Ei, the impact of the changes of the value of the dollar against those currencies, or basket index, B, for each year, y (y = 1970 to 1983), can be measured as

$$By = \sum_{i=1}^{n} Wi \,.\, Ei \qquad (1)$$

with i = 1, 2, . . . 9 for the weights of the Geneva I, trade, and Dailami baskets and i = 1, 2, . . . 11 for the Geneva II basket.

The weights of each currency—Wi in equation (1)—are equal for the Geneva I and the Geneva II baskets and are proportional to the size of imports to OPEC for the trade and Dailami baskets. Assuming Mi is the size of imports to OPEC from each of the industrial countries, the corresponding weights of imports for each currency will be

$$Wi = Mi / \sum_{i=1}^{n} Mi \,, \qquad (2)$$

where i = 1, 2, . . . 9 for the trade and the Dailama composite of currencies.

To measure the inflationary index, I, as applicable to OPEC, the export price indices, Xi, of those industrial countries have been used, weighted according to the relative size of their exports to OPEC as follow:

$$Iy = \sum_{i=1}^{n} Wi \,.\, Xi \,, \qquad (3)$$

where, Iy is the weighted import price changes for OPEC (the weighted export price indices of the industrial countries to OPEC) in each year y (y=1970 to 1983; i=1, 2, . . . 9). Finally, assuming the percentage increase of the price of OPEC oil in each year, y, to be Py, the change in the terms of trade of OPEC, Ty, can be

$$Ty = Py - By - Iy \,. \qquad (4)$$

All the measures in equation (4) are in percent.

Results of the Measurements

Currency Baskets: Using equation (1), the value of each of the five currency baskets is measured and shown in table 2. Based on all five basket measures and due to the relative strength of the dollar, OPEC's purchasing power increased in 1976, 1981, and 1982. It should be noted that the 1981 gain was the largest over the whole period of 1970 to 1983 by all five basket measures. In 1981 OPEC's gain due

Table 2

COMPARISON OF THE IMPACT OF DOLLAR VALUE ON OPEC'S PURCHASING POWER, BY DIFFERENT BASKETS[a]
(percent)

Year	Geneva I	Geneva II	Trade	Dailami	SDR
1970	– 0.03	– 0.30	0.18	0.17	0.00
1971	– 2.45	– 2.22	– 1.34	– 1.59	– 0.30
1972	– 8.04	– 6.29	– 5.94	– 6.02	– 7.62
1973	– 9.56	– 5.97	– 6.43	– 6.77	– 8.93
1974	2.28	1.78	3.65	3.47	– 0.87
1975	7.25	5.47	10.83	10.48	– 0.95
1976	1.56	0.41	0.31	0.19	5.17
1977	– 2.45	– 2.15	– 2.29	– 2.35	– 1.11
1978	–11.46	– 8.42	– 9.66	–10.10	– 6.75
1979	– 5.36	– 4.36	– 2.84	– 2.93	– 3.10
1980	– 0.61	– 0.34	0.04	0.00	– 0.73
1981	20.78	17.31	13.96	13.92	10.38
1982	14.84	11.36	11.19	10.96	6.81
1983	12.96	9.37	7.61	7.51	– 1.18
Mean	1.41	1.12	1.30	1.46	– 0.66
Standard deviation	9.53	7.38	6.91	6.94	5.35

[a](–) indicates loss; absence of sign indicates gain to OPEC.

to the strong dollar was 20.78 percent, 17.31 percent, 13.96 percent, 13.92 percent, and 10.38 percent by Geneva I, Geneva II, trade basket, Dailami, and the SDR baskets, respectively. In 1974, 1975, and 1983 only the SDR basket showed a loss, but the other four measures showed gains for OPEC. In all other years, based on all five basket standards, with minor exceptions OPEC's purchasing power declined because of the relative weakness of the dollar. The worst year for OPEC in this regard was 1978, when the U.S. dollar was relatively the weakest. The differences in the results of each of the five basket measures are due to the differences in the composition and weights of the currencies in each basket.

