

THEORETICAL ASPECTS OF THE HORIZONTAL RESTRUCTURING OF TELEBRAS PRIOR TO PRIVATIZATION IN BRAZIL*

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Abstract: *The previous restructuring of the Brazilian state-owned holding in telecommunications, TELEBRAS, was part of a strategy designed to foster competition and efficiency after privatization. One of the main questions was how many companies should TELEBRAS be split into? This paper addresses critically the main elements considered by Brazilian regulators and discusses theoretical arguments related to scale, scope and transaction cost economies, potential competition, yardstick competition and excessive dispersion of efforts. Weighing all arguments, we conclude that TELEBRAS should be further separated in to horizontal grounds by undertaking an alternative restructuring process.*

Keywords: *telecommunications, privatization, competition.*

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Introduction

An important issue in the reform of telecommunications in Brazil was that of TELEBRAS restructuring before privatization. The bulk of the Brazilian telecommunications system before privatization was a major federal state-owned holding, TELEBRAS, owning 54 subsidiaries, being at least one in each Brazilian state (with the exception of Rio Grande do Sul), and a long distance national and international carrier, EMBRATEL. According to the General Guidelines on Brazilian Telecommunications Reform (1997 – to present date), TELEBRAS comprised about 90% of all telecommunication services supply in Brazil.

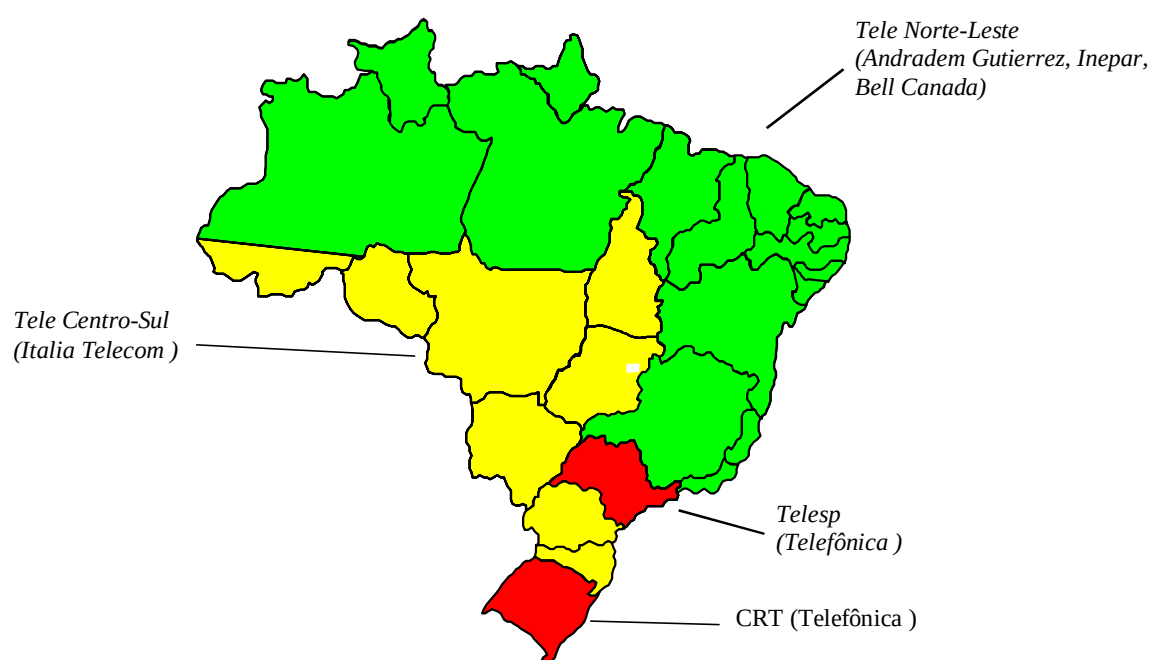
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The main characteristic of this restructuring was the geographical and service division of the holding. The twenty-seven (27) concessions of TELEBRAS were aggregated in three regional wire companies, one long-distance company (intercity and international calls) and eight mobile companies. Thus, TELEBRAS was consolidated in twelve companies and, only then, privatized. It is important to remark that the 27 concessions operated the city local networks of their respective states and part of the intra-state long distance network. EMBRATEL was the only company in Brazil responsible for the inter-state and international telecommunications services.

In the restructuring process, the three regional companies remained with the old local and intra-state long distance networks. Therefore, there was not an absolute separation of the local and long distance networks in TELEBRAS restructuring, since the regional companies remained owning intra-state long distance networks. So, immediately after the privatization, the three regional companies were already able to provide most of the intra-state long distance service without any need to interconnect with the long distance carrier, EMBRATEL. The map below taken from *Dores (1999)* summarizes the division of the new TELEBRAS wire telephone system in three separate regional companies in each of the three colored areas, with the exception of the extreme south². The map gives the names of the main new private owners in the Brazilian Model of Telecommunications Reform (BMTR from now on).

Map 1 - Geographical Division of the Country in the Fixed Telephony



² The independent company, CRT from the state of Rio Grande do Sul, was owned by the government of this state and privatized separately from TELEBRAS.

The BMTR followed what we call a “mild horizontal separation strategy” for the wire TELEBRAS restructuring. The holding was neither kept unified for privatization, nor split into the previous 27 concessions attached to TELEBRAS.

The main competitive aspect of the restructuring of TELEBRAS rests on the vertical break-up of the long distance (EMBRATEL) and the local service (the three regional and the eight mobile) companies. However, in this article, we will restrict ourselves to the assessment of horizontal restructuring³. The main problem for the sake of defining the best horizontal separation strategy rests on the fact that the previous (state-owned) structure was defined “*largely by political or administrative, not market, forces*”, as stressed by Beesley and Littlechild (1997, p.30). Moreover, these authors mention that the absence of competition complicates even further the search for the optimal horizontal structure of the industry post-privatization. In the next section, we explore critically the main alleged motivations behind TELEBRAS horizontal restructuring provided in the GGBT (1997).

Section III explores the idea behind scale, scope and transaction cost economies that can be obtained through a greater degree of horizontal integration. In telecommunications, the international empirical evidence does not present an unambiguous consensus about the usual argument of scale and scope economies. On the other hand, a less quoted argument based on transaction costs related to interconnection agreements seems a stronger motivation. It is connected to the question of standardization that can be interpreted as a kind of asset specificity and we show through a model adapted from Tirole’s textbook (1988) how it can influence the strategy of long distance investment of the companies and its impact on efficiency.

A relevant issue not quoted in the GGBT is the potential competition argument, used extensively in the case of the Bell-Atlantic/Nynex merger discussed in Brenner (1999) that we can translate to the issue of horizontal separation of TELEBRAS. We do this at section IV. Section V discusses the argument of excessive dispersion of efforts. Section VI concludes.

