International Trade in Used Cars and Problems of Economic Development

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This paper provides a price-theoretic explanation of the well-known phenomenon that automobiles in developing countries depreciate less rapidly and are scrapped at a greater age than they are in industrial countries. This paper then argues that the renewal of barriers to free trade in used cars would lead to substantial welfare gains for developing countries through both capital gains implicit in the arbitrage and positive externalities from car repair industries. Negative externalities from increased car supplies are evaluated and the final part of this paper considers what policies might be needed to develop international trade in used cars on a large scale.

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Casual observation suggests that in developing countries, automobiles last much longer and depreciate less rapidly than in industrial countries. In Section 1 of this paper, price-theoretic explanations of this phenomenon are provided. This analysis provides in Section 2 the background for the argument that free trade in used cars would lead to substantial welfare gains, which would all tend to accrue to the developing countries because their likely demand is only a very small fraction of the potential supply in the industrial countries.

After assuming that externalities associated with increased ownership of cars in developing countries on balance are positive, the analysis in Section 3 tums to the problem of what policies are needed to move towards free trade in used cars. The importance of trade liberalization policies in developing countries is discussed. Attention is also given to the need for institutions in industrial countries assuring a regular and efficient supply of fairly priced used cars and for the low-cost transportation of them to the developing countries. The initiation of a demonstration project is recommended and it is suggested that official aid-giving agencies in industrial countries might be interested in supporting such a project financially. This paper closes with a summary and conclusions. [1]

1. THE VALUE OF USED VEHICLES

It is well known that all capital goods and consumer durables lose market value as they become older. In the case of automobiles, there exists a functional relationship between age and value as shown as the line *IC* in Figure 1, where the value of the 'representative' car is measured along the vertical axis and the age of the car is shown along the horizontal axis.

The line *IC* in Figure l exhibits the well- known rapid rate of depreciation in the first few years, followed by a levelling of the rate, and finally, at *OC* years the attainment of a zero market value. At this age, the 'representative' car is scrapped with the market value of its components sold as spares or scrap just equal to the cost of disassembly and marketing the components.

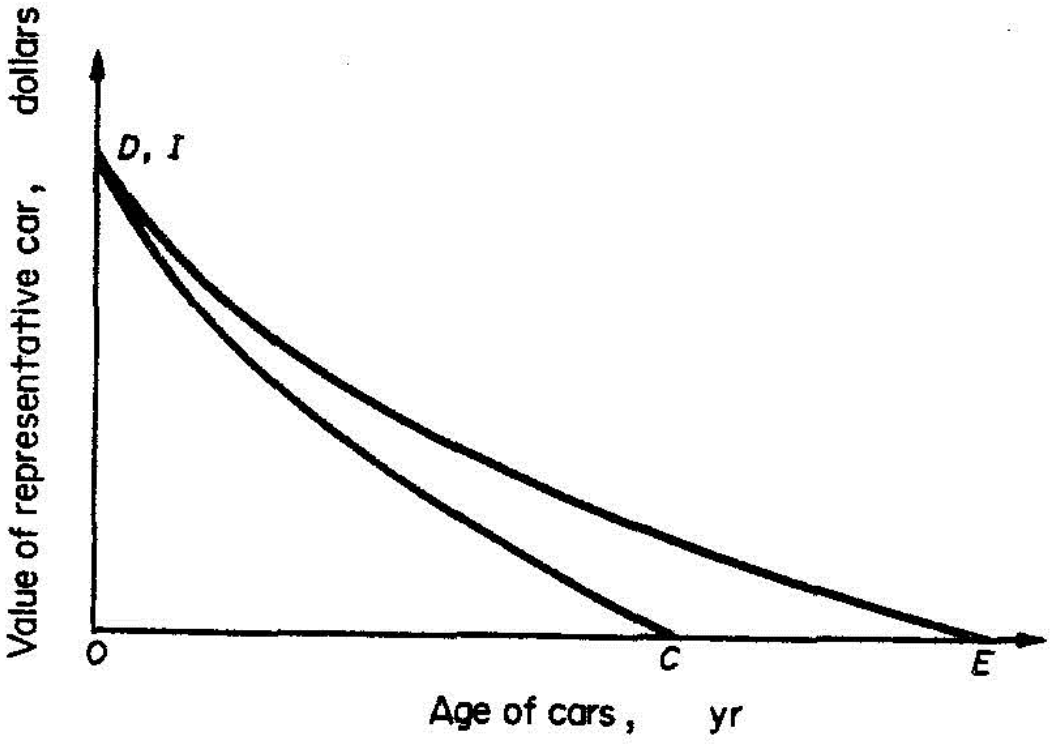

Figure 1. *The value of cars through time in industrial and developing countries.*

