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Suboptimization by Rationing

Minda R. Schechter

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I. INTRODUCTION

Government regulation of the sources of supply and production has had a significant impact on this nation's economic life ever since the inauguration of the New Deal in the 1930's. Rationing, price controls, minimum wage laws, and import quotas are just a few of the many devices now employed by the federal government in order to achieve desired social or economic ends. Frequently, however, well-intentioned regulations actually harm those groups that they were designed to protect.[1]

This article will explore how government regulation of petroleum marketing and, in particular, recently enacted legislation giving the President power to ration gasoline can have such counter-productive effects.

Since the 1973 oil embargo, geologic and economic factors which indicate that crude oil is a depletable natural resource have not significantly changed.[2] In fact, the OPEC nations have continued to increase their production and supply of oil to industrial nations,[3] price controls

1. A classic example is minimum wage laws which fix wages at artificially high levels. Because demand for laborers decreases as the wage scale is forced higher, employers will hire fewer people. The job market will shrink and the level of unemployment will rise. Thus, many potential wage earners, whom such laws were designed to protect, may ironically be left in a worse position by not being able to be employed at all. *See, e.g.*, P. SAMUELSON, ECONOMICS 393-94 (9th ed. 1973).

2. The finite amount of oil, the decreasing supply, and the limits on the rate at which it can be recovered are discussed in Flower, *World Oil Production*, SCIENTIFIC AM., Mar. 1978, at 42 [hereinafter cited as Flower]. United States domestic oil production, for example, is down about 700,000 barrels a day since 1972, while President Carter's announced oil import target of 8.5 million barrels a day was considerably more than the United States imported in 1978. *OPEC's Painful Squeeze*, TIME, July 9, 1979, at 12, 14; C. TUGENDHAT & A. HAMILTON, OIL THE BIGGEST BUSINESS (1975) (see especially *The Energy Crisis*, ch. 21, at 214).

3. *See OPEC's Painful Squeeze*, TIME, July 9, 1979, at 12.

on gasoline continue to exist,[4] and Congress granted to the President emergency gas rationing powers[5] in the event the so-called "shortage" should become more extreme. Eleven states and the District of Columbia imposed odd-even gas sales systems in July of 1979 evidencing a felt need to allocate limited supply.[6]

In 1979, Congress, in response to the recent crisis in Iran, granted to the President authority to impose gasoline rationing in the event of an emergency supply situation.[7] The Act requires the President to submit a standby rationing plan to Congress for review within 120 days of enactment that could only be rejected by a joint resolution of disapproval within thirty days of submission to the Congress. This requirement, that the President's plan be disapproved within thirty days or the plan is approved, was a point of great controversy in the congressional battle over this legislation, and was intended to eliminate potential politicism from the decision to impose rationing.

Congress is granted by the Act, however, power to veto a presidential decision to impose an approved gas rationing plan. The President cannot impose rationing unless there is a severe energy supply disruption. Such a disruption requires a 20% shortfall of home heating oil, gasoline, and diesel for at least thirty days. Additionally, the disruption must be one that is not manageable by other emergency procedures. With prior congressional approval, rationing can be imposed with a less-than-20% shortfall.

Under the Act, gasoline is to be distributed on the basis of the

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4. On October 24, 1979, Congress voted 225 to 189 against an amendment which would have eliminated the federal price controls on gasoline. *See House Votes to Keep Gasoline Price Curbs*, L.A. Times, Oct. 25, 1979, pt. I, at 1, col. 5.

Acting under the authority of the Energy Policy and Conservation Act (EPCA), 15 U.S.C.A. § 757 (West 1976 & Supp. 1980), the Carter administration ordered phased decontrol of domestic crude oil prices effective June 1, 1979. *See* Bachman, *Carter Will Phase Out Crude Price Lid*, OIL & GAS J., Apr. 9, 1979, at 80 [hereinafter cited as Bachman]. During the period of June 1979 to September 1981, the President has authority to control oil prices in any manner he chooses. In September 1981, when the President's authority to control prices will expire, domestic prices should have risen to the world level.

Thus, though phased decontrol has begun, gasoline remains price controlled while other petroleum products may command their free market price. This fact alone can contribute to a "shortage" of gasoline or its underproduction in the mix of petroleum products, as will be demonstrated in Figure 7 and accompanying text.

5. Emergency Energy Conservation Act of 1979, Pub. L. No. 96-102, 93 Stat. 749 (1979) (codified at 42 U.S.C.A. § 6261 and scattered sections of 42 U.S.C.A. (West 1980)). For a brief discussion of the Act, see text accompanying notes 7-11 *infra*.

6. 37 CONG. Q. WEEKLY REP. 1336 (1979).

7. Emergency Energy Conservation Act of 1979, Pub. L. No. 96-102, 93 Stat. 749 (1979) (codified at scattered sections of 42 U.S.C.A. (West 1980)).

number of driver's licenses, not on the number of vehicles.[8] Drivers would be issued coupons which they could use either to purchase gasoline or to sell to other drivers on a "white market."[9] Thus, for instance, drivers of fuel efficient cars might be able to sell their excess coupons at whatever price the market would bear to other drivers whose fuel needs were greater.

The Act also requires the states to assume primary responsibility for developing state plans to meet targets set by the federal government. In the event of an energy emergency, a state would be required to submit a plan to the Secretary of Energy within forty-five days of publication of the targets. If no plan is submitted, or the state plan is disapproved, the federal government would impose conservation measures. A state could request judicial review of the targets set by the President, of findings that the state failed to meet targets, or of a disapproved state plan. Yet, there would be no reason ever to impose rationing if the market forces were allowed to work freely.

In truth, shortage occurs only where price is controlled, thereby preventing supply and demand from equilibrating at the market-clearing price level.[10] Thus, to the extent that the federal government maintains direct or indirect controls over crude oil or gasoline[11] another shortage will likely be perceived in the near future.[12] Such controls

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8. H.R. REP. No. 96-763, 96th Cong., 2d Sess. 20-22 (1979), *reprinted in* [1979] U.S. CODE CONG. & AD. NEWS 1764, 1773-74.

9. NEWSWEEK, Feb. 19, 1979, at 25.

10. "This observation follows from the fact that at some price the energy market will clear. As long as either less is demanded or more supplied as price increases [or both], there is some price at which supply equals demand." E. MITCHELL, U.S. ENERGY POLICY 1 (1974) [hereinafter cited as MITCHELL]. M. FRIEDMAN & R. ROOSA, THE BALANCE OF PAYMENTS 1-5 (1967) [hereinafter cited as FRIEDMAN & ROOSA]. A. ALCHIAN, NO TIME TO CONFUSE 1, 7 (1975) [hereinafter cited as ALCHIAN].

11. Following the Arab oil embargo of 1973, the federal government responded with the Emergency Petroleum Allocation Act (EPAA) of 1973. 15 U.S.C.A. §§ 751-756 (West 1976). Among the provisions of the Act was a two-tiered price control system in which the price for "old" oil, that is, the quantity of crude oil produced in the United States in the corresponding months of 1972, was subject to an average maximum price, while "new," "released," "stripper," and imported oil were uncontrolled in price. These regulations were superseded in February, 1976 by provisions of the Energy Policy and Conservation Act. 15 U.S.C.A. §§ 753 (amending § 4 of the EPAA), 757-760h (West 1976 & Supp. 1980). This Act provided for a three-tiered pricing structure for domestic crude oil. Under this system only imported crude oil and, as of September, 1976, "stripper" oil were free from maximum price controls.

Under both Acts, refined petroleum products were originally subject to price controls. In 1976, all major petroleum products other than gasoline were exempt from such controls. *See Federal Energy Administration Regulation: Report of the Presidential Task Force* (P.W. MacAvoy, ed., 1977) [hereinafter cited as Task Force Report]. *See* note 4 *supra*.

12. As determined by a 1975 study undertaken by the American Enterprise Institute

could lead to a shortage severe enough to trigger government-controlled gas rationing pursuant to the Emergency Energy Conservation Act.[13] The purpose of this article is to demonstrate the many allocative inefficiencies, market distortions, and counterproductive consequences that would be created by gasoline rationing.[14]

II. DISCUSSION

A. *Objectives of Rationing*

Rationing is one scheme proposed to achieve the objective of limiting gasoline consumption in the United States and "equitably" dividing the limited supply by means other than the price system.[15] Whether existing supplies of gasoline should, must, or will be limited, is itself a debatable issue. The considerations and espoused objectives of such government intervention need to be explored.

Two principal arguments are advanced for the purported necessity of curtailing our present consumption of gasoline: (1) independence from foreign oil sources; and (2) conservation of a depletable natural resource. The Arab oil embargo of 1973 impressed many decision-makers with concern that dependence upon Middle East oil jeopardized United States foreign policy.[16] Such concerns, in conjunction with the presumed balance of payments difficulties caused by the flow of dollars to the Arab states, prompted then President Richard Nixon to announce his Project Independence that was to give the United States the potential to be energy self-sufficient by 1980. Obviously, the United States has been unable to approach that goal. In fact, world oil prices

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entitled *Performance of the Federal Office*, the "shortage" during the Arab embargo was more the result of government policies than of anything else. In other countries, the price was permitted to rise and lines in gasoline stations did not exist. So long as government price controls exist, perceived "shortage" is likely. *See* 37 CONG. Q. WEEKLY REP. 317 (1979).

