The World Oil Market *is* "One Great Pool:" A Response

A.E. RODRIGUEZ and MARK D. WILLIAMS

The authors are economists with the United States Federal Trade Commission's Bureau of Economics. Opinions are the authors' and not necessarily those of the Federal Trade Commission.

Rummy: I'm looking for my keys which I dropped over there somewhere.
Officer: Why then, pray tell, are you looking for it over here?
Rummy: Because this is where the light is.

-Anonymous

1. Discussion

We are pleased that Professor Weiner has chosen to comment on our paper in this *Review* (Rodriguez and Williams, 1993), which discusses geographic market definition, an important subject in the analysis of oil markets. However, we believe that his *Reply* does not successfully defend his proposition that oil markets are geographically separate and that his concept of "regionalization" is important. We stand behind our original conclusion that the crude oil market is a world market in the relatively short run.

Let us briefly summarize the previous exchange of papers. Professor Morris Adelman (1984) argued that oil trades in a worldwide market, or as he put it, "The world oil market is one great pool." Relying on an approach developed by Spiller and Huang (1986), Weiner (1991) disagreed and argued that crude oil markets are regional in character. In a 1993 paper in this *Review* (Rodriguez and Williams, 1993), we pointed out two critical flaws in Weiner's paper.

First, Weiner engages in tautological reasoning by defining "regionalism" as the inability of *individual* crude oils to arbitrage between two regions and then empirically demonstrating this "regionalism." Unfortunately, he fails to show why this concept of "regionalization" has any important policy implications. We argue that for "regionalization" to matter, it must lead to market power for either buyers or sellers in an oil market. As such, we believe that it is appropriate to define "regionalism" in terms of geographic antitrust markets.

Second, we noted that Weiner incorrectly specified his model by analyzing *individual* crude oils (e.g., Mexican Isthmus, Saudi Light, Brent, West Texas Intermediate, etc.). Because individual crudes are substitutable in refining, his specification will lead to inappropriately narrow geographic markets. For example, Mexico will not profit by unilaterally raising the price of its particular crude, since it will lose market share to other crudes. When determining the geographic scope of a "market" for a particular crude oil, it is appropriate to consider the movements of other crude oils

as a response to perturbations in the original "market." Not doing so will lead one to conclude, as does Professor Weiner, that these "markets" are geographically small and "regionalized." To avoid this, one should consider *all* crude oils when determining the appropriate size of the market.

We note, however, that as crude oil prices fall the US may be an emerging region for some crude oils in the sense of Weiner's original paper. Due to the continued decline of crude oil prices, the US may no longer import certain crude oils. It is unclear to us why this would have any meaningful economic consequences. Because of the relative homogeneity of oil, substitutability of, and arbitrage by, different crude oils implies that government energy policies couched on the premise of regional markets will be ineffective.

In addition to disputing Weiner's views, our paper tested the "one great pool" hypothesis directly and we were unable to reject Adelman's conjecture. This, by implication, rebutted Weiner's proposition. In his *Reply*, Weiner argues that our methodology is only appropriate for the analysis of long-term phenomena. We disagree with this, but this criticism could legitimately be levelled at Spiller and Huang's static methodology that Weiner used.[1] The antitrust market construct asks whether a hypothetical monopolist could profitably impose a small but significant and nontransitory price increase throughout a proposed market. By rephrasing the question as follows, one can explicitly introduce a time dimension into the analysis: "How long before the market would respond to a small but significant, nontransitory increase in price?" The United States antitrust agencies (arbitrarily) use a one year cutoff for responses from outside the proposed market in determining the appropriate size of an antitrust market.

We believe that it is important to point out two results from our previous paper that address this timing issue. We found that the correlation coefficients between monthly changes in different market crude prices were typically over 90%. This implies that most of the response to a price change in one crude oil to a change in another occurs within one month. Similarly, we found that the appropriate order for our vector autoregression (VAR) model was four months. This suggests that virtually all of the response of one crude oil to movements in price of another occurs rapidly.

1/ Ironically, although Weiner believes that the "philosophy of the US Federal Trade Commission" is inconsistent with energy security policy, the Spiller and Huang methodology he uses was developed at the FTC. Furthermore, one should recall the authors' disclaimer that staff economists at the FTC have their own research agenda which do not necessarily reflect the views or "philosophy" of the Commission.

2. A Residual Demand Model

In this section we test one of Weiner's original conclusions using a *different* empirical methodology. Our findings do not support his contention that markets are "regionalized." For government intervention through the buying or selling of oil (such as a drawdown in the strategic oil reserve) to be effective in responding to an energy shock, the government must be able to affect price and aggregate quantity (i.e., have market power) in a "regionalized" market. Thus, in a "regionalized" market, the "residual" domestic producers *collectively* must have market power for government policy to be effective. We find below that the residual demand curve is very elastic and consequently the oil market is not functionally "regionalized."

In a homogeneous product market such as oil, residual demand is defined to be the difference between total market demand and the aggregate supply of imported oil at any given price. The elasticity of the residual demand curve summarizes the potential for the collective exercise of market power by domestic producers[2] and depends on the elasticity of total market demand, the elasticity of imported supply, and the market share of domestic producers. We estimate a residual demand curve for the US oil market.[3] We estimate the following form using a two-staged least squares procedure:

$$POIL_d = f(Q_{res}, POIL_i, P_e, C1, C2, D),$$

where all variables are deflated; $POIL_d$ is the price of crude oil in the US; Q_{res} is the residual quantity demanded of crude oil, the total US demand minus imports; $POIL_i$ is the price of a foreign crude oil; P_e is a vector of other energy prices; C1 and C2 are vectors of cost shifters for domestic and foreign producers respectively; and D is a vector of demand shifters. Since all variables are in logs, the estimated coefficient of Q_{res} is the estimated inverse elasticity of residual demand.[4]

2/ See Landes and Posner (1981) and Baker and Bresnahan (1988)

3/ We note that Weiner identified several "regions." Of these, we feel that the United States was the most likely to be an independent geographic market. We do not analyze any other regions in this paper.

