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# IMPACTS OF HIGHER GASOLINE PRICES ON RURAL HOUSEHOLDS

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# IMPACTS OF HIGHER GASOLINE PRICES ON RURAL HOUSEHOLDS

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Automobiles consume over half of the energy used by the Nation's transportation sector. Efforts to curtail petroleum imports have focused on reducing gasoline consumption because private motor vehicles are viewed not only as significant energy-users, but inefficient in certain transportation situations as well. Also, any adverse impacts on income and disruptions in lifestyle are thought to be minimized by concentrating on this passenger transportation mode. Both higher gasoline prices and stringent rationing have been discussed as ways to achieve this reduction. Currently, raising prices seems the most probable energy policy. Thus, this paper will focus on the impact of higher gasoline prices on rural households.

Since the first quarter of 1974, sharply higher gasoline prices have become a fact of life for American drivers. These increases directly affect household incomes and consumer welfare. The severity of the impact depends on a number of factors including distance to jobs and shopping, the number of vehicles owned and their gas mileage, the availability of alternative transport modes and the household income. Rural households potentially face rather severe impacts because the above characteristics generally are less favorable for rural than for urban areas in terms of fuel use.

This paper highlights a few conditions in the transportation of rural people that need to be considered in forming an equitable energy

1/ Views expressed are those of the author and do not necessarily represent those of the U.S. Department of Agriculture.

conservation policy based on fuel prices. It will first show the role of transportation costs in the household's allocative decision and identify some welfare implications of higher fuel prices using the theory of the household. In addition, rural and urban passenger transportation characteristics will be discussed such as automobile ownership, trip distances, and vehicle mileage. Finally, the paper will examine some policy implications stemming from rural-urban differences.

The Demand for Mobility

Households must satisfy certain biological and psychological needs to survive. For example, they require food, medical care, recreation and interaction with friends and relatives. The theory of consumer behavior suggests that households maximize satisfaction within some income-budget constraint by allocating expenditures among all commodities on the basis of market prices.

This standard analysis obscures one aspect of the household's allocative decision. Consuming units are spatially separated from markets where transactions for physical commodities occur as well as where some leisure activities and friends and relatives are located. In essence, households purchase two items in every consumption transaction: the primary good and the associated transportation service necessary to obtain that good. Households must consider the transportation costs incurred in consuming goods and other services because such costs reduce the income available to purchase primary goods. In addition, the income allocation process includes commuting costs when earning income requires a transportation expenditure.

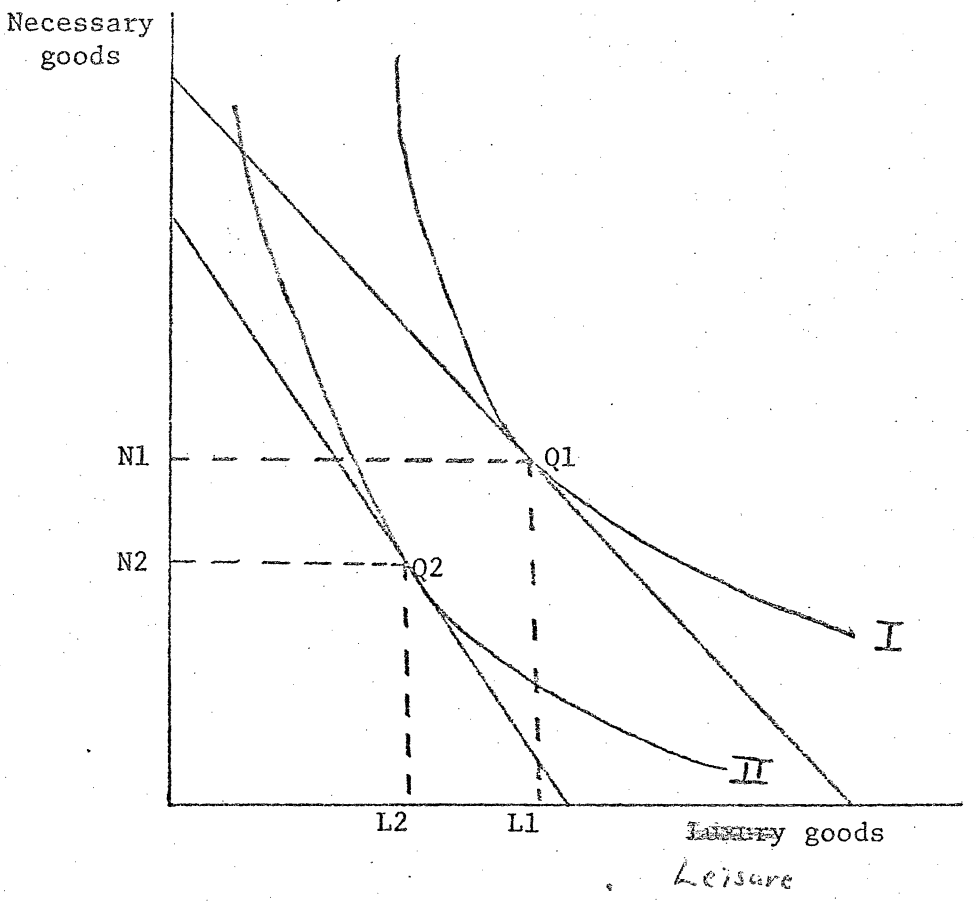
The household incurs out-of-pocket costs for public transit fares and/or fixed and variable costs for private automobile use. It presumably