For a prediction of shortage again occurring, see Reid, *Supply Pinch—The Worst Yet?*, NAT'L PETROLEUM NEWS, Apr. 1979, at 53-59. See also *Swearingen Sees Continued Tight Oil Supply*, OIL & GAS. J., June 18, 1979, at 61.

13. Pub. L. No. 96-102, 93 Stat. 749 (1979) (codified at 42 U.S.C.A. § 6261 and scattered sections of 42 U.S.C.A. (West 1980)). *See* text accompanying notes 7-9 *supra*.

14. The inefficiencies analyzed herein are allocative suboptimization and are in addition to the actual costs of administering a rationing program. Such costs are wasteful transaction costs. *See* Williamson, *The Economics of Antitrust: Transaction Cost Considerations*, 122 U. PA. L. REV. 1439 (1974). Such transaction costs, however, would not particularly cause distortions in consumption or production.

15. A de facto non-price form of allocating limited supply has been suggested in Barzel, *A Theory of Rationing by Waiting*, 17 J.L. & ECON. 73 (1974).

16. 37 CONG. Q. WEEKLY REP. 1394 (1979).

in the 1970's rose more than tenfold,[17] and the United States has pledg-
ed to "limit" oil imports to 8.2 million barrels a day through 1985.[18]
The Iranian crisis at the end of 1979 and rising prices from OPEC na-
tions[19] have only increased the desire in the United States for energy
self-sufficiency.

The desirability of curtailing demand for foreign petroleum, for
reasons of either foreign policy or balance of payments considerations,
is beyond the scope of this article. It is noteworthy, however, that Pro-
ject Independence was precipitously launched without public aware-
ness of the high cost of a protective energy policy,[20] and without public
consideration of alternative means of coping with the threat of being
cut off from foreign oil supplies, *e.g.*, stockpiling petroleum.[21]

Under the Energy Policy and Conservation Act (EPCA) of 1975, a
three-tiered price control structure was enacted for domestic crude oil,
while imported crude oil and "stripper oil" are free from maximum
price constraints.[22] In addition, the Federal Energy Administration's
Crude Oil Entitlement Program[23] enables domestic refiners to enjoy a
crude oil cost advantage which allows them to undercut foreign prod-
uct imports.[24] The Carter administration ordered plans for phased de-
control of domestic crude oil to begin by June 1, 1979 with complete
decontrol achieved by September 30, 1981.[25] There was much activity
in Congress, however, attempting to block Carter's decontrol plans.[26]
Those opposed to Carter's lifting price controls were sponsoring an
amendment to the energy department budget authorization bill which
would restrict the Department of Energy (DOE) from spending any

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17. President's Economic Report to Congress of Jan. 30, 1980, *reported in* [March 1980]
U.S. CODE CONG. & AD. NEWS 142, 151.

18. President's State of the Union Address, Jan. 23, 1980, [March 1980] U.S. CODE
CONG. & AD. NEWS 130, 135.

19. *See, e.g., OPEC Indicates Some Oil Prices Will Keep Rising*, Wall St. J., Dec. 21,
1979, at 2, col. 2.

20. *See* Nordhaus, *The Allocation of Energy Resources*, 1973 BROOKINGS PAPERS ON
ECONOMIC ACTIVITY 529, 567-68 (gains from international trade made from non-petroleum
products can be utilized to purchase oil more cheaply than would be produced by an energy
self-sufficiency program) [hereinafter cited as Nordhaus].

21. Oil stockpiling as a precaution against potential unavailability of imported oil is
discussed in MITCHELL, *supra* note 10, at 43.   .

22. Task Force Report, *supra* note 11.

23. 10 C.F.R. § 211.67 (1980). For a lucid description of the entitlements program, see
Sherwood, *Crude Oil Entitlements Program*, MONTHLY ENERGY REV., Jan. 1977, at 2.

24. Task Force Report, *supra* note 11, at 73.

25. *See* Bachman, *supra* note 4, at 80.

26. *See Oil Decontrol Wins in Close Committee Vote*, 37 CONG. Q. WEEKLY REP. 822,
822-23 (1979); Bachman, *Skirmishing Begins on Crude Decontrol*, OIL & GAS J., May 7,
1979, at 49.

money to implement oil decontrol.[27] Despite the difficulties, however, Carter's decontrol program did go into effect on June 1, 1979.

Increased prices due to Carter's decontrol program will lead to increased profits for the oil companies. In a move to capture some of these profits, President Carter signed on April 2, 1980 a $227.7 billion windfall profits tax bill on United States oil companies.[28] Although called a tax on profits, it actually would not apply to profits, but rather to price increases due to deregulation above the 1979 price levels.

The tax rate levied on the selling price of oil is 70% for most oil discovered before 1979 and produced by major companies. The tax is charged on the difference between a base price of $12.89 a barrel and the prevailing selling price. Tax rates of 30% to 60% are imposed for newly discovered oil, stripper oil, and the first 1000 barrels of oil pumped daily from independent producers. The tax is scheduled to phase out no sooner than 1988 or no later than 1991, depending on how quickly the $227.7 billion in revenue is collected.

If the real social cost of domestic petroleum is considered, it may be more advantageous to dispense with domestic price controls and allow international free trade to allocate the oil and other resources.[29] This can be demonstrated by Figure 1.

· In Figure 1, United States production possibilities of oil versus other goods which trade in the world market are depicted by the curved line, suggestive of diminishing returns and increasing costs. The prices at which these goods trade in the world market will determine the optimal production mix from the point of view of producers. A straight line can be drawn representing a fixed level of expenditure, and which slope is $-P_{oil}/P_{misc}$, or negative the ratio of the world prices.[30]

If the United States attempts to produce all its oil needs internally,

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27. *See Carter Bucks Antidecontrol Pressure*, OIL & GAS. J., June 4, 1979, at 67.

28. April 2, 1980, Pub. L. No. 96-223. Decontrol will allow U.S. prices of oil to rise to world market levels and cost consumers $1 trillion in the 1980's. L.A. Times, Apr. 2, 1980, pt. I, at 28, Col. 1.

29. In some instances, such as depletion of a scarce natural resource, the present private cost to the producer may be less than the social cost to society. *See* E. MANSFIELD, MICROECONOMICS THEORY AND APPLICATIONS 427-29 (1970) [hereinafter cited as MANSFIELD].

30. The equation of the line is:

Total U.S. Expenditure at World Prices = $P_{oil}Q_{oil} + P_{misc}Q_{misc}$ or rearranging,

$$Q_{misc} = \frac{Total}{P_{misc}} - \frac{P_{oil}}{P_{misc}} Q_{oil}$$

See, e.g., S. KAISH, MICROECONOMICS 98, 99 (1976) [hereinafter cited as KAISH].

then some point such as point A along the production possibility fron-
tier would represent the level of oil and miscellaneous goods available
to the United States consumers. Alternatively, the United States could
produce at point B where the production function is tangent to the
world price line, *i.e.*, where United States production's marginal rate of
technical substitution is equal to the price ratios dictated by world de-
mand.[31] This, it will be shown, is a maximization point. Since the
price line represents a fixed level of expenditure, the United States
would be able to trade the miscellaneous goods it produces for more oil
it desires, until reaching some point C. Such production maximization
and trade render possible a higher total consumption level for Ameri-
cans, than does any point A on the production possibility curve to
which we would be constrained if oil independence were sought.

Figure 1 - *Benefits of trade considering real costs and no price controls*

MISC.
OTHER GOODS

B

C

A

World Prices

U.S. Production Possibility
Frontier

OIL
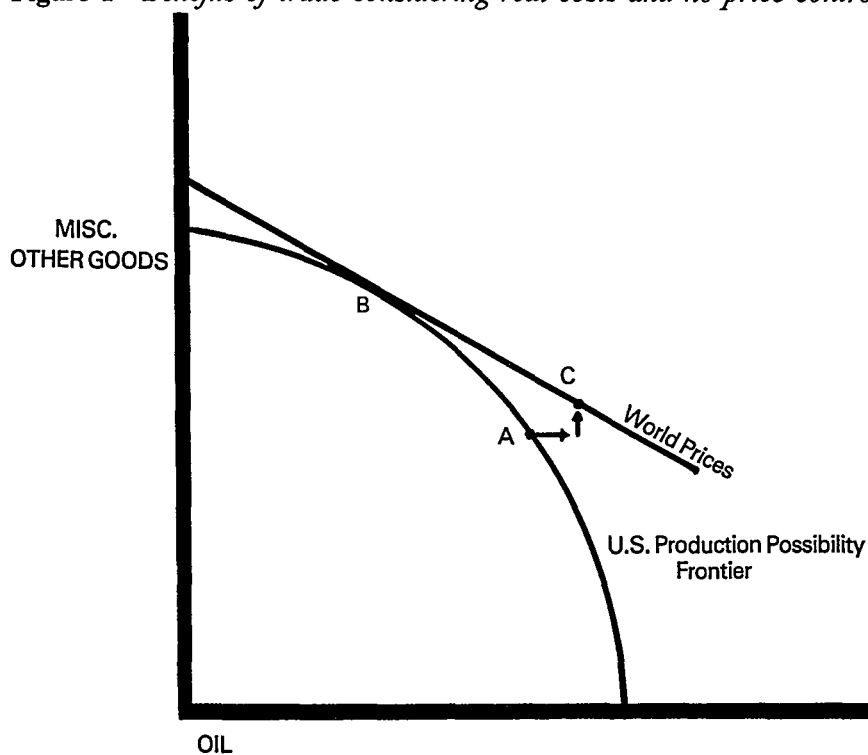
In any event, import quotas, price controls, and rationing would
be one means of achieving energy self-sufficiency. One problem with

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31. For maximization analysis of production possibility frontier, see G. STIGLER, THE
THEORY OF PRICE 162-65 (3d ed. 1966) [hereinafter cited as STIGLER]; and MANSFIELD,
supra note 29, at 92-95.

such a strategy, in addition to those discussed *infra*, is that if United States producers are legally precluded from importing substantial quantities of foreign oil, or economically precluded because the domestic price for gasoline is kept below the world price, United States producers will not bid for OPEC oil to be used in our domestic market. Consequently, there will be less likelihood that a member of the OPEC cartel can be offered a sufficiently large order at a sufficiently tempting price that it would consider breaking from the cartel.

