Interconnection regulation in India: Lessons for developing countries

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Abstract

Interconnection is not only a major competition issue per se, it is also a critical element of the basic telecommunications agreement of the WTO. An important issue in interconnection regulation is interconnection charging especially in the context of a dominant incumbent. Most regulators in developing countries face challenges in setting interconnection prices in the absence of market information on the incumbent’s or entrant’s costs, competition or demand and models suited for developing countries that also adhere to the WTO guidelines. There are few papers that illustrate the challenges faced by regulators in such a context. This paper attempts to bridge the gap by highlighting the nature of interaction between the regulator, incumbent, judiciary and the political environment, the role of formal models in setting interconnection charges and the implications of rapid technological changes in a developing country context through a case study of India.

The case study highlights the point that besides independence, it is important to vest enforcement powers in the regulatory agency for it to be credible. Incorporating the WTO interconnection guidelines within a developing country context has implications for network growth and poses challenges to the regulatory processes.

Although Telecommunications Regulatory Authority of India (TRAI) started with a distortionary, inefficiently priced network providing low coverage and quality, it has meandered its way to a more reasonable network access pricing regime. The decreasing cost of technology and increasing incomes in India and political interventions in regulation have put pressure on TRAI to provide lower interconnection charges and faster telecom growth. Thus, it is pragmatic for regulators to start with a “quick and dirty” estimate, provided that they can signal the downward trend in interconnection pricing, rather than wait for the “correct” estimates.

Adoption of future looking strategies (interconnection exchanges), use of a variety of formal models, and strengthening of regulatory capacity are all necessary steps in fostering a competitive environment. Interconnection regimes set up early in the reform process require a review. For successful competition, effective dispute resolution mechanisms and institutions are also important.

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1. Introduction

Interconnection is not only a major competition issue per se, it is also a critical element of the basic telecommunications agreement of the WTO [www.wto.org]. According to the WTO guidelines, interconnection must be provided at any technically feasible point in the network, on non-discriminatory terms, of a quality no less favourable than for the incumbents’ own supply, in a timely fashion and on terms that are transparent and reasonable and on an unbundled basis so that a buyer does not pay for unnecessary services. The challenge before regulators is to provide a framework that is not only within the WTO guidelines but also addresses the technical, economic and commercial aspects within specific national contexts.

An important issue in interconnection regulation is interconnection charging especially in the context of a dominant incumbent. Since regulators do not have market information on the incumbent’s or entrant’s costs, competition or demand, it is difficult for them to estimate costs for determining interconnection prices. This concern has given rise to considerable theoretical and empirical work on interconnection pricing and regulatory approaches—rate of return, price caps, deaveraged costs and long run incremental costs, efficient component pricing rules, models of regulatory behaviour in setting prices and dealing with asymmetric behaviour of the incumbent. Most of the work on interconnection pricing has been in the context of developed countries (USA, UK, Netherlands, New Zealand, and Australia). While these models have been found to be useful for setting prices and understanding the effect of various parameters on prices, they need to be contextualized for developing countries’ environments, which may face a different problem set. Developing countries are often characterized by factors such as public monopoly incumbent, low network penetration, inadequate regulatory capacity and unclear separation of policy/regulation and operations, leading to interference and overriding of regulation. There are relatively few papers that illustrate the challenges faced by regulators in such a context, specifically with respect to determining interconnection costs or prices.

This paper attempts to bridge the gap by highlighting the nature of interaction between the regulator, incumbent, judiciary and the political environment, the role of formal models in setting interconnection charges and the implications of rapid technological changes in a developing country context through a case study of India.

2. The Indian telecom sector

The Department of Telecom (DoT) was the sole provider of all telecom services until 1984 when sector deregulation started. Owing to initial problems, private operators started providing services only from 1994. Service areas for operators were designated as “circles”, geographic units that were usually co-terminous with state boundaries. Significant facilitators for private entry were provided by the National Telecom Policy (1999) that even now provides a blueprint for ongoing reforms [http://www.trai.gov.in/ntpt1999.htm]. By 2003, six operators had a pan Indian cellular footprint and four had pan Indian fixed service licenses.

