Recent U.S. Price Controls: How Does Business Respond?

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Rand

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PREFACE

This report is the text of a briefing delivered by Charles E. Phelps to the Board of Trustees of The Rand Corporation on November 14, 1980. It provides a nontechnical rendering of work jointly undertaken by the three authors for the U.S. Department of Energy and The Rand Corporation.[1]

Price controls have been common in U.S. economic history since World War II; since then, every President except one has employed some form of price control or guideline. This report summarizes research conducted on the consequence of the actual type of price controls used recently. The structure of these controls is very different from that usually assumed by economists, and their consequences are markedly different as well.

This report shows how these controls are structured, gives some visual analytical tools to help understand their effects, and provides evidence from recent controls in the petroleum refining sector to show their consequences.

Further study is needed to understand the consequences of such controls in other industries; the response of businesses to such controls is different in important ways for firms with different types of production technologies. An agenda for future research shows the most profitable next steps toward understanding this form of price control.

We anticipate that this version of our results will interest members of the business and economic policy communities concerned with the effects of wage-price controls on business decisions.

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[1]Frank Camm, Charles E. Phelps, and Peter J.E. Stan, *Resource Allocation Under the COWPS Price Guideline: The Case of Fixed Proportions,* The Rand Corporation, R-2634-DOE/RC.

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INTRODUCTION

This report is a brief analysis of how American business responds to wage and price controls. Although economists have previously examined such regulations at some length, we will argue that their analyses have been largely misdirected. Moreover, since some form of wage-price control has been present for nearly 20 of the past 40 years, a deeper understanding of the effects of this economic policy on private decisionmaking is required.

THE 1979 GASOLINE SHORTAGE

Our work on wage-price controls began in a search for causes of what has come to be known as the "1979 gasoline shortage." We found that this term contains three misnomers. First, the episode was not restricted to 1979: It started in 1978 and proceeded through 1980. Second, the events did not involve only gasoline: There were shortages of other refined products, including diesel fuel, heating oil, and jet fuel. Third, it was not simply a shortage. A number of other unusual economic events were taking place simultaneously; these led us to the analysis we describe below (see Table 1).

Table 1

UNUSUAL ASPECTS OF RECENT PETROLEUM PRODUCT SHORTAGES

- Dealers get rich quick.
- Product prices diverge.
- Pricing patterns become unusual.
- Inventories grow during shortage.
- Refiners charge $8 billion less than DOE rules allow.

The first unusual feature of this shortage (we will now call it a petroleum shortage) is that service station dealers received an extraordinary and continuing financial windfall. Second, a large spread of prices across refiners occurred for refined products. At an extreme it ranged from 55¢ to $1.09 per gallon for regular gasoline—a two-to-one spread during the month of July 1979, for example. The third

oddity, very difficult to explain, was the strange pattern of product prices charged by a single refiner. Compared with past prices, the prices of unleaded, diesel, and regular gasoline stopped bearing their traditional relationships to one another. Fourth, there were unusual changes in inventories during the shortage. Finally, and perhaps most puzzling for economists, during the peak of the shortages of gasoline and other products in the United States, refiners were charging at least $8 billion per year less than the Department of Energy allowed. It is hard to understand why there was a shortage if the oil companies could have increased their product prices substantially under DOE regulations.

Others have proposed a variey of explanations for these events, but none upon reflection seem adequate to account for a shortage (see Table 2). Perhaps the prevalent popular explanation for the shortage is the loss of Iranian oil. This explanation presents two problems for the analyst. First, many countries more dependent than we on Iranian oil had no shortage when the Iranian cutback occurred. Second, total oil production in the world actually increased after a very short decline because of increased output, for example, by other OPEC nations. Thus, the Iranian oil loss, while an important factor in precipitating the event, could not have caused it.

Table 2

ALTERNATIVE EXPLANATIONS OF THE SHORTAGES

- Iranian oil loss.
- DOE rules.
- Oil company actions.
- Council on Wage and Price Stability (COWPS).

A second and widely prevalent explanation within the U.S. economic community is that DOE regulations caused the shortage. But as indicated previously, refiners could have legally charged much more than they did under the DOE rules. More important, there were shortages of other refined products—diesel fuel, heating oil, and jet fuel—for which there were no DOE price controls or allocation rules. Thus it is difficult to place the blame on the Department of Energy.

The third explanation, a "conspiracy theory," says that the oil companies themselves caused the shortage. It is notoriously hard to dismiss this sort of argument. However, if one believes it, why did they

leave $8 billion that they could have legally collected lying on the table?

This leads us to the explanation that rules of the Council on Wage and Price Stability (COWPS) caused the shortage (see Table 3). COWPS administers a set of general economy-wide wage-price controls, supplemented by special rules for some industries. Unlike the wage-price controls typically postulated and analyzed by economists, these rules do not control specific prices. Rather, they constrain the total revenues that firms are allowed to earn. (We will show below how such constraints are devised.) In addition to not being a price control as such, a revenue constraint of this form is completely unrelated to market demand: If demand rises or falls, the revenue constraint is not affected directly. Finally, the controls establish a different revenue constraint for every firm, even if firms have the same output, since the controls depend on historical data specific to each firm. This cross-firm specificity becomes important, as we will see.

Table 3

COWPS RULES

- Apply to all industries.
- Constrain *total* revenues.
  - Not product prices.
  - Unrelated to market demand.
  - Different for every firm.