Public support for curtailing consumption of gasoline is also explained by a felt need to conserve a depletable resource. Support for rationing as a petroleum conservation measure betrays a distrust of the free market's ability to reflect petroleum scarcity value in an increasingly higher price. It is conceivable to advocate that supply and demand determinations be wrestled from the free market mechanism if one believes that the supply or marginal cost curve to producers does not reflect the true cost to society. One ordinarily expects the scarcity value of a commodity to be reflected in its price. It is possible, however, that private institutions systematically overestimate the potential of future alternatives in oil or other energy sources and hence have set price too low and output too high. In any case, on the assumption of producers' underestimation of societal costs, the government might attempt to estimate the "true" cost curve, S_s, and limit quantity according to where that curve intersects demand.[32]

While the efficiency of the market in valuing a depletable resource is not free from debate,[33] the market is likely to be more efficient than interventions by the government which amount to arbitrarily ordained cutbacks in permissible consumption levels achieved by artificial means. It is certainly not the case, as some believe, that every curtailment in consumption by whatever means is economically wise.

Finally, rationing is perceived by some as a means of protecting the poor from the upward drift in gasoline prices. The focus is not on decreasing gasoline consumption, but upon helping the poor bear the effects of increasing prices of gasoline.[34]

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32. An analysis of societal costs versus private costs appears in MANSFIELD, *supra* note 29, at 427-29.

33. *Compare* Nordhaus, *supra* note 20, *with* Davidson, Falk & Hoesung Lee, *Oil: Its Time Allocation and Project Independence*, 1974 BROOKINGS PAPERS ON ECONOMIC ACTIVITY 411, 413-19 (takes issue with Nordhaus theory that competitive market can most efficiently allocate scarce resources).

34. The income distribution impact of rationing is analyzed in Figures 7, 8, and 9 and accompanying text.

Figure 2 - *Supply curves reflecting real costs*
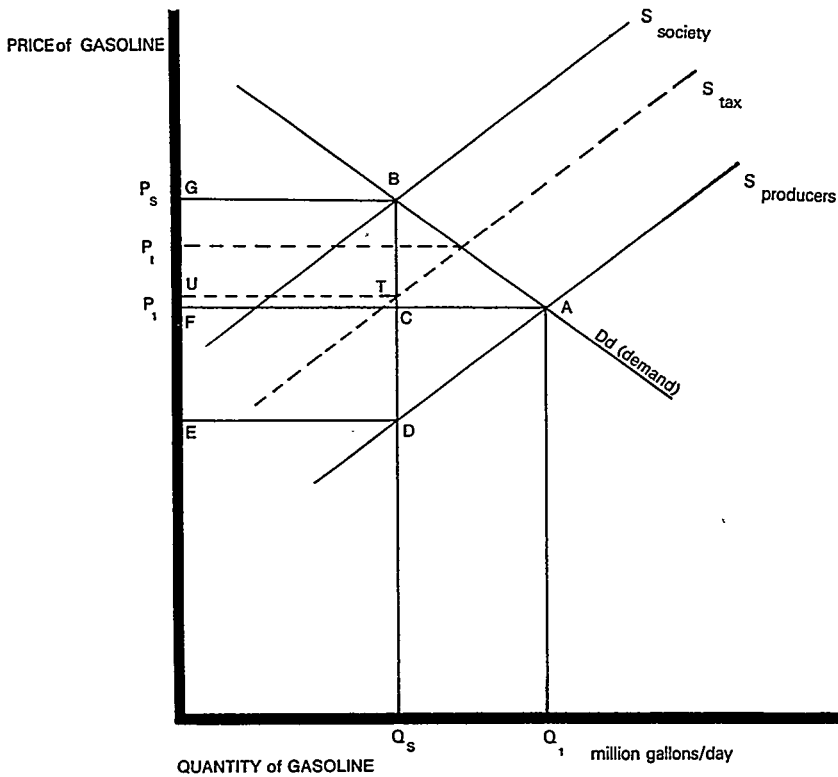
B.   *Consumer and Producer Surplus*

As soon as quantity is limited by non-market forces, there exists a discrepancy between producers' supply curve and consumer demand, as evidenced in Figure 2. It is at this point that debates arise as to the best mechanism for distributing the burdens, the benefits, and the gasoline. Four possibilities are immediately evident.

The first alternative would be for the government to merely limit producers' quantity of output, and leave the market otherwise untouched. Assuming such limitations were enforced, the effect, as seen in Figure 2, would be a rise in gasoline prices to P_s, the height of the demand curve at Q_s, the prescribed quantity. Under such circumstances, all of rectangle BDEG, constituting "excess profits," would go to the producers.

Because there is public concern about high profits to the oil companies, imposition of an excise tax is another alternative. A tax on producers has the effect of raising the supply curve to the extent of the tax. The government might want to impose a tax to the full magnitude of the societal cost curve. In that event, supply and demand would naturally arrive at Q_s in Figure 2 and the entire rectangle BDEG would go to the government. Alternatively, a tax of some lesser magnitude might be imposed, generating an effective supply curve at S_{tax}. Under such circumstances, if the quantity were still constrained to Q_s, then the price would be P_s rather than P_t with no quantity control. The company would then be permitted to keep profits BTUG, while TDEU would go the government. It is important to note that this analysis assumes naively that no adverse effects upon production incentives would be generated by the tax.

A third alternative not often advocated would be for the government to limit the quantity of production to Q_s, fix prices at the current level P_1, and distribute nontransferable coupons to the extent of Q_s. This system is not frequently advocated because consumers are always better off if they are permitted to trade,[35] and because a black market would inevitably develop for such purpose. If such a scheme were instituted and perfectly enforced, profits CDEF would go to the producers, and BCFG would go to consumers in the form of reduced price.

The fourth and most popular alternative scheme entails price-fixing at current level P_1 concomitant with distribution of transferable coupons to the extent of limited quantity Q_s. Under such a program, as above, the oil companies would maintain producer surplus CDEF. In this case, the consumer surplus BCFG would go not to consumers, but to coupon holders, whether or not they purchased gasoline. Under all four programs, because of the limitation in quantity supplied, producer surplus ACD and consumer surplus ACB are lost. It is interesting to note that Q_s might conceivably be chosen, as the diagram suggests, at some level resembling monopoly maximization. In such circumstances, the amount of deadweight loss of surplus could be virtually the same under government-imposed rationing as with pure monopoly in the gasoline industry.[36]

It is important to note that it is only where price is held fixed below the market-clearing level, as in options three and four, that the

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35. *See* text accompanying note 56 *infra*.

36. Monopoly maximization would be determined by the intersection of the marginal rate and the supply curve. *See* J. BAIN, PRICE THEORY 201-03 (1952). The level of output chosen for monopoly maximization could well resemble Q_s in Figure 2.

notion of "shortage" arises. Where the price reflects the height of the demand curve at the quantity being supplied, there is no "shortage."[37] Therefore, a crucial determinant of the effects of a rationing program is the fixed price element.[38]

C. Market Signalling.

It is important not to confuse the effects of "shortage" with the effects of rationing. When used with reference to the oil situation in the