1. The Main Motivations Behind Horizontal TELEBRAS Restructuring

After a first glance at map 1, the main striking feature is the enormous size of the green and yellow areas. Even the red one (TELESP) represents a relatively large economic unity, given the economic density of the state of São Paulo compared to the rest of the country. Therefore, even after the division, the regional companies remained very big compared to the other privatized telecom companies around the world.

In the US, the horizontal restructuring of the regional companies of AT&T resulted in seven companies. This issue was not very important for the Court decision, although Noll and Owen (1995, p. 350/351) state that the authorities did not disregard this issue completely. The main question for the US Supreme Court seems to have been the promotion of yardstick competition. On the other hand, AT&T decided for itself the number of RBOCS that would be sold and the Court, presumably, would only challenge this decision if the company decided for no horizontal separation at all. It is possible that even AT&T was not interested in divesting a single company owning all local networks, since it could reduce its bargaining power on the forthcoming negotiations on interconnection.

³ The assessment of the vertical break-up impacts of TELEBRAS is made in Mattos (2001).

Anyway, consistently with the charges against AT&T in the antitrust suit, there was little point to enforce an aggressive horizontal separation if the antitrust problem was derived from the vertical relationships backwards (manufacturing) and forwards (long distance).

The full reasoning behind the shape of TELEBRAS after its restructuring is stated in the GGBT (1997). The actual choice of the horizontal division of the wire part of TELEBRAS, splitting the holding into three regional companies and one long distance company (EMBRATEL), the former three responsible to provide the local service in each of the colored areas of map 1 and the intra-area long distance service and the latter one responsible to provide long distance service in all over the country was a balance of several factors. Based on the statements from GGBT, these factors were: i) a great enough size to guarantee competitiveness with other Latin-American telecommunication companies; ii) a large enough size to improve the ability of the companies to finance investments through their own resources; iii) scale to attract “strategic investors” (international partners with good know how and financial capabilities to invest in the Brazilian telecommunication sector); iv) avoidance of excessive dispersion of the investment efforts; v) reduction of the market power of the companies; vi) reduction of the information asymmetry between the regulator and the regulated firm (yardstick competition); vii) the geographical continuity and homogeneity of the regional company; viii) the incentive for a faster attendance of the universal service targeting; ix) avoidance of the “old” system of cross-subsidies; x) avoidance of collusive behavior.

While the first three arguments call for more aggregation (in the limit a single national company), the others call for a further division of the company. It is important to make some comments on the main motivations.

Competitiveness

The argument of competitiveness, as popularly used, commonly calls for a bigger size. If the analysis is elaborated, the links between competitiveness and firm size are related to scale, scope and/or transaction cost economies.

In the case of scale and scope economies, the argument calls for bigger unit size if average costs (by single and multiproduct measures⁴) are always decreasing. Scale and scope economies are the basis of all discussion about market structure in the telecommunication sector. The existence of scale economies would unambiguously call for less horizontal separation of TELEBRAS. Given the lack of empirical data for Brazil, we address the international empirical data about scale economies in telecom in section III.

There are two kinds of scope economies in the fixed telecommunication sector. First, those derived from the provision of several services within the same network, beyond the traditional telephone services. They are generally called value-added services and do not have any implication for our analysis of horizontal divestiture.

Secondly, and most importantly, the scope economies available to the firm that owns local and long distance services, simultaneously. This second type of scope economies is closely connected to transaction costs. The analysis of transaction costs is less usual in telecommunication

⁴ For a more complete description of the different measures of scale and scope economies under single and multiproduct production, see Panzar (1989, section 2) and Carlton and Perloff (1994, Chapter 3, including appendix 3B).

than in scale economies. There are two potential sources of transaction costs that are particularly important in telecommunications: i) negotiation and provision of interconnection and ii) compatibility and standardization.

Empirical evidence shows that interconnection agreements really present substantive transaction costs ex-ante (in the negotiations) and ex-post (in its implementation), mainly when there is an incentive to raise rival costs. In this regard, single ownership between networks that have to interconnect will really save in transaction costs and thus this effect recommends less horizontal separation. Of course, this problem can also be addressed through the regulatory intervention and not only through company restructuring. However, if interconnection regulation is not a perfect substitute for single ownership, some transaction costs will appear anyway with separation.

Standardization, in particular, seems to be a sensitive problem that requires continuous regulatory oversight. Indeed, compatibility problems were pervasive in the Brazilian experience in telecommunication before the National Code of Telecommunications in 1962 (Law 4.117/62), with a very fragmented and uncoordinated system. The National Code of Telecommunications created the National Council of Telecommunications –CONTEL- had several tasks, including the correction of coordination failures through the settlement of minimum compatibility requirements of the equipment across the Brazilian networks. According to Almeida and Crossetti (1997), this strategy improved compatibility in Brazil, enhancing the quality and decreasing the average costs of the service.

The question in the BMTR is whether avoiding further horizontal separation of the regional companies could prevent the emergence of these problems of standardization, mainly in the long distance services, dampening competitiveness? We discuss standardization in section III too, proposing a simple theoretical framework. Nowadays, standardization remains a relevant problem in telecommunications, but not so acute as four decades ago. On the other hand, given the externality problem relative to the investment in standards and the particular way in which the BMTR designed the TELEBRAS restructuring, this factor would recommend, *ceteris paribus*, less horizontal separation of the regional companies.

Standardization raises the same question of interconnection transaction costs and is, in some degree, part of it: Is regulatory oversight a perfect substitute for single ownership for coordinating the best standard choices? If not, standardization becomes a relevant issue in TELEBRAS restructuring. Actually, standardization can be considered as part of the general interconnection problem.

In sum, the two main effects behind “competitiveness”, e.g. scale/scope economies and transaction costs (interconnection agreements and standardization) call for less horizontal separation. The question is what the relevance of them in telecommunications in general (and in the BMTR in particular) is, which we address in section III.

Self-Funding

In a country with substantive capital market imperfections like Brazil, self-funding is an important issue. However, it is a reasonable approximation to assume that welfare will increase with more investment, at least in the short run, in the Brazilian telecommunications sector. However, the proposed connection between large sizes and a high ability of the companies to finance investments through their own companies' resources is far from clear. We provide the following

non-exhaustive list of features that make this presumed relationship flawed: 1) The set of firms belonging to TELEBRAS will have the maximum total volume of their own funds to finance investment when the sum of their profits is maximum as well and nothing guarantees that it will be achieved through the sale of TELEBRAS without any fragmentation; 2) Even having more self-funding available to finance investment, it does not mean that the company will invest more. 3) Even assuming that a greater size means more market power that increases profits, it can also be correlated with managerial slack in investment effort⁵; 4) What guarantees that the most liquid potential bidders will be relatively more attracted to the auctions only when big firms are sold?

