

Why World Oil Monopolization Lowers Oil Prices: A Theory of Involuntary Cartelization

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ABSTRACT *This paper first shows that, in the absence of long-term production commitments, time-consistent monopolistic sellers of a wasting natural resource will underconserve their resource. Since the present values of the profits of these uncommitted monopolists are generally much lower than under competition, the only rational explanation for the persistent recurrence of such monopolies in the oil industry is the high profits to current generations of oil buyers, who unite to establish such a producer monopoly. The victims of such a monopolistic cartel, besides future generations of consumers, are the producers who must involuntarily expand their current productive capacities in order to benefit the cartel leaders, who stand to benefit from the higher future prices. OPEC, rather than being a monopolistic cartel, is an excess-capacity cartel, one that has been induced by current generations of buyers to supply sufficient excess capacity to efficiently accommodate their prospective future emergencies.*

Key words: Time-consistency; monopoly; International cartels; natural resources; Conservation; OPEC; Intergenerational exploitation.

JEL classifications: D40–42, D60–62, D70–72, D90–92, FOZ, H23, H77, L10–12, L20–22, L70–72, N40–42, N50–52, N70–72, Q36–32, Q33, Q38.

Adnan Mazarei, currently at the IMF, provided much more than a research assistant's contribution to the empirical content of this paper. But for writing down a detailed historical-institutional elaboration of the following argument, which would surely increase the argument's general credibility, he would be a co-author of this paper. On the other hand, as the facts upon which this paper is based have all been stylized in order to facilitate the development of the sometimes-delicate theoretical argument, some points of historical-institutional disagreements between us may remain. In any case, the author is solely responsible for whatever errors may appear in this paper. Anne Lee's assistance in supplying the data and graph summarizing the history of crude-oil prices in the Appendix is also gratefully acknowledged. Finally, both an exceptionally diligent referee and the North American editor of this journal provided many helpful comments on earlier drafts of the paper.

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1. Introduction

A major peculiarity of modern economic history has been the systematic nature of the glut-induced declines in world oil prices that have accompanied the monopolization of the world's crude oil market, together with the analogous jumps in world oil prices that have immediately followed the subsequent de-monopolizations of that market. As summarized on the chart in the Appendix: the supply-induced fall in real crude oil prices accompanying the emergence of the Standard Oil Trust from 1870 to 1882; the jump in crude oil prices that immediately followed the sudden 1892 break-up of the Standard Oil Trust; the subsequent fall in prices after the Standard Oil of New Jersey holding company was formed in 1898; the price-jump following the sudden 1911 break-up of the holding company; the surplus-induced declines in real crude oil prices accompanying the emergence of the US-led 'Seven Sisters' and a US-European consortium from 1922 to 1928 (see e.g. Sampson, 1975); the jumps in world oil prices and correspondingly sudden declines in output that came with the US-monopoly-breaking Middle-Eastern nationalizations from 1973 to 1980; and the steady increases in oil production and gradual decreases in real oil prices after the mid-1980s as the post-Cold War US came to re-assert its political hegemony over the world's oil-producing regions—all of the major movements in the history of oil production and prices—amount to the same empirical contradiction of conventional economic thought.

The oil industry has been viewed both statically, as a perishable-goods industry subject to a standard comparison of competitive with monopolistic pricing practices (e.g. Adelman, 1990; Houthakker, 1983; and many others), and dynamically, as an industry arising to temporarily exploit an exhaustible natural resource by selecting alternative, present-value-maximizing, rates of competitive or monopolistic resource exploitation (e.g. Hotelling, 1931; Stiglitz, 1976; and many others). But neither view has prepared us for the above empirical paradox.

Economic discussions of the history of oil prices have been correspondingly awkward. We thus read of the 'great oil discoveries' of the 1870s and 1880s, and again of the 1930–1960s, windfall discoveries that made crude oil prices fall and kept them low despite the coincident monopolization; but we seldom see any explanation of the increases in oil exploration that accompanied the historic monopolizations. And we commonly read, after the 1973 and 1979 price jumps, of the sudden formation of a 'monopolistic oil cartel' even though: (1) the pre-1973, US-supported oil consortia had far more monopoly ownership and control over world oil production than any single country or organization had after the 1970s nationalizations of US oil interests; and (2) the Organization of Petroleum Exporting Countries, OPEC, has eschewed all of the obvious devices for inducing substantial collective reductions in total cartel output in favor of customer-monitored price and quantity controls.¹

Now economists have long been aware, at least since the pioneering work of Schelling (1963) on bilateral monopoly and Coase (1972) on durable-goods monopoly, that monopolists generally face a 'time-inconsistency', i.e. a future-optimal pricing plan that contradicts their presently optimal pricing over the same span of future time. But only rarely do we find economic discussions in which such time-inconsistencies are resolved in order to inform us as to how actual decision-makers behave.²

We submit that the above-described peculiarities, paradoxes, and inconsistencies can all be eliminated by a simple resolution of a fundamental time-inconsistency facing any monopolistic owner of an exhaustible natural resource.