The term 'representative' car requires some explanation. In the real world automobiles built in a given year tend to depreciate at different rates, depending on use, maintenance and other factors. The prices of cars in each age-category tend to be distributed normally and the median value of that distribution is assumed to be that of the 'representative' car. This means that when the representative car has reached a zero value after *OC* years, one-half of all cars that age are scrapped and one-half still have a positive value. The concept of a representative car is useful analytically and the lack of realism does not interfere with the validity of the main conclusions to be reached below.

Important for the present purposes of analysis are the causes of the decline in the value of the automobiles. It is useful to distinguish three such causes. First, there is technical and stylistic obsolescence. Technical obsolescence arises from the historically observed improvements in the power, comfort and reliability of cars and technological changes made to accommodate altered relative prices of fuel and wages of mechanics. Examples of the latter class of technological changes are the reductions in average size and weight of cars which were induced in the United States by the sharp rise in gasoline prices in the early 1970s. Increased wages of mechanics have led to the use of higher quality manufacturing techniques, which while raising capital costs have lowered the need for labour in maintenance and repairs. Stylistic obsolescence is created by design changes which are partly functional, but mostly aesthetic.

The second reason why cars lose value as they age is that the expected cost of repairs increases with time. The expected cost of repairs is itself a function of the probability and cost of repairs, both of which are an increasing function of age simply because all car parts are subject to wear and tear and eventual

functional breakdown.

An impressive analytical literature exists on the general problem of when existing machinery should be scrapped and replaced by new equipment.[2] In simple terms, old machinery is scrapped when its operating costs exceed the total cost of new machinery, where the latter includes the interest payments and depreciation as well as the operating costs. In the case of automobiles, the regular operating costs in the form of fuel and licensing tend to be fairly equal for used and new vehicles and the most important differences are the higher cost of repairs for used cars and the higher cost of depreciation, interest and insurance on new cars. Through time, costs of repairs on old cars are rising while depreciation, interest and insurance on new cars remain rather constant (abstracting from inflation). Disregarding the other decision variables discussed, used cars are scrapped when the discounted expected costs of repairs exceed the discounted costs of insurance, depreciation and interest.

The third cause of the fall in the market value of cars through time is the increased risk of mechanical failure which has a disutility quite separate from the cost associated with the need to repair the causes of failure discussed in the preceding paragraph. This disutility arises from the discomfort, danger and loss of time associated with a breakdown of cars. Thus, a non-functioning car can cause appointments to be missed. A breakdown can cause accidents in traffic or the exposure to dangers in inhospitable locations.

Next the analysis turns to the determination of the value of cars in an industrial and developing country, focusing on the causes of loss of value just presented and considering the line *IC* in Figure l to represent the age-value relation- ship in an industrial country.

(a) *Difference in the rate of depreciation*

To bring out the essential determinants of the difference in the value of used cars in industrial and developing countries, assume that there is free trade in new cars and spare parts, but that there is no trade at all in used cars. Under the further assumptions that there are no transportation costs and that all cars are manufactured in the industrial countries, the age- value profile of automobiles in the developing countries is represented by the line *DE* in Figure l. It coincides with the *IC* line at the initial purchase price, but then lies above *IC* over the entire range and reaches a zero value *CE* yr later than the *IC* line.

What explains the gap between the *IC* and *DE* lines? First, and probably most important empirically is the lower cost of labour incurred in repairing cars in the developing country, given that by assumption, spare parts are traded freely and cost the same in both countries. The representative car which is scrapped at *OC* yr in the industrial country can be repaired and kept functioning at such a low cost that at that age its value is positive. The same low cost of re- pairs explains the postulated differences in values at all ages and in the time when zero value is reached.