Nonetheless, this argument cannot be completely thrown away. On the contrary, this sounds as a very important argument if we make a simple change in it, but quite far from the official statements. The real target of the Brazilian government when bundled profitable areas as Rio de Janeiro, Minas Gerais and Espírito Santo with Amazonas and Acre (and Paraná, Santa Catarina and Brasília/Goiânia with Mato Grosso and Tocantins) for sale was to make universal service in the less attractive areas financially feasible. At the same time, the government could avoid the lack of attractiveness of these areas in the privatization auctions. This strategy clearly assumes implicit internal cross-subsidization of the companies since the same telephone company would raise profits in the most profitable regions to finance universal service in the less profitable regions.

Scale to Attract Strategic Investors

The strategic investors were really attracted to the Brazilian privatization. Attraction of strategic investors can be considered as an important objective on its own, given that: i) the previous state monopoly situation that undermined the emergence of a private business culture in the sector; and ii) the need to attain the benchmark technologies of the sector, which was also pointed as critical by Newbery (2000,p.61) in the case of the transitional economies of Central and Eastern Europe.

Avoidance of Excessive Dispersion of Investment Efforts

This problem can happen when a company undertakes several investment projects, or more generally, several “effort spending activities” simultaneously. In this case, the optimal effort spent on each activity tends to decrease with the introduction of further activities as shown by Laffont and Tirole (1993, p.81/82 and 181/187 and 2000 p.50). Everything happens as if the company regards all its activities such as investment and quality and productivity improvements as substitutes.

If we endogenize the choice of these multiple activities, all of their equilibrium values will be lower compared to the case of different companies running these activities. In this last case, the activity level will be higher, which is clearly an argument in favor of further horizontal separation. Given that the Brazilian authorities placed a large weight on the universal service target, which calls for an increase in the investment activity of the telecommunication sector, the argument calls for lower-sized companies.

⁵ Armstrong, Cowan and Vickers (1994, p.115) quotes the model of Holmstrom where “*insofar more competition improves the quality of inferences about performance made by participants in the managerial labor market, it will diminish managerial slack*”.

Yardstick Competition

The "reduction of market power" in the traditional sense is not a good argument to justify smaller sizes, at least when we look at the local service. As Vickers and Yarrow (1988, p. 237) point out for the UK experience:

if a dominant firm is divided into component parts, there may be scope for competition between those parts. In BT's case, however, the scope for competition between the parts is limited. For example, local network A would not compete with local network B head-on in the product market because each would enjoy a natural monopoly in its locality at the present state of the technology.

Analogously, the horizontal separation of TELEBRAS would not imply more direct "head to head" competition of networks, since local services are not substitutes among each other.

However, there are also other spaces for competition beyond the direct provision of the service, mainly the one related to smoothing information asymmetry of the regulator, usually called "yardstick competition". Vickers and Yarrow addressed this issue:

..., the ability to compare the performance of A and B would enhance the incentives of their managers and promote internal efficiency

... the effectiveness of regulation would be enhanced because restructuring the dominant firm breaks the monopoly of information. In the example of local networks A and B, some kind of yardstick competition could be used advantageously provided that the networks faced uncertainties that were correlated to some extent.

According to Noll and Owen (1995, p. 350/351), though there is not a strong concern on the issue of how many regional Bell companies should be divested by AT&T, there was a preference from the authorities that there was at least more than one Regional Bell Operating Companies (RBOCs) divested and yardstick competition was an important consideration behind this. Also, as Abdala and Hill (1996) observe, the division of Entel, the Argentinean telecommunication state-owned company, before its privatization, was also due to the explicit concern of the Argentina government to foster yardstick competition.

In sum, we consider, from the theoretical point of view, the most relevant arguments alleged by the GGBT to justify the "mild horizontal separation approach" in the BMTR: i) competitiveness, understood properly as scale, scope and transaction cost economies, ii) avoidance of excessive dispersion of efforts and; iii) yardstick competition. The first two are examined in more detail, respectively, in sections III and V, while the third is developed in Mattos (2001).

2. Scale, Scope and Transaction Cost Economies and Horizontal Separation

2.1. Scale and Scope Economies in Telecommunications

In the past, scale and scope economies were behind the "natural monopoly" argument that justified a single firm supplying all telecommunications services in a given area or country. The basic reason for the existence of scale economies in telecommunications is the high proportion

of fixed to variable costs. Scale economies are particularly strong at the local fixed network operation. According to Armstrong (1998, p. 134/135) *"....the sector which has the most widespread natural monopoly cost conditions is local fixed network. This is largely because of economies of density, whereby it is cheaper per person to build a local network connecting, say, 5000 people in a given area than it is to connect 500. (The reason is partly because the cost of a local exchange can be spread over more local users, and partly because the greater use of remote concentrators and the like means that a lower proportion of the local network is made up of costly dedicated cabling and ducting).*

The long distance service was the first one in telecommunications where the increasing returns hypothesis was broken up due to the technological change that reduced the requirements of fixed costs. According to Armstrong (1998, p. 135/136) *" there are probably no other significant areas of natural monopoly in the industry. For instance, traffic on many trunk routes is heavy, and once economies of scale in providing capacity are exhausted, the extent of natural monopoly is likely to be limited in the trunk network. This is specially so if competing networks can easily obtain rights of way and can, for instance, lay fibre-optic cable along railway lines or electricity transmission lines. Thus, except for remote areas, there is no reason to expect major natural monopoly cost conditions in long distance operation network.....Similarly, there is little evidence of natural monopoly in international network operation."* In the last twenty years, the natural monopoly argument in the local service has started to be challenged as well.

On the other hand, the fact is that scale and scope economies continue to be important issues in telecommunications, mainly regarding the kind of restructuring that transformed TELEBRAS before privatization. Indeed, in the current state of art of the telecommunications technologies, fixed costs are not as important as in the past and average costs may not be decreasing across all the TELEBRAS system. Therefore, this argument would not call always for a bigger size of the unit to be privatized, but only over a more limited range of the system. The implicit intuitive hypothesis that seems pervasive for most of the policy makers around the world is that "competitiveness" always justifies leaving domestic competition aside. The national companies would always benefit from being "big" and eventual harm to local consumers would be curbed through the "globalisation process". Dutz and Khemani (1995,p. 28/29) present several arguments that show why globalisation is not a perfect substitute for domestic competition. Furthermore, the authors (p. 20) challenge the myth of "competitiveness" as an argument against domestic competition, quoting an important part of the classical book of Porter (1990): *"Rivalry at home is not only uniquely important to fostering innovation but benefits national industry....In fact, creating a dominant domestic competitor rarely results in international competitive advantage. Firms that do not have to compete at home rarely succeed abroad. Economies of scale are best gained through selling globally, not through dominating the home market"*. This kind of discussion, however, is becoming increasingly blurred given the rapid changes in this sector and the broadening of available technological alternatives.