Figure 3 - *"Shortage" supply curve*

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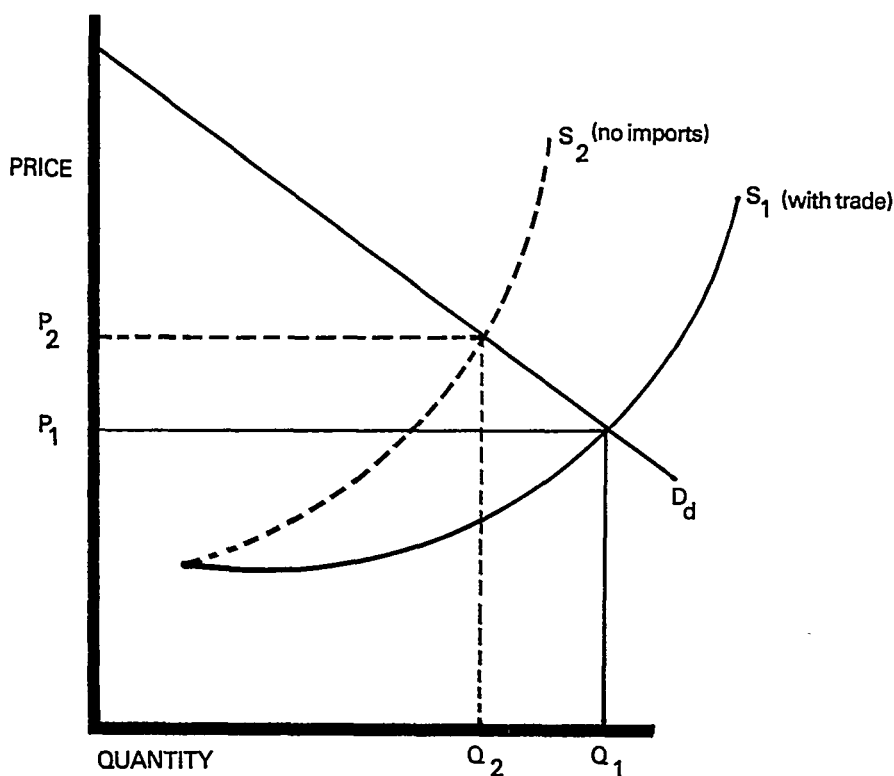
37. *See* MITCHELL, *supra* note 10, at 1, 12, 17 *passim*; FRIEDMAN & ROOSA, *supra* note 10, at 1-5; and ALCHIAN, *supra* note 10, at 7.

38. The fixed price element will be studied as part of the analysis of rationing programs, *infra*. One should keep in mind in reading the following material whether such price maintenance should be an objective in itself, as rationing advocates imply. If we are sincerely concerned about income distribution effects, is a gasoline rationing program the proper means to deal with it?

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United States, "shortage" implies a decrease in supply, or a steepening of the supply curve beyond a certain range. Thus, if S_1 in Figure 3 above represents the supply curve when trade is allowed, S_2 might reflect a good approximation of the new, steeper supply curve when, for example, imports are limited and domestic producers must begin to utilize additional but more expensive domestic sources.[39] Such a change in the supply curve without an immediate corresponding change in price would create a "shortage" situation.

The pre-shortage price is represented by P_1, and the "shortage" market-clearing price would be P_2. Rationing is an attempt by the government to distribute Q_2 gallons of gasoline at price P_1. If the coupons were nontransferable, and there were no black markets and abuses, that would indeed be the program achieved. Once coupons are transferable in either a white or a black market, however, the effective cost of gasoline to the consumer is the pump price plus the cost of the coupon. Basic demand theory would suggest that the value of the coupons would equilibrate to just equal the difference between P_1 and the height of the demand curve at Q_2, the quantity available.

The total cost to the consumer will be the height of the demand curve at the quantity supplied, whether coupons are used or the pump price is permitted to freely rise. If one thinks of demand as willingness to pay, then it becomes clear that neither a decrease in supply nor an artificial program to distribute gasoline should alter willingness to pay,[40] assuming no substantial psychological effects of the "shortage." The only way in which willingness to pay, or demand, might be affected is to the extent that distribution of coupons constitutes increase in income which might increase, not decrease, willingness to pay of some individuals. One cannot predict *a fortiori* whether such an effect, if existent, would be a shift in the demand curve or a change in slope.[41] There are two reasons to believe that any change in the demand curve as a result of coupon rationing would, in fact, be negligible. First, while the coupons would have a transfer value, the magnitude of increase in any individual's income as a result of the coupons is likely to

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39. The shape of these supply curves is merely suggestive of the technology. *See* Flower, *supra* note 2. The analysis would apply equally well with a straight shift in the supply curve, for example.

40. This conclusion is in marked contrast to World War II rationales which assumed that rationing limits demand. *See, e.g.*, S. HARRIS, PRICE AND RELATED CONTROLS IN THE UNITED STATES 269 (1945).

41. The result would likely depend upon the predominance of the income effect versus the substitution effect resulting from coupon distribution. Analysis of these effects as generated by rationing will be undertaken in the text accompanying notes 54-56 *infra*.

be quite small relative to his total income. Second, it is unlikely that any individual would spend all, or indeed a substantial portion of his increased income on a single good. The fact that it was received with the label "for gasoline" does not change the essential quality of the saleable coupons as being increased income, available for any purpose. This is true so long as the coupons have a resale value in either a white or black market where equal access to trade is facilitated.

Despite the above assertions that demand is not changed by the use of ration coupons, it is important to note that the market signalling function regarding demand is distorted by the coupon system. The problem arises because consumers and producers do not see gasoline being sold at the same price. The price producers or sellers receive is the pump price; the price consumers must pay is the pump price plus the coupon price.

If the free market were allowed to operate, the cost of gasoline to consumers would be lower and the quantity supplied would be greater than under a rationing scheme. This can be demonstrated by Figure 4. Therein, S_1 represents the supply curve with trade and S_2 depicts a domestic supply curve when no foreign oil is imported. The rationing scheme would fix pump prices at P_r, the price at which the free trade supply curve intersects demand. With the new cost curve S_2, the quantity produced will be constrained to Q_r, where S_2 intersects P_r. However, consumers will be paying P_C while producers receive only P_r.[42] If instead the free market were permitted to operate, then a new equilibrium of demand and S_2 would emerge such that consumers would pay and producers would receive P_f which is lower than P_C. At the same time, suppliers would be able to cover greater costs, and thus supply quantity Q_f which is greater than Q_r. (Q_1 is the original quantity).

This analysis reveals one of the fallacies underlying the rationing program and the discrepancy in estimates of market prices for gasoline in the absence of such a program. Rationing only operates on the demand side and ignores the price-elasticity of supply. Because supply increases as we allow price to rise freely, the ultimate cost to consumers will be lower when no rationing is undertaken, than when the government steps in attempting to mitigate a price increase. In fact, assuming a heightened supply curve S_2, if the elasticity of supply were exactly equal to the elasticity of demand, then the cost increase to consumers due to "shortage" would be half as much with no rationing as with such government interference. These bizarre effects are predictable because

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42. The misallocative effects of this discrepancy will be discussed in the text accompanying notes 47-50 *infra*.

Figure 4 - *Rationing worse than free market, when no imports*
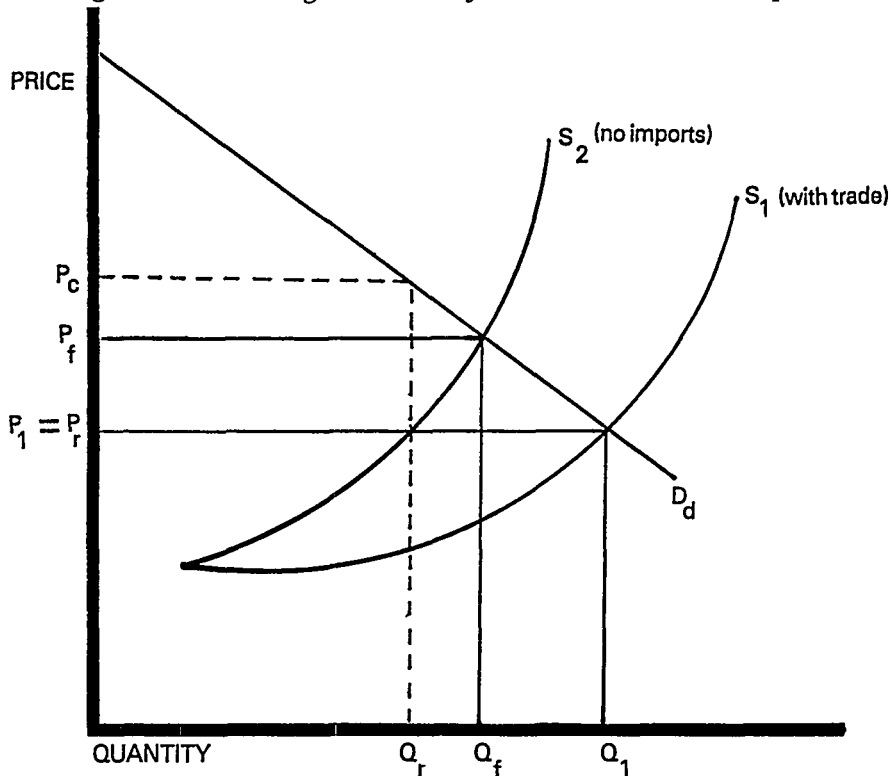
the rationing program distorts the natural market-signalling of the price system.

Not only is the incentive to increase production dampened by the price freeze of the rationing program, but incentive to actually decrease gasoline production may arise from the fact that gasoline is one of several possible joint end-products of crude oil refinement.[43] If the other end-products such as fuel oil, distillates, or petrochemicals, for example, were unregulated, then the price of these, unlike gasoline, would be permitted to rise with the "shortage" of crude oil supply. Incentive is thus created to alter the production mix to yield more of the unregulated goods and decrease the relative yield of gasoline which is less remunerative.[44] With the altered production technique, a new supply curve for gasoline might be drawn, as in Figure 5. It is evident that Q_a,

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43. *Hearings on the Gasoline and Fuel Oil Shortage Before the Subcomm. on Consumer Economics of the Joint Economic Comm.*, S. REP. No. 93-63, 93rd Cong., 1st Sess. 23-24, *reprinted in* [1973] U.S. CODE CONG. & AD. NEWS 1299, 1318 (statement of Senator John Tower).

