



American Finance Association

The Pricing of Oil and Gas: Some Further Results: Discussion

Author(s): Albert S. Kyle

Source: *The Journal of Finance*, Vol. 40, No. 3, Papers and Proceedings of the Forty-Third Annual Meeting American Finance Association, Dallas, Texas, December 28-30, 1984 (Jul., 1985), pp. 1018-1020

Published by: Blackwell Publishing for the American Finance Association

Stable URL: <http://www.jstor.org/stable/2327831>

Accessed: 26/11/2009 08:44

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=black>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



Blackwell Publishing and American Finance Association are collaborating with JSTOR to digitize, preserve and extend access to *The Journal of Finance*.

<http://www.jstor.org>

As before, we also broke HOTEL into its two components: OIL and GAS. Since the HVP applies equally well to these components, we would expect the same coefficients on each of the components, and that (row 3) is what we get. (We do not have data to do further separation into prices and costs.)

X. Summary

Our summary can be brief. The follow-up sample proved to be noninformative. Because petroleum prices varied relatively little in 1981–1983, the second sample did not provide as good a basis for testing the HVP as we had hoped. But there are some encouraging signs of more promising experimental conditions to come. The current (December 1984) recriminations about price cutting and quota violations within OPEC suggest its demise might be imminent. If so, we may soon be benefiting both as economists and consumers from dramatic falls in the price of oil.

REFERENCES

1. Russell Davidson and James G. MacKinnon. "Several Tests for Model Specification in the Presence of Alternative Hypotheses." *Econometrica* 49 (May 1981), 781–93.
2. Harold Hotelling. "The Economics of Exhaustible Resources." *Journal of Political Economy* 39 (April 1931), 137–75.
3. E. Allen Jacobs and Stephen T. Limberg. "Tax Issues in Petroleum Industry Reorganization: Royalty Trust Spinoffs." Graduate School of Business, University of Texas, November 1984.
4. Edward E. Leamer. *Specification Searches: Ad Hoc Inference with Nonexperimental Data*. NY: Wiley-Interscience, 1978.
5. Merton H. Miller and Charles W. Upton. "A Test of the Hotelling Valuation Principle". *Journal of Political Economy* 93 (February 1985), 1–25.
6. Robert S. Pindyck. "Uncertainty and Exhaustible Resource Markets." *Journal of Political Economy* 86 (October 1978), 841–61.
7. Suresh M. Sundaresan. "Equilibrium Valuation of Natural Resources." *Journal of Business* 57 (October 1984), 493–518.

DISCUSSION

ALBERT S. KYLE*: We now have two papers by Miller and Upton on the Hotelling Valuation Principle for oil and gas reserves, and the contrast between the results of the first paper and the results of the second appears striking. In the first paper, the HOTEL variable has a coefficient close to its predicted value of "one-or-a-little-less" in both the pooled cross-section regression and in the regression using first differences. In the second paper, the coefficient on the HOTEL variable falls to approximately one-half using the pooled cross-section data, and it is not significantly different from zero using first differences. What went wrong? The authors argue that measurement error is the culprit. Although present in the first sample, it is swamped by large systematic movements in prices. But in the second sample, systematic price movements are so negligible that measurement error biases HOTEL coefficients towards zero in a significant way.

* Princeton University.

To shed more light on why estimated coefficients changed so much, it is useful to examine more closely the differences between cross-section and time-series regressions in the two samples. This comparison suggests that unpooled cross-section regressions may have coefficients biased towards zero not only because of measurement error but also because of differences in the underlying economic characteristics of the reserves being priced. The real ability to distinguish the Hotelling Valuation Principle from alternatives such as tax models (with HOTEL coefficient predicted to be significantly less than unity) comes from examining first differences. I agree with the authors, however, that for the first difference regressions to be a powerful tool, large changes are needed in HOTEL over time. When there is essentially no significant movement, as in the second sample, even small measurement errors bias estimates of the HOTEL coefficient significantly.

The basic regressions examined by the authors in both papers are pooled cross-sections, in which two or three observations on each of several dozen firms are combined into one sample. It is interesting to ask what happens when the cross-sections are unpooled and separate regressions are run on several smaller cross sections with single observations on each firm. When the second sample is divided into three approximately contemporaneous subsamples, the authors have kindly reported to me that the HOTEL coefficient rises from 0.48 to 0.64, 0.51, and 0.56 (average standard error about 0.25). In the first sample, dividing the observations into early, middle, and late thirds (which are not quite contemporaneous) yields coefficients of 0.66, 0.93, and 0.88 (with similar standard errors); adding a time trend reduces the coefficient on HOTEL to 0.75 (as reported in the first paper). These results suggest that unpooled cross-section regressions are likely to yield consistently HOTEL coefficients substantially less than unity and not particularly variable over time. Pooling the cross-sections in the first sample allowed a large price movement which occurred over the period to drag the HOTEL coefficient up close to unity, while pooling in the second sample lowered the coefficient a bit.

Although a cross-section coefficient of HOTEL which is less than one may be due to measurement error, it may also arise due to the fact that different reserves have different extraction cost paths. Suppose that the difference between the current cost and the (expected present value weighted) average future cost of extracting reserves is negatively correlated across different reserves. For example, suppose that there are two kinds of reserves: those with a current measured cost of five dollars and an unobserved (but known to the market) average future cost of twenty dollars, and those with a current cost of fifteen dollars and a future cost of twenty-five dollars. Assuming a current price of oil of thirty dollars (and that it will be economic to extract all oil), the observed regression line will have a slope of one half and an intercept of $-\$2.50$. The correlation between the current cost and future cost changes biases the coefficient of HOTEL (in different directions depending on the correlation). This possibility is not considered by the authors in the theoretical analysis of the first paper because they consider the effect of price changes on reserves with given costs of extraction, not the effect of arbitrary changes in extraction cost functions at given prices. Their theoretical analysis is more appropriate for time series than for cross-sections.

Since there is little price movement in the second period, the twelve observa-

tions on oil royalty trusts can be interpreted as a cross-section observation. What do we make of the fact that the estimated HOTEL coefficient here is actually greater than (but not significantly different from) one? If measurement error is the problem in the original cross-sections, then it might be the case that prices and costs are less subject to such errors in royalty trust data, perhaps because such reserves tend to be more "established." If the problem in the original cross-sections is the correlation between current costs and future cost increases, then it might be the case that this correlation is not present in oil royalty trusts, perhaps because of the manner in which reserves are chosen to be put into trusts. For example, if among reserves with high HOTEL values, those with costs expected to increase relatively slowly in the future are chosen, some of the downward bias in the HOTEL coefficient would be eliminated.

The greatest potential power in the authors' approach comes, I think, from investigating the time series properties of VALUE and HOTEL. Measurement errors which persist through time will disappear with first differencing, and those which remain will be drowned out by a big movement in prices. This seems to be exactly what happened in the first time period, and the resulting coefficient on HOTEL close to unity in the first difference regression constitutes the authors best evidence in favor of the Hotelling Valuation Principle. While the big movement in prices did not occur in the second time period, perhaps it will occur in the third, or the fourth, or the fifth. I doubt that we have heard the last word from the authors on this important principle.