Viscusi, Vernon and Harrington (VVH-1995, p.487/488) show how the evolution of the long distance service telecommunications technology in the US implied a continuous fall of the fixed costs compared to variable costs, reducing the natural monopoly characteristics of the sector. However, it remains to be explained why with the revolution of the fiber-optic technology in the long distance service, that ensued in a large proportion of fixed to variable costs did not imply the return of these natural monopoly characteristics. We guess that though these characteristics of the fibre-optic technologies, single ownership of all long distance networks is not the sole response to

obtain scale economies. The lower number of switches compared to the local network allows for the replacement of interconnection contracts (with regulator intervention) for single ownership. This may explain why a “Big Crunch” of competition did not follow the “Big Bang” of competition in telecommunications from the 50’s after the introduction of fibre-optics technology. The existence of alternative technologies without increasing returns seems to be another explanation. But, the current movement of mergers in the telephone sector around the world together with what analysts⁷ foresee for Brazil can be partially explained by the characteristics of the fibre-optic technologies.

Turning back to the BMTR, we know that, up to the moment of the privatization, each of the 27 concessions owned by TELEBRAS in Brazil had their own long distance network inside each state with very few direct connections among each other. These inter-state connections were provided by EMBRATEL, also owned by TELEBRAS. As EMBRATEL was privatized separately, the scale/scope economy gains from keeping together several concessions in different states would only be positive within the boundaries of each state where there was, in fact, several operating connections among different locations off the EMBRATEL national network. As there were no relevant direct links among the states, there were no relevant scale economies to be explored beyond their boundaries, without the EMBRATEL network links by the time of privatization. In other words, scale and scope economies could be obtained in the TELEBRAS system, apart of EMBRATEL connections, coming from the local network at the city/municipality level to the whole state. However, beyond the limits of a state, scale economies went virtually to zero. As stated by Dores (1999), *“Each holding of the wire telephone systembefore the privatisation operated on an independent way and had their own plants with different technologies, given that in the past the Brazilian government was not concerned with technology standardisation. Therefore, currently, in each holding, there are several technologies for the same kind of equipment, which means difficulties in respect of the operation and maintenance as well as in the scale for acquisition and interconnection of the state networks .The networks of each local concession were isolated from each other, since they were not allowed to supply long distance services, an exclusive attribute of Embratel”*. This is an aspect that reduces the force of the scale argument to justify an aggregation of TELEBRAS beyond the state level.

At this point, it is important to address the validity of the scale and scope arguments in telecommunications around the world. In this regard, VVH (1995,p. 490/491) reports that the results of earlier empirical studies in telecommunications and the evidence about the existence of scale economies are mixed, even in the seventies⁸. Indeed, the international econometric

⁷ See Dores and Pires (2000).

⁸ See the early evidence in the survey of Fuss (1983) and in its updating in Waverman (1989 p. 83/95). This latter author concludes that *“the weight of the evidence of all these studies is simply not strong enough, since changing the level of aggregation, the functional form, the constraints imposed, or the objective function dramatically alters the results. The message is simply that the data available are insufficient to enable researchers to discriminate between alternative hypotheses. My view is that the subadditivity test for aggregate AT&T data is so sensitive to data and to econometric technique that it cannot be relied on for making policy”*. Waverman (p. 94) guess that given the huge size of AT&T, scale and scope economies between 1947/77 was unlikely. Roller (1990A) and (1990B) and Shin and Ying (1992) afterwards aimed to circumvent methodological problems from the earlier studies with the former concluding for the existence and the latter for the non-existence (at a regional level) of scale economies in telecommunications. Interestingly, the same debate about the existence of scale and scope economies in the wire sector is being done in the mobile sector. While McKenzie and Small (1997) found that scale economies exist in the US mobile segment only until a small range of subscribers, Foreman and Beauvais (1999), criticising the small sample exercise performed by the former, found for the GTE mobile company, significant scale economies.

evidence available (mainly from the US and Canada) does not provide a definitive conclusion about the existence of scale and scope economies in telecommunications. Furthermore, adding the recent technological developments in this sector and the current diversity of technological alternatives, the measurement of scale and scope economies in the local and long distance services of telecommunication becomes even more difficult.

The empirical weakness of widespread scale/scope economies in telecommunications disallows us to derive a “lower bound” for TELEBRAS horizontal restructuring even at the state level. Thus, we have to go further on the theoretical analysis to find elements to design this lower bound for TELEBRAS horizontal separation.

2.2. Transaction Costs and Common Ownership

The presence of scale economies is connected to a neoclassical explanation of the firm in terms of its technology as described by Panzar (1989). An alternative for this approach is based on transaction cost economics from the theory of firm as introduced by Coase (1937) and developed by Williansom (1975 and 1985) and others⁹. Guasch and Spiller (1998) discuss the application of transaction cost economics directly in the context of horizontal and vertical restructuring of infrastructure sectors before privatization. They state that there is really neither a monotonic relationship nor a clear cut-off point from which network firms must be horizontally and vertically split to achieve the best efficiency level. However, the theory of firm, based on transaction cost analysis, provides guidelines to weigh the trade-offs involved in keeping companies integrated or not. Guasch and Spiller (1998, p. 9-4/9-6 and 9-14) propose an analysis with several steps to evaluate which would be the optimal level of horizontal and vertical separation, mainly based on these theoretical tools. However, the authors themselves recognize the difficulty to make a detailed analysis on these grounds in the state-owned companies, since the integrated structure of them did not emerge as a natural efficient (or even non-efficient) market response¹⁰.

In telecommunications, the main transaction costs emerge in interconnection negotiations and agreements. Indeed, the qualitative empirical evidence¹¹ shows that they involve substantive transaction costs, which are even stronger when there is a tendency of the players for raising rival costs. The problem is that an interconnection agreement is quite complex and the incentives of the agents to act cooperatively are not guaranteed. The parties have to negotiate where the points of interconnection in their networks will be access price rules, standards, among several other qualitative aspects with low degrees of verifiability and even observability. Furthermore, investments are specific¹².

⁹ See Tirole (1988, chap 0) and Holmstrom and Tirole (1989) for surveys.

¹⁰ This point is also stressed by Beesley and Littlechild (1997,p.30).

¹¹ See the quotation of VVH transcribed in chapter 4, describing the history of the interconnection agreements between AT&T and MCI and Sprint in the US.