There were two incumbent operators—MTNL, the service provider in Mumbai and New Delhi and BSNL (erstwhile DoT) in the rest of the country—providing local, long distance and cellular services. International services are provided by VSNL, a state-owned enterprise until 2002 and partially privatized since then. International services are also provided by some private operators. In 1997, the government set up the Telecom Regulatory Authority of India (TRAI) (Jain, 2001).

The National Telecommunications Policy (NTP) 99 significantly relaxed conditions on private participation in telecom services by changing the then existing annual license fee to a one-time entry fee and an annual revenue share. It also provided for the entry of DoT and MTNL as the third operator for cellular services and increased the flexibility to private operators to carry their long distance traffic within a service area on their own networks. Private operators were slow to take off in providing basic services and none of them fulfilled the rural obligations associated with their licenses. In 2001/2 BSNL started providing cellular services.

During the period under consideration, there were initially two, and from 2002, four cellular operators in each of the circles. In 1999, TRAI allowed the roll out of a service that it called “Wireless in the Local Loop with Limited Mobility” (WLL (LM)) under the fixed service license that had associated rural roll-out obligations. Whereas spectrum for cellular licenses was auctioned, for fixed service licenses, it had a fixed price.
Because of discrepancies in the two licenses, there were several rounds of litigation and political intervention, ultimately leading to broadly similar service provision conditions (Jain & Sanghi, 2002).

In 2003, TRAI moved towards a “unified access” license, allowing for the existing licensees to provide either fixed or cellular services under the new regime, thus ensuring similarity across the two licenses. This essentially allowed the two WLL (LM) operators using CDMA to offer full-fledged cellular services, taking the number of possible licensees to six.

Appendix B provides some parameters of growth in the telecom sector in India. From a base of nearly 18 million subscribers in 1997, there were nearly 85 million subscribers in 2005. Significant growth came from mobile services, as is the global trend. Cellular services expanded at an annual growth rate of nearly 66.6%. The cellular teledensity in December 2004 was 4.84, up from 2.7 in December 2003.

3. Interconnection regulation

3.1. The first phase

In 1994, when private players were introduced, the interconnection framework was a part of the license for the private fixed line service providers (FSP), while cellular mobile service providers (CMSPs) had to seek interconnection agreements separately in the specific service areas of their operation. Long distance and international connectivity were to lie, respectively, with DoT and VSNL.

For a mobile to fixed call, the mobile operator collected charges from the subscriber for the airtime and the local and long distance charges incurred on the fixed line network. The entire charge for the fixed line network was to be paid to the DoT. For a fixed to mobile call, the DoT collected the appropriate fixed line charges, while the mobile operator collected the airtime charge from the receiver.

While CMSPs wanted multiple points of interconnection in order to maximize the distance over which they carried calls of their subscribers over their own network, the DoT preferred a single point of interconnection in order to maximize charges from CMSPs. In 1997, the DoT fixed the peak rate intra-circle landline to mobile tariff at 24 local calls so as to prevent its top-end customers from migrating to CMSPs since the cellular services treated intra-circle calls as local calls (by definition of the service area as specified in the license) and, therefore, were cheaper. Also, since mobile networks were very small at that stage, a large number of calls necessarily originated in the DoT’s fixed line network, leading to very high rates for landline subscribers to call cellular subscribers. In response to the increase, CMSPs went to the High Court of Delhi which directed them to seek redress from TRAI. As a consequence, TRAI directed the DoT to provide multiple points of interconnection. This also reduced the high long distance charges payable by CMSPs as they could now carry a larger part of the call on their own networks.

3.2. The second phase

In the second phase, TRAI specified interconnection charging as a part of tariff rebalancing that had begun in September 1998 through the first Telecom Tariff Order, March 1999 [TTO, 99, http://www.trai.gov.in/order.html]. While specifying the rentals and per minute usage charges, TRAI provided the option to fixed service providers to offer “alternative” tariff packages comprising higher rentals and lower per minute usage charge, as long as the TRAI specified “standard” package was available to the subscriber.