A second factor determining the difference in values is the lower average income in the developing country and the characteristic of the income elasticity of demand for the 'luxury' features of new car models. Put differently, the residents of developing countries tend to be more interested in obtaining basic transportation services from a car and are less willing to spend money on increased power, comfort, stylistic elegance, freedom from pollution and other such luxury features supplied in increasing quantities in new cars and depreciating the value of old ones. In a sense, older cars have basic utility and luxury features in a ratio more suitable for conditions in a developing than a developed country.

Third, the increasing cost of labour relative to capital in industrial countries has led to the use of production technology involving close tolerances, greater strength and low maintenance materials with the effect that new car prices have risen through time in real terms but expected labour costs for maintenance and repairs have fallen. This change in the relation between the cost of new cars and maintenance is valued highly in industrial countries and tends to depress the market value of used cars. In the developing country, on the other hand, the higher initial cost of new models is a dis- advantage and the lower cost of maintenance and repairs are less significant advantages. Therefore, the

value of older cars is depressed less rapidly by the introduction of new models in the developing than the industrial countries.

However, there are some technological innovations of new automobiles which are reactions to changed relative prices common in both industrial and developing countries. An example of these is the greater fuel economy of new cars induced by higher prices of petroleum after 1973. This development depresses prices of used cars in both types of countries, but theoretically should not affect the gap between their prices in the two types of countries because of the other factors being discussed.

A fourth reason why the *DE* line is above the *IC* line in Figure 1 is due to differences in the cost of suffering a breakdown of cars. Because the opportunity cost of labour and the average human capital value of drivers and occupants are lower in developing countries than industrial countries, the cost of missing appointments, waiting for repairs and even the economic cost of death and injury are less in the former than the latter countries. Consequently, the increasing probabilities of break- down and accidents of used cars lead to a smaller discount for them relative to new cars in the developing than the industrial countries.

(b) *Introducing some elements of realism*

In the real world, of course, there is no free trade in new cars or spare parts and it is useful to consider the implications of this fact for the conclusions reached above by continuing to assume that the importation of used cars is prohibited entirely or prevented through very high duties. Under these assumptions, the existence of tariffs on the importation of new cars implies a parallel upward shift of the *DE* line in Figure 1, creating a difference in the dollar value of new cars and an increased gap in the dollar value of used cars. On the other hand, the existence of tariffs on the import of spare parts twists downward the *DE* line, rotating it at the point of the new-car price. In other words, tariff-induced increases in the prices of spare parts raise the cost of repairs in the developing countries and narrow the gap in value of used cars in the two different types of countries. The preceding conclusions are not affected qualitatively by the existence of quotas on the import of new cars. To the extent that quotas rather than tariffs are the effective constraint on imports, the prices of new cars in the two countries diverge by more than the tariff costs and the *DE* line is shifted up more. The preceding conclusions are also not affected if, as a result of the protection, new cars are assembled or manufactured in the developing countries. New-car prices, adjusted for quality and design differences, diverge in the two types of countries by the amount of tariff charges while the relationship between used-car prices remains as discussed earlier.

2. GAINS FROM TRADE IN USED CARS

Return now to the conditions which were assumed initially to underlie the drawing of Figure 1, namely that there is free trade in new cars and spare parts with a total prohibition on trade in used cars. Let us consider now what happens if trade in used automobiles is permitted and costs of transportation are assumed to be negligible.

It is clear that under the above assumptions trade leads to an equalization of used-car prices in industrial and developing countries. After the initial stock adjustment further trade takes place only as a result of replacement of worn- out vehicles and growth in demand resulting from increased population and incomes. In the absence of production of new cars in the developing countries, there is a steady flow of both new and used cars from the industrial to the developing countries where the new cars may be expected to meet the demands of some high- income consumers.

