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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 creation by the monetary authority. The heavily subsidized rates bias the relative prices which confront users and distort resource use, while the usual means of dealing with the losses, issue of new money, stimulates inflation. Argentina, Brazil, and Chile have been thus afflicted in recent years with deficits running to 35-70 percent of operating costs.**

Reform in Brazil has long been exhorted by various Brazilian interests, foreign advisory missions, and the World Bank. In March 1968 the rate structure was extensively revised but no real improvement was secured. Freight classification was simplified and some minor increases were secured for certain

** Alan Abouchar, "Inflation and Transportation Policy in Brazil," Economic Development and Cultural Change, forthcoming.

commodities at some distances and in intercity passenger services.* The emerging pattern on the whole, however, represents a step back from the very defective previously existing structure, especially as regards 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 percent 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, although some improvement was reflected in their 20-percent higher level.

We begin the present paper with a summary of the rate structures. In Section II we consider the possible cost justifications for the new schedules and in Section III we review some of the implications for rational resource allocation.

I. The New Rate Structure

The new RFFSA rate structure** has eight basic commodity schedules for carload shipments. Three of these are special schedules for iron ore, lumber, and cement. Four of the other five replace schedules which formerly applied to 15 commodity categories and the fifth relates to commodities not previously

* Since the rate revision took effect late February, a 20-percent discount was instituted on passenger fares, more than offsetting the increase on the short-distances rates and vitiating most of the increase of the passenger schedule as a whole.

**The new rates went into effect in February 1968. They are listed in RFFSA, Tarifa Geral (3) da RFFSA (to be referred to as TG3). The new classification is contained in Contadoria Geral de Transportes, Pauta de Classificação e Condições Gerais de Transportes, 2a. parte-Capítulo VII, Nov. 1967. A summary of the rate principles is contained in RFFSA, Carta-Circular no. 99/SGT/68.

classified.*

Two important kinds of change have been introduced into the rate schedules. First, the short-haul rates have been adjusted, some upwards and some down. Next, the rate-distance relationships have been altered. The major change here was the introduction of two additional inflection points in the incremental rates of the general schedules, making a total of four incremental rates in each. The special schedules continue to be characterized by a varying number of inflection points, although fewer than previously. Table 1 shows the new schedules and compares them with their predecessors. All rates include loading and unloading. No additional charges are imposed for line or gauge changes.

The maximum very-short-haul cargo increase over the previous rate was 7 percent (at 100 kilometers) in the M-1 schedule, the highest general commodity schedule which applies to freight such as automobiles and parts, copper sheets, and explosives. However, as the column headed ARn/AR1 in Table 1 shows, the ratio between the new and old rates quickly falls, the increase averaging only 0.6 percent on distances up to 1,000 kilometers, beyond which the new rate is lower than the old. Schedule M-4, the lowest general commodity rate, which applies to coke, fertilizer, bananas, dolomite, etc. was unchanged at 100 kilometers. However the now higher incremental rate in this schedule does yield an average rate increase -- 4.3 percent -- on shipments less than 1,000 kilometers. Beyond 1,300 kilometers, however, the new rate for this group is also less than the old.

The short-haul schedules of the special rates all were reduced -- 10 percent for iron ore, 15 percent for lumber, and 18 percent for cement. Indeed,

* 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.

the only rate increases for these commodities at any distance were for lumber movement of greater than 900 kilometers. But at distances such as this last they are largely "paper rates" since little or none of the good is shipped so far and little importance can be attached to them.

The new incremental rates for the general schedules (the M-schedules) are generally lower than those of TG2. The incremental M-1 rate falls from 96 percent to 60 percent of the corresponding old rate. The incremental M-4 rate starts 8 percent higher than its former counterpart at 100 kilometers, reaches 116 percent of the former rate at distances of 500-800 kilometers, and then falls steadily, reaching 54 percent of the former incremental rate at 1,600 kilometers. In general, the pattern of the new incremental M-rates, shown in column headed IRn/IRn 100 is to fall by 100 percent at 400 kilometers, a further 22 percent at 800 kilometers, and again by 29 percent at 1,600 kilometers when they reach a level 50 percent lower than the short-haul incremental rate and 71 percent below the short-haul average rate. In the earlier TG2 schedules, by contrast, there was only a single change in the incremental rate schedules, which occurred at 500 kilometers. At this point the incremental rate fell by from 15 to 20 percent and remained fixed at the new level thenceforth.