44. *See* Figures 6 & 7 and accompanying text regarding effects on production.

the quantity supplied, is much less than Q_f, the free-market level, and P_a, the cost to consumers, is much higher. Thus, rationing with price maintenance generates two distorting effects upon suppliers and yields lower quantity and higher total cost to consumers than the free market would bring.

Figure 5 - *Altered production mix with regulation*
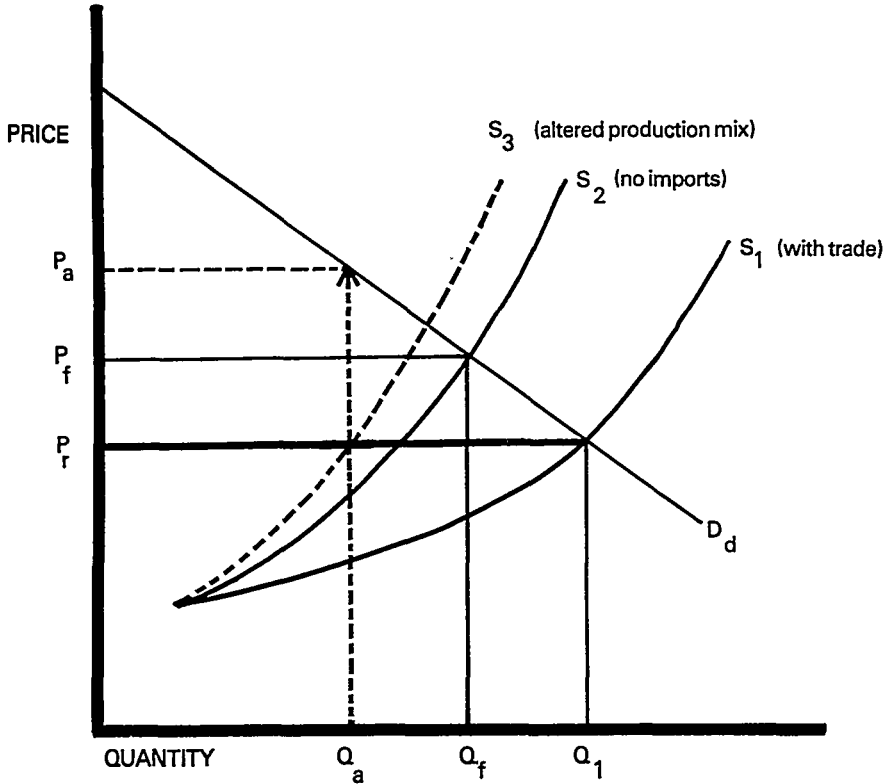
D.   Effects Upon Production

That multiproduct producers will actually alter their output mix in response to a change in the price ratios of their products, can be demonstrated with a basic economic model. For simplicity, let us assume that only two products, gasoline and fuel oil, for example, can be produced from crude oil. A "production possibility frontier" can be mapped to represent the trade-off in producing more gasoline versus more fuel oil. Then the slope of the curve at any point represents the

marginal rate of technical transformation.[45] The firm will maximize by operating at that point on the curve where revenues are maximum. As will be demonstrated, it turns out that such a point will be tangent to the highest possible iso-revenue line, which represents all combinations of the two products that will yield a given revenue, as suggested by Figure 6.

Figure 6 - *Producer maximization*

FUEL

Highest Iso-revenue line

Production Possibility

GASOLINE
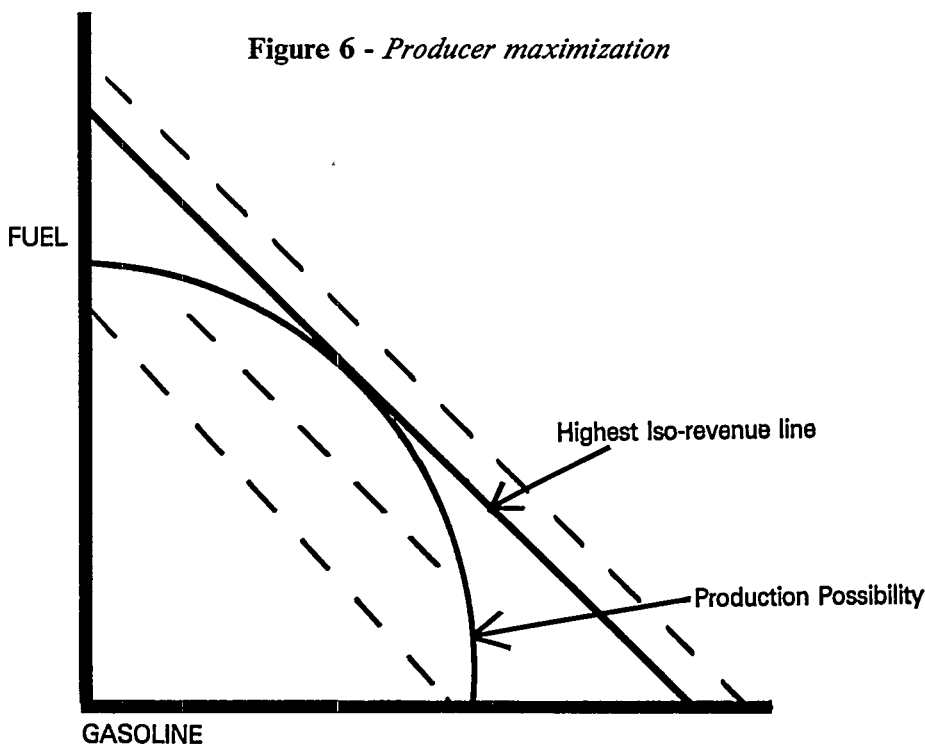
The equation of the iso-revenue line is:
$$\text{Revenue} = P_{gas}Q_{gas} + P_{fuel}Q_{fuel}$$
or rearranging:

$$Q_f = \frac{R}{P_f} - \frac{P_g}{P_f} Q_g$$

The significant observation is that the line which is tangent to the production possibility frontier has a slope equal to the negative of the price ratios, or $-P_g/P_f$. This means that the production mix will be determined by the ratio of prices of the two goods.[46]

If both the price of fuel oil and the price of gasoline change, it is possible that the ratio of the prices would remain the same. If however,

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45. *See* STIGLER, *supra* note 31, at 162-65, and KAISH, *supra* note 30, at 413-14.
46. *See* KAISH, *supra* note 30, at 413-18.

only one price changes, or the two change unevenly, then the ratio of prices will necessarily change as well. As a responsive consequence, production output mix will shift until the marginal rate of technical transformation is equal to the price ratio, or in short, until production reaches the point tangent to the new maximum iso-revenue line.

Where changes in the prices of the goods reflect free market signals of the relative desirability to consumers of the two goods, then a change in production mix is desirable and improves the allocation of resources. However, where one price is artifically inhibited, as would be the price of gasoline under a rationing program, the production mix chosen in response to the "false" price ratio would obviously be misallocative. Producers would not generate the output mix which consumers, through the price system, indicate they most desire. With coupon rationing, this result accrues (1) because the price which consumers are willing to pay (fixed pump price plus cost of coupon) is not the price which producers receive (pump price); and (2) because gasoline is rationed while other end-products of crude oil are not.
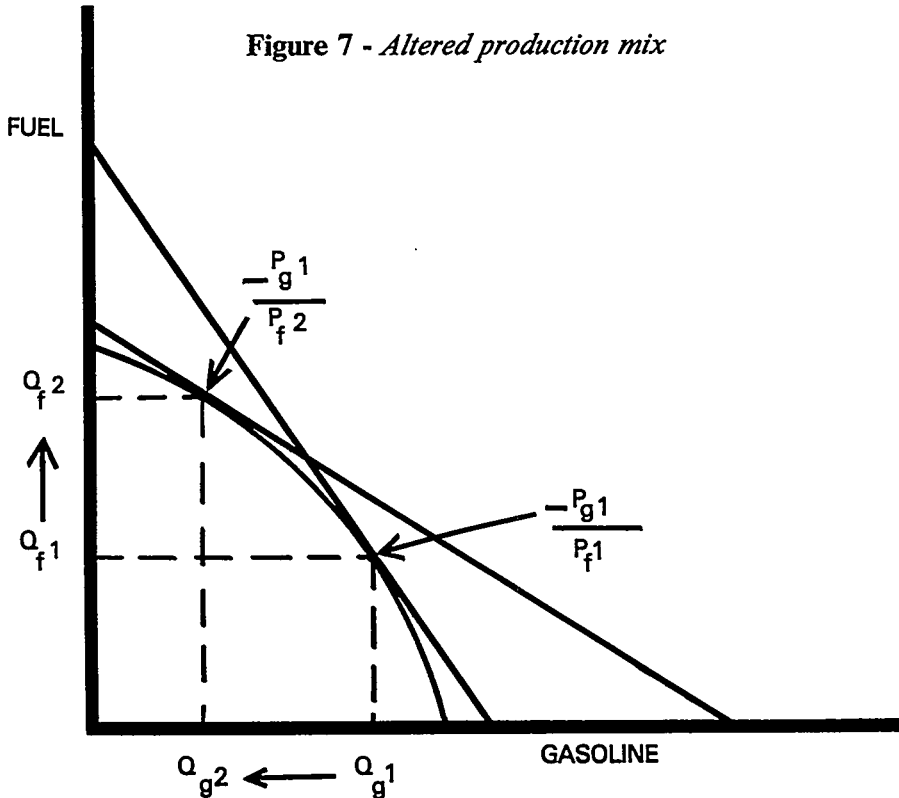

Figure 7 - *Altered production mix*

Figure 7 illustrates the effect on the iso-revenue slope and production

mix when fuel oil prices, for example, are permitted to rise in the shortage while gasoline prices are not.