2. Resolving Paradoxes

The Fundamental Time-inconsistency

The particular time-inconsistency characterizing a crude-oil monopoly is quite obvious. At any point in time, a crude-oil monopolist has already sold a significant quantity of as-yet unconsumed oil. An increase in the monopolist's current rate of output, and correspondingly increase in the current period's rate of oil consumption, will therefore both lower the value of these previously sold reserves and raise the value of the monopolist's unexploited reserve, thereby redistributing wealth toward the monopoly and away from its previous purchasers. Besides representing a time-inconsistent redistribution, one that would not have been possible had the monopolistic producer been committed to a previously announced production plan, this effect implies a monopolistic misincentive.³

Like any monopolistic inefficiency, the misincentive arises because the monopolist internalizes a self-redistributive, or 'pecuniary', effect that competition would leave external. In the case of a crude-oil monopolist, however, the pecuniary benefit, the induced increase the value of the inframarginal output, comes from *expanding* the current period's rate of production. In particular, expanding production at the end of a current production cycle increases the value of the monopolist's inframarginal—i.e. future—oil reserves, an effect that a competitive crude-oil supplier would simply ignore.⁴ Such an increase in production has a largely offsetting current price-effect because the increased production, whether or not it is rationally anticipated, also lowers the price of pre-existing oil supplies. However, the corresponding pecuniary loss is at-the-time-external to the monopolist. This is because the pre-existing stock of currently consumable crude oil has already been sold when the relevant production decision is made.

If the oil monopolist had subjected all of the current-period's oil production decisions to a pre-set price or quantity commitment—an assumption that is completely unrealistic in the traditionally observed institutional environment but is nevertheless implicit in the standard dynamical literature on natural-resource monopolies—the above-described decrease in current oil prices would have been internalized by the monopolist when pre-committing to the current production rate. In such a case, as we have already indicated, no systematic under- or over-production effect would emerge (e.g. Stiglitz 1976; Lewis, Matthews and Burness, 1979).

Why, then, would we ever observe the formation of a world crude-oil monopoly? A competitive solution (which again approximates the costly, pre-commitment, monopoly solution) is more profitable to the oil producers than the uncommitted monopoly solution.

Why Crude-oil Sellers Monopolize

The answer, at least at the private level, is that there is a small number of large buyers of crude oil—in particular oil refiners—that own significant amounts of physically depreciating assets whose economic values are substantially enhanced by lower current crude-oil prices. These large buyers, by vertically integrating into crude-oil production and reserve-acquisition, create for themselves an opportunity to organize a world crude-oil monopoly, an institution that will substantially lower the prices of the crude-oil inputs that complement their physically depreciating

capital stocks. Indeed, history's three major crude-oil monopolizations—the formations of the Standard Oil Trust, the Standard Oil of New Jersey holding company, and of the 'Seven Sisters'—were cartelizations of oil refiners gaining substantially from lower current crude-oil prices.⁵ Only when political forces have worked to unexpectedly weaken these refiners have we observed competition in the supply of crude oil, lower crude-oil production, and correspondingly higher crude-oil prices.

More basically, the direct governmental ownership or control over most of the world's crude-oil reserves, which began to emerge along with the 'Seven Sisters' soon after World War I and accelerated after World War II, makes it natural to view an alliance of governments as the underlying source of the world's post-World War I crude-oil monopolies. Although the owners of the world's major oil refineries are typically citizens of these allied countries, this would not explain the independent monopolizing activities of these popularly democratic governments. What *would* explain the observed governmental behavior is the fact that popular democracies are substantially biased towards favoring present over future generations of voters (Pigou, 1932). The corresponding political premium on high profits for current investors and low prices for current consumers, both of which result from artificially high levels of current oil production, would then induce these governments to favor an uncommitted crude-oil monopoly over competition and an intergenerational Pareto optimum.

The only apparent reason that we do not see similar governmental attempts to monopolize other wasting resources (e.g. coal or wasting metallic ores) is the relative abundance of these resources relative to projected demands, as reflected in the relatively low values of the mineral reserves and correspondingly small potential for decreasing current output prices.

Of course, neither governments nor organized refiners, viewed as unconstrained maximizers aiming at broader objectives, would ever want to exactly maximize the value of the prospective profits from the production of crude oil. Nevertheless, modelling the maximization problem of governments or organized refiners in this broader, unconstrained, form would be unrealistic. For the observed broader decisionmakers typically delegate authority, including authority over crude-oil exploration or production decisions, to separate divisions. The only apparent goal of these uncommitted divisions is the continuing maximization of the division's asset values.⁶ The broader initial goals of the monopoly-forming buyers are thus evidently best served when their specialized crude-oil decisionmakers ignore both their employers' broader interests and their own time-inconsistencies, which means passively allowing the inconsistencies to be resolved in favor of future rationality as in the previous sub-section. Indeed, if this were not the case, owing to the effective equivalence of the precommitted monopoly and competitive allocations, no one would ever rationally devote substantial resources to monopolize the crude-oil market. The only institutions that would rationally work to establish a crude-oil monopoly are institutions whose broader goals are served by setting up a profit center that does not bother to make future production commitments.

Privately Managed Monopolies: A Simple Illustration

Consider the world market for heating oil. First imagine a perfectly competitive equilibrium. The currently extra-marginal barrel of the heavy crude oil ideally suited

for refining into heating oil is withheld from this-year's market because next-year's expected price-cost margin is sufficiently greater than this-year's price-cost margin that the competitive supplier is just compensated for foregoing the interest that could be earned by devoting the heavy crude to this-year's market. This Hotelling equilibrium, of course, possesses all of the social efficiency properties of any standard competitive equilibrium.

Now assume that a specialized crude-oil monopolist—say at the behest of a co-operative of the current refiners of heating oil—emerges. The monopolist, initially keeping things exactly as they were, will naturally come to review the decision to withhold that last barrel of heavy crude oil from this-year's market. The same current revenues and costs that were obtained by the competitive supplier can be obtained by re-directing the barrel to this-year's market. But the monopolist sees an 'additional increment of return to current production' in that the revenue from all future sales will be enhanced due to the lower total quantity of crude oil available for sale in future markets. The effect is substantial, and a significant amount of the crude oil that perfect competitors were withholding for future markets will be advantageously sold at the end of the current season.