4/ We used the price of natural gas (PNATGAS) and coal (PCOAL) as energy prices, an index of manufacturing wages (WAGEMF) and an index of oilfield and gasfield machinery and equipment (TOOLS) as domestic cost shifters. An industrial production index (PROD), average temperature in Chicago (TCHI) and heating degree days in Chicago (HDDCHI) as domestic demand shifters, and an index of exchange rates (XRATE) and indices of industrial production in Japan (JAPAN) and Germany (GERMANY) as variables affecting importers' costs and sales outside the United States. A linear trend (TIME) is included to account

Table 1: Regression Coefficients and t-statistics

Variable	Coefficient	t-statistic
Constant	3.27	0.81
Q_{res}	0.34	1.15
$POIL_i$	0.90	19.00
PNATGAS	-0.03	-0.54
PCOAL	0.22	0.45
WAGEMF	-2.26	-2.57
TOOLS	-0.08	-0.20
PROD	0.02	0.10
TCHI	0.004	0.21
HDDCHI	0.002	0.53
XRATE	-0.04	-0.42
JAPAN	-0.19	-0.98
GERMANY	-0.09	-0.52
TIME	0.0002	0.11
WAR	0.03	1.03
ρ	0.38	4.73
R^2	0.987	
Durbin-Watson	1.82	

3. Results and Conclusions

The regression coefficients are presented in Table 1. Immediately,

for the rapid growth of refining productivity over the last decade and a dummy variable (WAR) for the Gulf War irregularities. Because Q_{res} is endogenous to the model under both the null and alternative hypotheses and $POIL_i$ is endogenous under the alternative hypothesis, these variables were instrumented by a GNP deflator (GNPDEF), household consumption of non-durables (NDURAB), durable goods shipments (SHIPMTS), a real interest rate (INTRST), and population (POP), as well as all the exogenous variables. All data are from various issues of the *Annual* and *Monthly Energy Review, Petroleum Marketing Monthly* and *Annual* (the price of West Texas Intermediate was $POIL_d$, the price of landed crude oil was $POIL_i$, domestic production was Q_{res}, PNATGAS, PCOAL), the *Survey of Current Business* (PROD, SHIPMTS, GNPDEF, INTRST, POP, NDURAB, INTRST), *Producer Price Indexes* (TOOLS), National Oceanic and Atmospheric Administration's: *Local Climatological Data: Monthly Summary* (HDDCHI, TCHI), *Federal Reserve Bulletin* (XRATE), *Economic Indicators* (JAPAN, GERMANY). The model was estimated on monthly data from February 1982 to December 1992 and was corrected for first order autocorrelation using a Cochrane-Orcutt procedure on the second stage. Current and one-month-lagged instruments were used in the first stage regression.

one notes three important conclusions. First, the statistical relationship is strong, with 98.7% of the variance in domestic prices being explained by the exogenous variables. Second, the estimated inverse elasticity coefficient has the wrong sign and is not significantly different from zero. We cannot reject the null hypothesis that the residual demand curve is perfectly elastic and domestic sellers have no market power and we conclude that a plausible oil market is larger than the United States. Lastly, we find that there is a statistically significant and sizeable relationship between domestic and imported crude oil prices. This is consistent with our previous finding of a homogenous world oil market, a finding which relied on a different empirical methodology altogether.

It appears that the oil market acts as "one great pool" and this result does not depend on the choice of empirical methodology. Only by formalizing what is meant by a market can one analyze potential government policies. We believe that if the policy requires that the government have market power to be effective, then it is appropriate to delineate markets using constructs such as have been developed by the antitrust agencies.

References

Adelman, M.A. (1984) 'International Oil Agreements,' *The Energy Journal*, 5:3:1-9.

Baker, Jonathan B. and Timothy F. Bresnahan (1988) 'Estimating the Residual Demand Curve Facing A Single Firm' *International Journal of Industrial Organization*, 6:283-300.

Landes, William and Richard A. Posner (1981) 'Market Power in Antitrust Cases' *Harvard Law Review*, 94:937-96.

Rodriguez, A.E. and Mark D. Williams (1993) 'Is the World Market "One Great Pool"? A Test' *Energy Studies Review*, 5:2:121-30.

Scheffman, David T. and Pablo T. Spiller (1987) 'Geographic Market Definition Under the U.S. Department of Justice Merger Guidelines,' *Journal of Law and Economics*, 30, April, 123-47.

Spiller, Pablo T. and Cliff J Huang (1986) 'On the Extent of the Market: Wholesale Gasoline in the Northeastern United States,' *Journal of Industrial Economics*, 35, December, 131-45.

Weiner, Robert J. (1991) 'Is the World Market "One Great Pool"?' *The Energy Journal*, 12:3:95-107.

—(1993) 'The World Market is not "One Great Pool:" A Reply to Rodriguez and Williams,' *Energy Studies Review* 5:3:225-30.