E. Resource Allocation

It is apparent that if the price of gasoline received by producers, P_{g1}, is held constant while the price of fuel oil, P_{f1}, is permitted to rise with the "shortage" to P_{f2}, then the set of iso-revenue lines facing a producer will exhibit a new, more gentle slope, $-P_{g1}/P_{f2}$. As can be seen in Figure 7, producers will perceive a new maximization point, tangent to the new iso-revenue line. Effectively, producers will decrease gasoline output from Q_{g1} to Q_{g2} and increase the yield of fuel oil from Q_{f1} to Q_{f2}.

Consumers, on the other hand, will not see the same price ratio as producers. Although the government may hold the pump price of gasoline at P_{g1}, the cost to consumers will be P_{g1} plus the cost of the ration coupons, which in turn will be determined by consumer demand for gasoline, as we have seen.[47]

A series of indifference curves can be mapped for consumers, representing various combinations of gasoline and fuel oil which will render the individual equally satisfied, or in welfare economics terminology, equally well off. The consumer will maximize his utility by reaching the highest possible indifference curve he can, given the constraint of his budget. The slope of the indifference curve at any point will represent the marginal rate at which the consumer is willing to substitute fuel oil for gasoline. He will be maximizing when this marginal rate of substitution (MRS) is equal to $-P_{gC}/P_{f2}$, the negative of the ratio of prices for the two goods and the slope of the budget line.[48] This result accrues because the budget line for consumption of gasoline and fuel oil is:[49]

$$\text{Budget} = P_{\text{gas including coupon}}Q_{\text{gas}} + P_{\text{fuel}}Q_{\text{fuel}}$$
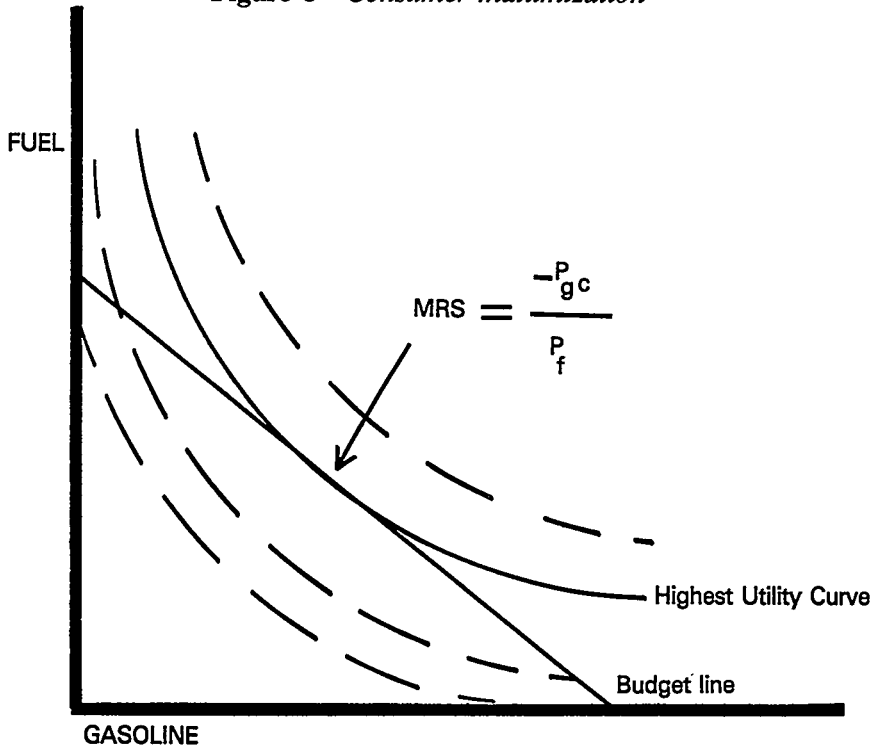
or rearranging:

$$Q_f = \frac{B}{P_f} - \frac{P_g C}{P_f} Q_g$$

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47. *See* text accompanying note 40 *supra*.

48. For a mathematical analysis of consumer maximization, see E. SILBERBERG, THE STRUCTURE OF ECONOMICS 223-33 (1978) [hereinafter cited as SILBERBERG].

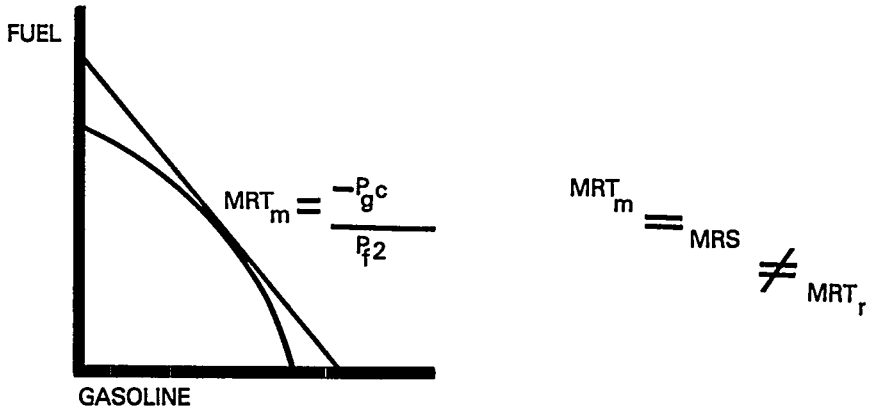49. *See* MANSFIELD, *supra* note 29, at 33-35.
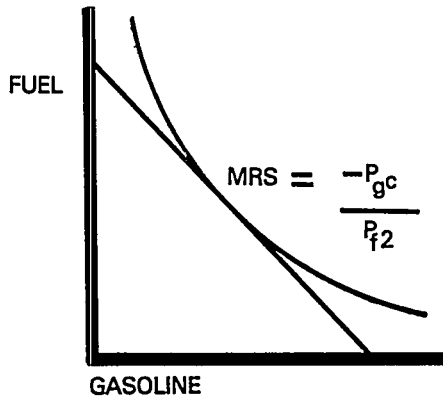
Figure 8 - *Consumer maximization*

Recall that producers are maximizing at the marginal rate of technical transformation (MRT) = P_{g1}/P_{f2} while consumers are maximizing at MRS = P_{gC}/P_{f2}. If P_{g1} were equal to P_{gC}, then MRT would be the same as consumers' MRS and resources would be perfectly allocated, assuming, of course, that $P_{f2producers}$ = $P_{f2consumers}$ and no other offsetting factors exist.[50] Such a result would be generated if the free market price system were left unencumbered. With coupon rationing of gasoline and not other oil products, however, a misallocation of resources will emerge, MRT ≠ MRS, as illustrated in Figure 9.
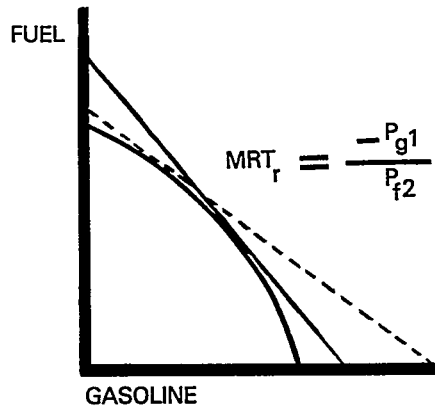
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50. *See* D. Winch, Analytical Welfare Economics 80 (1971) and Mansfield, *supra* note 29, at 414-17.

Figure 9 - *Producer maximization with free market*

FUEL

$$MRT_m = \frac{-P_gc}{P_f2}$$

$$MRT_m = MRS \neq MRT_r$$

GASOLINE

Consumer maximization

FUEL

$$MRS = \frac{-P_gc}{P_f2}$$

GASOLINE

Producer maximization under rationing

FUEL

$$MRT_r = \frac{-P_g1}{P_f2}$$

GASOLINE

F.   Consumer Utility

The effect of gasoline rationing upon consumer utility and consequent behavior can be depicted graphically in terms of price-consumption and utility functions. Visual comparison between rationing and free-market distribution of gasoline is thereby facilitated. For ease of analysis, assume that a consumer spends all of his income and has a choice between two goods, gasoline and miscellaneous. The consumer can select any product mix to the extent that:

$$Income = P_{gas}Q_{gas} + (ave)P_{misc}Q_{misc}$$

This yields a budget line:[51]

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51. *See* STIGLER, *supra* note 31, at 53-54, and MANSFIELD, *supra* note 29, at 33-34.