The expectation of informed buyers that such monopolistic sales will occur substantially reduces the prices they are willing to pay earlier in the current season. Nevertheless, these lower prices must be taken as amounting to an unavoidable loss, a *fait accompli*, to the uncommitted monopolist viewing the situation at the end of the current period. Only if the monopolist had made a firm pre-commitment, say to produce the same initial total outputs as would competitive sellers, could the monopolist avoid this loss.

Extending the argument to a multi-period decision-setting while retaining the realistic absence of price and production commitments, total monopoly outputs substantially rise above the competitive levels in each near-future period while necessarily falling in the many subsequent periods. This pattern generates lower crude-oil profits in the earlier periods that are only partially offset by higher crude-oil profits in the later periods. We know that this offsetting gain is only partial because the more favorable, present-value-maximizing, perfect-commitment, monopoly solution again approximates the competitive solution (e.g. again, Stiglitz, 1976; Lewis, Matthew and Burness, 1979).

The above illustration applies to the actual decisions of a private crude-oil monopolist, such as the oil production manager of the early Standard Oil monopolies. However, the actual decisions of more modern, governmental, monopolists have only occasionally reflected such micro-managed output decisions.

Governmentally Managed Monopolies

Governments do, however, regularly participate in making decisions with respect to the time that particular would oil prospects are to be drilled. Here, the cartelized governments, as co-operating owners of a very large portion of the world's undeveloped oil lands, exploit their leaders' democratic biases towards inexpensive oil products for current voters by setting up governmental agencies with a monopolistic misincentive to hasten the world-wide drilling of these prospects in order to raise the value of their intra-marginal—i.e. future—oil prospects. Such drilling-induced price-effects are, as one might suspect, qualitatively identical to the earlier-described, production-induced, price-effects. This is theoretically elaborated in the heterogeneous capital model of Section 3 below.⁷

Thus, once foreign interests had found significant reserves of crude oil and the US had begun to import significant quantities of crude oil, which occurred immediately after World War I, a remarkable confluence suddenly emerged in the expressed interests of the US government and its large oil refiners (e.g. Chester, 1983). The individually optimal strategy of both the US and its large refiners then became one of setting up institutions that would induce other countries to sacrifice by currently overdrilling their potential reserves of crude oil. In particular, the US government and its partially integrated major oil companies, by becoming separate owners of substantial reserves of crude oil and leaders of a worldwide monopolistic oil cartel, would each benefit—both in the present and in the future—from a monopolistically contrived current surplus of foreign crude oil and a corresponding future scarcity of domestic crude oil.⁸

The Nature of Co-operation: Involuntary Cartelization

This brings us to a critical point in the understanding of co-operative organizations. As pointed out in Thompson and Faith (1981), the distributional results of jointly efficient co-operation are generally unfavorable to large groups of participants. Only the leaders of the co-operative are clear beneficiaries; others are generally kept in the co-operative by rationally predatory pre-commitments by the leaders. The original Rockefeller trust was formed by punishing hold-outs with artificially high transport charges resulting from prior rational contracts between Rockefeller and the railroads (Tarbell, 1904). Moreover, ‘independent’ producers of crude oil, being rationally responsive to Rockefeller’s pre-committed reaction function, must be formally regarded as part of the joint-maximizing co-operative even though they did not assent to the prior reaction function. These independents, of course, were victimized by the cartel leaders, specifically because of their having to accept artificially high and intertemporally increasing overhead transportation charges and therefore adopt significantly higher-than-competitive individual output decisions.

The aggressive post-World War I governments leading their similarly involuntary international cartels gained by inducing other governments to accept the sub-competitive crude-oil prices resulting from the centrally determined local drilling and production rates. Such centralized decision-making consistently induced super-competitive oil drilling and production rates from foreign oil fields in the early, low-price, years, while allowing the cartel leaders to withhold much of their own exploration and production for the later, high-price, years. While predatory pre-commitments by cartel leaders kept foreign suppliers in the world’s monopolistic cartel, these governmental victims, like the private victims of the first-generation monopolists, would have been much better-off under simple competition.⁹

These governmental victims could not, even if it were a friction-less transaction, have compensated the cartel leaders for adopting competitive institutions. This is, again, because of the democratic undervaluation of future generations.

The informed domestic rate of resource-exploitation by private investors in the countries dominating the international cartel would be correspondingly delayed to take advantage of the artificially high internal rate of return to waiting. But small oil producers could hardly be expected to be so informed. Thus, as the first international cartel was finally formed in the late 1920s and the real price of US oil correspondingly fell, a false-expectational wave of oil-selling emerged among the independents. This in turn magnified an already existing technological external

diseconomy on neighboring wells in wildcatter-dominated Texas. The US response to this uninformed and wasteful domestic over-production was to permit the states, again in combination with the relatively informed major oil companies, to efficiently ration-back domestic oil production,¹⁰ thereby giving essentially all influential oil observers (see, e.g. Blair, 1976; Chester, 1983; Sampson, 1975) the indelible, yet quite false, impression that the government-supported crude-oil monopoly was predictably operating to reduce total output and raise world prices.¹¹

The Technological Environment

The above dynamic analysis is fairly obvious in a standard Hotelling environment, one implicitly containing a homogeneous stock of an exhaustible natural resource. We shall now show that the analysis can be generalized to a much more realistic environment, one containing a heterogeneous stock of the exhaustible resource.