In general, a firm has an allowed revenue constraint equaling the sum of two types of costs: "allowed" input costs and historical nonallowed input costs, adjusted by a 6.5 percent per year inflation factor. Actual costs incurred by purchase of allowed inputs can be passed through immediately in allowed revenue, but the passthrough of costs for other inputs is constrained.

$$\text{COWPS allowed revenue} = \left(\begin{array}{c}\text{Actual}\\ \text{"allowed"}\\ \text{input}\\ \text{costs}\end{array}\right) + \left(\begin{array}{c}\text{Historical}\\ \text{"nonallowed"}\\ \text{input}\\ \text{costs}\end{array}\right) \times \left(\begin{array}{c}1.065\\ \text{inflation}\\ \text{factor}\end{array}\right)$$

- Incentives to alter choice of inputs, *if possible*
  - More "allowed" inputs
  - Fewer "nonallowed" inputs

This division has been very common in price controls throughout the last four decades, the general notion being one of "fairness." If costs are thought to be outside the control of the firm, the firm is allowed to pass them through. If they are thought to be controlled by the firm, the costs are subject to this sort of constraint. A serious difficulty with analyses of wage-price controls to date is that they accept this rationale as an acceptable, and even desirable, basis for the form of such controls without asking how it affects firm behavior. Presumably, however, it is more appropriate to judge a government program on its results than on its intentions.

Under this type of rule, a firm using fewer nonallowed and more allowed inputs to produce a given output can increase the allowed revenue associated with a given amount of output. If the firm can substitute between these two types of inputs, there would be a strong incentive to use fewer nonallowed inputs. We will examine below other forms of firm behavior that derive from similar concerns.

The specific controls for the refining sector changed in an important fashion during this period. In FY 1979, the first year of the program, the allowed inputs included only crude oil. Nonallowed inputs accounted for all other historical costs of the firm.[1] These were subject to the 6.5 percent inflation adjustment.

$$\begin{pmatrix}\text{1979}\\ \text{allowed}\\ \text{revenue}\end{pmatrix} = \begin{pmatrix}\text{Crude}\\ \text{oil}\\ \text{costs}\end{pmatrix} + \begin{pmatrix}\text{All other}\\ \text{historical}\\ \text{costs}\end{pmatrix} \times \begin{pmatrix}\text{1.065}\\ \text{inflation}\\ \text{factor}\end{pmatrix}$$

In January 1980, there was an adjustment in these rules. Crude oil costs remained allowable costs, but refinery fuel costs, an important part of total refinery costs, also became an allowed cost.

$$\begin{pmatrix}\text{1980}\\ \text{allowed}\\ \text{revenue}\end{pmatrix} = \begin{pmatrix}\text{Crude}\\ \text{oil}\\ \text{costs}\end{pmatrix} + \begin{pmatrix}\text{Refinery}\\ \text{fuel}\\ \text{costs}\end{pmatrix} + \begin{pmatrix}\text{All}\\ \text{other}\\ \text{costs}\end{pmatrix} \times \begin{pmatrix}\text{1.065}\\ \text{inflation}\\ \text{factor}\end{pmatrix}$$

This presented a major relaxation of revenue constraint for the refiner using this rule.[2] As we shall see, this has some important implications for interpreting the events surrounding the shortage.

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[1]Firms could also choose a profit-margin constraint, in which returns to capital became the "nonallowed" factor. COWPS reports that, for the large refiners, about half selected the profit margin and half the gross margin constraint.

[2]For firms using the profit margin constraint, the rules were unchanged.

It is important to note that we are dealing with special technology in the refining sector. Although there is still incentive to switch from other inputs toward crude oil to make the same amount of products, it appears from what we have been able to learn that refining technology does not allow this. While there are incentives for such substitution, they do not appear to be achievable, thus affecting the results to some extent.

THE SIMPLE ANALYTICS OF CONSTRAINED PROFIT MAXIMIZATION

To understand the consequences of these partial cost-passthrough rules, consider an analytical tool that we call "profit hill." (See Fig. 1.) It is simply a graph of total profits that a firm can earn plotted against its output. Generally, profit expands as the firm increases its output until it reaches an optimal output giving it maximum possible profits. If a firm then continues to expand output, its profits can actually fall. For example, it might have to start using older, and possibly outmoded, machinery or overtime labor. The point is that there will be some output that gives the maximum possible profit. Briefly consider how this analytical tool works.

The size and shape of this profit hill is partly determined by the market price (see Fig. 2). Obviously, for any given output—for example, that indicated by the dotted line—if the market price goes up, profits are higher. The second feature we generally expect is that as the price goes up, the output leading to maximum profits is higher. This is a long way of showing something well known: When the market price goes up, firms produce more.

The shape of this profit hill is determined by a variety of forces. One of these is the technology of the firm. Moreover, as demonstrated, the higher the market price, the higher the profits the firm will have. Finally, market-allowed profit falls if the firm's input prices go up. This is common sense: The more costly its inputs, the lower the profit will be at any output. (We separate the firm's costs into both the allowed and unallowed inputs, as defined by COWPS.) (See Fig. 3.)

