PRICING RATIONALITY AND DEFICITS ON THE BRAZILIAN RAILROADS

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Typically, railroads in underdeveloped countries fall within the public sector and run large deficits, which must be financed out of general public sector revenues or through new money created by the monetary authority. The heavily subsidised rates affect relative prices and hence influence the use of resources, while the usual means of dealing with the losses, issue of new money, stimulates inflation. Argentina, Brazil and Chile have been thus affected in recent years, with railway deficits running at 35 to 70 per cent of operating costs.[1] In Brazil the deficit of the federal railway system amounted in the period 1961–65 to 68 per cent of operating costs and to 77 per cent of total federal railway expenditures.

Reform in Brazilian rate and investment policy has long been recommended by some Brazilian interests, by foreign advisory missions, and by the World Bank. Resistance to reform has come from shippers benefiting from the heavy subsidies, and from federal government personnel threatened with curtailment of their operating scope. There has been no growth in federal rail traffic since 1950, while highway traffic has gone up almost sixfold to a level exceeding federal railway goods movement by nearly 800 per cent. (Only the Vitória-Minas line, a subsidiary of a public mining company and not part of the federal system, has shown large traffic gains; by the mid-sixties it was accounting for one-third of total rail goods traffic.)

The views of the interest groups are reinforced by a widespread belief in the role of railways as generators of economic development; by a belief in their external benefits, however vaguely defined; by an incorrect understanding of the marginal cost criterion for optimal activity levels (which frequently is taken to refer to very short-run variable costs excluding the cost of rolling stock and most, if not all, of the labour force); and finally by inadequate accounting practice, which permits asset valuation at acquisition cost uncorrected for inflation in an economy which since 1950 has experienced annual rates of inflation varying from 15 to 165 per cent.

The position of railway proponents was elaborated by the National Railway Department's Administrative Reform Study Group in a major presentation in the

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*This paper was written when the author was with the University of California (Berkeley) Brazil Development Assistance Program. His conclusions do not necessarily reflect those of the Program, or of any other organisation.

[1]Alan Abouchar, "Inflation and Transportation Policy in Brazil." *Economic Development and Cultural Change*, Fall, 1969.

annual supplement of the *Revista Ferroviaria.*[2] This paper argues the case for construction of new lines (section 2.2) and electrification (section 5.1), although both policies have been strongly discouraged by independent expert studies,[3] and presents such unsupported generalisations as: "Not to invest in the Brazilian railways today is to frustrate Brazil's destiny," and "Not to invest a lot is to introduce irreparable transportation distortions into the economy" (p. 37).

In March 1968 a major rate reform took place, but no real financial improvement was achieved. Freight classification was simplified and some minor rate increases were made for certain commodities for some distances and for intercity passenger services.[4] In general, however, the new pattern represents a step back from the previous defective structure, especially in the incremental rates of the general commodity schedules and the level and structure of the three most important freight schedules – iron ore, lumber, and cement – which cover 40 per cent of the cargo of the RFFSA (Federal Railroad Network). The rate structure of the São Paulo state railroads in 1967 continued to show the serious deficiencies, especially in rate-distance relationships, which existed in earlier years. (The new rate structure was, however, 20 per cent higher.)

We begin the present paper with a summary of the rate structures. We then consider the possible cost justifications for the new schedules, and finally we review some of the implications for rational allocation of resources.

THE NEW RATE STRUCTURE

The new RFFSA rate structure[5] has eight basic commodity schedules for carload shipments. Three of these are special schedules for iron ore, lumber, and cement; another four replace schedules which formerly applied to 15 commodity categories; the final schedules relates to commodities not previously classified.[6]

Two important changes have been introduced. First, the short-haul rates have been adjusted, some up and some down. Secondly, the rate-distance relationships

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[2]Grupo de Estudo da Reforma Administrativa do Departamento Nacional de Estradas de Ferro, "Estudo e Análise da Reforma Administrativa nos Transportes e Orgãos Ferroviarios", in *Annuário das Estradas de Ferro, Suplemento da Revista Ferroviária,* 1967, pp. 5–66.