calculates the private motor vehicle's cost per mile per passenger, or "fare", in making its choice among modes. Most analyses of modal choice also consider the travel time and the passenger's valuation of that time as an important variable possibly equal to or more important than out-of-pocket costs. The time value expressed in money terms outweighs the transport cost differences in many settings. This is especially true for higher income groups and for those in sparsely traveled corridors with infrequent or non-existent public transit schedules (Conference).

Households are assumed to have already considered the cost and service characteristics of available modes and established a modal choice for job commuting and for obtaining particular goods. Households allocate expenditures based on the prices and utility derived from the various goods and services. The "price" explicitly includes the market price of the good and the marginal cost of the transportation service. Any fixed transport costs operate on the net income available to the household, but probably are not explicitly allocated to the prices of the primary goods. Graphically, in the indifference curve analysis, this affects the location of the budget line.

Using indifference analysis, one can examine the relative effects of higher gasoline prices on rural versus urban households. For example, consider two households, one rural, the other urban. Each has similar preference patterns and an income net of job commuting costs such that a single indifference map is applicable to both. Assume that the households have equal transportation costs before the rise in fuel prices; further, each household purchases two goods and, therefore, has two trip purposes. One good is a composite of goods necessary to sustain the household; say, food and medical care (Oi, p. 11). The other composite good consists of

Effect of Increased Gasoline Prices



various leisure items such as visits to friends and recreation. The relevant prices of these two composite goods then include the market price plus the marginal transportation cost for a previously chosen mode and distance. An initial equilibrium point is established showing the quantities consumed of the two goods; the marginal rate of substitution of necessary goods for leisure goods equals the ratio of the relevant prices.

Now introduce a rise in fuel prices which increases commuting costs and the gross prices of both goods. The budget line thus moves to the left. However, transportation costs appear to be a smaller part of the relevant price for the composite of necessary goods than of the leisure items. For example, transportation costs for consumers comprise a relatively small part of the total expenditure for food bought at a supermarket, while transportation costs often dominate the price of leisure activities. Thus, an increase in the costs of commuting and the gross prices of the two goods due to higher fuel costs not only shifts the budget line to the left, but it also changes the price ratios. Different mixes of primary goods are now purchased.

Both urban and rural households would be expected to adjust their use of transportation to offset some of the welfare loss due to higher prices. Either household may switch to less fuel-intensive modes, reduce the traveling distance or consolidate trips in attempting to offset the increased prices of the goods. For example, carpooling or public transit may be used for work trips reducing commuting costs and increasing the household's net income to purchase other goods. Consolidating trips and reducing travel distances would lower the absolute prices and also increase net purchasing power.

Given the household's preference pattern and the change in relative prices, these actions may be implemented individually, concurrently, or for particular trip purposes. Nevertheless, the result is a smaller downward shift of the budget line for primary goods than would occur if prior transportation patterns were maintained.

The problems faced by households are now more visible. Both urban and rural households may react to higher fuel prices by the types of action described above. However, the rural household perhaps cannot alter the gross prices of goods as readily as the urban household can. For example, the rural household may find it more difficult to reduce the distances in obtaining food or medical care. In addition, fewer alternatives to private motor vehicles, such as public transportation, normally exist in rural areas; carpooling may be difficult to implement because of more scattered origins and destinations.

Urban households, on the other hand, may have more favorable options available in terms of distances and modes. Therefore, the price shifts they can make are greater than those available to rural households. Thus, under energy conservation policies, the urban household would suffer less loss of welfare and purchasing power than the rural household. Also, public transit may receive preferred treatment in the form of lower fuel prices or guaranteed quantities of fuel. Urban households would, in effect, be receiving a subsidy, further exacerbating the rural-urban differences.

The above analysis is theoretical and greatly simplified, but some empirical evidence exists to support the hypothesis. The next section presents data on distances, trip purposes and transportation alternatives in rural and urban areas.