Figure 10 - *Budget line*
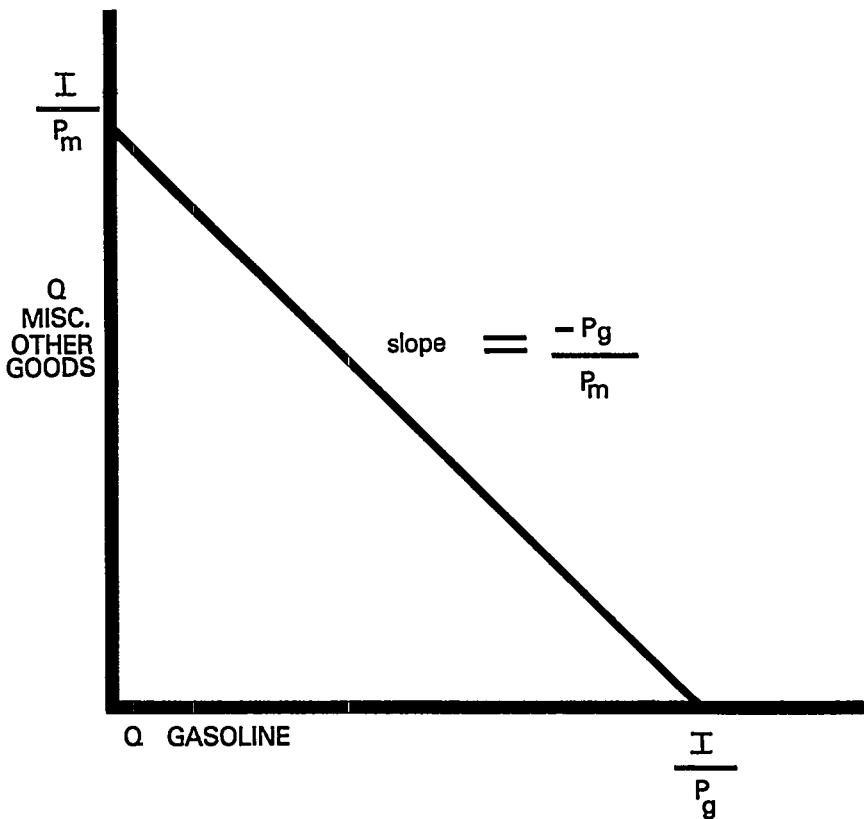
Further assume that consumers can map a series of indifference curves between the two goods, along which the consumer feels he is equally well off. The individual will want to be on the highest possible indifference curve subject to the constraint of his budget. Graphically, this means that he will choose a product mix depicted as the point where the indifference curve is tangent to the price-consumption line, as we have seen in Figure 9 and above discussion.[52] The slopes at the point of tangency will obviously be equal. When there is a change in the price ratios which a consumer faces, there will be a new maximization point at which the tangency condition is fulfilled. A rise in the price of gasoline will affect the budget line and level of consumer utility as suggested by Figure 11.[53]

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52. *See* text accompanying notes 48-49 *supra*.

53. For mathematics of the price effect, see SILBERBERG, *supra* note 48, at 235-37. See also STIGLER, *supra* note 31, at 53-54, 62-63, and MANSFIELD, *supra* note 29, at 56-58.

Figure 11 - *Price increase in gasoline*

Q
MISC.
OTHER
GOODS

Consumer
Utility

Budget Line

Q GASOLINE $\dfrac{I}{P_{g}2}$ $\dfrac{I}{P_{g}1}$
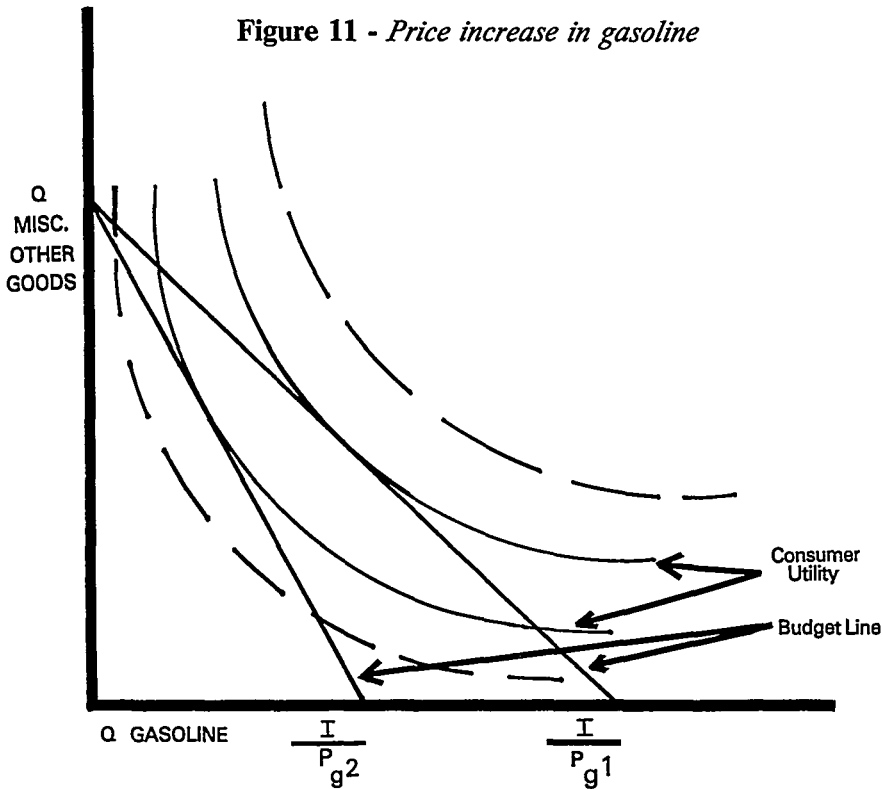
As previously shown, the effective price to consumers of gasoline will increase, when quantity is cut back, irrespective of a government program to fix pump prices at current levels. In fact, for a given quantity of output, the cost to consumers should be the same under either free market or saleable coupon rationing program, because the demand function is the same.

The distinguishing feature in using transferable coupons, rather than the market system, is the added dimension of income augmentation. If we attribute the value of the coupon as an added cost of gasoline consumption, then we must also recognize receipt of one's ration of coupons as income to the extent of the value of the coupons which are saleable. Thus, where a "short" supply of gasoline is to be rationed with transferable coupons, there will be both a price effect and an income effect as shown in Figure 12:[54]

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54. Further discussion of the income and price effects can be found in SILBERBERG, *supra* note 48, at 350-62; STIGLER, *supra* note 31, at 63-64; and MANSFIELD, *supra* note 29, at 63-64.

Figure 12

a)   The price effect   *b)   Income plus price effects*
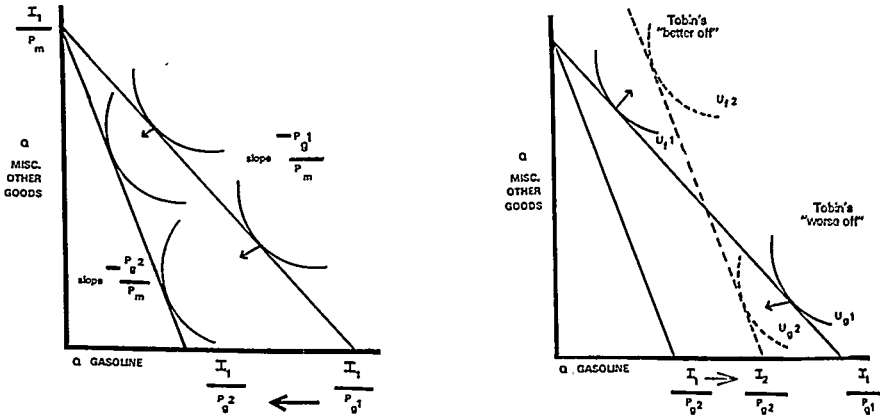
It is for this reason that Tobin[55] and others depict a rationed economy as simply a change in slope, as from line A to line C in Figure 12 above. In order to distinguish consequences of the rationing program from effects generated by the decreased supply and increased price to consumers which result irrespective of a rationing program, it is necessary to segregate the phenomena.

In Tobin's analysis, there appear to be persons made better off and some made worse off by the rationing scheme. Specifically, those persons whose indifference curves fall in the left-most region of the graph are made better off, *i.e.*, are able to reach a higher indifference curve than pre-rationing, while those in the right-hand portion of the diagram are constrained to a lower indifference curve than their pre-rationing level. Segregating the income and price effects, however, illuminates an interesting interpretation of Tobin's observation.

The price effect alone implies a pivoting inward of the price-consumption line, such that the gasoline intercept is diminished and the slope is increased. Everyone, to a greater or lesser degree depending on his horizontal position, will be worse off in being constrained to a lower indifference curve. When the income effect is added, the new slope prevails, while the former income level is reinstated. It now becomes apparent that if anyone is made better off, it is because of the grant of income which happens to come in the form of gasoline coupons.

If a scheme of non-transferable coupons could be instituted, essen-

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55. Tobin, *A Survey of the Theory of Rationing*, 20 ECONOMETRICA 521, 534 (1952).

tially a two-currency system would be created.[56] Individuals would experience a budget constraint from their money income, and an analogous constraint imposed by their fixed coupon allotment.