[3]See, *e.g.*, GEIPOT (Grup Executive da Integração da Politica dos Transportes – Executive Group for the Integration of Transport Policy), *Draft Report on the Railroads,* Rio de Janeiro, 1967.

[4]Since the rate revision took effect a 20 per cent discount has been instituted on passenger fares, more than offsetting the increase on the short-distance rates and vitiating most of the increase on the passenger schedule as a whole.

[5]The new rates came into effect in February 1968. They are listed in RFFSA, *Tarifa Geral (3) da RFFSA.* The new classification is contained in Contadoría Geral de Transportes, *Pauta de Classificação e Condições Gerais de Transportes, 2a. parte-Capitulo VII,* Nov. 1967. A summary of the rate principles is contained in RFFSA, Carta-Circular no. 99/SGT/68.

[6]Although this fifth schedule, M-5, is the highest of the general schedules it appears to be of very limited applicability. We will, therefore, speak of M-1 as the highest general rate.

TABLE 1

New and Old Brazilian Railroad Rates: Rates per ton in Carload Lots
(NCr$. at February 1968 prices)

Rates Schedules	*Distance (kilometres)*												
	100	200	300	400	500	600	700	800	900	1000	1300	1600	5000
I. *General Schedules* RFFSA													
1. Highest (M-1)													
a. New Rate	8.8	13.3	17.9	22.5	26.6	30.7	34.8	38.9	42.1	45.3	54.9	64.5	142.1
b. New Rate per ton-km.	0.088	0.067	0.060	0.056	0.053	0.051	0.050	0.049	0.047	0.045	0.042	0.040	0.028
c. New Rate/Old Rate (%)	107	103	101	100	98	99	100	101	99	98	95	93	72
d. IR/IR_{100}* (%)	100	100	100	90	90	90	90	70	70	70	70	50	50
2. Lowest (M-4)													
a. New Rate	6.6	10.0	13.4	16.8	19.9	23.0	26.1	29.2	31.6	34.0	41.2	48.4	106.6
b. New Rate per km.	0.066	0.050	0.045	0.042	0.040	0.038	0.037	0.036	0.035	0.034	0.032	0.030	0.021
c. New Rate/Old Rate (%)	100	102	104	105	104	105	106	107	106	104	101	99	76
d. IR/IR_{100}* (%)	100	100	100	90	90	90	90	70	70	70	70	50	50
II. *Special Schedules* RFFSA													
1. Iron Ore (E-1)													
a. New Rate	4.5	5.6	6.6	7.7	8.8	9.9	11.6	13.2	14.9	16.6	21.6	26.6	82.9
b. New Rate per km.	0.045	0.028	0.022	0.019	0.018	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
c. New Rate/Old Rate (%)	90	90	90	90	90	90	90	90	90	90	90	90	90
d. IR/IR_{100}* (%)	100	100	100	100	110	148	155	155	155	155	155	155	155
2. Lumber (E-2)													
a. New Rate	4.7	7.4	10.1	12.8	15.5	18.2	20.9	23.6	26.3	29.0	35.8	40.2	89.0
b. New Rate per km.	0.047	0.037	0.034	0.032	0.031	0.030	0.030	0.030	0.029	0.029	0.028	0.026	0.018
c. New Rate/Old Rate (%)	85	86	87	87	87	87	93	99	109	119	143	156	271
d. IR/IR_{100}* (%)	100	100	100	100	100	100	100	100	100	89	59	44	59
3. Cement (E-3)													
a. New Rate	5.4	8.0	10.6	13.2	15.8	16.3	16.8	17.3	17.8	18.4	19.9	23.0	76.5
b. New Rate per km.	0.054	0.040	0.035	0.033	0.032	0.027	0.024	0.022	0.020	0.018	0.017	0.015	0.015
c. New Rate/Old Rate (%)	82	82	82	82	82	80	78	76	78	80	78	74	78
d. IR/IR_{100}* (%)	100	100	100	100	20	20	20	20	20	20	59	59	59
III. *Highest São Paulo rate*													
a. New Rate	4.9	9.4	13.3	16.8	19.7	22.2	24.2	25.6	26.6	27.1			
b. New Rate per km.	0.049	0.047	0.044	0.042	0.039	0.037	0.034	0.032	0.024	0.027			
c. New Rate/Old Rate (%)	121	121	121	121	121	121	121	121	121				
d. IR/IR_{100}* (%)	100	88	80	68	57	45	34	23	11				