Characteristics of Rural-Urban Transportation

As hypothesized, under higher fuel prices rural households may incur greater losses of purchasing power and welfare than would urban households. Some data on rural-urban transportation characteristics are available for a preliminary evaluation of the hypothesis. Rigorous analysis using this data is difficult because some travel by light truck is not reported and this mode is an important form of personal mobility in rural areas. In addition, the Department of Transportation (DOT) Reports use a residential classification--unincorporated areas and incorporated places--that does not exactly conform to the standard rural-urban designations. However, some general observations are possible.

Private vehicle ownership and alternative modes.--The data show that rural households depend somewhat more heavily on private vehicles to achieve mobility than do urban households. For example, in 1972, 96 percent of the nonmetropolitan households with incomes over $5,000 owned at least one automobile or light truck; the comparable urban figure was 85 percent. These nonmetropolitan households also tended to own more than one vehicle. In addition, almost 70 percent of low income (less than $5,000) rural households owned a vehicle compared with only 40 percent of the low income households residing in central cities (Census, Current Population Reports, Table 2, pp. 11-12).

Rural households rarely used modes other than private motor vehicles for work trips and, given the superior modal characteristics of private vehicles, the same pattern likely was true for non-work trips. Only one percent of the rural farm and nonfarm workers used public transportation, while 85-90 percent in each group were either automobile drivers or passengers in their home-to-work trips. In comparison, 12 percent of the

urban workers used public transportation while 80 percent traveled to work in cars (Census of Population, Table 87). Seventy percent of the workers in unincorporated areas reported that public transportation was not available. As the population size of the incorporated place increased, the percentages with this problem declined; only 5 percent of workers in the largest incorporated places mentioned the nonavailability of public transportation (U.S. DOT Report No. 8, p. 74). Rural households would find themselves hard-pressed to substitute among modes in the short term. The characteristics of rural areas suggests that automobile travel likely is the efficient mode in most cases.

Trips and vehicle-miles.--Average one-way automobile trip lengths for all purposes are generally longer in unincorporated areas, incorporated places with under 5,000 people and incorporated places with one million or more population, where trip lengths of 10, 10½ and 11½ miles, respectively, occur (table 1). However, the data obscure some special rural characteristics; for example, farmers and farm managers have the longest average trip lengths for family business trips, over 11 miles, more then double the length for other occupational groups (U.S. DOT Report No. 10, p. 71). Also, there are fewer opportunities for reducing work and other trip lengths in farming and other countryside areas than in metropolitan areas.

The number of automobile (including taxi) trips and the vehicle-miles traveled by a household in various areas and places yield further insight into possible adverse impacts of higher fuel prices. Households in unincorporated areas made about 1,600 trips a year on the average. This total is almost 15 percent more then the national average of 1,400 trips and over twice as many as those by households in the largest incorporated

Table 1.--Annual trips, vehicle-miles and average trip length per household according to residence and purpose, 1969-70 a/

| Purpose | Unincorporated areas | Incorporated places | | | | | | All places and areas |
|---|---|---|---|---|---|---|---|---|
| | | Under 5,000 | 5,000-24,999 | 25,000-49,999 | 50,000-99,999 | 100,000-999,999 | One million and over | |
| | | | | Annual trips | | | | |
| Earning-a-living | 561 | 401 | 661 | 511 | 481 | 438 | 324 | 506 |
| Family business | 493 | 297 | 601 | 480 | 430 | 369 | 181 | 432 |
| Social and recreational | 336 | 278 | 421 | 343 | 299 | 286 | 125 | 312 |
| Other | 178 | 80 | 187 | 145 | 134 | 133 | 70 | 146 |
| Total all purposes | 1,568 | 1,056 | 1,870 | 1,479 | 1,344 | 1,226 | 700 | 1,396 |
| Average daily trips | 4.3 | 2.9 | 5.1 | 4.1 | 3.7 | 3.4 | 1.9 | 3.8 |
| | | | | Vehicle-miles | | | | |
| Earning-a-living | 6,438 | 4,124 | 6,180 | 4,682 | 4,275 | 3,801 | 4,155 | 5,166 |
| Family business | 3,316 | 2,271 | 2,675 | 2,177 | 2,087 | 1,649 | 1,027 | 2,401 |
| Social and recreational | 4,455 | 3,946 | 5,086 | 4,202 | 4,016 | 3,426 | 2,580 | 4,094 |
| Other | 1,178 | 635 | 755 | 540 | 462 | 523 | 448 | 762 |
| Total all purposes | 15,387 | 10,976 | 14,696 | 11,601 | 10,840 | 9,399 | 8,210 | 12,423 |
| Average daily vechicle-miles | 42.1 | 30.1 | 40.2 | 31.8 | 29.7 | 25.8 | 22.5 | 34.0 |
| | | | | Average trip length (miles) | | | | |
| | 9.8 | 10.4 | 7.9 | 7.8 | 8.1 | 7.7 | 11.7 | 8.9 |

Source: U.S. Department of Transportation Report No. 7, pp. 16-17 and Report No. 10, p. 16.

a/ For trips where an automobile or taxi was the predominant mode used.

places. Households in unincorporated areas traveled 15,400 vehicle-miles a year and averaged 42 vehicle-miles a day--more than households in any other residential grouping.

