AN AGENDA FOR RESEARCH IN TRANSPORT PRICING IN AN ERA OF DEREGULATION

by **Sylvester Damus**[*]

Economists for many years had pressed for the deregulation of transport,[1] with studies purporting to show constant returns to scale in motor transport,[2] the disappearance of increasing returns to railroads,[3] and staggering losses inflicted on the economy by regulation,[4] especially by stubborn adherence to old-fashioned value-of-service pricing.

Deregulation is now the order for the day in the United States. In Canada, railroads have had a measure of freedom since 1967, motor carriers are much less regulated than in the United States (not at all in the province of Alberta), and the Economic Council of Canada recently has recommended further deregulation.[5]

Unfortunately, the economists who can be credited for setting the deregulation process in motion must be debited for having had little to say about what deregulated transport industries will look like and what prices they will set.[6] They have less to say nowadays, while revising their thought after their rediscovery of economies of scale,[7] economies of traffic density,[8] and the merits of a certain form of regulated monopoly pricing, called Ramsey pricing.[9]

The suggestion of Ramsey pricing seems to take us full circle and back to nineteenth century public interest rationales for regulation. As a further irony, it has been shown that Ramsey pricing is perhaps no novelty, but value-of-service pricing with a new name.[10] This serves to show that we do not yet have a solid grasp on transport prices, that the theory of freight rates has not advanced much beyond

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[1] J.R. Meyer, M.J. Peck, J. Stenason, and C. Zwick, The Economics of Competition in the Transportation Industries (Cambridge: Harvard University Press, 1959).

[2] R.H. Spady and A.F. Friedlaender, "A Hedonic Cost Function for the Regulated Trucking Industry," Bell Journal of Economics 9 (Spring 1978), 159-79.

[3] George Borts "The Estimation of Rail Cost Functions," Econometrica, 28 (January 1960), 108-31; and T.E. Keeler, "Railroad Costs Returns to Scale, and Excess Capacity, Review of Economics and Statistics, 56 (May 1974), 201-08.

[4] A.F. Friedlaender "The Social Cost of Regulating the Railroads," American Economic Review, 61 (May 1971), 226-34 and R.W. Harbeson, "Towards a Better Resource Allocation in Transportation," Journal of Law and Economics, 12 (October 1969), 321-38.

[5] Economic Council of Canada, Reforming Regulation (Ottawa: Canadian Government Publishing Centre, 1981).

[6] This opinion is shared by Richard C. Levin, "Railroad Rates, Profitability, and Welfare under Deregulation," Bell Journal of Economics, 12 (Spring 1981), 2.

[7] Randall S. Brown, Douglas W. Caves, and Laurits R. Christensen, "Modelling the Structure of Cost and Production for Multiproduct Firms," Southern Economic Journal, 46 (July 1979), 256-73.

[8] R.G. Harris "Economics of Traffic Density in The Rail Freight Industry," Bell Journal of Economics, 8 (Autumn 1977), 556-64.

[9] Ronald R. Braeutigam, "Optimal Pricing With Intermodal Competition," American Economic Review, 69 (March 1979), 38-49. The reduced economic cost of enforcing Ramsey prices was estimated by Clifford Winston "The Welfare Effects of Interstate Commerce Commission Rate Regulation Revisited," Bell Journal of Economics, 12 (Spring 1981), 232-43.

[10] Sylvester Damus, "Two-Part Tariffs and Optimum Taxation: The Case of Railway Rates," American Economic Review, 71 (March 1981), 65-79.

where it was 100 years ago.

Part of the problem is that freight rate theories are deficient in several respects, of which I would like to mention four:

> (1) One must cease thinking about freight rates and costs as if there were no transport;
> (2) There seems to be confusion about factors which elevate discriminatory prices to the status of Ramsey prices;
> (3) The study of transport must be made consistent with other branches of economics; and
> (4) We must have a consistent definition of transport industries and make up our minds on whether to include what is below tires and wheel flanges.