Sources: TG2, TG3, and IBGE, *Annuario Estatistico do Brasil.*

*New incremental rate at each distance as percentage of new incremental rate at 100 kilometres.

have been altered, the major change being an increase from two to four inflection points in the incremental rates of the the general schedules. (An *incremental rate* is the rate charged for additional distance; the *inflection points* mark the distances at which the incremental rates are changed, usually downwards). The incremental rates on general schedules used to fall by 15 or 20 per cent at 500 kilometres. The new rates give reductions at 400, 800 and 1,600 kilometres.[7]

The special schedules continue to be characterised by a varying number of inflection points, though fewer than previously. Table 1 shows the new schedules and compares them with their predecessors. All rates include loading and unloading.

The maximum very-short-haul cargo increase over the previous rate is 7 per cent (at 100 kilometres) in the M-1 schedule (the highest general commodity schedule, which applies to freight such as automobiles and parts, copper sheets and explosives). But the new rate/old rate ratio quickly falls, the increase averaging only one per cent on distances up to 900 kilometres, beyond which the new rate is lower than the old. Schedule M-4, the lowest general commodity rate, which applies to coke, fertiliser, bananas, dolomite, etc., was unchanged at 100 kilometres. The higher incremental rate in this schedule does yield a total rate increase – 4.3 per cent – on shipments up to 1,000 kilometres, as we can see by averaging the M-4 new-rate/old-rate ratio. Beyond 1,300 kilometres, however, the new rate for this group also is less than the old.

The short-haul schedules of the special rates were all reduced – by 10 per cent for iron ore, 15 per cent for lumber, and 18 per cent for cement. Indeed, the only rate increases for any of these commodities at any distance were for lumber being moved more than 900 kilometres (of which there is little anyway).

The new incremental rates for the general schedules (the M-schedules) are generally lower than before. In general, the pattern of the new incremental M-rates, shown in Table 1, is to fall by 10 per cent at 400 kilometres, by 30 per cent at 800 kilometres, and by 50 per cent at 1,600 kilometres. By contrast, in the earlier schedules there was only a single change in the incremental rates: a decrease of between 15 and 20 per cent at 500 kilometres.

The new incremental rates for the special E-schedules follow varying patterns, as did the former special schedules. The iron ore incremental rate is steady up to 500 kilometres and then rises. The incremental lumber rate is steady up to 900 kilometres and then begins to decline. The cement incremental rate is lower than before at all but a few distances.

Table 1 also shows the 1967 rate structure on the São Paulo railroads for raw cotton, coffee beans, fats and oils, hides and skins, metal bars and sheets, and other commodities. The structure is the same as that for many other products including manioc flour, wheat flour, beans, rice, and sugar, but the rate is 23 per cent higher throughout than for these products. This São Paulo rate structure, which has existed since 1964, shows even sharper reductions for distance than the RFFSA structure:

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[7]The new incremental rates may be readily calculated from the total rates for distances up to 1,000 kilometres, shown in Table 1. For example, the incremental rate for the highest general cargo tariff between 100 and 200 kilometres is (13.3–8.8)/100, or 0.045 NCr$. The incremental rate at 800 kilometres is 0.032, or 70 per cent of the 100-kilometre incremental rate.

the incremental rate at 900 kilometres is 89 per cent below that at 100 kilometres.