The combination of COWPS-allowed revenue and actual costs likewise provides a COWPS-allowed profit hill. The allowable profit hill from COWPS has a generic shape similar to the market profit hill but is not the same. The size and shape of the COWPS-allowed profit hill are affected by the firm's technology but are independent of market price. Further, allowed input costs do not affect this profit hill, whereas higher costs of nonallowed inputs lower profits. While the

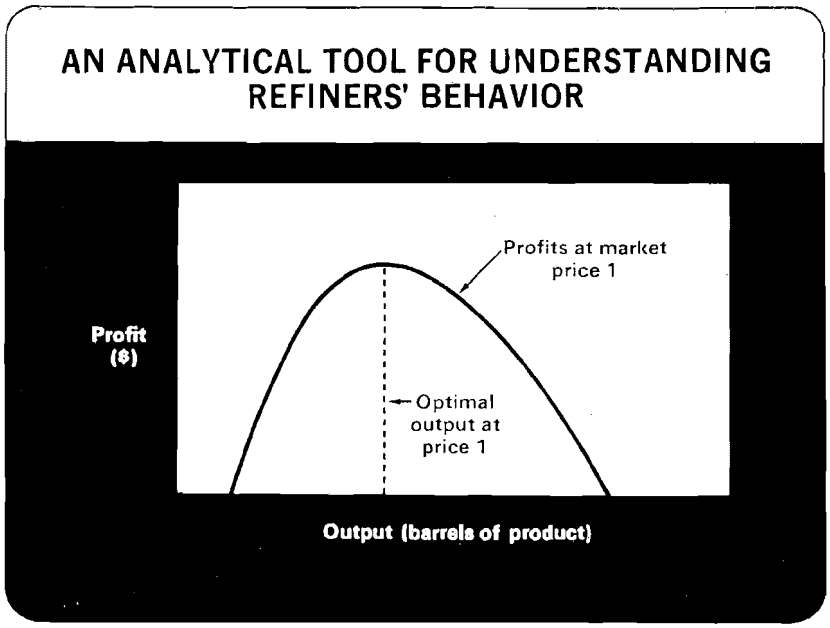
AN ANALYTICAL TOOL FOR UNDERSTANDING REFINERS' BEHAVIOR
Profits at market price 1
Profit ($)
Optimal output at price 1
Output (barrels of product)

Fig. 1

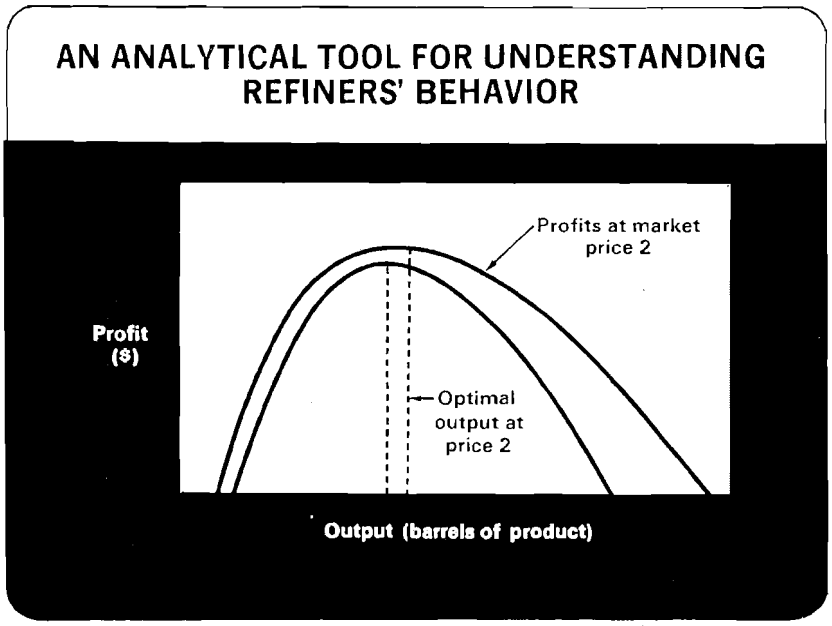
AN ANALYTICAL TOOL FOR UNDERSTANDING REFINERS' BEHAVIOR
Profits at market price 2
Profit ($)
Optimal output at price 2
Output (barrels of product)

Fig. 2

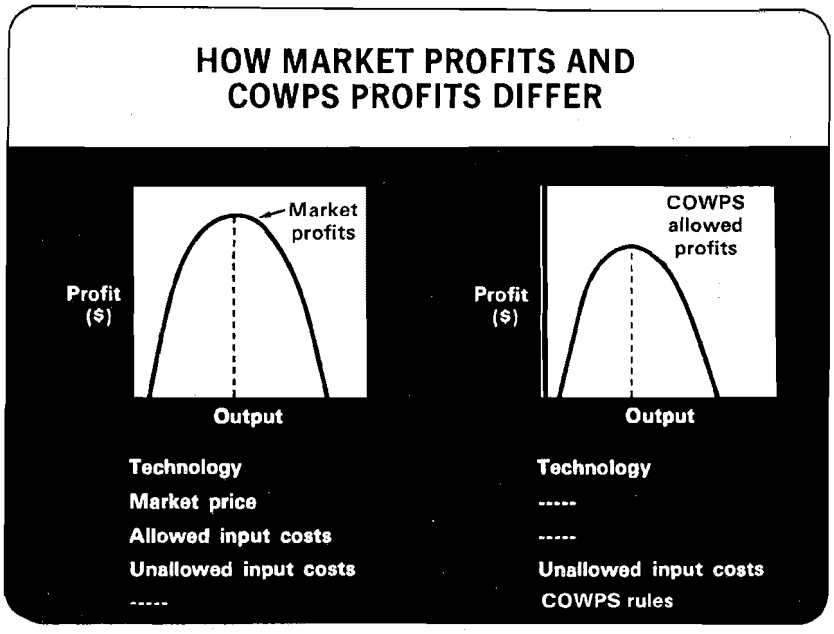

Fig. 3

COWPS rules do not affect market profits, market price and allowed input costs do not affect COWPS profits. Hence, although both profit hills have similar generic shapes, different forces determine their specific shapes and locations.

