The Evolution and Persistence of Economic Assumptions

Craig Freedman*

Periodically ever since I was a small boy, there has been an agitation predicting an oil shortage, and always in the succeeding years the production has been greater than ever before. (Howard Pew, President of Sun Oil 1925 quoted in Yergin, 1991 pp. 222-23).

The force of custom is no less a factor in academic research and writing than it is in any other economic activity. In both areas it can, and often does, perform an invaluable service. When economic environments are stable, habitual behaviour increases operational efficiencies by reducing the transaction costs involved in accomplishing a given set of objectives. One does not therefore extend a metaphor too far by claiming that customary modes of analysis reduce, in a similar manner, the attendant transaction costs of research. A persistent policy of re-inventing the wheel would of course prove grossly counterproductive. Enforced amnesia can only serve as a policy of despair. But the periodic re-examination of the core assumptions of any discipline is a necessary therapeutic in preventing research from permanently steaming down the wrong track. It is even occasionally worth derailing an engine of analysis rather than acquiescing in such a deleterious approach.

Research into the history of economic thought should enable us to see the perennial issues as well as assumptions of economics with new eyes. Properly done, such pawing through the back numbers of economic theory can help us escape the often too narrow boundaries set by conventional thought and analysis. This is exactly what Tim Robinson has set out to accomplish in his very useful book on the enduring debate over exhaustible resources.

A Review Article of **Economic Theories of Exhaustible Resources** *by T.J.C. Robinson (Routledge: London, 1989). Distributed by the Law Book Company Limited Pp. 190 ISBN-0-415-00988-X Hardback $59.95*

The force of convention in economic writing has meant that certain lists of assumptions have become an unquestioned litany to be repeated at the beginning of journal articles. Such assumptions over the years achieve a state of immaculate conception. Their source is forgotten, but their influence lingers on. By donning a cloak of self evident necessity, if not truth, they largely escape scrutiny. However, once some intrepid analyst revokes their inviolate and implicit status, the contingent nature of all such assumptions becomes evident. They serve not merely as devices for analytical simplification, but to structure the nature of the arguments made. Even a simple classification scheme contains an underlying rhetorical base which will influence any subsequent analysis.

Such unacknowledged or under discussed assumptions can shift the terms of economic debate. Though the validity and consequences of models are often discussed at great length, hidden persuaders in the form of implicit assumptions may lie dormant for decades. Coase's 1960 article, and all the ensuing developments from it, depended on the implicit acceptance of the prevalence of symmetry in human choice. Without symmetry, even the absence of transaction costs does not insure the Pareto conditions Coase hypothesised. By taking issue with the self evident status of such an assumption, recent empirical research (Kahneman, Knetsch, and Thaler, 1991) reopens the issues presented not only in Coase's original article (1960), but in the voluminous work generated as a result of it. Symmetrical preferences contradicts observed experimental tests since initial endowments of goods seem to influence outputs.

Current prevailing theories in the analysis of exhaustible resources also have at their core an assumption that leads to an irreconcilable difference between analytical and observable results. The oil industry can best illustrate this sharp contrast. For more than a century, oil men have battled to contain a glut of supply that periodically threatened to undermine the profitability and even possibility of their operations. Yet discussion in both popular and academic circles has usually concentrated on impending shortfalls.[1]

As Robinson points out, the answer to this conundrum lies with the primary economic assumption of scarcity as applied to resources which from a physical standpoint are exhaustible. The prevailing methodology of economics grafted to an analysis of the optimal use of resources which are by definition strictly limited, has resulted in focusing on the seemingly non issue of resource depletion. Consequently, the frequent gluts so characteristic of mining and drilling operations became merely periodic and necessary aberrations no different from those characterising all economic activities. Like many other areas of analysis, exhaustible resources was forced to fit the Procrustean bed which characterises standard economic examinations. The challenge to the historian of economic thought is to illuminate the process by which such a development eventuated as well as to evaluate its validity.

Harold Hotelling in his 1931 paper provided the discipline with an elegant presentation of what was to become the lodestone directing most future work attempted in this field. Whether directly or indirectly, economists are indebted to Hotelling for defining the key issues underlying the use of exhaustible resources. The basis for his approach is an assumed antagonism between present and future mineral output. Under this scenario, the owner of a mine or well faces a classic cake eating dilemma. Possessing a fixed cake (the definition of an exhaustible or non-re-

newable resource), the cake owner must decide the optimal rate of consumption. The antagonism is due to the fixed or non-renewable nature of the resource. Today's production must necessarily mean a reduction in future production. It is this choice between the present and the future which differentiates this specific form of analysis from that more appropriate to manufacturing or agriculture.