Very short-distance passenger rates on the RFFSA, not shown here, rose by 16 per cent. The average rise over the first 1,000 kilometres was 31 per cent. As already noted, however, a subsequent 20 per cent reduction in June 1968 largely cancelled this increase, leaving a net advance of less than five per cent. The biggest gain was in short-haul livestock rates, also not shown in the table, which more than doubled on average. However, livestock is relatively unimportant – it accounted for only about four per cent of RFFSA transport revenues in 1965 and 1966.[8]

COSTS AND RATEMAKING

The RFFSA has lost money ever since its formation in 1958, as did its predecessors throughout the postwar period. Between 1963 and 1966[9] the subsidy varied between 50 and 70 per cent of operating expenses, as defined by the railroads. But these expenses understate the true operating costs, since they do not provide for adequate depreciation on rolling stock and locomotives.[10] Also, while there is no need to allow for a return on the capital already invested in permanent way, since it is an unrecoverable sunk cost with no alternative uses and hence has zero opportunity cost, the investment being undertaken today in new permanent way and signalling should be built into the railroad cost. But no attempt is made to do so.

The new rate structure is intended to improve the financial performance of the railroads by raising revenues. But it is not likely to do so. One way to compare the probable performance under the new rates with that under the old rates is to calculate the revenues that would derive by applying the new and old schedules to the actual traffic composition for 1966. This calculation, summarised in Table 2, shows that the new schedules increase revenue by 3 per cent.

But this procedure overstates revenue under both tariff regimes, since it assumes that all tonnage of any commodity class travelled the average haul for that class, and the rate for that distance is higher than would be the weighted average of the rates applicable at the various distances which the cargoes actually did travel. The overstatement is greater for the new rates, since they contain bigger reductions for distance than did the old rates. Moreover, the new rate used for passengers is the rate charged before the subsequent 20 per cent reduction. If one allows for this and

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[8]RFFSA, *Anuário Estatístico*, 1967, pp. 96, 99.

[9]RFFSA, *Relatório 1966*, p. 19.

[10]A recent study of railroad operating procedures disagrees "entirely with the methods being used to charge depreciation to Operating Expenses". It goes on to estimate that, because of faulty procedures, operating costs in 1965 were understated by at least NCr$90 million—20 per cent of the operating expenditure reported by the RFFSA for that year. The study urges that attention be given to better cost accounting in general and for specific services. See GEIPOT, *Brazil Transport Survey, Railroads, The Recommended Reorganization and Plan of Action*, Volume IV-A, 1966, pp. VIII-6, 7, 8.

TABLE 2

RFFSA: Potential Revenue under Old and New Rates with Actual 1966 Traffic (NCr$ at 1966 prices)

Commodity	*Volume Originated* (10^3)	*Average Length of Haul* (*kilometres*)	*Rate Applicable at this Distance* (*per ton*)		*Potential Revenue From Traffic* (10^6)	
			Old rates	*New rates*	*Old rates*	*New rates*
Iron ore (tons)	4,955.9	512	6.8	6.2	33.7	30.7
Lumber (tons)	1,047.5	482	12.2	10.6	12.8	11.1
Cement (tons)	1,185.3	510	13.3	10.9	15.8	12.9
Other freight (tons)	21,152.4	264	9.9	10.1	209.4	213.6
Animals (units)	1,753.0	438	6.8	10.1	11.9	17.7
Baggage (tons)	304.1	230	18.3	16.0	5.6	4.9
Passengers intercity	46,583.0	82	1.2	1.4	55.9	65.2
Suburban*	242,721.0				26.0	26.0
Total					371.1	382.1

Source: RFFSA, *Anuário Estatístico 1967*; TG2; TG3.

Rates are converted to 1966 prices by Furdacão Jetulio Vargas official price index, which rose by 46 per cent between 1966 and February 1968.