Interconnection regulation took the form of specifying a cost based interconnection charge (set-up charge) and revenue share based usage charge.¹ For interconnection between fixed service providers, revenue sharing for local calls was on the basis of bill and keep. For national long distance (NLD) calls, revenue sharing was in the proportion of 40:60 for the originating and terminating service provider, respectively. For international long distance (ILD) calls, this proportion was 45:55. Since the network of private fixed operators was nascent and much smaller in size than the DoT’s, the majority of calls were likely to terminate in the DoT’s network, allowing it to keep a larger proportion of the call revenue. In contrast, mobile operators who had to follow the

¹The set-up cost of interconnection is the initial cost of any engineering work needed to provide specific interconnection facilities and usage charge is the charge levied by a service provider for carriage of telecommunication traffic on its network.
receiver party pays regime did not get any revenue share for NLD and ILD calls. This neither allowed them to cover their customer acquisition costs nor did it take into account the additional revenue that such calls generated for the DoT.

3.2.1. Proposed shift to calling party pays

With the shift from a one-time entry fee to revenue sharing regime as envisaged in NTP 99, the cost structure of cellular services underwent a change. Therefore, TRAI revised the monthly cap on cellular rentals and per minute charges. The revenue share for NLD and ILD continued as before. TRAI also came up with a plan to shift to the calling party pays (CPP) regime by specifying a mobile termination charge (MTC) as a revenue share of 33:67 between the fixed and mobile operator that the mobile operators would receive for calls that originated in the fixed network and terminated in the mobile network. Through MTCs, TRAI attempted to make the mobile services commercially more attractive.

3.2.2. Judicial intervention

MTNL and a consumer organization approached the High Court of Delhi for a stay on the implementation of the CPP regime on the grounds that it would require network upgrading and increase customer costs owing to increase in bill collection costs and bad debts. They also contended that TRAI had no jurisdiction to issue or regulate revenue share arrangements amongst service providers with which the court concurred. In response to the court ruling, the government issued the TRAI Amendment Ordinance (2000) in January 2000, specifically giving it the power to fix interconnectivity terms. The ordinance also set up the Telecom Dispute Settlement Appellate Tribunal (TDSAT), which would also be the appeal mechanism for decisions of TRAI. Decisions of the tribunal could be appealed against only in the Supreme Court (Jain, 2001; Sinha, 2001).

3.3. The third phase

A significant development in the third phase was the announcement of the National Long Distance Competition policy in August 2000 that was expected to reduce long distance call charges by bringing in competition. Since the earlier TRAI interconnection framework only dealt with the DoT as the sole NLD provider, TRAI brought out a consultation paper on December 14, 2001, putting forward the general framework for interconnection (GFI) in the context of private NLD operators’ entry. GFI provided a methodology for charging a long distance call in a multi operator environment [http://www.trai.gov.in/intpap.doc]. Consequent to competition in the national and ILD segments, there was a decrease in tariffs. In addition, owing to the roll out of WLL (LM) and its treatment under the fixed service licenses, TRAI felt that a significant interconnection review was required. The review led to cost based tariff rebalancing, mechanisms to estimate IUC, and bundling access deficit charges (ADC) with IUC.

In July 2002, TRAI announced that for any service provider with significant market power, publication of a reference interconnect offer (RIO), as prescribed in the WTO guidelines was mandatory. The RIO was envisaged as a model interconnect agreement that would facilitate a new entrant’s connectivity with the PSTN. A player with significant market power was defined by TRAI as one that had more than 30% of the relevant market share. The RIO would need the TRAI’s approval before publication. The RIO was required to specify the IUC for origination, transit and termination based on unbundled network elements consumed for carriage of calls based on minutes of usage (MOU) on a fully allocated cost model. Other players were encouraged to seek interconnection on mutually agreeable terms and file the agreements with TRAI. Service providers were required to follow the model RIO, while also being given the freedom to enter into mutually acceptable terms and conditions of interconnection. In such a scenario, it was not clear what the role of the model RIO was.

This clause led to subsequent judicial intervention. BSNL submitted its RIO to TRAI, which approved it with some changes. BSNL challenged before TDSAT the power of TRAI to effect changes and to prescribe terms and conditions of interconnectivity. During the pending period of the appeal, BSNL executed about 40 agreements relating to interconnectivity. Since TDSAT passed an order in favour of BSNL, TRAI lodged an appeal in the Supreme Court, where the matter is yet to be heard.