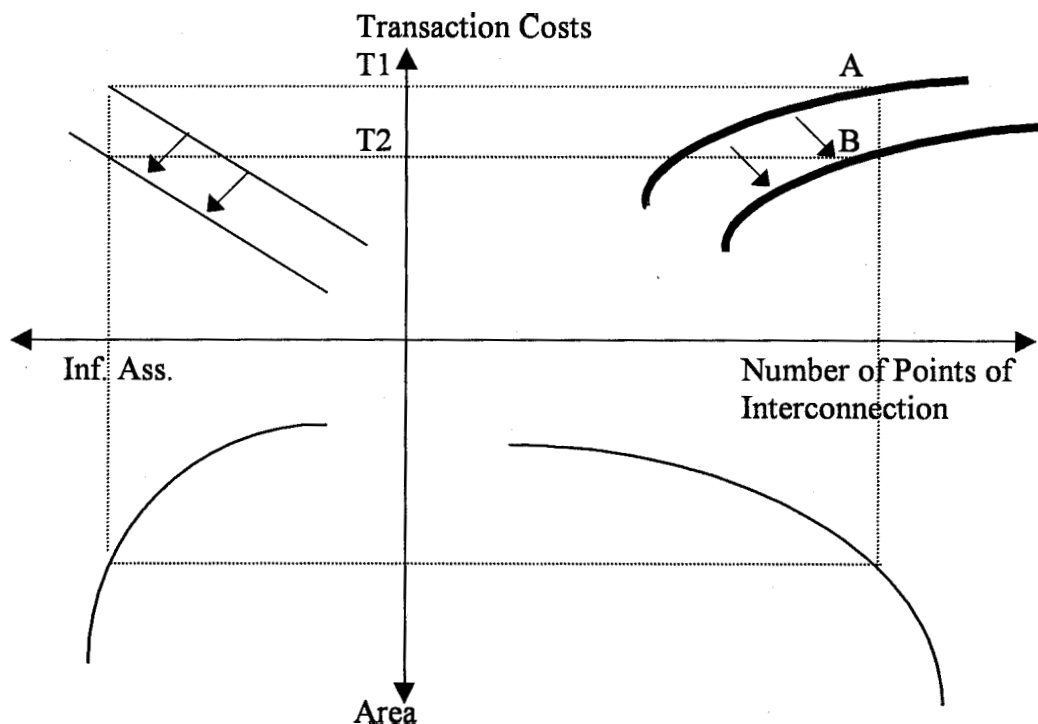
¹² According to Williansom (1989 p.142/143) “*Asset specificity has reference to the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value*”. For more detail on asset specificity, see Williansom (1985) and for a simple formalisation, see Tirole (1988,p.25).

Moreover, the greater the quantity of points of interconnection among different firms, the more substantive transaction costs will be. The number of points of interconnection is proportionally higher for smaller areas. For example, two neighbor areas within a city may have more interconnection points in proportion to the area than two neighbor towns. In other words, interconnection transaction costs are concave functions regarding the geographical area.

There are two (complimentary) ways to deal with interconnection transaction costs in a restructuring process prior to privatization: i) less segmentation of the company, transferring several interconnection points to the boundaries of the firm; ii) a very good regulatory agency with a highly skilled staff on interconnection technicalities and economic principles.

However, the regulator always suffers from at least some asymmetric regulation compared to firms. Even if the two parties in an interconnection agreement were able to “observe” the fulfillment of the contract, it can be difficult to “verify” it to the agency. Thus, there are limits on which we can reckon with regulatory oversight to enforce interconnection agreements and, so, we cannot push fragmentation that far, establishing an upper bound on horizontal separation. These relationships are summarized in the four-quadrant graphic depicted below:

Figure 1 - Transaction Interconnection Costs



The number of physical points of interconnection grows at decreasing rates with the area, reflecting the fact that smaller areas (a city, for instance) require more interconnection points in proportion to the area than larger areas. This results in the curve depicted in the bottom-right quadrant. Total information asymmetry of the regulator also grows at decreasing rates with the area as depicted in the bottom-left quadrant. The higher the information asymmetry of the regulator, the higher the transaction costs that will result from the interconnection agreements. As it is not clear if this relationship grows at decreasing or increasing rates, we have assumed a general linear form as depicted in the upper-left quadrant of the graph. These relationships result in a positive and concave relationship between the number of points of interconnection and transaction costs at the upper-right quadrant. This reflects the fact that in smaller areas, transaction costs are very high proportionally to the area.

If the regulator had had the chance of restructuring the sector before privatization as in the case of TELEBRAS, when he concentrates the industry, not fragmenting very much the state company in horizontal grounds, for the same degree of information asymmetry, there are less transaction costs resulting from interconnection agreements because there are more points of interconnection within the firm that do not need to be monitored by the regulator. This means a downward shift of the upper-left curve and probably a shrink on the slope of the curve reflecting a smaller sensitivity of transaction costs in response to the degree of information asymmetry of the regulator. It is easily checked that this also shifts the transaction costs/number of points of interconnection relationship downwards as indicated. Thus, for any number of interconnection points, transaction costs are lower than otherwise. In the extreme case of a single ownership, there are not interconnection transaction costs anymore by construction and the relationship depicted in the upper-left quadrant coincides with the horizontal axis.

Thus, we can conclude that, assuming a less than perfect ability of the regulator to enforce interconnection agreements, much horizontal separation could have increased excessively interconnection transaction costs of telecommunications in post-privatization Brazil. This points at a lower degree of horizontal separation of TELEBRAS.

There are also transaction cost arguments related to the optimal investment in standardization of the equipment. The outstanding expansion of the long distance regional companies networks in Brazil, including the strengthening (or even the creation) of direct links among the state networks reveals that this effect seems to have worked after privatization. These gains can justify less horizontal separation as it was done with TELEBRAS in the BMTR.

The main question here is whether less horizontal separation really induced the investments in expanding the links of the networks and/or improved their compatibility? This kind of investment linking networks with different owners raises typical problems of asset specificity with the likelihood of opportunistic behavior¹³. In this regard, one of the principal specificities is equipment compatibility. Indeed, standardization always represents a movement of one network toward another, enhancing both present values, a classical externality problem.

As we see in section II, problems with lack of standardization seem to have occurred in Brazil before the promulgation of the National Code of Telecommunications in 1962. The Code addressed this problem through a more direct State intervention in the compatibility coordination and the creation and growth of TELEBRAS as a state-owned company. Bringing the same concerns about system compatibility to the turn of the century, the question is whether less horizontal separation of the regional companies in the BMTR could prevent the re-emergence of these coordination failures.

¹³ See Williansom (1985,p. 52/56,64/67, chapter 3).

There is a well-established literature in the economics of standards surveyed by Katz and Shapiro (1994) and Besen and Farrel (1994) that clarify some of those issues. The main question is that the social benefits that one company generates when it makes its technology compatible with others are spread over all other companies and thus social benefits exceed private ones which lead, with more than one firm in the market, to an equilibrium level of standardization lower than the social optimum. When there is a single company in the market, this problem vanishes, since the social benefit equals the private. By the same token, it is plausible that this problem increases with the number of firms. The authors stress that the company itself established technical standards before the AT&T divestiture in 1984 and thus the issues of standardisation did not involve coordination and/or competitive problems in the US. However, the movement of entry, fragmentation and internationalisation of telecommunications in the US after the AT&T antitrust trial, made standardisation a matter of permanent concern for the American regulatory authority.