*Suburban passenger revenue is actual revenue, taken directly from RFFSA *Anuário Estatístico 1967*. Since no suburban rates are stated in the new schedules we assume them to be the same as before.

for the cargo revenue bias, the total revenue under the new rates would be possibly 7 per cent *lower* than that estimated under the old rates.[11]

In this comparison we have applied the new rates to the old traffic mix. But the new rates are structured very differently from the old rates and will themselves affect

[11]In this analysis we have compared the revenue that would have accrued under the new rates with that which would have accrued under the old rates, not with the actual 1966 revenue, which, at NCr$ 220 million, was 41 per cent lower than the hypothetical revenue. The discrepancy between actual and hypothetical revenues is partly due to the following factors: (1) Underweighting of the round-trip second class fare and neglect of half-fare and 75 per cent discount schedules, causing us to estimate intercity passenger revenues at NCr$ 55.9 million while the actual intercity passenger revenue was NCr$ 24.4 million. (2) The assumption, implicit in our use of the 1966 price deflator, that the March 1966 fares were effectively adjusted throughout the year to keep pace with inflation. In fact adjustments are made periodically, and there is bound to be some inconsistency between rate adjustments and price indexes. In this case the hypothetical and actual revenues will diverge the more as the seasonal traffic patterns are more severe. (3) The possibility that general cargo may be shipped under four different rate classes, depending on the nature of the goods. But no summary statement exists which classifies the year's activity according to these rates. We have assumed that general cargo was evenly distributed over the four rates, but undoubtedly larger shares of the low-rated commodities were shipped. The result is an overstatement of perhaps 5–8 per cent in the general commodity revenue. (4) Finally, as noted in the text, our use of the rates applicable to the average haul for each traffic category. This would cause an especially severe bias in the revenue projections for cement and lumber. These four factors lead to an overestimate of revenue, but there is no reason to believe that they lead to a systematic bias between the old and new estimates other than that noted in the text, the effect of which is to overstate the new estimate relative to the old.

transport demand. In particular, the new inflection points in the incremental rates should raise the demand for long hauls by diverting traffic from highways and coastal shipping. Since, as we will argue in a moment, long-distance haulage costs do not decline in like proportion, the corresponding expenditure will rise relative to revenue.

If the new rates are in fact likely to lead to a higher deficit, why were they put forward in the first place? Evidently some people believe that they will either lead to a lower deficit or, at the least, raise railroad output without increasing the deficit. Supporters of this view can present two different arguments. Let us see whether these are valid.

1. The Cost-Length Function

The first defence of declining incremental rates is that unit costs decline steadily with increasing length of haul. Certainly the fixed costs of train operation, such as train formation, loading and unloading, and paperwork associated with shipment, are all sources of declining average unit costs for a given cargo shipment. But this would justify a declining *average* rate and not a declining *incremental* rate. The bulk of railroad operating costs, including rolling stock, fuel, crew costs, rail and tie wear, and line maintenance beyond a certain minimum, are closely related to annual output measured in gross train-kilometres. To be sure, these costs will be slightly less for a train moving a given distance than for two similar trains each moving half as far, since the former needs less braking, with consequent savings in rail and equipment wear, and there is some fuel economy associated with express movement. But this is the only effect. The new incremental rate discounts refer not to shipments on unit trains, but rather to tonnages shipped in regular freight trains (some limited portion of the iron ore differential may be said to reflect unit train economies). And these rates show very sizable incremental rate decreases, the incremental ton-kilometre rate falling, at various distances, by 10 per cent, 30 per cent, and 50 per cent below the 100-kilometre incremental rate. Since the fixed costs in train operation are incurred only once, they obviously cannot be used to justify declining incremental rates. (Marshalling operations in Brazil do not provide a continuing source of declining cost, because the pattern of the network lacks direct long-distance connections. For example, on a geographically broad sample of arcs, rail routes average 30 per cent longer than highway routes. To the extent that long-distance trains can be formed, however, some reduction in average rate is called for on this account. This would justify a small part of the reduction for iron ore shipments.)