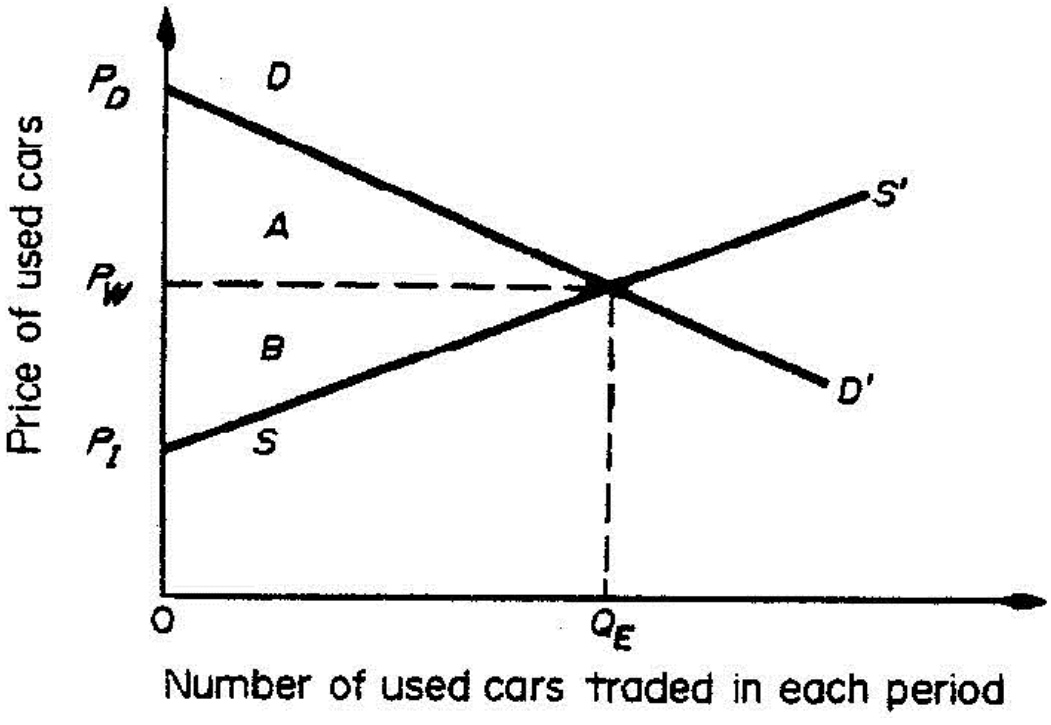

Figure 2. *Welfare gains from used-car trade.*

The effects of trade on prices of used cars and welfare are shown in Figure 2, where along the vertical axis the average prices of used cars of all ages are measured and along the horizontal axis the quantities of used cars traded per time period are shown. In the pre-trade situation prices are OP_D in the developing countries, which is above the prices OP_1 in the industrial countries for reasons analysed above. The demand and supply curves for used cars shown in Figure 2 represent those of the developing and developed countries, respectively. As can be seen, after the opening up of trade, equilibrium is reached at OPw and a level of OQE used cars traded per time period.

The gains in welfare which are produced by the strategy of having free rather than no trade in used cars are represented by the areas *A* and *B* in Figure 2. Area *A* is equal to the consumer surplus enjoyed by buyers in the developing countries while area *B* is the producer's surplus accruing to the industrial countries.

Figure 2 lends itself to making an important point about the relative distribution of the gains from trade in used cars. This point is that the more elastic is the supply curve, the greater is area *A* relative to area *B.* In other words, if the demand for used cars from developing countries is small relative to the supply of used cars, then free trade causes the equilibrium price to be established very close to the industrial countries' price and the developing countries enjoy the maximum amount of consumer surplus.

It may be useful to consider the effect which free trade in used cars would have on Figure l. The primary effect would be to bring together the lines *DE* and *IC,* a remaining gap reflecting only costs of transportation. Gains to developing countries are greater the more *DE* shifts downward and the less *IC* shifts upward. In developing countries prices of used cars would fall and in industrial countries they would rise. The age of scrapping of the representative car in the developing countries would fall and it would rise in the industrial countries.