We can still ask whether an adequate regulatory oversight can substitute less horizontal separation for the purposes of increasing standardization toward the optimal. However, the economic literature is skeptical about State intervention to provide standardization. According to Katz and Shapiro (1994, p.112/113): *"Since market outcomes may be inefficient, it is theoretically possible for government intervention to improve market performance. But there are several issues that must be addressed before concluding that government intervention is warranted in practice. First, the extent of the market inefficiency is unclear, once recognition is given to the many private institutions that arise to achieve coordination and internalize externalities. Second, there is the question of whether the government would have incentives to improve matters. One plausible hypothesis is that the government will act to serve the current generation of producers and users, while acting to block or impose inefficiently high costs on an emerging technology. Third, even if policy makers try to maximize total surplus, they may lack the information needed to do so.....Moreover, the government may have a significant informational disadvantage relative to private parties when emerging technologies are involved. In short, we are far from having a general theory of when government intervention is preferable to the unregulated market outcome"*.

It does not mean that the regulatory agency may not intervene at all. There are other ways of intervention that can prevent important anticompetitive practices. Besen and Farrel (1994, p. 128), for example, points that since *"dominant firms have also tried to prevent compatibility through frequent changes in technology,.....Federal Communications Commission...require communication common carriers to provide information about changes in network design and technical standards to rival suppliers of customer-premises equipment and enhanced telecommunications services before the changes are introduced into their networks"*. Other possible example is when two or more dominant firms collude, choosing a single standard for them, but excluding the others. Clearly, the interventions provided in these examples are too far from the regulatory agency choosing standards. At most, the government should mandate the voluntary standards produced by external bodies representatives of the industry. According to Besen and Saloner (1989,p. 186) *"It is particularly remarkable that, for the most part, this community has emerged at the initiative of industry participants and without governmental intervention or direction. Indeed, governmental agencies often take their guidance from the industry bodies and formally adopt as mandatory standards the voluntary standards that these bodies*

produce”. Although we will not analyse this question more deeply, it is remarkable that the intense debate happened in Brazil in 2000 about what standard the regulatory agency, ANATEL, should choose for the new wave of mobile service that would enter in that time. As noticed in the press, after a voting process of the ANATEL commissioners by June 2000 and after a strong lobbying from European companies from one side and American companies from the other, the final choice of the agency was tailored for the European standard.

Furthermore, single ownership is not crucial to avoiding standardization problems in the telecommunications sector. According to Farrel (1991, p.1204), *“given enough cooperation, whether inspired by benevolence, by enlightened self-interest, or by court order, telecommunications could work with dispersed ownership”*.

It should be noted that each regional company, being allowed to compete in the long distance service inside its own area will bring strong incentives to achieve a high degree of standardization among networks in their respective area, improving efficiency. It happens since the investment in standardization by one regional network brings benefits for all regional networks, which is a positive externality. If a higher proportion of the benefits of standardization accrue to the regional company profits through single ownership, the externality is internalized. We show this formally.

Assume that we have two different networks in two different states and both wish to interconnect each other to make long distance calls without depending on EMBRATEL’s network. We focus on a specific long distance call between a certain location “a” in one state and location “b” in another state. Suppose, as in Tirole (1988, p.25), that the (perfectly symmetric) average costs of providing one single call for each one of these networks are a deterministic monotonically increasing and concave function of the aggregate investment in interconnection, I , made by both of them (I_a by the network of state “a” and I_b by the network of state “b”, being that $I_a + I_b = I$) such as:

$$\begin{aligned} c_a(I) &= c_b(I) = c(I) \\ c'(I) &< 0 \\ \text{and} \\ c''(I) &> 0 \end{aligned} \tag{1}$$

In other words, as the long distance call between these two localities is jointly and complementary supplied, any effort from one company to make its equipment compatible with the other will reduce both average costs (though at a decreasing rate). Both become closer to each other and perform much better the jointly task of providing the long distance call between “a” and “b”. The main question here is what the best investment level is and, consequently, the optimal ex-post equilibrium average costs in the two networks with or without ownership integration.

Suppose that there is a single unit of long distance call between “a” and “b” ($Q_{ab}=1$) that implies a value of v to the caller and 0 to the receiver that, by assumption, pays the call. Furthermore, we assume that the operator knows v and sets the price exactly at this level, not being constrained by any price regulation. The total profit of the operator who owns both networks (case of ownership integration), using (1) is:

$$\Pi_{\text{int}}(I) = v - c(I) - c(I) - I = v - 2c(I) - I \tag{2}$$

Maximizing $\tilde{O}_{int}$ with respect to I , we reach the expression that defines the optimal value of I_{int}^* :

$$\begin{aligned} -2c'(I_{int}^*) &= 1 \\ c'(I_{int}^*) &= \frac{-1}{2} \end{aligned} \quad (3)$$

On the other hand, the total profit of both operators with non common-ownership, assuming that α of the revenue of the call “v” goes to operator A and $1-\alpha$ to operator B is given by the following expressions:

$$\begin{aligned} \Pi_{non\ int\ a}(I_a) &= \alpha v - c(I_a + I_b) - I_a \\ \Pi_{non\ int\ b}(I_b) &= (1-\alpha)v - c(I_a + I_b) - I_b \end{aligned} \quad (4)$$

Maximizing each $\tilde{O}_{nonint}(I_i)$ in respect to I_i for $i=a,b$, we reach:

$$\begin{aligned} -c'(I_a^* + I_b) &= 1 \\ -c'(I_a + I_b^*) &= 1 \end{aligned} \quad (5)$$

Given the symmetry of the problem, we have $I_a^* = I_b^*$ and thus $I_a^* + I_b^* = I_a^* + I_b^* = I_a^* + I_b^* = 2I_a^* = I_{nonint}^*$. Thus, summing the conditions in (5) at the equilibrium values of I_a^* and I_b^* , we reach:

$$\begin{aligned} -2c'(I_{nonint}^*) &= 2 \\ -c'(I_{nonint}^*) &= 1 \end{aligned} \quad (6)$$

Comparing (6) with (3) and reminding that the cost function is concave in the investment, we reach that $I_{int}^* > I_{nonint}^*$. As the total investment in the integration case is higher than in the non-integration case, both equilibrium average costs $c^*(I)$ will be lower with integration, since the cost function is monotonically increasing with I . In other words:

$$c_i(I_{nonint}^*) \geq c_i(I_{int}^*) \quad (7)$$

Then, we can conclude that the ownership integration of separate networks provides more incentives for cost-reducing investments. Moreover, note that (2) is also the objective function of the benevolent regulator, which means that indeed, horizontal separation implies a sub-optimal investment level in compatibility

This kind of reasoning recommends a less aggressive horizontal separation before privatization. Standardization problems are a real possibility as a by-product of a more fragmented system.