These profit hills are constraints facing the firm. The market profit hill gives the maximum possible profit the firm can earn by charging a market-determined price at any given level of output. The COWPS profit hill gives the maximum profits the firm can earn while complying with the COWPS guidelines at any output. A competitive firm under the COWPS guidelines must satisfy both constraints simultaneously.

First, consider a situation where the COWPS rule is written so generously that it has no effect on the firm's behavior (see Fig. 4). As shown, COWPS allows higher profits at every output than does the market, and with this sort of price control rule, COWPS is irrelevant. The firm is bound most severely by the constraint of market profits and chooses output level A that gives it the maximum of these profits.

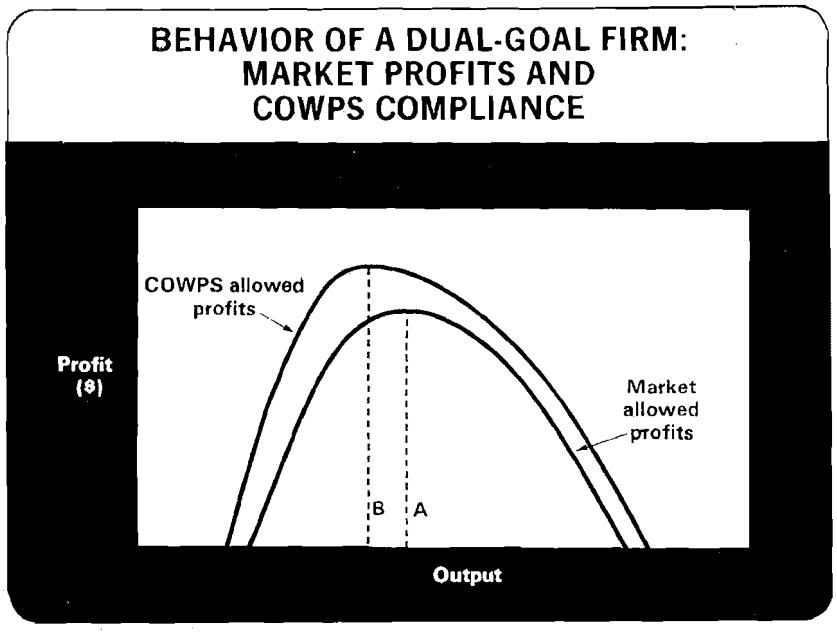

Fig. 4

Next, take the same market profit hill for the firm and impose a more restrictive COWPS constraint, as indicated by a lower COWPS-allowed profit hill in Fig. 5. If the firm is producing at output A and such a rule is imposed, then its continuing to charge the same price at output A would mean that it makes greater profits than COWPS allows. COWPS allows higher profits. However, if the firm reduces its output; and the firm can continue to increase profits by reducing output to the point where the COWPS rules and the market allow the same level of profits (output level C).

In this situation, the lower COWPS profit hill represents a *relatively* more binding regulatory constraint. As the COWPS constraint becomes relatively more binding, the firm moves away from the point of maximum market-allowed profits (A) and toward the point of maximum COWPS-allowed profits (B). Output level C "balances" consideration of the separate goals associated with these two constraints. This firm will be in compliance with the COWPS guidelines but will still charge a market-clearing price.

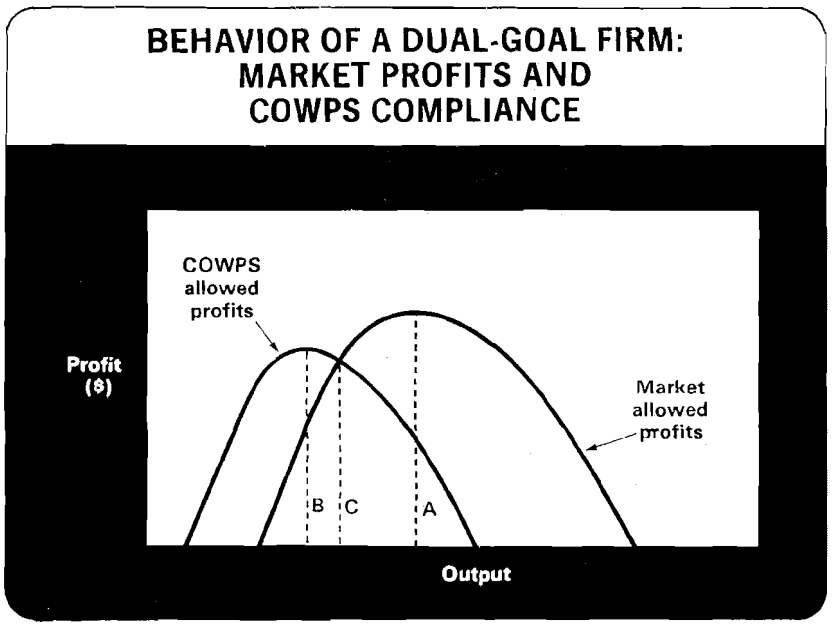

Fig. 5

Now consider a COWPS profit hill still more restrictive (see Fig. 6). Eventually, the COWPS-allowed profits could become everywhere less than the market-allowed profits. In this circumstance the best that the firm can do is its optimum under the COWPS rules at output B. The market constraint is irrelevant here, and the situation is just the reverse of the first case: The COWPS constraint is so tight relative to the market constraint that the firm completely ignores market signals. Further, the gap between COWPS and the market profits requires that output price be reduced at a given output to stay in compliance with COWPS.