Too much has been written about carriers as producers of homogeneous ton-miles, comparable to power plants producing kilowatt-hours, or manufacturers of mass-produced, identical widgets, without sufficient attention to the changes of location and distances that define transport as an industry worthy of separate study. True, there are cost equations estimated as functions of average length of haul, or of tons and ton-miles, but this is far from bringing distance to the fore and integrating transport with spatial economics. As matters stand now in this respect one has to consult engineers who wrote 90[11] and 140 years ago,[12] only to find we are no further ahead than the New York Senate's position in 1860.[13]

Ramsey pricing is being suggested as a new regulatory tool, but the objectives of regulation are not sufficiently clear, so that the literature contains now at least three versions of Ramsey pricing. These differ in their specification of the constraints on revenue imposed by regulation. At least two of them must be false, in the sense of imposing constraints which Frank Ramsey may not have accepted.[14]

Economic theories of prices and competition in transport also must be made consistent with what we know about the circulation of money and the balance of interregional trade. One result of this may be an understanding of a previously unrecognized source of increasing returns available to all modes and of mutual interests of railroads, motor carriers, and barge operators. It is not sufficiently appreciated that transport can balance the value, but not the weight, of front- and backhauls. The ordinary course of commerce makes empty backhauls inevitable, and therefore there are no freight rates-however low-which can remove excess transport capacity. Looking at this problem in another way, one may say that those who make the inevitable empty hauls provide an unremunerated service to carriers of balanced hauls.

Looking below rubber tires by including roads as inputs to transport on a par with rails, we may discover the inefficiency of governments as setters of road user charges. With this I am not alluding to the old issue of fair shares in infrastructure costs of trucks versus railroads, but raise a new issue of fairness to different classes of truckers, and of the allocation of costs among long- and short-haul shippers, regardless of the mode they employ.

Distance as a Factor in Transport Pricing

Rates depend upon distance, as much as costs and demand depend upon it. Very little is known about the effect on cost. The taper in per-ton-mile charges traditionally has been justified by reference to terminal costs. The description of these costs, however, seems to encompass items which are incurred not only at terminals, but also at several points between them. But if so-called terminal costs are suffered throughout a journey, they may be directly proportional to the length of haul and no justification for terminal charges. Indeed, there is evidence that terminal costs can be nil. One can find

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[11] Wilhelm Launhardt, *Theorie der Tarifbildung der Eisenbahnen* (Berlin: Springer Verlag, 1890).

[12] Charles Ellet, An Essay on the Laws of Trade in Reference to the Works of Internal Improvement in the United States, 1839, reprinted by Augustus Kelley, New York, 1966.

[13] The Senate had defeated a motion to enforce pro-rata freight rates, siding with railroads and merchants to sanction tapered rates, and through rates below the level of local ones on a per-ton-mile basis. New York Assembly, Select Committee on Petitions for Regulating Freights on Rail Roads in this State Pro-Rata Freight Bill, 1860.

[14] For Ramsey's original formulation see his "Contribution to the Theory of Taxation," Economic Journal, 37 (March 1927), 47-61.

freight rates made like passenger fares, at so many cents per mile without terminal charge, and waivers of terminal charges, as in the case of milling in transit.[15] But economists often hypothesize that railroad costs decrease as the length of haul increases, and furnished some evidence.[16] But their statistical proof is unconvincing. We know rates are tapered, and we know all railroads have costs about equal to their revenues, and so the statistical results may have been generated by the revenue structure, not by costs. In the case of motor carrier costs, DeVany and Saving were led by theoretical----not statistical---analysis to say that the distance taper ought to be inverted.[17] Thus, anything seems possible, except explaining why competition has been observed to weaken the taper, and even to produce constant rates per ton-mile regardless of distance.

On the demand side we know a little more, namely that---everything else equal---the demand for long-haul transport is more elastic (more responsive to price changes) than for short hauls. The reason for this is that the price of a long haul represents a large amount, compared to what the shipper and receiver hope to gain from their trade, and it pays more to economize on large expenses than on small ones. One consequence of this characteristic of demands for hauls of different length is that a monopolistic carrier will quote tapered rates to captive shippers, even if there is no taper in his costs. A particularly interesting kind of monopoly carrier is the one who enjoys (or suffers the consequences of) increasing returns to scale. In his case, average cost exceeds the marginal cost level of competitive prices, and he needs to exercise some monopoly power (perhaps protected by the State) just to break even. This is the case of the regulated carrier. But how should a regulator set rates? If he does it in a public- minded way, he will set value-of-service prices with a distance taper, just as the unregulated monopolist would, but at a lower level. This is the Ramsey price, which can be discovered by observing the adjustment of conveyance rates to terminal charges.[18]

Ramsey Prices, or Old Wine in New Bottles

The Ramsey price equals marginal cost plus a charge calculated as optimum contribution toward fixed costs. It is optimum in the sense of requiring the least possible sacrifice on the part of shippers. This is achieved by setting the excess of rates over marginal cost in some inverse proportion to elasticities of demand. The proportion is whatever is necessary for unsubsidized operation of railroads at a break-even level. Mathematically, one sets rates which maximize the public utility of transport, subject to a revenue constraint. The function of the constraint is to prevent demand-based prices from yielding a monopoly profit.