The new incremental rates for the special E-schedules follow varying patterns in relation to the basic 100-kilometers incremental rate, as did the TG2 special schedules. (Note that the new TG3 schedules, denoted E-1, E-2, and E-3 correspond respectively to what were designated E-1, E-3 and E-4 in TG2). The iron ore incremental rate is at first constant and then rises after 500 kilometers. The incremental lumber rate holds steady up to 900 kilometers and then begins a steady decline. While this is a decided improvement over the

Table 1
New and Old Brazilian Railroad Rates
(NCrs. at Feb. 1963 prices)

Rate Schedules	100	200	300	400	500	600	700	800	900	1000	1300	1600	2000
I. General Schedules RFFSA													
1. Highest (H-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 kil.	.088	.067	.060	.056	.053	.051	.050	.049	.047	.045	.042	.040	.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	6.5	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 kil.	.066	.050	.045	.042	.040	.038	.037	.036	.035	.034	.032	.030	.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 kil.	.045	.028	.022	.019	.018	.017	.017	.017	.017	.017	.017	.017	.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 kil.	.047	.037	.034	.032	.031	.030	.030	.030	.029	.029	.028	.026	.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 kil.	.054	.040	.035	.033	.032	.027	.024	.022	.020	.018	.017	.015	.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 Sao 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 kil.	.049	.047	.044	.042	.039	.037	.034	.032	.024	.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 this distance as percent of new incremental rate at 100 kil. [illegible]

former patterns, which saw the incremental rate decline by over 98 percent at 800 kilometers, the lumber rate structure as a whole is worse than its predecessor, most lumber is shipped less than 900 kilometers --- from the stands in Rio Grande do Sul and Paraná to ports for export (Porto Alegre, Paranaguá, and São Francisco do Sul) and to São Paulo, and at such distances the new rate is from one to 15 percent below the old one. Finally the new cement incremental rate pattern is lower than the former rate at all but a few distances. And a total rate relationship, Tn/Tf, shows the new cement rate to be at least 18 percent lower throughout.

Table 1 also shows the rate structure for the São Paulo railroads as of 1967. The rate depicted relates to raw cotton, coffee beans, fats and oils, hides and skins, metal bars and sheets, and other commodities. Its relative structure is the same as that for many other products including manioc flour, wheat flour, beans, rice, and sugar, although at a level 23 percent higher. This São Paulo rate structure, which has existed since 1964, shows even sharper rate declines than the RFFSA with the incremental rate at 900 kilometers being 89 percent below that at 100 kilometers. (The pre-1964 schedule also showed sharp but somewhat different incremental rate declines.)

Very short-distance passenger rates on the RFFSA, not shown here, rose 16 percent. The average rise over the first 1,000 kilometers was 31 percent. As already noted, however, a subsequent 20-percent reduction in early June largely canceled this increase, leaving a net advance of less than five percent. The best gain was secured 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 around four percent of RFFSA transport revenues in 1965 and 1966.*

* RFFSA, Anuário Estatístico, 1967, pp. 96,99.

II. Costs and Ratemaking

Many indications point to the neglect of costs in Brazilian railroad ratemaking. First of all, the RFFSA has lost money ever since its formation in 1958, continuing the trend that characterized the operations of its predecessor entities throughout the postwar period. The subsidy varied between 50 and 70 percent of operating expenses, as defined by the railroads, between 1963 and 1966.* In the second place, these expenses understate the true annual variable operating cost since they do not provide for adequate depreciation of rolling stock and locomotives.** Thirdly, 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, signaling and capital consumption should be built into the railroad cost. But no attempt is made to do so.

The new rate structure is intended to improve the traditional deficitary financial performance of the railroads by raising revenues. But it is not likely that this result will follow. One way to project the probable performance under TG3 and compare it with that under the old rates is to calculate the revenue that would derive by applying the new and old schedules to the actual traffic composition for 1966. The calculations are contained in Table 2 which shows that the new TG3 schedules would have increased revenue by three

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* RFFSA, Relatório 1966, p. 19.