Figure 13 - *Constrained by coupons or income*
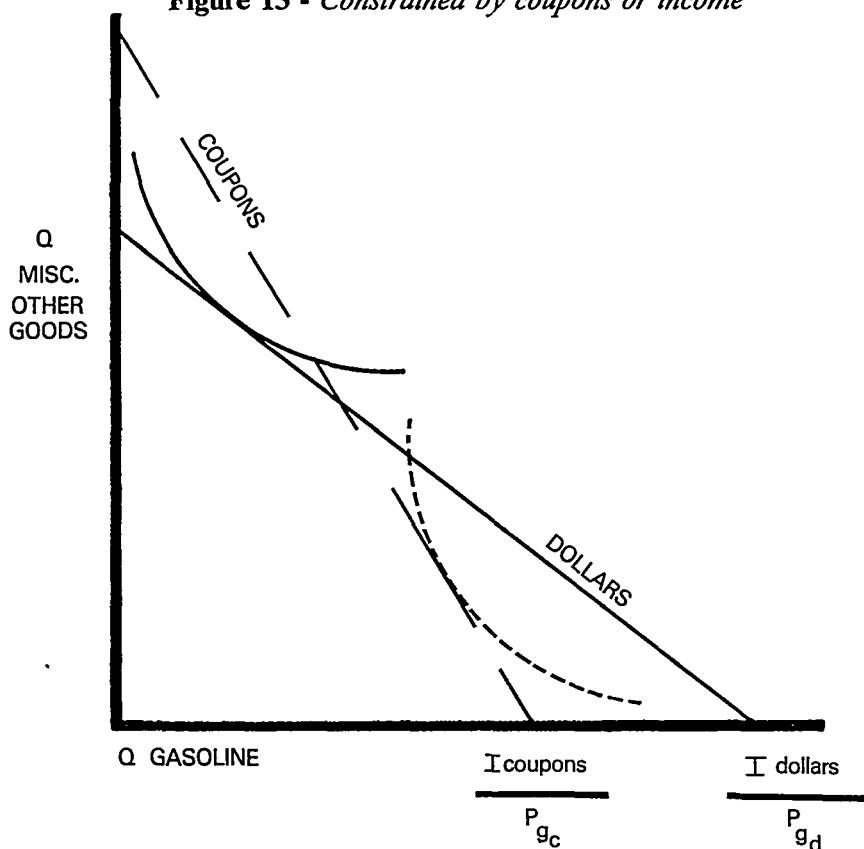
Persons whose indifference curves lie in the left-most region of Figure 13 would be constrained by their budgets to leave coupons unused. In contrast, persons, whose preferences between gasoline and miscellaneous place them toward the right of the graph, have money they would like to spend on gasoline but lack the coupons to do so. It is clear that both would be better off if trade were permitted. This illustration with non-transferable coupons makes it clear that giving coupons a transfer value generates windfall income to those who choose to sell their allotment or part thereof.

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56. *Id.*

G.   Income Distribution

The significance of the coordinates of the graphs in Figures 12 and 13 is that those who gain from the rationing program, those whose indifference curves fall toward the left, are persons who consume relatively little gasoline. Therefore, the gasoline rationing program ironically appears to benefit most those who consume the least amount of gasoline. According to Tobin's diagram, the gain to these persons is ostensibly realized in the sale of the windfall coupons.

Many advocates of the rationing program assert that the poor will be selling their coupons to the rich, and thus a beneficial income redistribution will occur in those situations where the recipient does not himself purchase gasoline. However, the economic model presents little reason to believe that the horizontal position of a consumer's indifference function bears any significant correlation to his income level. The aggregate graph, as in Figure 12, is misleading since it assumes a

Figure 14 - *Distribution of income levels and utility functions*
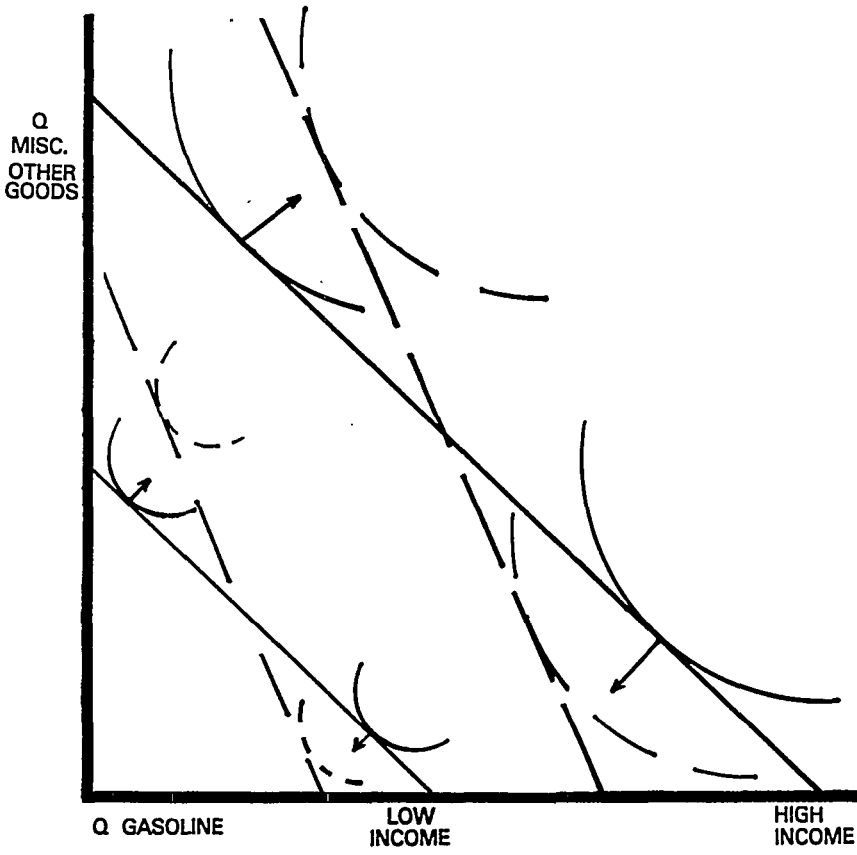
single or average income. More explicitly, a series of parallel budget
lines could be drawn reflecting differing income levels which face the
same price ratios.

The income and price effects of gasoline coupon distribution then
can be depicted as parallel rotation of each of those budget lines yield-
ing a new common slope $-P_{g2}/P_m$ for the new set of parallel lines. At
all levels of income, the model demonstrates increased utility at the
left-most portion where relatively little gasoline is consumed, and de-
creased utility toward the right, for those who desire higher quantities
of gasoline. The point suggested by the model is that distribution of
gain and loss of utility bears no necessary relation to income level.
Thus, poor people might be found to the right, buying coupons, while
high income persons toward the left, earning windfall gain in the sale
of their coupons. If this scenario were accurate or prevalent, then gaso-
line coupon distribution would clearly not be achieving a desirable in-
come redistribution.

In fact, empirical evidence suggests that on the average, lower in-
come persons will consume relatively little gasoline and therefore will
be selling their coupons, while the reverse is likely to be true for per-
sons at high income levels. This would correlate with finding indiffer-
ence curves at low income levels primarily toward the left, and high
income indifference curves mainly in the right-hand region of the
graph. To the extent that such a pattern does emerge, coupon rationing
would indeed be redistributing income from wealthy drivers to low in-
come drivers. One may note that there are a number of qualifications
inherent in the preceeding sentence. First, there will be many cases in
which the "pattern" is not followed. Rigidity of jobs and residence lo-
cations in the short run, particularly with extensive unemployment, as
well as lack of capital to purchase more efficient automobiles, will dic-
tate inelastic demand for a number of low income persons, for whom
alternative transportation is not available. Moreover, one can expect a
number of wealthy individuals whose driving habits require little gaso-
line. To the extent that these two categories of consumers emerge, the
rationing program will be redistributing income from the poor to the
rich. Second, even if a desirable direction of flow is established, the
income redistribution is confined to "drivers." The question then be-
comes whether "drivers" is the appropriate class of individuals to re-
ceive income subsidy, and whether a government scheme which would
expend one billion dollars in administering itself is the best means of
achieving such aims.

If we insist upon using a gasoline rationing mechanism for meeting the income distribution concerns, then we might want to give coupons only to persons below a certain income level. Even then, the program concentrates upon drivers, as a privileged subset of the poor. It is not clear why consumers of gasoline should receive better treatment than consumers of any other commodity whose price increases. A decision must be made whether subsidy is a desired goal and to whom it should flow. If poor people are the target, then a direct income subsidy would be more efficient than any plan related to gasoline. If indeed the goal is subsidization based upon gasoline consumption, then there are more efficient possibilities than rationing.

One alternative plan which has been suggested would entail letting the free market set price (and quantity) for gasoline and then give a pro-rata tax rebate based upon the prior year's consumption levels that might be determined through tax returns, for example.[57] Under this scheme, there is no distortion of the pricing system, thus no misallocation of resources.

III. CONCLUSION

It becomes clear that the goals, means, and consequences of a gasoline rationing program are all subject to serious question. Rationing generates severe distortions in market signalling, utility maximization, and resource allocation. If subsidy designed to mitigate the burdens of high gasoline prices is a desired goal, then other nondistorting mechanisms might be utilized, at lower administrative cost. The ultimate question as to whether gasoline-based subsidy is itself a worthwhile endeavor deserves a rather dubious response.

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57. Informal communication with Professor William F. Baxter, Stanford Law School.