2. Marginal Cost Orientation

Declining incremental rates are also defended on the ground that the marginal cost of increasing railroad output in present circumstances is below average cost. The railroads today cannot do much to reduce their labour force. Although the Federal system has successfully reduced its labour force by about 12 per cent in the last few years, legislation limits the progress that can be made in this direction except at the cost of high discharge penalties. Since retirement pay would have to start earlier for many workers, only the excess of salary over pension plus penalty could be considered an unequivocal gain for the government. Therefore, it is argued,

the basis for calculating the marginal cost of the new traffic which the railroad attracts should reflect only its extra labour cost, *i.e.*, the net saving which the government might have derived from early retirement of the workers in the absence of the new traffic, together with the directly variable material inputs. Viewed in this way, the marginal cost of new traffic is far below average cost, and it is held that this should serve as the pricing standard.

This argument cannot be used by itself to support a declining incremental rate policy. The implication of low marginal costs is that low rates should be used to attract more traffic, but they should preferably not be available to existing traffic, *i.e.* to customers prepared to pay higher rates. In other words, a means of discrimination is needed to attract new traffic without incurring undue loss of revenue from existing traffic. It might be argued that the length of haul would serve as the basis for discrimination. Declining incremental rates would permit discrimination even within commodities in favour of the new traffic, which would, for the most part, consist of long-haul goods presently moving by coastal vessel or highway. The rate structure would be determined in such a way that, even while the incremental rate might fall below marginal cost as defined in the preceding paragraphs (variable material and capital input and avoidable labour costs), the average rate for the whole journey would exceed marginal cost, thus reducing the absolute and relative size of the railroad deficit.

This argument certainly constitutes a rational approach to rate-making; and the railroad's justification for the rate schedules does stress the need to utilise excess capacity to reduce average unit costs, an argument which follows implicitly the one just presented here. The question whether the new railroad rates are consistent with this line of attack then reduces to determining marginal cost, as it has been defined here, and comparing it with the average rates at various distances. The railroad's accounts are extremely deficient for analytical purposes, failing, as they do, to show depreciation on equipment. There is available, however, a historical series on actual shipping costs published by CONSULTEC, a Brazilian consulting firm, in 1962. In this study, *O Transporte Rodoviario no Brasil*, estimates are made of all costs, not just the costs to shippers or even the monetary costs of the transport agencies. The study takes account of exchange subsidies, depreciation and interest, as well as direct operating costs. After adapting these estimates for our purposes[12] we obtain a total of 62.2 billion (1960) cruzeiros as the real cost of operation of the RFFSA and São Paulo state systems in 1959; this gives an average total cost of Cr$ 2.94 (1960) per ton-kilometre. The labour expenditures comprise 52.6 per cent of this amount. Let us suppose that the net marginal labour cost as we have defined it above, *i.e.* the excess of cost to the railroads over the potential lay-off penalties and pensions, amounts

[12]Minor modifications are needed to (a) eliminate the traffic and costs of the Vitória-Minas, which is not part of the federal or São Paulo state systems; (b) eliminate the traffic of the VFRGS, which was not part of the RFFSA at the time (its capital costs were not included); (c) adjust the capital cost basis to eliminate the sunk cost of permanent way; and (d) adjust the imputed intercity passenger-km. cost from a basis of equality with one freight ton-km. to a level 12 per cent higher (as suggested by Othon de Araújo Lima in "Custos médios específicos de transporte ferroviario do passageiro e da carga," *Revista Brasileira de Transportes, Jul/Set 1966*), and a suburban passenger-km. cost from equality to 60 per cent lower.

to 50 per cent of the wage bill.[13] This reduces the average real cost per ton-kilometre to Cr$ 2.17 (1960), which is equal to NCr$ 0.048 at general price trends in February 1968. (We emphasise that the estimate of 50 per cent is used for illustrative purposes only and may be too high or too low.)