A very interesting feature of both the Ramsey and the monopoly price is that its conveyance rate is always less than marginal cost, so there is no reason to fear it may be set at excessive levels.[19] Only the terminal charge needs to be regulated, paying attention to the fact that it must cover both the fixed cost and the deficit implicit in conveyance rates. Thus, both charges must be determined simultaneously,

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[15] The terminal charge is the constant part of the rate per ton which does not increase with distance. It is eroded by competition, which was easily observable in Argentina, whose foreign-owned railways were not protected by government enforcement of value-of-service pricing by motor carriers. See Buenos Aires Western Railway Co., Ltd., Proceedings of the Annual General Meeting London, October 23, 1932, and Lino Camaño, "*La competencia carretera en la República Argentina: las tarifas proyectadas por el Ferrorarril Central Argentino para contrarrestar sus efectos*," Fourth Pan American Railway Congress, Bogota, 1941, Vol. 3, 167-85. The best American example is afforded by the original McGraham scale. There may be some significance to the fact that it took Albert Fink's reorganization of the Trunk Line pool before a terminal charge could be added to this scale.

[16] Supra, n. 8.

[17] In their "Product Quality, Uncertainty, and Regulation: The Trucking Industry," American Economic Review, 67 (September 1977), 583-94.

[18] This paragraph is based on the article mentioned in n.10, supra. The conveyance rate is the amount by which the charge per ton increases for each additional mile.

[19] For an early and lucid discovery of the fact that profit used to be derived from terminal charges, and that conveyance rates included a discount for distance, see Herbert O. Whitten, "Profit Opportunities from Dynamic Rate-Making Policies," Chesapeake and Ohio Railway Company, October 25, 1975 (mimeo.).

in mutually consistent ways. They cannot be set independently of each other. The attempt to do so, around 1890, was fatal for English railways, and vigorously but unsuccessfully resisted by them.[20] The Interstate Commerce Commission does not seem to have followed this bad example, not while M.O. Lorenz had a hand in ratemaking.[21] His ratemaking formula started off in the correct way, from an assumption about the percentage of revenue to be raised by terminal charges. This percentage appears to have been very nearly what was required to bridge the gap between marginal and average cost of railroad services.[22]

So much for history. Nowadays the most important characteristic of Ramsey prices is that they are unsustainable in face of competition, because they involve cross-subsidization between long- and short-haul shippers, and between main and branch lines.[23] Also, Ramsey's revenue constraint is not firm-specific. It is set for the transport industries as a whole, causing one carrier to subsidize another. This means Ramsey pricing is impossible under deregulation, and the so-called Ramsey prices one encounters do not really deserve that name.

The revenue constraint on demand-based pricing can be applied at any one of three levels. One can set a single constraint for all transport industries at once, separately for each firm which has a transport monopoly in its area, or separately for each firm in monopolistic competition with other carriers.

In the first case we have true Ramsey pricing which produces divergences of rates from marginal cost which are commodity-specific, not firm-specific.[24] The industry-wide constraint makes the industry break even, while some individual carriers lose money and others ring up profits. This is a case of uniform tariffs with subsidization of weak carriers by strong ones, reminiscent of some Interstate Commerce Commission policies.

The second is the case of value-of-service pricing as applied by nineteenth century railroads in their captive markets. It involved as many revenue constraints as there were railroads. Revenue requirements included deficits suffered in competitive markets and excluded cross-subsidization between carriers. The multiplicity of constraints made this an inferior application of Ramsey's inverse-elasticity rule. Railroad mergers and inter- modal ownership may have been fitting attempts to reap gains by removal of excessive revenue constraints and approximating a more Ramsey-like tariff structure.[25]

Ronald Braeutigam's "partial regulation"---demand-based pricing by railroads and competitive marginal-cost pricing by other modes---involves as many revenue constraints as there are railroads required to stand alone, plus sustainability constraints to ensure that rail rates are not eroded by point-to-point competition. The multiplication of constraints on any railroad's rates removes this scheme very far from Ramsey's. It makes it indistinguishable from price discrimination in monopolistic

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[20] In terms of the article cited in n.10, supra, one cannot set one value of m to compute the terminal charge, and a different one to figure out the conveyance rate. For an account of an attempt to do this, see James Mavor, "The English Railway Rate Question," Quarterly Journal of Economics, 8 (April 1894), 3-54.