Finally, let us consider briefly the analytical effects of relaxing the assumption that there is free trade in new cars. Under these conditions, free trade in used cars would cause the line *DE* in Figure 1 to have a higher intercept than the line *IC* because of the tariff-induced gap between new car

prices in the industrial and developing countries. However, the postulated free trade in used cars would bring together the sections of the *DE* and *IC* lines to the right of the vertical axis, for reasons and in the manner discussed above. Clearly, under these conditions, there would be no shipments of new cars since cars used even for the shortest time and only legally 'used' carry a lower price. Therefore, if a country wishes to have production for its new-car industry it cannot have free trade in used cars. However, a system of tariffs which makes the level of production a decreasing function of the age of cars presumably could be adopted to assure at least a part of the effects arising from free trade in both used and new cars.

(a) *Some speculations about magnitudes*

Data on the stocks of used cars, scrapping rates and values are not readily available. How- ever, there are some data which permit establishment of orders of magnitude involved in the potential trade in used cars.

According to the UN *Statistical Yearbook* (1977) the world stock of passenger cars went from 236.2 million in 1973 to 247.3 million in 1974, while world production in 1973 was 29.8 million. The growth in stocks was 11.l million, implying that 18.7 million cars were scrapped in 1973.

Stocks of cars in the developing regions in 1974 were 4.5, 8.0 and 4.9 million in Africa, South America and Asia (excluding Japan), respectively, giving a total of l 7.4 million. This figure represents about 7% of the world total. Assuming that scrapping takes place proportionately to stocks, 93% of all cars were scrapped in the industrial countries. Therefore in 1973 there were over 17 million cars that reached zero value in the industrial countries.

This figure of 17 million has to be related to potential demand for used vehicles in develop- ing countries. Such demand is not known and probably would be constrained by policies of governments. However, if one assumes that the stock of passenger vehicles would be allowed to grow at 20%/yr which is twice the rate experienced in 1973-1974, then there would have been a demand for 3.5 million cars in 1973. Assuming that this demand was met entirely from the supply of cars about to be scrapped in the industrial countries, the quantity demanded represents only about 20% of the supplies of that year.

If there were free trade in used vehicles, of course, trade would take place in cars of all ages and the demand would be met potentially from the entire stock of cars in the industrial countries. For 1973 the figures would be a demand of 3.5 million met from a potential supply of 216 million.

However rough the preceding calculations and suspect the basic figures are, they do suggest that the opening up of free trade in used cars would raise prices very little in industrial countries and lower them substantially in developing countries with therefore practically all of the welfare gains accruing to the latter countries. This conclusion is strengthened if only one or a few countries adopted a strategy of free trade in used cars.

(b) *Externalities*

The import of large numbers of used cars would have some positive and some negative externalities in the developing country. On the positive side, the increased availability of motor transportation at low prices raises the efficiency of the entire economy as farmers can bring products to markets more cheaply, the distribution costs of consumer and industrial goods are lowered and labour time lost in walking to places of employment is reduced.

Another important source of positive externalities is connected with the maintenance, repair and modification of used cars. One would expect that used cars are cannibalized to obtain spare parts, cottage industries for the reconditioning of critical parts develop and firms are established to turn passenger vehicles into mini-buses and trucks for commercial use. These activities create employment and induce the learning of skills required for industrialization. It is not inconceivable that such activities can lead to the establishment of industries exporting reconditioned parts and vehicles.

Negative externalities arise from the in- creased congestion of roads, greater need for the import of petroleum products requiring scarce foreign exchange and more frequent accidents due to the

malfunctioning of the used cars, with all the accompanying costs of medical care and loss of human capital.

It is not possible to measure the value of these positive and negative externalities. However, it may be useful to make some general comments about them. It is obvious that in industrial countries it has been decided that the positive outweigh the negative aspects of widespread car ownership. Its continued growth in spite of increased incidence of some negative externalities is the best evidence of this state of affairs. There is every reason to believe that people in the developing countries will reach similar conclusions and will continue to strive for widespread car ownership. Trade in used cars will facilitate attainment of this goal.

More specifically, it is highly likely that the increased productivity resulting from having more cars will make it possible to generate more exports with which to pay for the increased use of gasoline. Domestically, the stimulus to employment in the automobile related industry will generate income tax revenue to pay for the construction of more and better roads which is a necessary expenditure if development is to be achieved anyway and is merely made sooner if the stock of cars grows more rapidly. There are technical and administrative methods available for reducing the frequency and cost of accidents and congestion, but remaining costs simply have to be accepted as the inevitable consequence of development which most societies have been and are willing to bear.