Households in the smallest incorporated places had particularly interesting trip characteristics. They made next to the lowest average number of annual trips, about 1,050. Perhaps some of their trip needs are met by walking. However, they had the fourth highest number of vehicle-miles since their average trip length was rather long.

Households in incorporated places with population between 5,000-24,999 had the highest number of annual trips, 1,900, and the second highest vehicle-miles, 14,700.

Households in the largest incorporated places made the fewest number of automobile trips annually, 700. They also had the lowest annual vehicle-miles of all the residential groupings, 8,200. As the population increased, there was an inverse relationship to vehicle-miles of travel. Increased use and availability of public transportation may partially account for this. Over 50 percent of the vehicle-miles of households in the largest incorporated places were logged on occupational trips in contrast to residents of other jurisdictions where such trips accounted for only about 40 percent of the annual vehicle-miles.

Rural areas and places usually lack alternative modes (U.S. Senate, pp. 173-191). Households in these areas make greater use of their automobiles, as shown by the trip and vehicle-mile figures. In addition, a greater proportion of the miles are incurred for other than occupational trips, especially family business trips such as shopping and medical care.

Automobile Fuel Use and Energy Policies

The relative energy efficiency of rural and urban automobiles also

deserves consideration in formulating equitable energy policies. Motor vehicles operating in a congested urban environment have poorer gas mileage than those operating on relatively open roads. Traffic signals and peak-hour traffic loads in urban areas cause a cycle of speed variations that result in greater gasoline consumption. Hirst has estimated than urban autos are a highly energy intensive transport mode; they require more British Thermal Units (BTU's) per passenger mile, 8,100 BTU's, than all other passenger modes except airplanes. Intercity autos, on the other hand, are more than twice as efficient as urban autos; at 3,400 BTU's per passenger mile, they rank below urban mass transit in terms of energy used. A part of this difference is due to a higher occupancy rate for intercity travel (Hirst, p. 32).

We can calculate gallons of gasoline consumed by applying the miles per gallon (mpg) figures to the vehicle-mileage data. Automobiles in the United States average about 13 mpg. However, it is estimated that urban fuel consumption is 11.5 mpg, while rural consumption is 15.5 mpg (Healy, p. 41). Of course, considerable variation could occur because of terrain, driver operation, load, vehicle weight, and mechanical condition of the vehicle.

Assuming that all the "rural" vehicle-miles are operated in relatively uncongested areas, the household in the unincorporated area would consume about 1,000 gallons of gasoline annually. The household in the largest incorporated place, traveling in a congested environment, would use about 700 gallons. Thus, in this polar case, the rural household consumes about 40 percent more gasoline but travels almost twice as many vehicle-miles as the urban household. Other assumptions would result in a narrower differential in gasoline consumption between these

two types of households.

A gasoline tax of 25 cents a gallon would increase the cost of transportation by $250 for the household in the unincorporated areas. The household in the largest urban area would pay only $175, assuming no change in travel habits. However, since the rural households probably have fewer opportunities to reduce travel distances or switch to alternative modes, welfare impacts would potentially be greater for them. Even if a portion of the gasoline tax for a stipulated number of gallons was refunded through the income tax, inequities may occur. Rural households may suffer relatively greater impacts because they may require more fuel to meet their mobility needs.

The necessity of energy conservation policies is evident. An equitable energy policy should allocate the burden among the urban and rural population to minimize any excessive dislocations on either group. Preliminary analysis reveals greater impacts on rural households than urban ones. In addition, private motor vehicles operating in a congested urban environment with low passenger occupancy rates are inefficient energy-users. Energy policies should account for these varying characteristics. At present, the limited data available are still not adequate for the design of both equitable and effective policies. However, future surveys are currently being formulated to provide better information on these transportation characteristics.

While the focus of this paper has been on impacts of pricing policies, evaluations of impacts are also needed if rationing schemes are pursued. The possible short and long run effects of these policies on rural development, agricultural production, and quality of life in rural areas would be considerable.

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