The cost just evolved must serve as the minimum standard for acceptance of traffic. As we can see from Table 1, some parts of a few schedules are acceptable on this criterion. The M-1 schedule, the highest general rate schedule, is acceptable up to 900 kilometres. On this criterion the three special rates are entirely unacceptable; the only portions of the rates exceeding NCr$ 0.048 per ton-kilometre are cement shipments less than 200 kilometres, and it is safe to say that little if any cement traffic moves so short a distance. A slightly lower price criterion might be appropriate for iron ore, if unit trains are the method of movement; but, even if we assume unit train economies to be 20 per cent below this all-cargo average, we are left with an average cost of Cr$ 0.0384 per kilometre, which is still higher than the average iron ore rate for trips of over 200 kilometres.

The São Paulo rate, judged by the all-cargo criterion deduced here, is barely acceptable below 200 kilometres, and unacceptable thereafter.

Finally, the same kind of analysis can be applied to passenger traffic. The average passenger-kilometre cost is NCr$ 0.054. But average rates under the new schedule were lower than even this minimum standard – right from the start. And that was before the across-the-board decrease in intercity passenger fares, which widened the differential to nearly 70 per cent.

Our analysis shows that neither of the two possible arguments which might support the new rate schedules is valid. Distance-incremental cost behaviour does not follow the declining incremental rate pattern of the schedules. And the railroads' marginal cost, which here reflects only equipment and materials costs and the conservatively estimated excess of wages over those labour expenses which would have to be met even in case of railroad shutdown (50 per cent of labour costs), is higher than the average railroad revenue which would accrue at most distances on most schedules. We now review the possible consequences following from this rate structure.

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[13]In making this rough estimate we are assuming that 20 per cent of the labour force have 30 years of service and so would be eligible for 80 per cent retirement benefits. These more senior employees are assumed to receive 30 per cent of the total railroad wages, suggesting an average 71 per cent higher than the average wage of the rest of the force. The retirement benefits for this group would amount to 24 per cent of the total wage bill, and we assume that it would have to be met entirely from new funds rather than through the conventional mechanism of past social security contributions and current contributions made on current wages. This may err on the high side, but it is probably more realistic than to assume that the now much larger pension could be met out of past accumulations unsupplemented by current payments. Inflation is partly to blame. We assume that the rest of the labour force would receive, on average, one year's pay as discharge penalty under existing law; this, amortised with interest over ten years, would add another 15 per cent of present wages to our estimate of what the government would have to continue to pay, bringing it to a total of 39 per cent of the present labour expenditure. We have assumed that 50 per cent would be required, leaving 50 per cent of the present wage bill as the marginal labour cost of maintaining the railroads in operation. This would allow for some additional welfare payments to those having re-employment difficulties. This seems a conservative approach to the valuation of marginal cost, as defined here, but we repeat our caution that it is conjectural and is designed for illustration only.

THE EFFECT ON INFLATION AND ALLOCATION OF RESOURCES

1. Inflation

The deficit which the railroad sector has long incurred presents a definite inflationary threat to the Brazilian economy. We reviewed this in an earlier paper and concluded that, owing to continuing labour expenses which the economy would have to bear in any event, this inflationary stimulus could not be successfully countered in the next few years.[14] As our analysis has shown, the new rates will almost certainly result in even higher deficits than those of past years, since the new traffic which they attract, which will be primarily long-haul shipments, will yield a lower revenue per ton-kilometre, while expenses do not fall in anything like the same proportion. Thus, while in the railroad sector little could be hoped for in the short run to reduce inflation under any rate regime, with the new rates the inflationary stimulus in the long run will be even worse than under the old.