Considering the significant growth in the mobile segment and changes in the cost structure, TRAI also undertook a review of the tariffs for cellular mobile service.
3.4. The fourth phase

TTO 2003 and the accompanying Telecommunications Interconnections Usage Charges (IUC) Regulation, 2003, were the basis of the fourth phase of rebalancing. While the NLD and ILD tariffs had substantially been reduced, according to TRAI “adequate increments in rentals and local charges had not taken place”. This created an access deficit for fixed service providers. Therefore, TRAI included an ADC in the IUC payable to fixed service operators “which they must get in order to keep the rentals as well as local calls affordable”. [http://www.trai.gov.in/consul25.htm, page 6, point 1]. The IUC was determined on the basis of the cost of unbundled elements both for local and long distance charges based on MOU as given by BSNL. (Although all service providers had given the data, it could not be used in the form that was presented.) The IUC was calculated on the basis of the capital and operational expenditure (capex and opex, respectively) per line. Historical network costs were taken for this purpose. To compute the ADC, TRAI used an affordability criterion, driven by populist perceptions and an ad hoc assessment of what a rural consumer could “afford to pay”. The rental and per minute usage charges were compared with an “affordable” level for rental/local call charges, special concessionary local call charges and free calls to arrive at the ADC. The estimated ADC formed nearly 40% of the revenue of the sector. Appendix C provides the details of the estimation for the ADC.

TRAI also decided that the IUC (including the ADC component) would be uniform (independent of distance categories) as it would be difficult to implement the differential calculation with the available hardware and software employed in the network. Fixed to cellular calls would be chargeable at Rs 1.20 for 90 s in metros and Rs 1.20 for 60 s in circles. For cellular services, TRAI fixed a MTC based on costs of termination. With this, the receiving party was not required to pay for incoming calls. In effect, this implemented CPP. The cellular operator would get Re 0.30 a minute (much lower than in the earlier regime) as MTC and the rest would be retained by the fixed service provider. For intra-circle calls, the charge was Rs 1.20 a minute and the cellular operator would get Re 0.40 a minute for termination. TRAI felt that the additional costs to be borne by the fixed subscriber (to pay for MTC) were not high, as these had come down owing to a fall in the prices of network elements, increasing subscriber base and additional revenue from value added services. On the plus side, the call completion rate would go up as the called party would not have an incentive to keep the handset off to avoid unwanted calls.

The changes in tariffs were viewed as significant because of shorter call duration, reduction in number of free phone calls (from 75 to 30 for urban), and what was viewed as differential pricing for BSNL/MTNL subscribers making calls to cellular/WLL (LM) phones. While a 3 min call from a landline in a metro to a cellular subscriber in the same service area earlier cost Rs 1.20, it would now cost Rs 3.60 and a call to a WLL (LM) would cost Rs 2.40.

4. Political fall-out

Thanks to political pressure and media coverage, the government announced a partial rollback of the tariff increase and a review of the implementation of IUC owing to the high proposed costs of different services while the existing market rates had been lower (Appendix D provides the comparison between TRAI mandated tariffs and those prevailing in the market). The IUC varied by type of call and whether it was inter- or intra-circle and was applicable only on calls originating, terminating or passing through the fixed line network, since ADC was required to be paid only for fixed line networks. Since ADC was to be collected only for calls involving a fixed line at either origination and/or termination, it provided greater flexibility to cellular and WLL (LM) operators to offer lower priced calls. A variety of IUC charges that varied with distance and the issue of whether these were inter- or intra-circle calls complicated the implementation of the regime. TRAI’s determination was criticized as being based on unscientific premises and seen as commercially unsustainable (Jain, 2004). The FSPs did not implement this regime and sought approval for lower tariffs. This was allowed by TRAI, but this raised the question of sustainability of its notified tariffs. Therefore, TRAI held a review in October 2003.
5. October 2003 review