** 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 percent of the operating expenditure reported by the RFFSA for that year. The study goes on to urge that attention be given to better cost accounting in general and in regard to 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 TG2 and TG3 with Actual 1966 Traffic

(NCr$ at 1966 prices)

Commodity	Volume Originated (10^3)	Average Length of Haul (kilometers)	Rate Applicable at this Distance		Potential Revenue from Traffic under (10^6)	
			TG2	TG3	TG2	TG3
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
Animal (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
Passenger 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.

* Suburban passenger revenue is actual revenue taken directly from RFFSA Anuário Estatístico 1967.
Since no suburban rates are stated in TG3 we assume them to be unchanged from TG2.

percent. However, this procedure overstates revenue accruing under either tariff regime, since it assumes that all tonnage of any commodity class traveled the average haul for that class, the rate for which is higher than would be the weighted average of the rates applicable at the various distances; the overstatement under TG3 is greater since the TG3 rate declines more than TG2. How much is conjectural -- perhaps ten percent or more -- implying an overstatement of NCr$ 25 million or more in estimated TG3 cargo revenue. Moreover, the TG3 estimate uses the passenger rate before the 20-percent reduction which was effected subsequently. Using the modified rate and adjusting for the cargo revenue bias would result in a total revenue of NCr$ 345 million -- seven percent lower than that estimated under TG2.*

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* In this analysis we have compared the revenue that would have accrued under TG3 with that which would have accrued under TG2 and not with the actual 1966 revenue which, at NCr$ 220 million, was 41 percent lower than the hypothetical TG2 revenue. The sources of the discrepancy between actual and hypothetical TG2 revenues are uncertain. A part is due to the following factors:

1. Underweighting of the round-trip second class fare and neglect of half-fare and 75-percent 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. Actually, adjustments are made periodically and there is bound to be some inconsistency between rate adjustments and price indexes. In this case the hypothetical TG2 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 good. 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 percent in the general commodity revenue.
4. Finally, as noted in the text, our use of the rates applicable at the distance equal to the average haul for each traffic category. This would cause an especially severe bias in the revenue projections for cement and lumber whose rates continue to decline sharply at distances far beyond the average haul of these commodities. While the factors just adduced lead to an overestimate of the TG2 revenue relatively to the actual 1966 revenue, and also, to an overstatement of the TG3

In the comparison just made we considered the new rates and the old traffic mix. But the new rates are structured very differently from the old rates and will themselves affect transport demand. In particular, the new inflection points in the incremental rates will raise the demand for long hauls, whose incremental and average rates decline over a long range of distances. This will create new traffic and divert some former traffic from highways and coastal shipping. Since, as we will argue in a moment, costs do not decline in like proportion, the total expenditure will rise absolutely and relatively more than revenue.

If the new rates will lead to a higher deficit, why were they put forward in the first place? Evidently, many people must believe that they will improve the financial state of the railroads by reducing the deficit or, at the least, improve railroad output while not increasing the deficit. Supporters of this view can present two different arguments. Let us see whether they are valid.

1. The Cost-Length Function

The first defense of the declining rate is that unit costs decline steadily with increasing length of haul. And certainly the fixed costs in train operation, such as train formation, loading and unloading, and paperwork associated with the shipment, are all sources of declining average unit costs for a given cargo shipment. However, this would justify a declining average rate and not a declining incremental rate. Other costs, which comprise the bulk of railroad operating costs, including rolling stock, fuel, crew costs, rail and tie wear, and line maintenance beyond a certain definable minimum, are

(con't)

revenue, there is no reason to believe that they lead to a systematic bias in the relationship between the TG2 and TG3 estimates other than that noted in the text, whose effect is to overstate the TG3 revenue. Thus, there seems no reason not to accept the implications for railroad revenues suggested by this analysis, i.e., that they will decline by 5-8 percent under TG3.

related primarily -- almost uniquely to annual output measured in gross train-kilometers. To be sure, these costs for a unit train moving a given distance will be slightly lower than those for two trains each moving half as far, since in the former situation less braking is required with consequent savings in rail and equipment wear, and there is some fuel economy associated with express movement. But this is the only effect. However, 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 declines, with the incremental ton-kilometer rate falling, at various distances, by 10 percent, 30 percent, and 50 percent below the 100-kilometer incremental rate. Since the fixed costs in train operation are incurred only once they obviously cannot be used to justify the declining incremental rate exemplified by the M-schedules in Table 1, that of the São Paulo state railroads, or the special RFFSA schedules.

