"In my old age," Paul A. Volcker, the former chairman of the Federal Reserve Board, told me, "I've learned that there's a lot of corruption in the world." Mr. Volcker, who heads the independent committee investigating the United Nations oil-for-food program in Iraq, was not talking about the program per se, but about corruption in general.

A new study by Chang-Tai Hsieh and Enrico Moretti, two economists at the University of California, Berkeley, sheds light on just how much corruption could have taken place in exchange for oil sales in the oil-for-food program. Although their estimate greatly exceeds the Central Intelligence Agency's figure, the amount of kickbacks and political favors given for lucrative oil deals was still fairly limited, probably no more than 3 percent of the total oil revenue collected, they concluded.

The methods used by Professors Hsieh and Moretti clearly show how economics can be used to gauge the extent of corruption.

Under the oil-for-food program, Iraq could sell a limited quantity of oil and use the proceeds for purposes approved by the United Nations, mostly purchases of food and medicine and compensation for victims of the first Persian Gulf war.

Iraq was permitted to sell to buyers of its choosing; Saddam Hussein personally reviewed the list. From the first oil sales in March 1997 until September 2001, the selling price had to be approved by United Nations overseers at the beginning of each month.

Oil is a commodity, so a given grade of crude oil should trade for the same price.

Here is why the price matters. Suppose that Iraq's leaders sought bribes or political favors, and that the market price of crude oil was $50 a barrel. If Iraq offered to sell its oil for $50, then buyers would have no incentive to provide kickbacks for the privilege of buying Iraqi oil; they could have bought the same grade of oil for the same price from another supplier without having to pay kickbacks. To give buyers an incentive to pay kickbacks, Iraq would have to underprice its oil.
The Berkeley professors have amassed compelling evidence that Iraq underpriced its oil, in all likelihood for the purpose of obtaining bribes and political favors.

Iraq produces two types of crude oil, Basra light (from the Rumaila oil fields) and Kirkuk oil. Professors Hsieh and Moretti compared the price at which Iraq sold oil with the weekly price of its closest competitors: Arabian light from Saudi Arabia, for Basra light, and Urals oil from Russia, for Kirkuk oil.

In the 15 years before the oil-for-food program began, there was no difference in price between either type of Iraqi oil and that of its closest competitor, on average. When the program was in effect, however, the price of Basra light fell more than $2 a barrel below the price of Arabian light, and the price per barrel of Kirkuk oil was 70 cents below Urals oil.

The gap was particularly large in 2000 and 2001, reaching $5 for Basra light and $1 for Kirkuk oil. The Volcker committee cited testimony that Iraq deliberately sought to underprice its oil in late 2000 for the purpose of collecting surcharges outside of the United Nations program.

In response to rumors that bribes were being paid for Iraqi oil, the United Nations switched in September 2001 to a retroactive pricing system, in which buyers learned the price of oil only after it was loaded onto their tankers and the world price was known. This made it much harder for Iraq to charge less than the market price -- and, in fact, there is little sign of underpricing after 2001.

Although not all 1,300 oil transactions during the program could be examined in detail, the pattern of traders selected to buy oil by the Iraqi regime hints of corruption. In periods when Iraqi oil was underpriced the most, small traders were much more likely to be selected than major oil companies, which are probably less likely to pay kickbacks.

Over the entire life of the oil-for-food program, Professors Hsieh and Moretti estimate, oil was underpriced by $6 billion, with this extra profit divided almost equally between small and large companies.

If small companies returned half their extra profit to Iraq to secure lucrative oil contracts, the regime would have reaped $1.4 billion in kickbacks. Not all of this money had to be paid in cash surcharges, however. Iraq also sought political help to ease the trade sanctions, and oil traders had an incentive to use their political influence to lobby on Iraq's behalf in exchange for oil contracts.

By comparison, the Iraq Survey Group reported to the C.I.A. that Iraq received $230 million in cash surcharges on oil sales, based on a review of Iraq's Oil Ministry records. This figure, however, misses some bribes and the implicit value of any political favors.
Although corruption tainted the oil-for-food program, especially on the procurement side, Professor Moretti said that by "making the minor change to retroactive pricing, the U.N. was able to undercut the scope of bribery at essentially no cost." He further said that for all the criticism it has received, the oil-for-food program did manage to deliver more than $30 billion of humanitarian aid to Iraq, while the country was apparently prevented from obtaining weapons of mass destruction.

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