[21] The Lorenz ratemaking formula was explained in Upson Co. v. Ann Arbor R.R. Co., 157 I.C.C. (1929), 615-16.

[22] Lorenz assumed terminal charges ought to raise revenue equal to one-third of total cost. In terms of the article cited in n. 10, supra, total revenue equals $\int qf(x)dx$, and the revenue from terminal charges is $t\int q dx$. Assuming linear demand curves, the first integral is three times larger than the second if m equals 1/6, in which case the surplus over variable cost is 2/7 of variable cost, and the degree of returns to scale is 9/7. This differs by only 0.004 from Lawrence Klein's estimate of 1.29 in his Textbook of Econometrics (Evanston, IL: Row Peterson & Co.,1953), p. 226-36.

[23] Supra, n.10, p. 70.

[24] D.J. Brown and G.Heal, "Two-Part Tariffs, Marginal Cost Pricing, and Increasing Returns in a General Equilibrium Model," Journal of Public Economics, 13 (February 1980), 25-49, demonstrate that Ramsey prices are not firm-specific.

[25] S. Damus, "A Two-Part Ramsey Optimum Railroad Tariff," unpubl. doctoral dissertation, University of Chicago, 1979, ch. 7.

competition, which has no special merit that recommends it as official policy. Its similarity with true Ramsey pricing is only superficial. It is well known that every discriminating monopolist prices according to elasticities of demand, and may break even in the process. However, one does not become a Ramsey-pricer by attention to elasticities, but by submission to a broad revenue constraint which dictates commodity-specific, not firm-specific, deviations of rates from marginal costs.

Research is needed to compare the feasibility, costs, and advantages of each of the above three types of monopoly ratemaking. One or the other of them is needed to cope with increasing returns to scale. These, or cost conditions resembling them, indeed exist.

The Backhaul Problem

Suppose the White Pass and Yukon Railway were the only avenue of commerce in Canada's Northwest. This single line carries heavy minerals down from Whitehorse---its northern terminal---and the up trains return with provisions from the port of Skagway for the Yukon. This trade must balance. The territory's inhabitants cannot afford to import goods from Skagway for more value than what they export. But if the railway carries goods of the same value up as down, it cannot balance the tonnages. Empty backhauls from Skagway are inevitable. If the company were to attempt to increase its Whitehorse-bound traffic by rate reductions, it would need additional revenue and raise rates on the mineral traffic to Skagway. But by raising rates in one direction as they are lowered in the other, there would be no change in the charge for the round-trip, and there is no reason to expect change in its cost either. This cost of the round-trip is the real impediment to development of the Yukon's trade, which will not expand by the simple expedient of changing rates charged for transport in opposite directions without altering their sum. International economists know this by the title of "the symmetry between import and export taxes."[26]

Instead of a single line, we assume now a network of lines which criss-cross each other. There may not be a single point on this network where the number of loaded vehicles coming in can equal the number going out. But neither is it necessary that equal numbers of vehicles run up and down any given route. All that is required is that the number coming in from all directions equal the number going out in all other directions. Vehicles do not have to run back and forth between A and B. They can return to A from B via C or D. In this way one can minimize the number of empty hauls, scheduling some vehicles like tramp ships, and others like liners. For a monopolist owning the entire network, the minimum empty hauls remaining after all possible adjustments in tariffs and itineraries represent an overhead cost suffered to maintain a balanced flow of interregional trade (balanced in dollar values). To cover this overhead cost, freight rates must exceed the direct cost of any particular movement. The distribution of this overhead over all shipments is done in a simultaneous solution for all rates and all routes, subject to the conditions that total cost including empty hauls be minimized and that traffic flows balance the dollar payments at each point, so that money keeps circulating instead of piling up at one corner of the network. Because of the simultaneous character of the solution, it is not possible to single out any one route for special treatment and say, for example, that because there happen to be very few or no empty hauls on that route, freight rates can be lowered. Thus, each shipper has to pay for a share of empty hauls, even when he ships over a route where there are none.[27]

If on every route rates exceed direct costs by a charge for system-wide empty hauls, we have a condition resembling one of increasing returns to scale. There may be genuinely increasing returns if by enlarging a network one gains degrees of freedom to schedule vehicles and effect further reductions in empty hauls and if the cost of administering a larger network does not outweigh this gain. This condition affects railroads, ships, trucks, and any other carriers of freight. Thus, the problem of pricing their services is similar to the railroads'. It is the same old problem of finding a good way to distribute

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[26] Abba P. Lerner, "The Symmetry Between Import and Export Taxes," Economica, 3 (August 1936), 306-13.