Several things will happen in this situation (see Table 4). First, the output of the refiner will fall. Second, prices charged by the refiner must also fall, and buyers will attempt to purchase more product at this lower price—a standard economic phenomenon. We thus have less output, a lower price, higher demand, and hence a shortage. We believe that this is actually what happened in 1979-80 in the refining

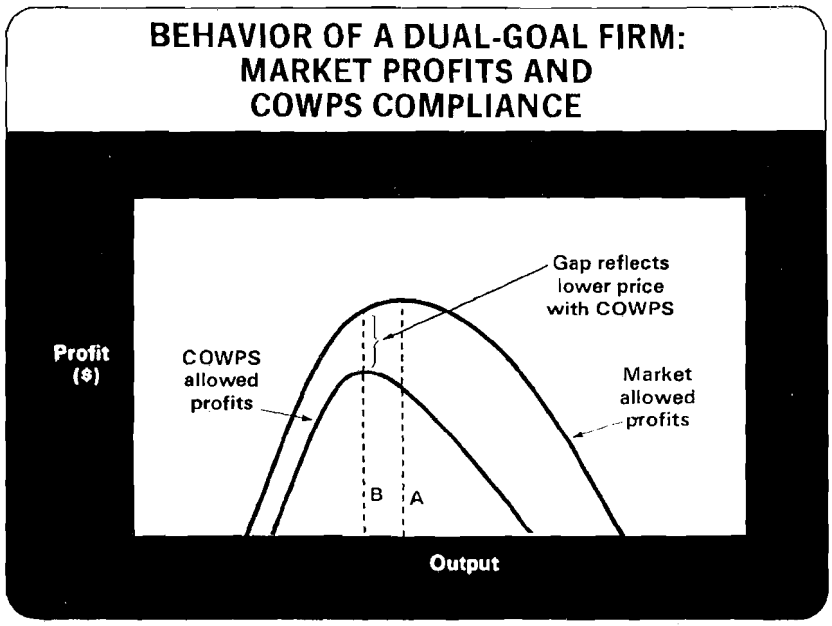

Fig. 6

Table 4

CONSEQUENCES OF FULLY BINDING COWPS CONTROLS

- Refiners' outputs fall.
- Consumers demand more at lower prices.
- *Shortage* results.
- Refiners all charge different prices.

market.[3] Third, all refiners will be charging different prices because the height of the COWPS-allowed profit hill differs for each refiner, depending on historical data within the refining company. Hence, the gaps between market- and COWPS-allowed profits may be different, since each refiner can face a different revenue constraint under the COWPS guidelines.

THE EVIDENCE

We now step away from this analytical tool and present some brief examples of data that support the notion that COWPS caused the petroleum shortage and the other phenomena discussed earlier. The first of these is the retailers' profit windfall. Recall that some refiners, the firms severely constrained under COWPS, reduce their outputs and selling prices. Hence to clear the *retail* market, in which less product is now available because of refiner cutbacks, the retail price must rise. The difference between the local service station's buying and selling prices for gasoline must expand. This difference is called the "retail margin"; if DOE rules eventually prohibit its rising to clear the market, a *retail* shortage emerges.

Consider what happened in the retail market during this period (see Fig. 7). Retail margins averaged a 6¢ to 7¢ per gallon average in the industry during normal times. COWPS introduction in October 1978 is indicated by the first dotted line. The second dotted line at January 1, 1978, is when the first quarterly compliance statements were filed by the refiners. Immediately thereafter we see evidence of a product shortage moving from refiners into the retail industry. The retail margin increased to nearly double to triple the historical levels. DOE retail margin rules were almost certainly a binding constraint at this time, so that a market-clearing price could not be charged by many service stations. The combination of a COWPS-induced refiner shortage and DOE retail margin controls thus led to the 1979 gas lines. Retail margins declined slightly at the point indicated by the third line at August 1979 because there was a small change in DOE rules for retailers. Then in the first quarter of 1980, retail margins started a long, slow, steady decline. In other words, the pressure on the retail industry faded away, and retail margins started to fall.

The plausibility of a causal link between COWPS and the shortage is great. Retail margins went up immediately after COWPS was in-

[3]Note that a shortage occurring at the refinery level does not necessarily cause a retail shortage. We will discuss below how this occurs.