3. A Simple Model of Crude-Oil Monopolization

We think of the world as currently having W potentially profitable remaining oil wells. The current real cost of finding and developing the least expensive well is C_1 , the next-least expensive is C_2 , . . . , and the most expensive is C_W . As the relative cost of drilling any particular well can be assumed to be invariant over time, and the consumption goods producible from the resources necessary to drill the 1st well can be taken as the *numeraire* in each period, each of these real drilling costs can be taken to be time-invariant.¹² The prospective real profit from any well is thus given by $\pi_i(t) = P_t - C_i$, $i = 1, \dots, W$, where t represents the time at which the well is drilled, the simplifying assumption being that all profitable oil wells produce the same total output, which we take to be a unit of oil.

Figure 1 displays the profit opportunities for each well in a neighborhood of a competitive equilibrium, where the successive concave profit lines are, owing to the rationally expected time-invariance of the real drilling costs, all parallel to one

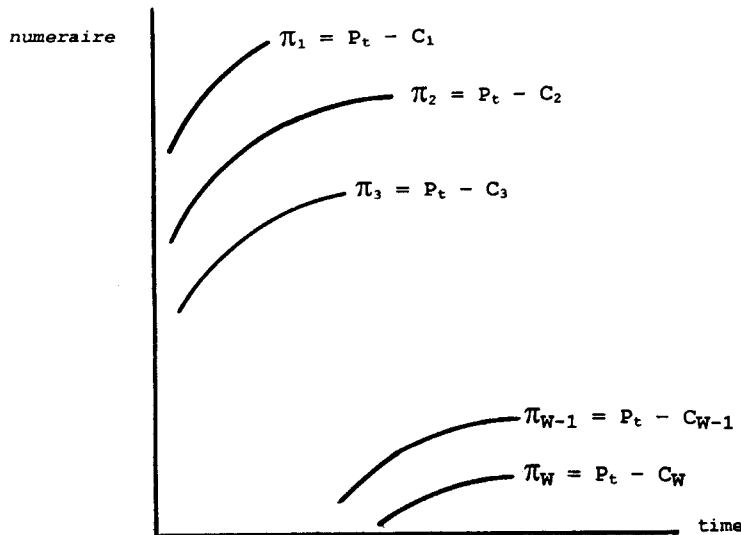


Figure 1. How profits depend on the drilling date for each prospective well.

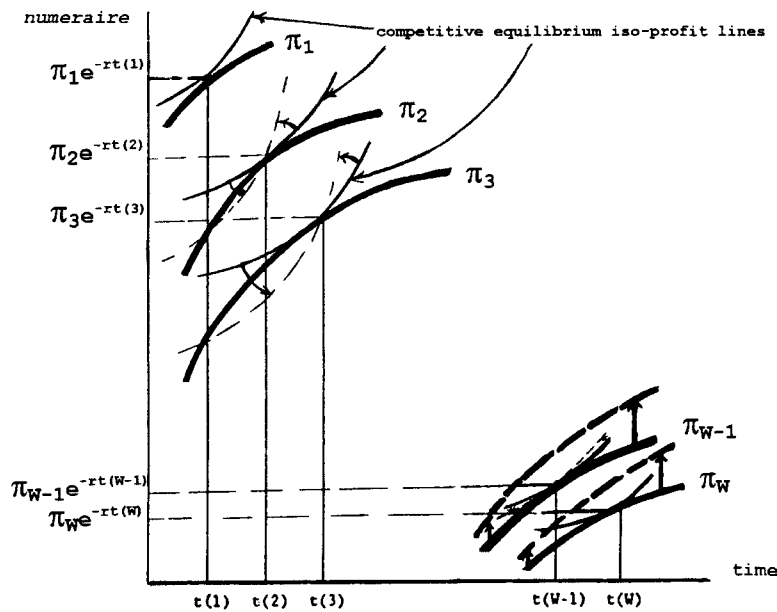


Figure 2. The competitive equilibrium drilling dates and the effect of period $t(1)$ -monopolization on the iso-profit and profit functions.

another. Real prices rise over time, but, owing to the strong likelihood of increasing future substitutes (Nordhaus, 1973), at a decreasing rate. Given a positive real interest rate for each period, r , Figure 2 then superimposes on these profit possibilities a series of logarithmically parallel *iso*-present-value lines, the convex-from-below lines on the figure reflecting a common investor-assumption that real interest rates will remain roughly constant over time.

The resulting, competitive path of development is also shown in Figure 2 as $\{\tau(1), \tau(2), \dots, \tau(W)\}$. The obviously sufficient first-order conditions for this succession of optima are described below (in equation (1)).

Ricardo, and anyone in the oil business, would accept the graphically obvious implication that the prospects are exploited in the order of their potential profitability. (Solow (1974) has also argued the same point, although he should have noted that we can produce exceptions to this rule by allowing well costs to differentially vary over time.)