Explicit in Hotelling's treatment is the assumption that rising net prices[2] must increase exponentially at a rate equal to the prevailing rate of interest if the resource is to be depleted at an optimal rate. Net price will then strictly reflect relative scarcity value. Rising net prices depend upon increasing costs at the extensive margin of production. Continued and rising demand for output will then mean the opening up of new mines or wells to produce additional supply. These new mines must be less productive than their predecessors since richer mines would rationally be exploited prior to those which have less abundance, just as more fertile land is tilled before that which is more niggardly in its yield. Over the long run, the market would allocate use of such resources in an optimal self adjusting fashion. Under or over supply in any period would of necessity be a self limiting phenomenon. If net prices are expected to rise too slowly, resource deposits are a bad way to hold wealth and production will be brought forward. This would seem to cause a non optimal depletion of exhaustible resources. However, given the prevailing interest rate, the capitalised value of the mine as an asset would drop. At the new valuation, a more optimal depletion of the natural resource would prevail regulated by the newly adjusted rate of return.

Robinson suggests that an alternative route for analysing the use of such resources exists. The more appropriate tool would be to employ the notion of user cost as defined by Keynes (1936) and which later forms the basis for articles on mineral and oil exploitation by Scott (1967) and Davidson (1979) respectively. In effect, user cost measures the opportunity cost of mining now as opposed to keeping one's economic assets in reserve. Robinson sees the problem as failing to disentangle the physical sense of resource depletion from its economic meaning. The discovery of a higher yield mine or well may cause the user cost of an existing, higher cost well to drop to zero though not yet depleted in the physical sense at all. But on another plane, the argument is really between long run and short run analysis. Though Hotelling and, some decades later, Solow (1972) allow for deviations from the optimal path of resource depletion, deviations from this long run path tend to be self correcting. Therefore, deviations become at best of secondary importance only. What is at issue here, as so often is the case in economic controversies is an argument over starting points. By accepting a user cost approach, such deviations become the natural focus of analysis. A long run optimal path approach sees such concerns fade into matters of more secondary importance.[3]

To fully understand the triumph of the current conventional thinking on natural resources, it is therefore necessary to look at the historical development of that theory. Namely, the evolution of ideas concerning natural resources, the debates, and the reason for the eventual dominance of one approach over contending alternatives. For unless one is an evolutionary teleologist, it is hardly legitimate to dismiss any but the prevailing theory as obviously inferior.

To explore this issue, and by doing so cast some indirect light on the reasons that theories become predominant, Robinson assembles the usual cast of suspects along

with some lesser lights. As with so much else in economics we can once again lay the responsibility for this outcome on the narrow shoulders of David Ricardo, just as others have saddled him with promoting the now ingrained predilection for abstraction and a priori reasoning in economic analysis. The two antagonists defining the ensuing debate were as expected, Ricardo who opted for the simplicity of analytic analysis over the stumbling blocks of empirical and historical data and his dead sparring partner, Adam Smith, who explicitly leaned toward the historical cum empirical approach to economics.[4]

As Robinson points out, there is an inherent difficulty in Ricardo's approach. Though initially distinguishing between agricultural rent, based on the indestructible nature of the land, and the rewards received by the owner of exhaustible resources, he then turns around and uses the same model for analysing both cases. As with farm output, additional production must come from increasingly inferior sources. No rent can be earned by the marginal mine, the market price just covering expenses and profit. The marginal producer thus defines the market price. The static long run nature of Ricardo's model is obvious. The presentation assumes that all relevant sources of ore are known and pre-existing. It is then only a matter of tapping each source in turn according to its potential output. In this context, the logic of such a model is irrefutable. But placed in a more historical environment, problems inevitably appear. Smith avoids historical disparities by allowing the price of the ore to also be regulated by the low cost as well as the high cost producer. New discoveries bring forth riches which make previous mines uneconomical or, in the language of Robinson, drop the user cost of these mines to zero. It is perhaps more accurate to concede that prices are regulated by the high cost producer for some given period but that over time new discoveries can shift the range of relevant costs. The marginal high cost producer changes, but not according to the Ricardian scripture. The change need not inevitably be in the upward direction. Extra-marginal units are quite capable of displaying increasing returns. Smith saw no historical evidence to suggest that the richest mines were inevitably those which were discovered first. Difficulty in transport or technology could render mines inoperable during earlier periods. Later those same mines could prove to be more cost efficient than its predecessors.

To an extent, the debate as it would continue to exist was largely defined. The dark pessimism of Ricardo would prove triumphant over the cautious optimism of Smith. While Smith's view was championed by Henry Carey and Karl Marx, the Ricardian tradition was upheld, in part, by J.S. Mill and Alfred Marshall. The bleak view gained the trappings of orthodoxy though even here the idea, as well as possibility, of an increasing return on the extensive margin remained an important subtext in Mill and Marshall. Low user cost reflects the idea of only minimal antagonism between present and future production. It is however true that for Marshall the leavening effect of extra marginal increasing returns in the case of zero user costs had been reduced to a footnote. What then accounts for the removal of such a moderating factor in more recent work?