[27] For a different opinion, see John W. Snow, "The Problem of Motor Carrier Regulation and the Ford Administration's Proposal for Reform," in Paul MacAvoy and John W. Snow, Regulation of Entry and Pricing in Truck Transportation (Washington, D.C.: American Enterprise Institute for Public Policy Research,1977), p. 16. According to Snow, each shipper should pay for as many round-trips as the number of fronthauls he demands. The implicit backhaul rate is zero.

an overhead cost.

Unfortunately, this condition of increasing returns will not show up in statistical cost studies. I have yet to see one that considers the cost of system-wide empty hauls. If there is not one, it may be because in the normal course of affairs empty hauls represent an almost fixed proportion of all trips, especially when measured in a dark glass full of statistical averages. These averages will not betray this peculiar overhead cost, and thus economists could be led by cost studies to recommend competitive pricing by truckers, if not also by railroads.

What would this competitive pricing look like? The experience with deregulated airlines provides a misleading guide, because airlines---although they fly with empty seats---do not suffer this kind of empty haul problem. Passengers have the very convenient habit of sooner or later returning to their point of origin, so that at any airport the numbers deplaning and boarding over some period of time are equal. There is no counterpart to the inevitable imbalance between tonnage exported and imported, forced on the freight carrier by the requirement of balance between dollar values of commodities bought and sold. Therefore, one cannot extrapolate from experience with airline deregulation to predict success with truck and railroad deregulation.

Competition for freight lets each carrier think he can evade the minimum required empty hauls. He thinks he can cut prices to fill backhauls and let somebody else get stuck with the empties. The consequence was evident in the Yukon: rates rise in some directions and fall toward zero in others, without any beneficial effect on resource allocation by shippers. What is not visible in the Yukon, for lack of a competitive network, is that shippers will elect cheap routes. Trade changes direction, follows roundabout routes to thread itself through points where carriers are slashing prices to fill empties. The result is that what seemed like backhauls become underpriced fronthauls, and it is no longer clear that transport prices can be relied upon to direct the country's trade through the most efficient channels. I can only be certain that many carriers will provide unremunerated service by making unforseen empty hauls.[28]

Instead of network problems, consider the case of two carriers who serve the same locality. Carrier X takes only full loads in and out. Carrier Y makes all the empty hauls. Should he attempt to fill them by cutting prices, he will shift some of them over to X. Therefore, X's cost per ton depends on Y's output and prices. Y will discover he previously had been providing an unremunerated service to X. The two carriers then may put their heads together, run their businesses more profitably as if they were one, and allocate empty hauls to each. These empties are then an overhead cost, one they cannot trace and charge to any particular movement.

One may object that front- and backhauls are joint products like beef and hides, and, like them, can be priced competitively.[29] However, the analogy is false, since butchers do not have to obey a balance of payments constraint such as that which governs commodity trade. Butchers can dispose of entire carcasses, whereas carriers as a whole cannot dispose of all their round-trips. Neither is excess capacity to transport comparable to an equilibrium unemployment or apartment vacancy rate. It cannot be removed, not even in a world of complete certainty and costless information. The problem with competition in transport is therefore that individual carriers can cut prices in an attempt to balance their hauls, attempt the impossible, and behave like butchers.

If impossible attempts to evade empty hauls by rate reductions make competition in transport

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[28] Robert J. Lord and Jack Shaw, "A Comparative Examination of the Impact of Regulation on the Operations and Cost of Intra-Provincial Trucking Firms in Alberta and Ontario," Economic Council of Canada, Regulation Reference, Working Paper No. 3, Studies in Trucking Regulation, Vol. 2, 1980, found that in Alberta, where motor carriage is unregulated, operators complain of irrational competition, make excessive empty hauls, rely more heavily on brokers, and charge rates very often higher than Ontario carriers (where there is entry, but no rate regulation). James M. McRae and David M. Prescott "An Econometric Analysis of the Effects of Regulation on the Canadian Common Carrier Industry," in the same volume, found Alberta motor transport rates to be higher than those in Saskatchewan and Manitoba, and to have the weakest distance taper of any Canadian province.