We now turn the entire industry (the sum of the above profits) over to a monopolist, one who is unable to make pre-commitments respecting future economic activities. The price of oil at any date depends upon the monopolist's decision variable, the number of wells in existence at that date.¹³ While a given parameter to a competitive supplier, price is not a given parameter to the monopolist. In particular, the sooner a middle well is drilled, the higher the price obtainable from any, given, later well. Although the prices of the earlier-produced oil from the earlier wells will correspondingly fall on the expectation of the hastened drilling of the middle well, these prices must be taken as given datum when actually drilling the middle well.¹⁴

Thus, consider the monopolist's optimal drilling time for well No. 2, assuming that the monopolist takes over immediately after well No. 1 is drilled and its product sold to final users, who hold oil inventories. First, for comparison, $e^{-rt}(P_t - C_2)$, the

individual competitor's objective function for a constant r , yields a profit-maximizing level of t that satisfies

$$\begin{aligned} 0 &= e^{-rt} dP_t/dt + (P_t - C_2) de^{-rt}/dt \\ 0 &= e^{-rt} d\pi_2/dt - r\pi_2 e^{-rt} \\ r &= \frac{d\pi_2/dt}{\pi_2} \end{aligned} \tag{1}$$

as in Figure 2. In contrast, the monopolists' variable profit function is:

$$\sum_{i=1}^W \pi_i [t(i)] e^{-rt(i)} = \sum_{i=2}^W [P_{t(i)} - C_i] e^{-rt(i)}$$

Again, maximizing with respect to $t(2)$,

$$\begin{aligned} 0 &= e^{-rt(2)} [d\pi_2/dt] - e^{-rt(2)} r\pi_2 + \sum_{i=3}^W \frac{[d\pi_i[t(i)]/e^{-rt(i)}]}{dt(2)} \\ r &= \frac{d\pi_2/dt}{\pi_2} + \frac{1}{e^{-rt}\pi_2} \sum_{i=3}^W \frac{d[\pi_2(t(i))e^{-rt(i)}]}{dt(2)} \end{aligned} \tag{2}$$

The additional term on the right in Equation (2), compared to Equation (1), is unambiguously negative, signifying the fact that the later the drilling of well No. 2, the more oil there will be to compete with well Nos. 3, . . . , W .

Graphically, then, we need only transpose the additional term to the left and regard it as an increase in the marginal time cost of drilling well No. 2. The result, as is graphically obvious from the effective steepening of the originally tangent *iso*-profit curve to the monopolist's π_2 -curve, the move to the broken-line *iso*-profit curve on Figure 2, is a hastening of the drilling of the No. 2 well by the monopolist and a corresponding decrease in current oil prices. Essentially the same argument applies to well No. 3, except for a very slight change in prices owing to: (a) the slight rise in price occasioned by the earlier drilling of well No. 2 and (b) the largely offsetting fall in price occasioned by the earlier drilling of wells Nos. 4, 5, etc.

The same reason for hastened drilling applies with steadily decreasing strength to all further wells up until the last one. Nevertheless, there is a gradually emerging possible counter-tendency toward delay based upon the accumulation of induced increases in distant future prices and corresponding twist up in the later prices and π_i -functions. Although this emerging twist-effect is dominated by the above-described hastening-effects for the earlier wells, which are the chief concern of this paper and the subject of our theorem on the near-term price-reducing effects of monopolization, after a while, the higher-future-price-effects may conceivably accumulate to the point that the possible delay due to the induced future price-twist may come to exceed the contemporaneous hastening-effect. This possibility is also illustrated on Figure 2, where the broken line illustrates the above-described upward twist in later prices, a shift potentially delaying the monopolist's distant-future drilling decision. However, since the levels of both of these later prices are also higher for the monopolist, earlier drilling is indicated for both wells because the firm would rather have the given increase in future revenue earlier than later. The price-twist

resulting from the hastened prior production would therefore have to outweigh both the basic monopolization effect and this simple impatience-effect in order for the drilling of a distant future well to be actually delayed.

4. Generalizing the Environment

We now generalize the entire discussion, first by considering other functions of the state and other forms of time-inconsistency and later by exploring the technological and economic bounds of the above monopoly argument. The initial generalization shows how some cartels emerge, again with the state's blessing, not to foster monopoly but to induce an intertemporally efficient pattern of outputs as between peacetime and wartime. The initial generalization will thereby help us provide a more balanced, and more self-contained, picture of governmental policy toward the oil industry.

Non-monopolistic Cartels

When a state's very survival is critically dependent upon its ability to optimally resolve an ordinary time-inconsistency (i.e. to establish a pre-commitment favoring the present decision-maker), the inconsistency will clearly have been so-resolved within observed, successfully surviving, states.

In particular, as elaborated elsewhere (Thompson, 1974: footnote 4; 1979: Section IIB.4), a time-inconsistency threatening the very existence of stable democratic states has concerned the magnitude of future governmental expenditures in prospective military emergencies. An optimal resolution of this societal time-inconsistency imposes future war-time price controls and rationing on certain goods. This, in turn, implies the optimality of prior peacetime subsidies to ordinary competitive investments in capital necessary for the future production of the war-rationed goods. Oil products have been quite significantly price-controlled and rationed during our most severe wars. A significant peacetime subsidy to US oil investors is therefore a qualitatively efficient policy response to the potential problem of domestic peacetime underinvestment, a policy response moving peacetime prices and incentives towards the after-subsidy prices and incentives that would exist if future wartime rationing and price controls were somehow obviated by a lump-sum method of future emergency taxation.

However, because of the domestic political resistance to simply subsidizing foreign capitalists, the domestically optimal aid to investors in foreign capital necessary for the production of war-rationed goods comes in an entirely different form. In particular, the importing government oversees and enforces an excess-capacity-inducing international cartel of foreign exporters of the war-rationed outputs. Such a cartel is administered by accepting an above-market peacetime price set by the foreign suppliers, enforcing the cartel by rationing back the resulting excess-supply among the potentially competing sellers, and granting rights to sell at the above-market price in proportion to the excess production capacities built up by the cartel members. This investment-inducing-cartel amounts to a subsidy to the foreign holding of this particular kind of capital (Thompson, 1979: Section IIB.3b). For all but the most severe wars, the induced peacetime build-up of excess capacity will exceed wartime demand; so wartime demand will be filled at prices that are not significantly higher than the cartel-augmented peacetime prices, and wartime rationing will be unnecessary.