On the other hand, notice that when considering the existence of EMBRATEL's network, a positive social benefit of a higher investment of the regional companies in long distance networks cannot be taken for granted even if this reduces average costs. Indeed, a higher incentive provided by less separation can imply wasteful bypassing of long distance networks with the established network of EMBRATEL and even with the mirror long distance entrant.

If there are scale economies in EMBRATEL's operation, the average costs of this company may increase when a less aggressive horizontal separation approach of the regional companies is adopted. In the model of Laffont and Tirole (1993, p. 290), for instance, some consumers can be hurt by the construction of a new network, because the bypass of the incumbent (EMBRATEL) network "steals" consumers from the latter and increases its average costs, since returns are increasing. The result is that prices may increase too. Therefore, the higher incentive to promote cost reducing investment through a single ownership can reduce average costs of the regional companies at the cost of decreasing scale economies of EMBRATEL. The more complete welfare analysis provided by Laffont and Tirole (1993, chapter 6) brings ambiguous results. Remaining consumers (low-demand consumers in the model) on the incumbent network can benefit from the advantageous terms that the incumbent network will provide to avoid business stealing from the entrant network. This kind of analysis proceeded by the authors is particularly pertinent in the Brazilian case, since EMBRATEL operates all over the country, encompassing both, profitable (high consumers in the author's model) and non-profitable areas ("low-demand" consumers). The same is true for, at least, two regional companies that operate in the very large yellow and green areas of map 1. The net social impact of this is unclear¹⁴.

One can easily overestimate the standard argument based on the problems that occurred in the past and seems to have been important to justify the existence of TELEBRAS as a state-owned company. However, this comparison is not appropriate. The Brazilian telecommunications sector is completely different from forty years ago. Even with the widening of alternative technological paths, technical barriers for interconnection and compatibility are much lower nowadays, given the extensive knowledge of current technologies.

Another important aspect is that several ANATEL regulators came from TELEBRAS and have a greater degree of knowledge about compatibility compared to what public officials had in the past when each piece of the Brazilian telecom system emerged independently with a very dispersed structure of technical information about the networks. In sum, Brazilian regulators are much more able today to enforce minimum compatibility standards than before. Of course the current speed of technological improvements in this sector can erode very quickly the information assets of ANATEL regulators, but not to the levels that prevailed before the 60's. Economic and engineering knowledge about how to make adequate rules for interconnection has improved altogether mainly in response to privatization and deregulation around the world.

Furthermore, much of the capacity of telecommunications equipment in terms of interoperability and protocol standardization comes from equipment producers. These suppliers tend to follow minimum requirements established by international standard bodies like ITU (International Telephone Union)¹⁵, ISO (International Standard Organization) and ANATEL

¹⁴ For more on these kinds of results, see also Curien, Julien and Rey (1998).

¹⁵ ITU launches yearly updated standardisation rulings that have been helping companies and regulators around the world to avoid such problems.

itself. Indeed, the emergence of bodies external to the firms responsible to promote standard coordination is a common characteristic of the sectors where this issue is crucial. According to Besen and Saloner (1989, p.186) *“an important response to the need for coordination of product design has been the evolution of a strikingly large and complex standard-setting community charged with the responsibility and authority to negotiate and adopt standards for its various industries.”*

However, even with the most modern regulatory framework for interconnection, the degree of information available to the regulators will never avoid completely the transaction costs associated with agreements on interconnection of the several local and long distance networks around the country, when compared to a situation of single-ownership. In other words, the regulatory contract will never be a perfect substitute for the replacement of single ownership (or less fragmentation) for the sake of improving standardization.

This is particularly true in the case of the Brazilian regional companies that already owned their own intra-state long distance networks. These companies after privatization rapidly expanded their long distance networks to interconnect with each other inside the boundaries of the three regions depicted in map 1, improving long distance intra-area competition with EMBRATEL. If, for example, Rio de Janeiro and Espirito Santo were not bundled for privatization, the expansion would be slower or even not happen.

Of course if the inter-area long distance constraints were kept, the expansion would not happen anyway, given the design of the BMTR. But note that our assertion goes beyond that. Given the existing standardization and interconnection (mainly transaction) costs between networks with different ownership, the pace of the expansion of the long distance network by regional companies competing with EMBRATEL would be naturally curtailed, regardless of the constraints of the BMTR.

In sum, transaction cost savings through improved perspectives of standardization may justify at least part of the “mild horizontal separation approach” in the BMTR. However, given the counteracting forces in the current situation of the sector worldwide and in Brazil, this argument should not go so far. Our feeling is that the BMTR could increase the TELEBRAS horizontal separation even further than three companies without serious risk of standardization problems. On the other hand, we can safely say that the incentive to invest in inter-state network links would actually be curtailed with further horizontal separation.

3. Potential Competition and Horizontal Separation

A relevant consideration that also pushes for more horizontal separation is the argument of potential competition. The greater the number of players throughout the country, the more likely their reciprocal pressure to enter each other markets. Although this was not possible until 2002, given the cross-ownership constraints and the duopoly policy of the BMTR¹⁶, this will only start to matter afterwards.

To assess the relevance of potential competition on the issue of horizontal separation in telecommunications, we can follow Brenner, (1999) who presents the evaluation made in the US on the merger of Bell-Atlantic and Nynex, two Baby-Bells that had emerged from the AT&T divestiture.

¹⁶ See Mattos (2001).

First of all, it is important to distinguish between two types of potential entrants, the “effective potential entrant” and the “perceived potential entrant”. The importance of the former rests on the incentive that this entrant would have to enter another area and challenge the market of the incumbent. In the case of the second, the simple perception that a potential entrant exists disciplines the behavior of the incumbent, increasing welfare. In the Bell/Nynex case, the authorities defined that only the “effective potential entrant” was relevant, since the long expected timing of entry and high sunk costs should not constrain the incumbent behavior.

Contrary to Bell arguments, the authorities concluded that Bell Atlantic was one of the most well positioned entrants in the area served by Nynex since it already owned operational support systems in Nynex area, a good know-how and corporative experience to provide local service (including to negotiate interconnection agreements) and brand recognition in Nynex area, obtained through common media shared between adjacent areas. Indeed, geographic proximity of the areas (they were adjacent) led authorities to conclude that Bell would be a potential entrant more effective than other Baby Bells located far away.

However, the operation was cleared with only minor requirements since the authorities also found that AT&T, MCI and Sprint could be taken as “effective potential entrants” as Bell Atlantic, given their long distance business in Nynex area. The horizontal merger guidelines from 1984 prescribed that the existence of three or more “effective potential entrants” meant that the elimination of one of them would not bring substantial competition concerns.