2. Marginal Cost Orientation

According to this view, the marginal cost of increasing railroad output in present circumstances is below average cost. The railroads today cannot do much to reduce their labor force which for a period of many years of lax organization was permitted to grow to its present size. Thus, although the Federal system has been successful in reducing its labor force by about 12 percent in the last few years, existing legislation limits the progress that can be made in this direction except at the cost of high discharge penalties which the net would suffer. And 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 cost of the new traffic which the railroad attracts should reflect only its extra labor 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.

But one further step must be taken before this argument can be used to support the declining incremental rate policy, since by itself the fact of marginal cost being lower than average cost would justify lower prices for any new-found traffic that the railroad was trying to win. new traffic in limestone, for example, would pay less than present limestone shipments. Clearly, however, it would be impossible to set one price for shippers already using the railroad and a lower rate for new shippers of the same commodity. The present user would simply stop shipping and then start afresh as a new shipper entitled to the new rate. Rather, a different method of discrimination must be found to attract new business.

To take the final step, then, adherents of this view would recommend that the length of haul serve as the tool for discrimination. A decline in incremental rates would permit discrimination even within commodities in favor 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, the average rate for the whole journey would exceed marginal cost, thus reducing the absolute and relative size of the railroad deficit.

The preceding argument certainly constitutes a rational approach to ratemaking and the railroad's justification for the rate schedules does run

in terms of the need to utilize 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 that concept is here defined, and comparing it with the average rates at various distances. As noted earlier, however, the railroad's accounts are extremely deficient for analytical purposes, failing, as they do, to reflect 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 to take full account of all costs rather than merely the costs to shippers or even the monetary costs of the transport agencies. To this end they take account of exchange subsidies, depreciation, and interest, as well as direct operating costs. To adapt these estimates for use here requires minor modifications to: eliminate the traffic and costs of the Vitório-Minas which is not part of the federal or São Paulo state systems; eliminate the traffic of the VFRGS, which was not part of the RFFSA at the time (its capital costs were not included); adjust the capital cost basis to eliminate the sunk cost of permanent way which was included in the study; and adjust the imputed intercity passenger-kilometer from equality to a level 60 percent lower. Proceeding in this manner gives a total of 62.2 billion (1960) cruzeiros as the real cost of operation of the RFFSA and São Paulo state systems in 1959.

Dividing the total just derived by traffic results in an average total cost of Cr$ 2.94 (1960) per ton-kilometer. The labor expenditures comprise

* Othon de Araújo Lima, "Custos médios específicos de transporte ferroviário do passageiro e da carga", Revista Brasileira de Transportes, Jul/Set 1966. Araújo Lima bases his estimate on the experiences of the Paraná - Santa Catarina. Although his passenger estimate is an average of intercity and suburban passenger costs, we may take it to represent intercity costs exclusively since suburban traffic on this railroad comprises only 1 percent of passenger traffic.

52.6 percent of this amount. Let us suppose that the net marginal labor cost as we have defined it above, i.e., the excess of cost to the railroads over the potential layoff penalties and pensions, amounts to 50 percent of the wage bill.*

Subtracting the "sunk" labor cost then gives Cr$ 2.17 (1960). This is equal to NCr$ .048 per ton-kilometer for commodities in general at February 1968 prices. We emphasize that the estimate of 50 percent used here is for illustrative purposes only and in fact it may be higher or lower.

The cost just evolved must serve as the minimum standard for acceptance of traffic. As we can see from the An column of 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 kilometers. On this criterion the three special rates are entirely unacceptable; the only portions of the rates exceeding NCr$ .048 per ton-kilometer are cement shipments less than 200