Thus, for example, our most recent, to-us-moderate, wars in the Persian Gulf and Kosovo consumed relatively large amounts of oil but fortunately did not substantially increase contemporary oil prices because of the prior, OPEC-cartel-induced, excess capacity of oil production.

If prices were never controlled and product rationed, even during the most severe wars, and the cartel correspondingly dissolved, the prospect of high wartime prices would induce pre-severe-war levels of *laissez faire* capacity accumulation that would equal the currently optimal cartel levels. In other words, the cartel works to create the consumption and investment pattern that would arise if wartime prices could be allowed to rise to their market-clearing levels. Thus, for the oil industry, the cartel works to both expand drilling and reduce peacetime outputs, just as would a price system that eschewed price controls and rationing during extensive wars.

Similarly, other, earlier, international cartels—those in tin, coffee, and sugar—have been traditionally unfairly maligned by economists, who have mistakenly viewed these cartels as monopolistic despite the obvious cartel encouragement to investment and excess peacetime capacity and the fact that the US has actively participated in the cartels by directly enforcing their capacity-based export quotas (Thompson, 1979: section III.B).

We are now prepared for a simple analysis of the dramatic changes occurring in the world oil market since the ignominious US failure in Vietnam.

The Vietnam Watershed

The Vietnam War was a turning point in US history. Besides suddenly ending a 200-year-old tradition establishing the effectiveness of the US citizen-soldier—the military tradition upon which the US's 'rights-of-man' liberalism was founded (Hickson and Thompson, 2000)—this unprecedented US military failure led to: (a) a substantial increase in the commonly perceived US military dependency on foreign oil; and (b) a new independence on the part of previous political dependencies.

The latter effect—although systematically reversing itself since the mid-1980s through the weakening and collapse of the Soviet Union—was sufficient to temporarily free the Middle-East from US political domination and generate the observed rash of 1970s oil nationalizations. It was thus temporarily sufficient to transform the world oil market from a US-run monopolistic cartel to an essentially competitive market. There were, of course, two steps to the transformation, which began in the early 1990's. For Iran stubbornly remained a US dependency up until late 1978, when their anti-US Revolution generated the large oil price increase observed in the Appendix. Once Gorbachev and his policy of Glastnost arrived on the scene in 1985, the ability of Middle East exporters to rely on Russia to support their independence from the US soon vanished. Oil prices then collapsed as the US reasserted its hegemony over the area by the early 1990's.

But oil prices did not, as is clear from the Appendix, fall back to their pre-Vietnam-War level. This is because the former effect was also working. The continuing post-Vietnam War reliance on foreign oil meant that the US has rationally continued to support OPEC as an excess-capacity-inducing, international cartel. As explained in the above sub-section, such a cartel merely works to create the equivalent to the drilling and production incentives that would emerge if oil importing countries did not have to rely upon sub-competitive price-controls and rationing during their most severe defensive emergencies.

Nevertheless, because industry economists have traditionally mis-analyzed these investment-inducing international cartels—preferring to represent them as monopolistic cartels and examples of gross governmental inefficiency rather than acknowledging the subtle efficiency of these pragmatically produced institutions—a large majority of economists have been led to regard OPEC as a monopolistic cartel despite the availability of both the alternative interpretation described in the above sub-section and a continuous stream of economic studies showing that OPEC possessed none of the organizational characteristics of a monopolistic cartel.¹⁵

Since the ineffectively internally cooperating OPEC members had sharply decreased their outputs, and this was indeed the primary cause of the increases in oil prices during the 1970s, economists could have alternatively inferred that the output-decreases were the result of a switch from an involuntary monopolistic cartel to relatively free competition in the world oil market. It would, as we have already argued, have been entirely consistent with the history of oil prices and the nature of crude-oil monopolization. All it would have taken is a realization that crude-oil monopolists faced a time-inconsistency and a corresponding theoretical analysis of the effect of uncommitted monopolization on the prices of wasting natural resources. Then, when the USSR fell apart during the latter half of the 1980s—thereby eliminating the abilities of oil-exporting nations to rely on a US rival for political support and returning political dominance to the US—our theory would not be alone in predicting (a) the corresponding collapse of world oil prices and yet (b) the maintenance of OPEC output restraints and corresponding oil prices in excess of their pre-1974 levels.

The Lack of Empirical Generality of the Monopoly Overproduction Argument

Exhaustibility appears to be the sole essential technological characteristic of the under-conserved resource under discussion. What ‘exhaustibility’ (or the ‘wasting’ character of a resource) introduces is, by definition, an intertemporal margin of substitution in which a greater current rate of utilization of a given resource presents the society with a lower future supply of the resource.

It is therefore tempting to extend the range of application of our monopoly argument, applying it to any industry in which a single firm is the sole owner of a kind of capital that is no longer worth producing. In the corresponding absence of replacement investment, and assuming a specificity of the capital to a particular quality of output, this capital-and-output monopolist faces a time-inconsistent incentive to over-exploit the capital in the current period, generating excessive current outputs and an excessive wearing out of the underlying capital stock in order to increase future prices. Thus, even a simple, uncommitted, perishable-goods, monopolist might currently overproduce in order to physically depreciate the firm’s capital inputs so as to induce an increase in future prices.