Translating this discussion to the debate on TELEBRAS restructuring in the BMTR, we could infer that more horizontal separation could increase the number of “effective potential entrants” after the transition period. Considering that the two other regional incumbent privatized companies and the long distance incumbent carrier EMBRATEL, given their accumulated knowledge on telecom operation in Brazil, could be taken as the most relevant effective potential entrants, more regional incumbents generated in the horizontal break-up process would mean more effective potential entrants and thus more potential competitive threats after the transition. On the other hand, using mechanically the standards of the 1984 guidelines as done in the Bell/Nynex case, breaking TELEBRAS beyond four wire companies would not be meaningful. In other words, the existence of three most relevant potential entrants in Brazil would be just enough by these standards when considering potential competition.

4. Excessive Dispersion of Efforts

As we saw in section II, one of the arguments of the GGTB to split TELEBRAS was to avoid an excessive dispersion of investment efforts. The theoretical basis for this statement rests on private agents regarding effort in each area as substitute activities among themselves in their (dis)utility function.

Laffont and Tirole (1993, p.81/82) had already shown that the inclusion of any second activity in their basic model would imply in a reduction of the power of the incentive scheme of the regulated firm. The optimal effort level in any activity, e^* , decreases with the level of any concurrent activity, “ z ”. The authors (chapter 3 p.183) also evaluate the case of multidimensional effort in a multiproduct setting, an effort level being attributed to each product (or area in our case) and the general conclusion was that *“the regulator lose some power to extract rent through price distortions when the firm can allocate effort among product lines”*.

The first model that addressed this question in the general principal-agent theory was by Holmstrom and Milgrom (1987). In their model, the agent's costs depend on their total effort in all tasks and an increase in one agent compensation in any one task would cause some effort reallocation from other tasks. The same authors wrote another paper afterwards (1991) that introduced difficulties for the principal to measure agent performance in at least one of these tasks. In these cases, the direction of the effort reallocation comes from the less to the more measurable tasks.

Our more general question is how we can apply this idea for the decision of privatizing a holding company as TELEBRAS with more or less horizontal separation? In other words, what is the relevance of the excessive dispersion argument in this setting?

Applying the Holmstrom and Milgrom (1987) model to this problem, note that if the principal (ANATEL) has difficulty to enforce minimum quality standards or any other operator duties in more distant regions from the agency's main headquarters in the south of the country, it becomes a relevant issue when studying the restructuring of TELEBRAS. In this regard, the BMTR should avoid grouping areas with different degrees of regulator's ability of supervision, since the firm can always reallocate effort (and resources) among the areas differently from the committed targets. However, given the sizes of the yellow and green areas in map 1, this is a problem likely to emerge. For example, in the green area, it is clearly easier for ANATEL to measure tasks fulfillment of the operator in Rio de Janeiro compared to Amazonas.

The main message of this section is that this argument calls for more horizontal separation.

Conclusions

The arguments presented in this article do not point for an unambiguous answer regarding the issue of horizontal separation. The regulator would gain from increasing his ability to undertake yardstick competition, efforts carried out by the companies would be less dispersed and the fragmentation of TELEBRAS would strengthen potential competition after the transitional period of the BMTR (that ended at the beginning of 2002).

The arguments of scale and scope economies, though classical in telecommunications, cannot be taken for granted in view of the econometric studies in the international experience. The studies do not often isolate local services from the long distance ones. We think that scale economies in the local service is still a strong argument but scope economies between the local and long distance service and scale economies across the long distance networks are not very robust ones. Everything depends on the incentives of the local company to foreclose long distance competitors¹⁷.

On the other hand, transaction costs seem a stronger argument in favor of less horizontal separation by reducing the problems with interconnection agreements and by providing a greater incentive for investment linking all areas.

Weighing these effects, we can say that there was some scope for increasing horizontal separation in the BMTR with net gains for social welfare. In particular, we think that the incentive that less horizontal separation provided for long distance investment as described in the theoretical model of sub-section III.2 could have been better shaped.

¹⁷ See Mattos (2001).

We can explain the alternative in the following terms. The analysis proceeded took as given the privatization of EMBRATEL as the single incumbent inter-area long distance company in Brazil. Consistent with this choice, apart from the transaction cost arguments, it was important to design some source of “incumbent competition” to EMBRATEL in the short-run to avoid monopolistic practices. The point is that even allowing new entry, it is not expected that these entrants could challenge the incumbent’s market power in the very short run. That is why regulators defined that regional privatized companies could provide intra-area long distance services and compete with EMBRATEL in this market (though not inter-area service).

However, this alternative was not the single way to foster short-run incumbent competition in the long distance and to provide the incentives for investment in standardization. A feasible alternative would be to separate the long distance network of the regional companies from the local networks. In this case, a second national competitor of EMBRATEL would be formed and should be able to buy not only the permission to operate in the long distance (inter and intra areas) but also these physical networks that would smooth the incumbency advantage of EMBRATEL. The speed in which the regional companies would have expanded their long distance networks inside their respective areas suggest that this would also be the case for the mirror company of EMBRATEL.

Moreover, there would be an incentive for this mirror company to invest in the network links among the three big regions, as shown in the theoretical model of subsection III.2, which does not happen within the actual model adopted. The long distance mirror company would have some incumbent assets and could be much more effective in challenging EMBRATEL market power. The regional companies do not have this economic incentive at the same time that they were forbidden to provide inter-region long distance service, given the vertical break-up strategy of the BMTR.

The sale of these assets to a second competitor of EMBRATEL would allow for two changes in the BMTR. Firstly, the mild horizontal separation approach based on the standardization argument would be weakened and thus the conclusion that more than three regional companies would be an optimal arrangement for the BMTR reinforced. Secondly, there would be no need to follow the mild line of business constraints of the BMTR, following something closer to the inter-LATA restrictions of the US antitrust suit¹⁸. In the short-run, there would be a deeper separation of the long distance service from the local one, avoiding potential problems of vertical foreclosure and reducing the need of heavy regulation in interconnection between long distance and local carriers.

Beesley and Littlechild (1997,p.30) also defend more horizontal separation in the state-owned restructuring whenever feasible. Even not knowing what is the optimal horizontal industry configuration after privatization, the best strategy, according to these authors would be to create smaller companies for privatization and allow horizontal mergers afterwards. For the case of TELEBRAS restructuring, the 27 regional concessions could be sold separately, but without imposing cross-ownership constraints for all pairs of companies. The structure of cross-ownership constraints should be designed to avoid merging the most similar areas aiming to improve yardstick competition regulation. This set of constraints would comprise a lower bound for horizontal integration and, perhaps, this should not be stricter than the actual scheme adopted in the BMTR.

¹⁸ See Noll and Owen (1995) for a description of the decision taken by the Court to divest AT&T in the US in 1984.

The potential problem with this strategy is that given that the integration of these long distance networks owned by the old state concessions with their local networks was very great (greater than the integration among the networks of the old state concessions), separation could be difficult to implement in practice.

Finally, notice that these conclusions also challenge, in some degree, the view that the current wave of mergers among telecom companies in Brazil is unambiguously welfare enhancing. The analysis above shows important elements out of the common sense that must be considered in this process.

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