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* In making this rough estimate we are assuming that 20 percent of the labor force has 30 years of service and so would be eligible for 80-percent retirement benefits. These more senior employees are assumed to receive 30 percent of the total railroad wages, suggesting an average wage for this older group 71 percent higher than the average wage of the rest of the force. The retirement benefits for this group would amount to 24 percent of the total wage bill in this case, and we are assuming here that it would have to be met entirely from new funds rather than through the conventional mechanism of past social security contributions together with current contributions which are made on current wages as long as the railroads continue to operate (approximately 16 percent of total wages). This may err on the high side but it is probably more realistic to proceed this way 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 in this regard. Assuming the rest of the labor force would receive on average, one year's pay as discharge penalty under existing law and amortizing it, with interest, over ten years, would add another 15 percent of the present wage to our estimate of what the government would have to continue to pay, bringing it to a total of 39 percent of the present labor expenditure. In our example we are assuming that 50 percent would be required, leaving 50 percent of the present wage bill as the marginal labor cost which is implied by maintaining the railroads in operation. This would allow for additional welfare payments to ease the problem of those having reemployment difficulties beyond the payments which the government would be legally obligated to make. This seems a conservative approach to the valuation of marginal cost but we repeat our caution that it is conjectural and is designed for illustration only.

kilometers, distances over which it is safe to say that little if any traffic in this commodity moves. However, a slightly lower price criterion might be appropriate for iron ore, if unit trains are the method of movement, but even assuming unit train economies to be 20 percent below this all-cargo average, would leave an average cost of Cr$ .0384 per kilometer, which is still higher than the average iron ore rate for trips upwards of 200 kilometers.

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

Finally, the same kind of analysis can be applied to passenger traffic. The average passenger-kilometer cost is NCr$ .054. But average rates under the new schedule were lower than even this minimum standard -- right from the start. And this was before the across-the-board intercity passenger rate decrease which then widened the differential to nearly 70 percent.

Our analysis shows that neither of the two arguments which might be presented to support the new rate schedules is valid. Incremental cost behavior simply 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 labor expenses which would have to be met even in case of railroad shutdown (50 percent of labor costs), is higher than the average railroad revenue which would accrue at most distances of most schedules. We now review the possible consequences following from this rate structure.

III. The Effect on Inflation and Resource Allocation

1. Inflation

The deficit which the railroad sector has long incurred presents a definite inflationary thrust to the Brazilian economy. This was reviewed in an earlier

paper where we concluded that, owing to continuing labor expenses which the economy would have to bear in any event, this stimulus could not be successfully countered in the next few years.* As our present analysis showed in Section II, the new rates will almost certainly result in still higher deficits than those of past years since the new traffic which they attract, which will be primarily long-haul shipments, yields a lower revenue per ton-kilometer, 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 will be still worse than under TG2.

2. Resource Allocation

The old rates were already conducive to irrational resource allocation 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, following the subsequent 20 percent reduction, are about 5 percent higher than the old rates. The old rates reflect a subsidy of 60 percent below marginal cost as that concept has been applied in this paper. Since the railroad rate is set about 30 percent 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 as higher total national economic cost.

ii. Intramodal Traffic Allocation: Iron Ore. The new iron ore rate is ten percent lower than its predecessor with inflection points much the same as they were. The new rate at 615 kilometers is NCr$ 10.35. At the same time the

* Abouchar, op.cit.

average total variable cost in Sept. 1966 was calculated by the RFFSA to be NCr$ 9.2*, or NCr$ 12.3 in Feb. 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 percent lower than our estimated all-cargo marginal cost of NCr$ .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 offset the cost reductions inhering in the new CVRD ore loading facility at Vitória. Thus, again an inefficient traffic allocation will be the result.

iii. Location of Industry: Cement. Over 30 percent 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 kilometers. At the same time extensive limestone deposits abound in the state of Rio de Janeiro. Indeed, a large traffic does now move from here to the city of Rio with an average haul of 290 kilometers, barely half that from Minas. It seems clear that the Minas traffic is stimulated entirely by the near-zero incremental cement rate between 500 kilometers and 1.000 kilometers which keeps Minas cement competitive with that produced much closer by. The average ton-kilometer rate at 600 kilometers, incidentally, is NCr$ .027 which is 44 percent 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.

* 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 actuality the "fixed cost" consists of long-run variable costs.

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

IV. Conclusion

In this paper we have reviewed the revised Brazilian railroad rates which took effect in late February of this year. 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, with the incremental rate at certain critical distances being especially designed to encourage flows over certain major routes. Finally, passenger traffic continues to be heavily subsidized, especially so after the 20-percent 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 cost arguments which might be applied. Distance-incremental costs do not behave as the rates do; and a marginal cost concept which abstracts from those continuing expenditures on labor which would have to be made in any event yields costs which are still higher than all of the special commodity average rates, the passenger average rate, and the general commodity average rates at most distances.

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.