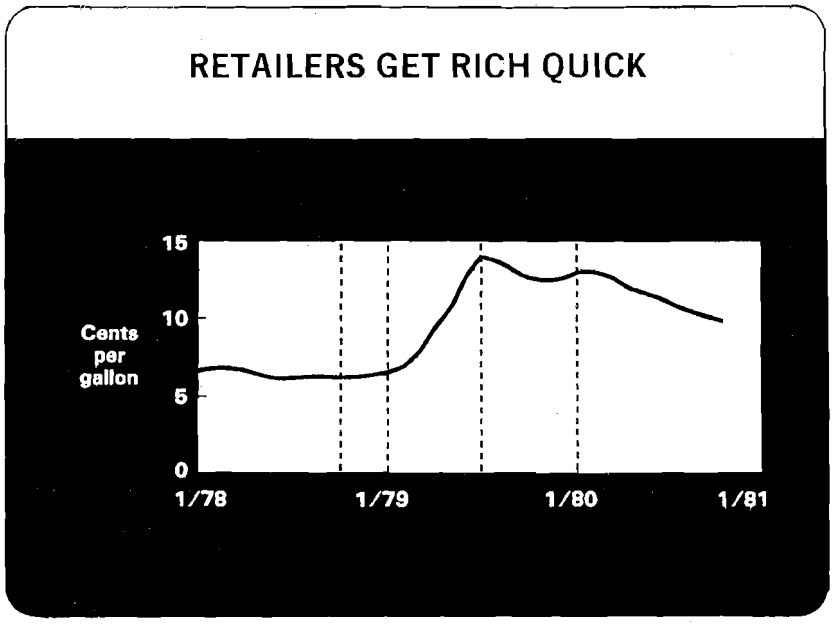

Fig. 7

troduced and began to decline when the COWPS gross margin for refiners was relaxed. As these rules were relaxed, we would expect refiners to start producing more and thus reduce the pressure on retail margins. We see not only the immediate upsurge after COWPS but also a return to normalcy after the refiner gross margin guidelines were relaxed.

A second feature of this market was a substantial divergence in product prices across refiners (see Fig. 8). In a normal competitive market we would expect every refiner to charge the same price for the same product. Under COWPS rules we expect prices to differ when the COWPS rules are sufficiently binding to produce a shortage. Shown is the variability of prices for barge lots of #2 fuel oil in New York harbor. Note that #2 fuel oil *was not controlled* by the Department of Energy; the price quotes are all *from the same location;* and the quotes are all *for the same quantity*. Under normal circumstances we would expect to have an extremely small variability in such prices across refiners. In fact, measured by the coefficient of variation—the standard deviation divided by the mean of price—we find an extremely small variation until COWPS was introduced in the fourth quarter

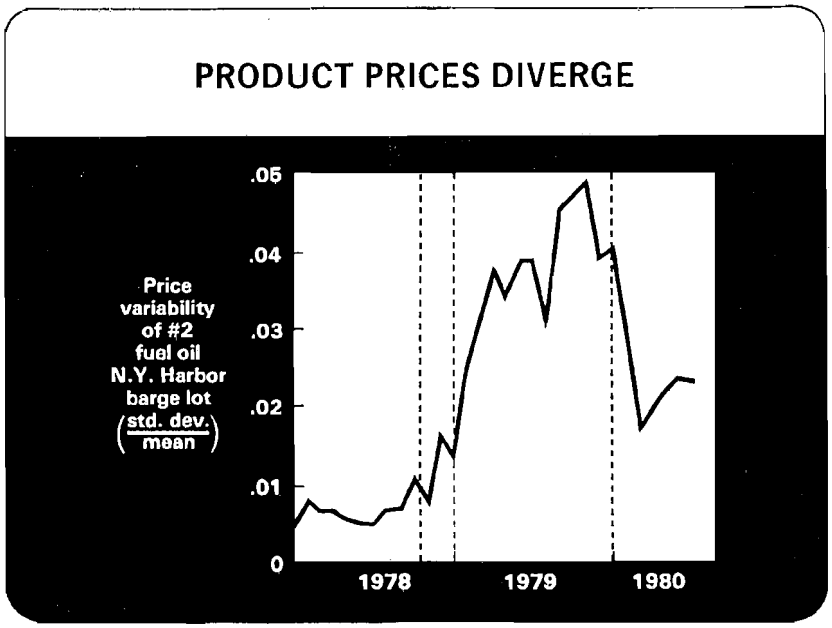

Fig. 8

of 1978. By the time refiners filed their first quarterly reports, the variation in prices underwent a spectacular burst. This variability continued until January 1, 1980, when the gross margin was relaxed. We could replicate this same picture for a number of other products but have chosen this one because the Department of Energy did not at this time control #2 fuel oil prices. This seems to eliminate the Department of Energy as a possible cause for this sort of behavior.

The third feature of the shortage was the unusual pricing patterns for refined products. Recall that under the COWPS guidelines refiners face a constraint on the aggregate revenues received on the sale of *all* products but no restrictions on the prices of *specific* products. In the absence of the COWPS guidelines, the relative product prices in markets with joint production (such as refined products) reflect relative costs of producing the products and product demands. This pricing system ends when the COWPS guidelines become fully binding, and we might therefore expect pricing patterns that normally prevail to be altered.

Indeed, Fig. 9 shows the distribution of differences between refiners' prices for leaded and unleaded gasoline at two points in time: before and after COWPS went into effect. Before COWPS, in July 1977, this gap varied very little across refiners, resulting in a very tight distribution of price differences. This is the type of distribution expected in a competitive market. After COWPS became effective, a broadly distributed pattern of prices emerged. We can find no explanation for this change other than the effects of refiner compliance with the COWPS guidelines.

Finally, all of these events were taking place at the time when DOE price controls seem irrelevant. There is, in fact, specific evidence in the DOE rules as to their irrelevance—the "banked costs" of refiners. These are revenues allowed by the Department of Energy that the refiners did not capture in pricing their products and that are stored in an account as they accumulate. Generally, banked costs have slowly eroded in the refining sector for the last few years, hovering at a level of about $1 or $2 billion with some seasonal fluctuations. When the COWPS guidelines came into effect in the fourth quar-