[29] This was all that Arthur C. Pigou and Frank Taussig could agree on at the end of their famous controversy over railway rates. See D. Philip Locklin, "The Literature on Railway Rate Theory," Quarterly Journal of Economics, 47 (February 1933), 167-230.

somewhat unworkable and pointless, then maybe it made sense to force everyone into at least some empty hauls, even at the cost of surpassing the minimum required to serve the trade. Therefore, I do not think that past regulatory practice (and nineteenth century railroad traffic pools) deserved all the criticism heaped upon them.

Road User Charges

Even if there were no pricing problems related to increasing returns to scale and to the cost of system-wide empty hauls, any hopes that deregulation will improve resource allocation may be exaggerated unless government---which is one of the major suppliers of transport services---puts its house in order.

The investment by all levels of government in highways represents a significant part of the cost of transport and is paid for mainly in fuel taxes. These taxes are neither competitive nor efficient. They are strictly proportional to ton-mileage. This method of setting highway tolls already has been rejected by other authors.[30] Its defect is not that it does not raise enough revenue (and may be unfair to railroads) but that the same revenue could be raised with less sacrifice by motor carriers and shippers. To achieve this result, the fuel tax should be replaced by a tonnage tax coupled with a mileage subsidy. Road transport prices thus would become similar to railroad rates set under one or the other interpretation of Ramsey's rules. The tonnage tax is the equivalent of a terminal charge, and the mileage subsidy causes conveyance rates to fall below marginal cost. Only this time the assimilation of motor-truck to railway rates has a different purpose and cannot be circumvented by private carriage. If road user charges were thus reformed, there would be fewer problems with intermodal competition, and there would be more scope for Ramsey pricing by railroads, although the unsustainability problem would not be totally eliminated. A start in this direction could be made by auctioning off controlled access highways to private entrepreneurs who---like railroads before them---would know how to set tapered value-of-service tolls.

Maybe this proposal is too radical and impractical. It can be put aside with persuasive reasons for noncompetitive provision of highways priced in the manner least advantageous to their owners and users, if any can be shown. Whatever the case may be, one should have little faith in any scheme for the optimization of transport and be more tolerant of actual practices in the industry. I am not convinced that the industry can be accused of as much past wrongdoing as it is, and that in the future we can do much better.

Conclusion

A spatial model of Ramsey pricing by carriers with increasing returns to scale produces distance rates incompatible with the Staggers Act definition of reasonableness. Ramsey's terminal charges can make short-haul rates exceed variable cost by more than 160 or any other percentage. Instead, terminal charges should be regulated directly. The requirement that carriers stand alone and the necessity to observe sustainability constraints to monopoly pricing remove the structure of freight rates away from Ramsey's second-best. They result in a kind of price discrimination which never has been an objective of public policy. The multiplication of revenue constraints is a cause of inefficiency and a source of potential incentives to merger and traffic pooling. These incentives are magnified by the dependence of one carrier's costs on another's output and pricing. Road user charges are inefficient and inconsistent with what we expect from motor transport and other modes. Therefore, deregulation can only be advocated per se, not for efficiency or economic welfare reasons. For real improvement in transport efficiency we still have to learn to set optimum prices with the least impediments to competition, to set backhaul rates without destabilizing the industry, and to set road user charges by the same principles applied throughout the transport industries. Deregulation may be welcomed as a unique opportunity to experiment with different ways of solving these problems.

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[30] C.E. Ellet, "A Popular Exposition of the Incorrectness of the Tariffs on Tolls in Use on the Public Improvements of the United States," Journal of the Franklin Institute, 29 (1840), 225-32, and Alan A. Walters, The Economics of Road User Charges (Baltimore: Johns Hopkins Press, for the International Bank for Reconstruction and Development,1968).

UNPUBLISHED NOTE ON THE DISCUSSION

During discussion, Ronald Braeutigam asked why empty backhauls would be inimical to competition; their effect did not seem different as, say, that of apartment vacancies on competition for housing.

The answer is that empty backhauls are no way analogous to vacancies, business inventories, etc. A potential tenant, on finding an apartment to be occupied, can be directed to a vacant one. The vacancy may *hold down* the rent of occupied places. The effect of backhauls is quite the opposite. An offer of a seat on the train from B to A is no answer to finding that the train from A to B is fully booked. And if empty backhauls persist, then the fare from A to B is *raised*.