Recall, however, that prospective output purchasers, those profiting from lower current output prices, must generally organize and work to prevent the above monopolist from establishing an approximately efficient output or price commitment. The unfettered monopolist may, for example, promise to refrain from selling at prices below its initially advertised prices for an entire season. This form of commitment is indeed frequently observed. This is probably because the requisite form of buyer-co-operation is generally considered an illegal restraint of trade, at least as regards our domestic economy. We therefore suspect that our over-producing monopolists do not extend far beyond the oil industry. It is apparently

the scope and the intergenerational nature of the petroleum resource problem that suffices to organize oil buyers, including the governmentally involved members of the current generation, in the exploitation of this 'opportunity'.

5. Policy Conclusion

The governmental support for institutions generating the monopoly overproduction of current crude oil is based upon the well-known Pigouvian weakness of democracies in which future generations lack effective political representation. It is useless to suggest world oil conservation to such governments despite the economic efficiency of such a policy. The inefficiency can be practically eliminated only by a Constitutional amendment eliminating the political imperfection responsible for democracy's inefficient exploitation of future generations (Thompson *et al.*, 2000). Such a reform, in fundamentally improving domestic intergenerational efficiency of any modern nation's democratic legislation, would give politicians an incentive to end their governments' monopolistic overexploitation of the world's oil reserves.

Notes

1. This absence of anything resembling an optimally monopolistic cartel policy has induced many critical oil observers to dismiss the common view that OPEC is analyzable as a monopolistic cartel. However, thoroughly non-monopolistic views have uniformly characterized these critical observers. In particular, these minority views emphasize changes in property rights and capital market imperfections within a steadily competitive market environment in their attempts to explain the OPEC price hikes of the 1970s.

Johany (1980), for example, argues that the switch of ownership from the relatively insecure, therefore short-horizon, US oil-companies to the relatively secure OPEC countries in the early 1970s lowered the discount rate of the relevant decisionmakers and thereby lowered the production rates of the OPEC countries. Even if this view were a qualitatively accurate characterization of the relevant horizons of the alternative oil-owners (which it almost certainly is not), the view is not consistent with the price-increasing effect of the 1979 shock, which clearly increased the insecurity of existing owners.

Another, more recent, stand in the literature on market imperfections suggests that OPEC members, rather than forming a monopolistic cartel, individually follow a target-revenue policy. Each country separately determines its development budget and proceeds to produce only that amount of oil satisfying these budgetary needs. Oil revenues above and beyond these budgetary needs are not pursued because of the limited 'absorptive capacity' of these economies and imperfections in international capital markets (e.g. Teece, 1982). As a result, OPEC countries display a *backward bending* supply curve for oil, and the observed reductions in output that have accompanied the price increases are the result of normal, imperfectly competitive, supply responses to the demand increases of the early 1970s (Crémer and Salehi-Ishfahani, 1991). Besides similarly failing to explain the second jump, 1979, in oil prices, and the steadily mounting fiscal deficits of OPEC's dominant members, the hypothesized capital-market imperfection is wholly inconsistent with the fact that the superior security of a balanced portfolio of diversified foreign assets relative to a portfolio of domestically fixed assets increases with the price of the latter assets.

Section 3 below deals with the nature and consequences of OPEC-type cartelization.

2. Rather, theoretical niceties such as time-inconsistency are typically—quite indefensibly—regarded by economists as being too difficult for sub-Oddysean decisionmakers—especially governmental decisionmakers—who are implicitly presumed too weak-minded or unsophisticated to attack such subtle problems. In contrast to this standard view, the author (e.g. Thompson and others, 1974; 1979; 1980a,b; 1981a,b) has argued that individual decisionmakers—especially governmental decisionmakers—not only respond to such time-inconsistencies but optimally solve wide classes of such policy problems long before economists and other social thinkers even conceive of them. An extended example of this latter argument, one particularly relevant to OPEC-type cartelization, will be provided in Section 4.

3. Customer oil storage across production or consumption seasons is strictly unprofitable in any initial competitive equilibrium, wherein storing oil in a well out-competes consumer storage because the former enables the investor to save current lifting and reservoir costs. Thus, while the competitive prices of shut-in oil wells increase at the relevant rates of interest, the competitive prices of crude-oil increase at less than the relevant rates of interest (see Section II below).
4. If the monopolist were selling a durable, rather than an exhaustible, or 'wasting', natural resource (e.g. diamonds rather than oil), then expanding current output would, by lowering the prices of future outputs, reduce the present value of future profits. Thus, time consistent monopoly sellers of a durable natural resource will overconserve their resource (Malueg and Solow, 1990).
5. This refiner-participation might suggest, quite counterfactually, an output-decreasing monopsony-model rather than the output-increasing monopoly-model we are developing in this paper. However, our simple monopoly-model can be rationalized by pointing to the British, Dutch and US governments, who have substantially constrained refiner organizations by making them serve the national interests of these governments. We shall elaborate upon this latter influence at various points in the text below.
6. To the extent that the division heads are hired by refining firms or current-generation-biased governments, we may expect that their general aims are qualitatively consonant with their employers. But we do not know whether satisfying the employers exact quantitative optima would generate lower or higher prices, given that the division manager's time-consistent wealth maximizations already reduce current prices substantially below competitive levels.

One may still object to our methodology here. The ultimate maximizers are governmentally constrained, vertically integrated refiners or, more basically, the current-voter-dominated governments. Adopting these alternative maximizers, however, would introduce an extreme degree of vagueness into the analysis because many current voters are parents. Although parental collectives have substantial concern for future generations, they still have insufficient concern (Thompson *et al.*, 2000). Besides this pragmatic defense of our assumption, a methodological defense is that any exercise in applied economic theory adopts independent maximizers that, in fact, must bend to various forms of governmental interventions leading them away from strict wealth maximization and toward a kind of governmental welfare maximization (Thompson and Faith, 1981).