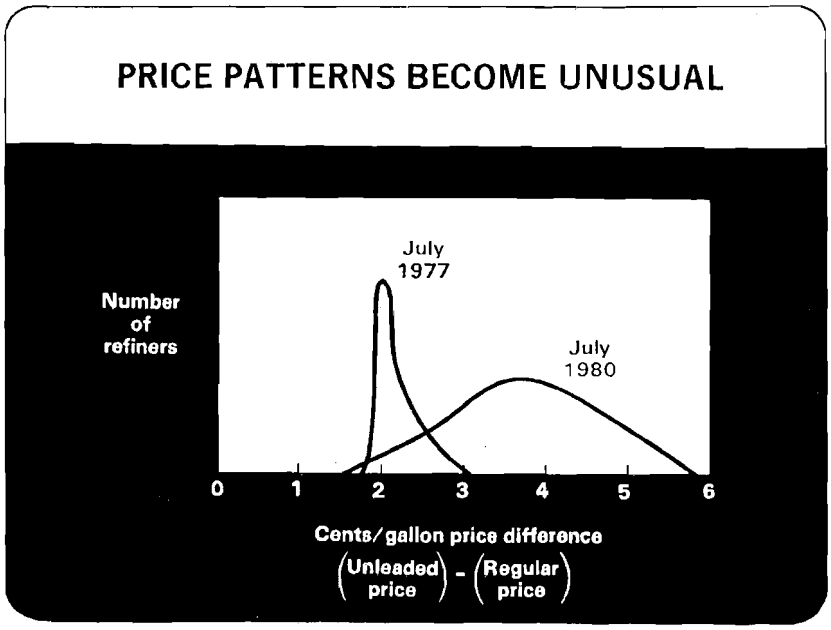

Fig. 9

ter of 1978, however, banked costs suddenly started to accumulate rapidly (see Fig. 10). Why? As mentioned previously, under COWPS refiners have no incentive to reflect relative production costs in their product prices. In addition, they can also store up banked costs for gasoline but not for other uncontrolled products, under the DOE rules. Thus, if they reduce the relative price of gasoline and keep the price of other products as high as the market will permit, they can accumulate banked costs under the DOE rules. Banked costs are a valuable asset if COWPS is eliminated, but DOE rules still apply, because they would possibly allow higher future profits under DOE rules than would otherwise be available. The highest previous level of banked costs for the large refiners that generated these data was about $4 billion; it is now about $10 billion. Obviously, banked cost accumulation accelerated when COWPS came in. This once again suggests that the cause was compliance with COWPS rules. It also provides compelling evidence that DOE rules had nothing to do with the refiners' pricing, since the refiners could have legally received $8 billion more revenues during this period than they in fact did.

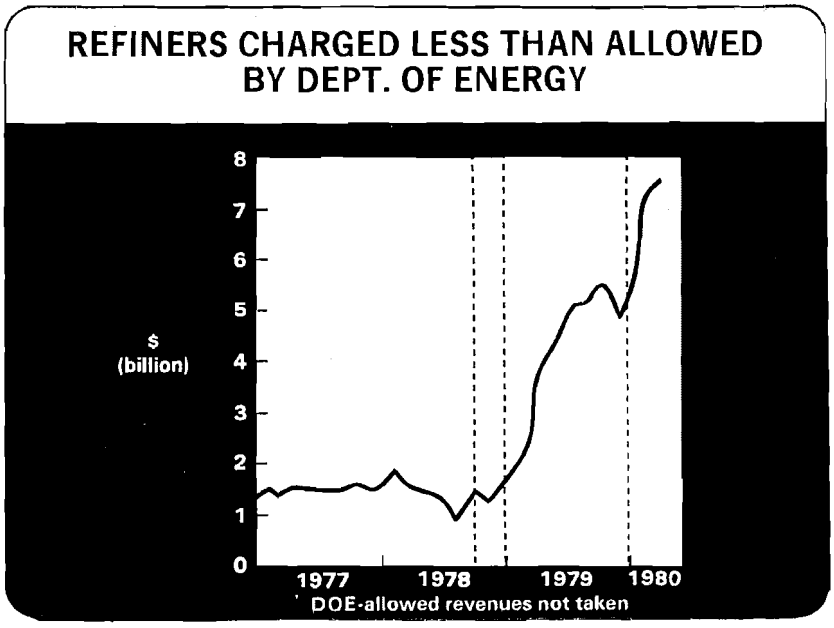

Fig. 10

OTHER RESEARCH DIRECTIONS

We have found in our research on the refining industry that COWPS-like wage-price controls can produce major distortions in business decisions, including how much of each product is produced, what kind of inputs are used to produce it, and what kind of capital investment is undertaken.

An example of the type of distortion we expect to find is shown with the profit hill in Fig. 11. Compliance with the COWPS guidelines in the case shown in the figure would lead a profit-maximizing firm to produce at output level A. If the price of the product were to go up, so that the higher market profit hill pertained, the normal response for a competitive firm would be to expand output. But the new output chosen to maximize allowable profits under COWPS would be where the new (higher) market profit hill and COWPS profit hill intersect. In other words, output would *fall* as the market price *rose*. Although this is an extraordinary prediction, our model allows us to explain it quite simply. A rising product price makes the market constraint less