Inflationary Index Measure: Using equation (2), the weights for the inflationary index for the nine countries whose currencies are in the trade basket were measured. Substituting these weights, Wi, with their corresponding export price indices, Xi, in equation (3), the weighted import price index for OPEC (IMP-PI) is calculated and shown in the last column of table 3. The largest inflationary impact on OPEC was in 1974—22.45 percent. Only in 1981 and 1982 did the prices of imports to OPEC drop, by 2.70 percent and 3.75 percent, respectively. In all other years, from 1970 to 1983, this measure increased.

Table 3

COMPARISON OF THE TERMS
OF TRADE OF OPEC BY DIFFERENT BASKET MEASURES[a]
(percent)

Year	TOT.GV1	TOT.GV2	TOT.TRD	TOT.DAL	TOT.SDR	D-POP	IMP-PI
1970	- 2.70	- 2.97	- 2.49	- 2.50	- 2.67	1.56	4.23
1971	18.16	18.39	19.27	19.02	20.31	26.92	6.31
1972	- 2.04	- 0.29	0.05	- 0.03	- 1.63	15.15	9.16
1973	13.34	16.93	16.47	16.13	13.97	42.11	19.21
1974	241.32	240.82	242.68	242.50	238.16	261.11	22.45
1975	3.80	2.02	7.38	7.03	- 4.40	9.84	13.29
1976	8.77	7.62	7.52	7.40	12.38	7.37	0.16
1977	- 3.88	- 3.59	- 3.73	- 3.78	- 2.55	7.73	9.17
1978	-23.44	-20.40	-21.64	-22.08	-18.73	2.42	14.40
1979	16.41	17.42	18.94	18.85	18.68	35.91	14.13
1980	52.77	53.04	53.42	53.37	52.64	66.11	12.73
1981	36.84	33.37	30.02	29.98	26.43	13.36	- 2.70
1982	21.28	17.80	17.63	17.40	13.25	2.98	- 3.45
1983	1.25	- 2.34	- 4.11	- 4.20	-12.89	-11.71	0.0

[a](–) signs indicate loss; absence of sign indicates gain to OPEC.

Rate of OPEC Oil Price Change: The rates of changes of OPEC oil prices (D-POP) are calculated and shown in table 3. The price of Saudi Arabian light crude, the so-called marker crude, was used for this measurement. This crude is the most abundant crude, with 34 degree of API gravity, and is used as a benchmark for the price of OPEC oil.[7] According to the table, the price of OPEC oil has been increasing in all years from 1970 to 1982. We find 1983 was the only year that the nominal price of OPEC oil dropped. The highest price increase was in 1974, a rise of 261.11 percent.

Measurement of the Terms of Trade: The net impact of the changes in OPEC oil prices, the rate of inflation, and the value of the dollar against other currencies in each year can be represented by the terms of trade. Accordingly, these changes in the terms of trade can be expressed as

$$\dot{t}y/ty = \dot{p}y/py - \dot{b}y/by - \dot{i}y/iy\ , \qquad (5)$$

[7]The price of Saudi Arabian light crude, the so-called marker crude, was used for this measurement. This crude is the most abundant, with a 34 degree API gravity, and is used as a benchmark for the price of OPEC oil.

where t is the terms of trade, p is the price of OPEC oil, b is the basket measure of the fluctuation of the dollar against other currencies, and i is the price index for OPEC's imports in each year, y. The · above each variable in equation (5) denotes the time derivative of that variable. Substituting Ty for $\dot{t}y/ty$, Py for $\dot{p}y/py$, By for $\dot{b}y/by$, and Iy for $\dot{i}y/iy$, we get equation (4).