Robinson suggests that this triumph of pessimism was a reflection of the prevailing economic environment at the time these influential papers on natural resource use appeared.

> While the natural resource outlook is bad, men care for natural resource economics, which may tell us how it is to be improved; when that condition is

> improved, natural resource economics ceases to have the same popular interest, for it can no longer prescribe anything which helps the people's life. (Robinson, 1989, p.178).

It is here that the reader wishes the author might be bold enough to engage in a bit more speculation. Specific events may well have been reflected in those papers which have over the years served to define this field. If it is true that work on natural resources has progressed most rapidly during times of crises, it is then quite natural that researchers turning their gaze once again on a recurring problem should look toward the major works of the past for their guidance. Trends in this manner become self reinforcing and gain dominance. It is not surprising however that what might be termed the long run equilibrium approach gained dominance in the realm of natural resource use as it did in so many other fields. As with most methodological issues, the approach taken had important consequences. If we start out by demonstrating that markets work to optimally allocate mineral resources in the long run, we reduce the need for any governmental correction to or regulation of those markets. The more short run, user cost approach provides no basis for preferring market to non-market mechanism. Neither Hotelling or Solow in his updated version of the orthodox model rules out a role for government to play in such an allocative process, but the onus must be at least implicitly on those proponents of intervention to demonstrate their case.

Hotelling's article appeared after an ongoing debate among oil producers over whether extraction needed to be rationalised. A minority in the industry favoured a program of conservation through a unitised field approach. Instead of many straws in one field draining the oil at a too rapid rate, there would be a pro rata allocation ensuring a maximum recovery of existing recoverable resources as well as use of technologically superior production practices. Unfortunately implementing such a program required the Federal Government to step in as monitor and policeman of such practices. Opposition to direct regulation met with overwhelming opposition amongst the majority of producers. Ironically, this opposition was virtually swept away in the U.S. oil industry as the newly discovered East Texas field flooded the market with oil in the early thirties.

Forty one years later, Solow's 1972 article appeared as the first environmental wave was gaining momentum and the Club of Rome was warning us of the limits to growth. Solow explicitly sought to calm the nerves of his audience by reminding his readers of the strength and resilience of the market process. He found his guide in Hotelling's piece. As Robinson acknowledges, even economists follow the news headlines. Both Hotelling and Solow responded to the crises of their day not explicitly to defend market processes but were inevitably led in that direction by the presuppositions of their methodology.

Robinson has done us a service by reminding us that assumptions that are now taken for granted have not in the past gone unquestioned. They have triumphed over equally or possible more plausible alternatives not because of their inherent superiority but because of the historical circumstances that marked the development of economics as a discipline.

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* School of Economics, University of New South Wales

Notes

1. The supply of crude petroleum in this country is being rapidly depleted' (US Federal Trade Commission 1923 quoted by Yergin, 1991, p. 220).

Thus despite a history of one major discovery being succeeded by an ever larger one, discussion since the early days of Drake in Titusville, Pennsylvania has focused on the imminent demise of oil stocks due to an every rising demand. The same time that the Federal Trade Commission was making its gloomy prognosis, rising oil supply led to American crude oil production exceeding domestic demand for the first time in a decade. More ironically, Harold Hotelling's 1931 landmark article on exhaustible resources came out almost simultaneously with the unprecedented gushers in East Texas. While Hotelling talked of the optimal use of exhaustible resources, the flood of oil from East Texas nearly meant the collective suicide of the industry.

2. For an industry operating under constant costs, net price is defined as market price net of unit extraction costs, or the unit profit margin.
3. As is well known, Keynes himself took issue with the penchant for classical economists to focus exclusively on long run equilibrium relegating short run considerations to a position of trivial importance. Present economists do not need a long memory to recollect the consequences of the price of oil deviating from its long run path in the seventies nor the latter effects of monetary policy aimed at correcting the stagflation in part generated by such a deviation. To claim that such a result is consistent with the long run growth paths for many of the world's economies is at best a heroic assumption.

   Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is long past the ocean is flat again. (Keynes, 1973, p. 65)

4. With Ricardo economics took a major step toward abstract models, rigid and artificial definitions, syllogistic reasoning - and the direct application of the results to policy. The historical, the institutional, and the empirical faded into the background, and explicit social philosophy shrank to a few passing remarks. Comparative statics became the dominant - though usually implicit - approach: Ric' ardo declared: 'I put those immediate and temporary effects quite aside, and fixed my whole attention on the permanent state of things which will result from them. (Sowell quoted in Robinson, 1989, p. 80).

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