2. Allocation of Resources

The old rates were already conducive to irrational allocation of resources, and the new rates are much worse. We will cite just a few examples of the misallocation which they promote.

i. *Intermodal Traffic Allocation: Passengers.* The new passenger rates, after the 20 per cent reduction, are about 5 per cent higher than the old rates. The old rates reflect a subsidy of 60 per cent below marginal cost as that concept has been applied in this paper. Since the railroad rate is set 30 per cent or more below bus fares, passenger rail demand is artificially stimulated. Most interurban traffic would go by bus if rail fares were raised. There would then be a reduction in national economic cost.

It is also to be expected that rail will now replace truck on some cargo shipments as well, at higher total national economic cost.

ii. *Intermodal Traffic Allocation: Iron Ore.* The new ore rate is 10 per cent lower than its predecessor, with inflection points much the same as they were. The new rate at 615 kilometres is NCr$ 10.35. At the same time the average total variable cost in September 1966 was calculated by the RFFSA to be NCr$ 9.2,[15] or NCr$ 12.3 at February 1968 prices. Measured against a marginal cost criterion for iron ore similar to that which has been developed in this paper for commodities in general, the new rate would most probably continue to be too low. (It is over 50 per cent lower than our estimated all-cargo marginal cost of NCr$ 0.045).

The old rate appeared to be based on the iron ore carrying costs of the Vitória-Minas railroad, the CVRD line outside the federal system. This permitted iron ore export through Rio to be competitive with that of the CVRD through Vitória. The new lower rate may have been designed to help Rio exporters to combat the cost

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[14]Abouchar, *op. cit.*

[15]RFFSA, *Custo e Frete do Transporte de Minerio de Ferro*, Rio, 1967. This is the sum of two cost components, called in the study "marginal cost" (p. 112) and "fixed cost" (p. 114). In reality the "fixed cost" consists of long-run variable costs.

reductions inhering in the new CVRD ore loading facility at Vitória. Thus, again, the result will be an inefficient traffic allocation.

iii. *Location of Industry: Cement.* Over 30 per cent of the nation's cement output is shipped on the Central, most of it from Minas Gerais to Rio, with an average haul of 570 kilometres. At the same time extensive limestone deposits abound in the state of Rio de Janeiro. Indeed, a large traffic does now move from there to the city of Rio, with an average haul of 290 kilometres, barely half that from Minas. It seems clear that the Minas traffic is stimulated entirely by the near-zero incremental cement rate between 500 and 1,000 kilometres, which keeps Minas cement competitive with that produced much nearer. The average ton-kilometre rate at 600 kilometres, incidentally, is NCr$ 0.027, which is 44 per cent below the all-cargo marginal cost calculated in Section II. In the absence of this preferential rate all Rio's needs would be supplied by the state of Rio over the much shorter haul via the Leopoldina.

More and more examples of irrational location of industrial production will arise under the new rate schedules with their new inflection points, since regional production cost advantages and scale economies will assume a disproportionate importance in the determination of local delivered cost.

CONCLUSION

In this paper we have reviewed the revised Brazilian railroad rates which took effect in late February 1968. The new schedules provide for a few higher rates than previously existed, but most rates have been reduced. The new incremental rate structure for the general schedules has added two inflection points, making a total of four incremental rates. This is designed to encourage new long-haul traffic. The special schedules for iron ore, lumber and cement continue to be even more demand-oriented than the general schedules, the incremental rate at certain critical distances being especially designed to encourage flows over certain major routes. Finally, passenger traffic continues to be heavily subsidised, especially after the 20 per cent reduction in June.

In reviewing the cost structure of the railroads we concluded that the new rates could not be justified by either of two possible cost arguments. Distance-incremental costs do not behave as the rates do; and a marginal cost concept which abstracts continuing expenditures on labour which would have to be made in any event yields costs which are still higher than the average rates for all the special commodities, for passengers, and at most distances for general commodities.

The new rate structure will be more inflationary than the former rates, which led to a large annual deficit. The more important consequence, however, will probably be a worsening in allocative efficiency as new demand for rail service arises; the old rates were already very faulty in this regard, and the new structure exacerbates the problems.

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