A final negative externality is likely to arise in developing countries which have built up a native automobile assembly and manufacturing industry behind protective barriers. The availability of used cars at low cost from abroad would strongly reduce sales by these typically very high-cost industries and may force them out of business. During the adjustment, there is a loss of capital invested and employment in these industries and over the longer run the country foregoes the infant-industry benefits which were expected to result from the establishment of the firms. However, the loss of the capital, employment and infant-industry benefits are reduced and may be more than compensated for by the positive effects of the creation of a used-car-oriented industry which uses machines from the contracting industry and employs workers whose acquired skills provide the same kinds of infant-industry benefits as does the new-car industry. Furthermore, as noted above, if it is deemed absolutely critical that a new-car industry is maintained, it should be possible to institute tariffs on the used-car market that give less protection the higher is the age of the used cars. There would always be reduced sales of new cars, but the rates could be set in such a way that the welfare losses from reduced new-car production are less than the welfare gains from the import of used cars.

In the literature about the costs and benefits of buying used capital goods and machinery, it is noted that used machines often produce output of lower quality and widen the technological gap between industrialized and developing countries. These types of externalities are not relevant in connection with trade in used vehicles because the quality of the service provided by used cars is not an important aspect of the basic output of cars and it is not traded internationally, as is for example, the low-quality cloth produced on used textile machinery. The technological gap may be closed more rapidly as used cars of recent vintage with the latest technological innovations are imported in large numbers and maintained and repaired by a work force learning by doing rather than if new cars are only assembled from imported components.

(c) *The question of net benefits*

The preceding analysis of the welfare gains and social costs arising from free trade in used vehicles is very rough and qualitative only. The evaluation of some of the costs and benefits accruing in the form of externalities involve personal value judgements. Consequently, it is not possible, in this paper, to establish more than a presumption that developing countries generally can be expected to enjoy a net increase in welfare by adopting a strategy for the encouragement of trade in used vehicles. Furthermore, conditions are likely to be different in each country.

For these reasons, the following part of the paper is developed on the assumption that a careful welfare calculus has shown that the import of used cars leads to positive social benefits. The analysis then concerns the policies which are necessary to bring about such a trade.

3. POLICIES TO ENCOURAGE TRADE IN USED VEHICLES

In developing countries, the most obvious policy change required to achieve substantial imports of used vehicles is the elimination or reduction of quota and tariff protection to which they are subject at present. Presumably, the changes would be geared to achieve a level of imports consistent with other development objectives and the required use of foreign ex- change earnings. Private firms or public agencies administering the importation of new cars before the new policy can be relied upon or charged with the task of importing used cars. Competition among buyers and sellers would quickly lower domestic prices of used cars to where they are only equal to the world price plus transportation costs, tariffs and a normal return to the importers. In countries in which imports and domestic trade are handled by the state, the setting of domestic used-car prices can be integrated with other development plans.

However, there are certain characteristics of the market for used cars in industrial countries which lead to high transaction and transportation costs which probably can be reduced substantially by the initiation of some policies in the industrial countries, either through government agencies or the private automobile industry. The first of these is the organization of used-car exchanges that can, with the help of appropriately trained experts, generate efficiently a supply of used cars large enough to meet the demands of developing countries. Important in this process is the establishment of prices appropriate for the quality of the used cars. This takes both skill and integrity of the agent acting as a buyer for the developing countries.

A second problem associated with the programme for the export of used cars is that the cost of transporting them from the place of purchase to a harbour and from there to the developing countries is likely to be very high, both absolutely and as a proportion of the value of the vehicle. This problem can be dealt with in the same manner in which the producers of new cars have achieved significant reductions in the cost of transporting new vehicles: the use of specialized road transporters, railroad cars and sea-going vessels.

If sufficient demand for used cars existed, firms specializing in the provision of such transport services could be expected to develop. However, such developments could be assured and speeded up considerably if the new car manufacturers in the industrial countries could be made to organize the purchase and shipment of used cars for the developing countries. Existing road and rail transportation equipment could be used to bring back to the factory used cars from the markets to which they delivered new cars. Storage and trans-shipment facilities for sea transport could readily be adapted or enlarged to effect the export of the cars. Sea- going vessels may be used to even out cyclical fluctuations in the demand for new-car shipments.