Using equation (4), the terms of trade of OPEC by all five basket measures were calculated and shown in table 3. For example, the terms of trade for 1970 and 1974 using the Geneva I basket are calculated as follow:

$$\begin{aligned} TOT.GV1 &= 1.56 - 0.03 - 4.23 \\ &= -2.70 \quad (1970) \\ TOT.GV1 &= 261.48 - (-2.28) - 22.45 \\ &= 241.32 \quad (1974) \end{aligned}$$

The largest improvement in the terms of trade of OPEC (TOT) occurred in 1974 by all five basket measures. In that year the trade basket showed the highest improvement with 242.68 percent. The second largest terms-of-trade increase was in 1980—at least 52 percent. Also, in 1981, 1982, and 1983, with the nominal oil-price reduction, the terms of trade of OPEC increased. During these years, the improvement was due to the combination of the strong dollar and the reduction of the prices of imports to OPEC. On the other hand, the terms of trade sharply declined in 1978 by at least 18 percent and by all basket measures. This reduction is due to the increase in the import prices of goods and services to OPEC (14.4 percent) and to the weakness of the dollar.

Average Performance of the Baskets: The means and standard deviations for each of the five basket measures are also calculated and shown in table 4. Accordingly, the Geneva I measure, with a mean of 1.409 percent, shows the highest average annual gain, and the SDR, with a mean of -0.656 percent, shows the largest average annual loss for OPEC between 1970 and 1983. On the other hand, the Geneva I basket, with the highest standard deviation (risk), 9.531 percent, is the most unstable, and the SDR, with the lowest standard deviation of 5.353 percent, is the least unstable basket measure for OPEC.[8] The means and standard deviations for each of the five terms of trade are calculated and shown in the table.

[8]The standard deviation of a distribution around its mean is commonly used as a measure of relative risk. The larger the standard deviation, the greater the risk of the measure.

Table 4

COMPARISON OF THE MEANS, STANDARD DEVIATIONS OF DIFFERENT BASKETS AND TERMS OF TRADE (TOT) OF OPEC[a]
(percent)

Variable	Mean	Deviation	Minimum	Maximum
Geneva I	1.409	9.531	-11.461	20.783
Geneva II	1.119	7.376	- 8.425	17.313
Trade	1.302	6.911	- 9.663	13.965
Dailami	1.146	6.936	-10.104	13.923
SDR	- 0.656	5.353	- 8.927	10.377
IM-PI	8.506	8.089	- 3.455	22.448
TOT-Geneva I	27.276	64.365	-23.438	241.316
TOT-Geneva II	26.986	64.136	-20.401	240.816
TOT-Trade	27.243	64.561	-21.640	242.679
TOT-Dailami	27.077	64.569	-22.081	242.500
TOT-SDR	25.211	63.929	-18.725	238.160

[a](-) signs indicate loss; absence of sign indicates gain to OPEC.

Summary and Conclusion

In this article the relative strength and weakness of the dollar, inflation, oil price changes, and the terms of trade of OPEC have been measured for 1970 to 1983.[9] Overall, during this period the terms of trade of OPEC improved most in 1974 and deteriorated most in 1978. A recent strong dollar has improved OPEC's position substantially. But high prices of imports in some years and the oil-price reduction of 1983 offset this impact. The future of the terms of trade for OPEC depends upon future oil price changes, the strength of the dollar, and future world inflation. As the major element of the terms of trade of OPEC is the price of oil, the changes in OPEC's terms of trade in the future depend on the future price of oil, which itself depends upon the unity of OPEC members as a viable cartel.

[9]Other sources used to prepare this article include: Morris A. Adelman, "International Oil in the Eighties," in *DRI Readings in Macroeconomics,* ed. Allen Sanderson (New York: McGraw-Hill, 1981); Jahangir Amuzegar, "OPEC and the Dollar Dilemma," *Foreign Affairs,* July 1978, pp. 740-50; Mark R. Eaker, "Special Drawing Right and the Purchasing of Oil," *Journal of World Trade Law,* January-February 1979, pp. 22-33; International Monetary Fund (IMF), *Direction of Trade Yearbooks* (Washington, D.C.: IMF, 1977-83) and *International Financial Statistics,* selected issues, 1970-1983; R. Safford Johnson and Richard A. Zuber, "A Model for Constructing Currency Cocktails," *Business Economics,* May 1979, pp. 9-16; and J. J. Polak, "The SDR as a Basket of Currencies," *IMF Staff Papers,* December 1979, pp. 627-53.