7. The government does have an opportunity to encourage domestic oil production through various tax incentives. Although percentage depletion may work in this direction, the corresponding government-induced discouragement to domestic oil production through the government-induced tying of land royalties to current outputs substantially offsets this encouragement. Similarly, regarding domestic drilling, although observed US drilling subsidies may be conceivably rationalized by the government's monopolistic incentive to hasten the development of known oil fields, the existence of prospective future wartime price controls and rationing of oil products is what actually rationalizes the subsidization of such investments (see 'Non-monopolistic Cartels' under Section 4).
Governmentally managed oil monopolies must therefore have concentrated on the policy-manipulation of foreign production and drilling.
8. This monopoly surplus of foreign oil would generally occur even if we ignored the transaction costs of international redistribution by allowing costlessly negotiated transfer payments. A rationally foregone current opportunity cost of the cartel leaders would then be potential lump-sum payment from the foreign oil producers, reflecting a profit-based offer enabling the foreign producers to share in the benefits of the future scarcity. The monopoly's current surplus of foreign crude oil would then be strictly based upon the lower costs of developing and producing foreign oil (Section 3).
9. Viewing the issue historically, mistakes and all, probably reverses this distributional conclusion as regards the governmental 'victims'. The heavy monopolistic exploration and production investment by cartel leaders in Third-world countries were unexpectedly nationalized in 1973 through appraisal principles that unrealistically assumed a perpetuation of the artificially low crude-oil prices previously paid by the leaders of the suddenly defunct cartel.
10. Even if we were to disregard expectational errors and common-pool externalities, we should note here that there was, during the 1930s, a growing US interest in encouraging excess-capacity-generating oil institutions, as explained in Section 4.
11. Similarly, the consistently expressed desires for increased national oil production by Middle Eastern nations in the years just prior to 1973, desires created by the theretofore increasing degree of monopoly by the US, have been falsely taken to imply that the reversal of their position in 1973 was due to a sudden increase in the ability of Middle-Eastern countries to monopolize their market (Adelman, 1990). This sudden switch to a contractionist policy can, as explained in Section 4, be consistently understood to be the result of a concurrent *demonopolization* and buyer-induced formation of an excess-capacity cartel.

12. The *numeraire* consumption good is thus implicitly chosen to be a good whose marginal cost of production is not rationally expected to systematically change compared to the cost of drilling a given oil well. Expected future relative costs enter the problem as present certainty-equivalents. The possibility that the future world may simply not exist enters our problem by increasing the common discount rate applied to all future return and costs.
13. Destroying a socially valuable resource, a back-door method of making a future production commitment, is assumed to be strictly illegal.
14. Some ambiguity would arise if a large part of the production from earlier wells were remaining to be marketed when the middle wells came on line. To eliminate it, we assume all of the oil from the earlier wells is marketed before the oil from the subsequent wells reaches the market.
15. See, e.g. note 1.

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Appendix

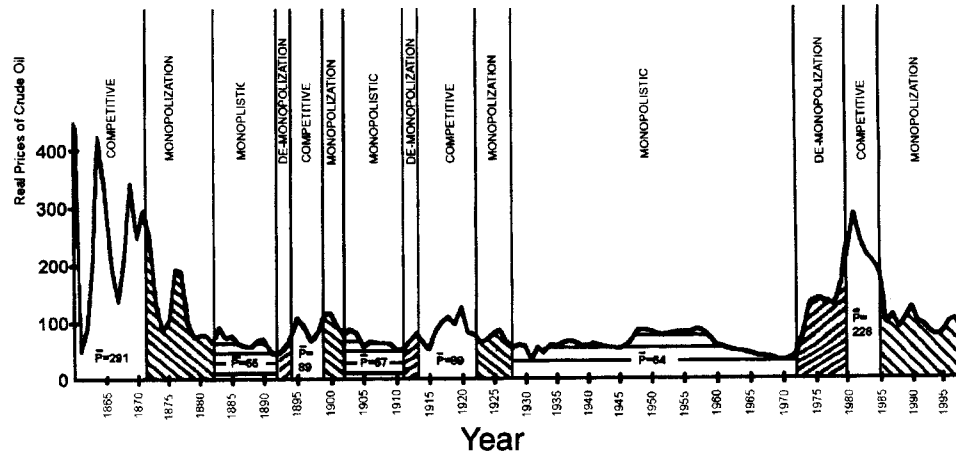


Figure A1. Average annual real prices of crude petroleum at well per barrel in the US.

- (1) The nominal price of crude oil comes: (a) for 1860–1958, from US Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*. Bicentennial Edition, Part 1, Washington, D.C., 1975; (b) for the years 1959–1972, when the US rationed imports of crude oil to the major refiners, from a linking of our previous index to the average world price of crude oil delivered in Japan, a large non-cartel customer, obtaining our data from Neil Jacoby, *Multinational Oil*, New York Macmillan, 1974, p. 228; and (c) for the years 1973 to the present, from *The Statistical Abstract of the United States*, US Department of Commerce, Bureau of the Census, Washington, D.C.
- (2) The price level is the Consumer Price Index, which comes from two sources. For 1860–1989, the data comes from John J. McCusker, ‘How Much is That in Real Money? A Historical Price Index for Use as a Deflator of Money Values in the Economy of the United States,’ *Proceedings of the American Antiquarian Society*, 1992 101, part 2, pp. 297–373. From 1990 onward, data comes from *The Statistical Abstract of the United States*, US Department of Commerce, Bureau of the Census, Washington, D.C.