The new-car industries have the managerial and technical skills to mount such an operation and make it profitable. But for these firms, the reduction in the supply of used cars would have the additionally important benefit of encouraging the sale of new cars in the industrial countries. In addition, by creating familiarity with its brands in developing countries, the new car producing firms can create brand loyalty which will pay off in new-car sales in the future as the developing countries' rising incomes permit the importation of more new cars.

The preceding analysis suggests that the level of trade in used automobiles and the magnitude of the gains in welfare will be greater if the governments of developing countries initially become involved in the setting up of the trade. They might deal directly with new-car producers and develop plans for the trade of sufficiently large numbers of used cars to ensure that the available economies of scale and externalities are taken advantage of.

Governments in the industrial countries in tum can assist these attempts to develop trade in used vehicles. The costs of creating the necessary institutions may even be considered to be within the legitimate area of activities for official aid-granting institutions. The required policies would be likely to have strong support from domestic interest groups in the industrial countries.

(a) *Some demonstration projects*

Because considerable uncertainty surrounds the establishment and likely effects of large- scale flows of used cars from the industrial to the developing countries, it would be useful if some

demonstration projects could be under- taken to establish that the trade is feasible and what its effects are likely to be. Thus, the official aid-giving agencies of an industrial country may be asked by the government of a developing country to finance the shipment of some boat-loads of used cars. Such a boat-load of used cars could be scheduled to arrive every 3 months for the duration of 2 yr. The cars might be auctioned at the port of entry in the developing country, after they have been made available for inspection by potential buyers, with the local currency proceeds being used to finance the administration of the programme in the developing country.

In undertaking such an experiment, data can be collected on the cost of buying and transporting used cars, and on the availability of facilities capable of doing the job in the industrial countries. In the developing country, it can be observed how markets for used-car prices are affected, how readily firms are created for the reconditioning and resale of the vehicles, and what is the effect of the trade on the demand for spare parts and new cars. It is clear that some of the effects of the experiment take time to manifest themselves, so that it is important to plan the experiment to last for a long period and involve a relatively certain supply of used cars.

4. SUMMARY AND CONCLUSIONS

This paper has analysed the price-theoretic causes of the slower rate of depreciation and longer life of cars in developing as compared with industrial countries. These causes suggest that free trade in used cars would lead to an increase in world welfare. Relative quantities of demand and supply in such trade suggest that most of the gains would accrue to developing countries.

A speculative analysis of the externalities likely to accompany trade in used cars suggests that, like in industrial countries, benefits should outweigh costs of increased car ownership in developing countries.

In the third part of the paper, it was assumed that trade in used vehicles was socially beneficial for developing countries and it was considered what policies are necessary to start up such trade. In developing countries, tariffs and quotas restricting the trade have to be relaxed. The private new-car industry in the industrial countries may have to be involved in setting up efficient and reliable institutions for the purchase of large numbers of used cars and for their low-cost shipment to the developing countries. Official aid-giving programmes may be made to assist the development of these institutions and, through the experimental free shipment of some boat loads of used cars, can assist in gathering data about the feasibility and consequences of a programme for liberalized trade in used cars.

In closing, it should be noted that the arguments made about passenger cars are applicable also to trucks, buses, tractors and motorcycles. Eventually, if trade in used passenger cars proves to be feasible and desirable, analogous policies in support of trade in these other modes of transportation can be initiated. This fact further enhances the attractiveness of an experiment designed to discover relevant data for trade in used passenger cars.

NOTES

1. I have not been able to find any articles or books in the professional economics literature discussing the economics of used cars specifically. However, see the second note for references to the extensive literature on technical change and the decision to scrap old machines, which is germane to one aspect of this paper. It is interesting to note that Baranson (1969} does not contain any references to trade in used cars.

2. The standard reference on technological change and investment decisions generally is Salter (1960}. Several publications deal with the problem of second- hand machinery in development. Among the most recent ones are Schwartz (1973}; Sen (1962}; Smith (1974}; Strassman (1968}; Todaro (1970}; and United Nations (1966}.

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