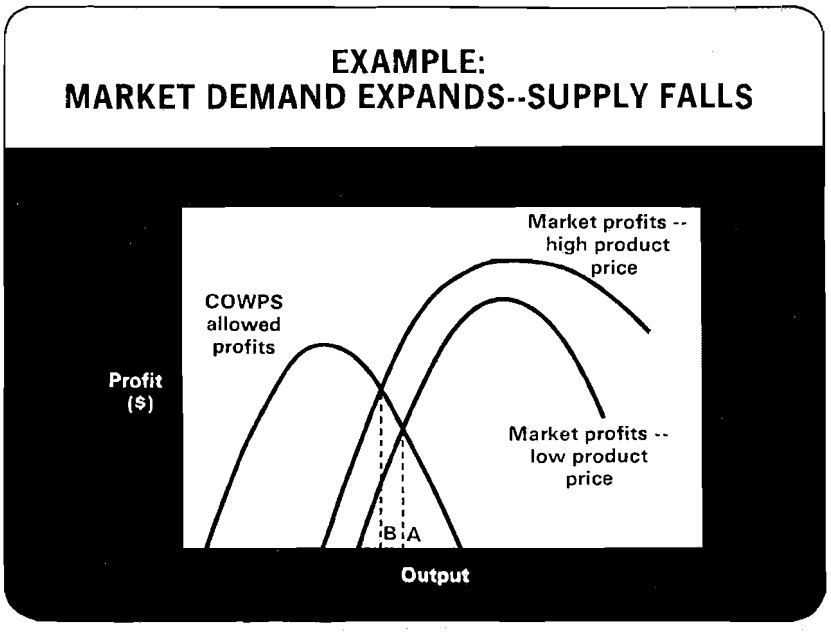

Fig. 11

binding *relative* to the COWPS guideline constraint. A firm in compliance would respond to this price change by moving away from its competitive output level and toward the output level chosen when the COWPS rules are fully binding. As a result, the firm would do exactly the reverse of what an unbound firm would do: Instead of output expanding in response to higher market price and demand, it can fall for a complying firm. Note too that if there are many such firms in the market, price "controls" with the same generic structure as COWPS can lead to *higher* prices, *even when all firms comply.*

Similar sorts of unusual behavior are predicted for the use of inputs to production, and especially for the formation of physical capital. Since capital is almost always included in nonallowed costs, there will be incentives to reduce its use and formation. Similar results should likewise be expected for R&D investment. Thus, sustained application of such controls could have economic consequences long after they are eliminated.

CONCLUSION

This generic type of price control has been a prevalent feature of the American economy over the last four decades (see Fig. 12). Since President Roosevelt during World War II, only President Eisenhower employed no price controls. Presidents Kennedy and Johnson had less formal guidelines, called "price guideposts," which were removed in 1968. President Nixon enacted formal price controls in August 1971; these were modified several times and eliminated in 1974 under President Ford (except for the remaining controls affecting the refining and crude oil sectors). President Carter imposed the current COWPS guidelines in the fourth quarter of 1978 and they remained through 1980. Thus, between 1940 and 1980 we have had some form of price control or guideline, with potential for causing the adverse effects described, in about *half* the years. Even now, speculation is common on the *date* when President Reagan will employ controls (*Business Week,* December 1, 1980; *Los Angeles Times,* November 25, 1980). We thus intend to pursue this line of research as vigorously as funding and staff availability permit.

Our research agenda is outlined in Table 5. We hope to establish a funding base for this research that will allow us to look across several recent periods of price control, contrasting in particular the recent voluntary COWPS guidelines and the mandatory Nixon-era controls. Their structure is similar, but each was employed with different rules, emphases on enforcement, and consequences for noncompliance. From such research we hope to learn not only the consequences of the con-

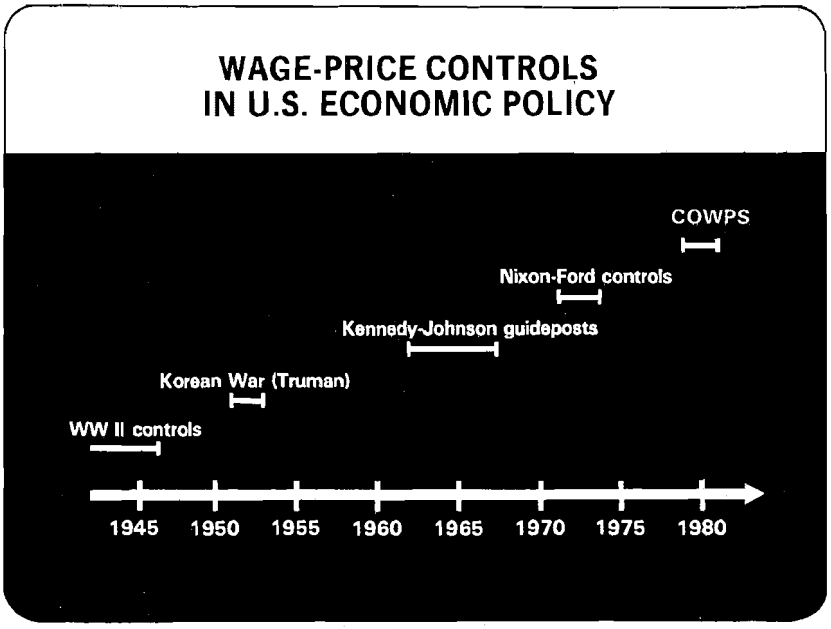

Fig. 12

Table 5

FUTURE WAGE-PRICE CONTROLS RESEARCH

Scope	Topics for Analysis
• Other industries	Output changes Choice of factors
• Other price-control eras	Capacity utilization Capital formation R&D
• Other nations	Shortages Backlogs/unfilled orders Labor mix Sanctions/enforcement

trols but reasons for business compliance with informal guidelines and controls. We thus plan to investigate a broad enough set of industries to allow us confidently to generalize our results. The work must encompass both new theoretical developments and new empirical measurements of the wide range of behavior we feel can be affected. We hope to have much of this research completed before the next debate begins—as it surely must—about imposing such controls.

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