5.1. Historical cost models

TRAI recognized that using historical costs as a basis for calculating ADC had led to high estimates. However, it could not adopt the forward looking long range incremental costs (FLLRIC) that it felt would be more appropriate, since it felt that BSNL would be left with very high stranded costs. Therefore, it decided to use the most recent cost data (2002–03) of fixed line provision (after removing the investments in cellular networks and also the grants and concessions received from the government for meeting rural targets). TRAI’s argument was that, by doing so, it had adopted a better cost model than the historical one used earlier, as during the year, BSNL had deployed the latest technology and lower cost equipment. This substantially brought down the ADC part of IUC. While TRAI reviewed the cost data for private operators, it did not use it in its calculations since these were unaudited and the cost per line was much higher than that for BSNL. This resulted in ADC applicable to all intra-circle calls to Re 0.30 a minute and a maximum of Re 0.80 for inter-circle calls. Per minute ADC on international calls was reduced to Rs 4.25 from Rs 5.00. The levels of ADC were substantially lower and TRAI did not expect reduced usage on any type of network (Appendix E).

5.1.1. Parity in types of calls for ADC

In order to bring in a technology neutral regime, ADC covered all types of calls. This removed the regulatory distortion in the earlier regime where ADC was to be paid only on calls originating or terminating in the fixed network. Similar terminating charges for different types of services (fixed, cellular) were provided for, even while recognizing that the specified charges were above the costs for the fixed line. This was, however, taken into account while computing ADC. In TRAI’s estimates, a more streamlined and lower basis of IUC could be accommodated within the prevailing tariff regime, since tariffs had already sharply fallen.

ADC was applicable for all calls, except fixed to fixed local and “0 to 50” km intra-circle calls and intra-circle calls from cellular/WLL (M) to cellular/WLL (M). This was done to keep local calls “affordable”. TRAI felt that there should have been greater parity in the 0–50 km fixed intra-circle and cellular calls, since the former covered a limited distance and the latter covered the entire state.

5.1.2. Only one type of ADC regime accepted

TRAI had provided for a uniform ADC (independent of distance), since the incumbent (BSNL) would find it difficult to implement the “escalating” ADC. However, BSNL implemented the escalating ADC, and TRAI also adopted the escalating ADC regime.

5.1.3. Phasing out of the ADC regime

Even while substantially reducing ADC available to BSNL, TRAI specified that ADC would be phased out eventually and merged with USO in 3–5 years.

6. Subsequent reviews

TRAI continued to receive representations regarding the method and basis of calculating ADC as, during the interim period, there had been a rapid increase in the subscriber base. TRAI undertook a review of ADC in June 2004. However, it could not get accurate and verifiable data from service providers and, consequently, there were delays in specifying any particular regime.

The reasons for considering a change in the existing regime were the following:

- Despite 4 months having elapsed since the requirement of implementation of the ADC regime, few settlements had taken place. There appeared to be problems with the data reported by many of the operators. The operators did not submit details of ADC payments.
- ADC was payable on calls that did not involve fixed line subscribers, but payments were due to fixed line operators. Reconciliation had been a problem owing to growth of mobile subscribers and usage as BSNL had delayed implementation of a Call Detail Record (CDR)-based system that would have helped.
Reconciliation was found to be difficult, since different amounts of ADC were payable for the same distance, depending on whether the call was intra- or inter-circle as this required changes in the hardware and software.

TRAI considered a revenue share regime for ADC, as this would obviate the need for detailed reconciliation and would not be based on type or distance of call. However, the issue would be the allocation of amounts to different operators. TRAI’s view was that:

- ADC funding was “normally” provided to the incumbent.
- Migration to the unified access license had led to reduction in rural roll-out requirements and operators should be willing to contribute to the USO.
- Despite MTNL being an incumbent, it was operating in the “premium” service area. Since it received higher monthly rentals it should not get ADC.
- TRAI would consider not imposing a revenue share on those fixed service providers who were not recipients of ADC.

TRAI considered the period October 2004–October 2005 as a reasonable starting point for the implementation of the revenue share regime. In this phase, the more current costs were considered.

Since 2003 TRAI had decided to forbear from regulating tariffs (other than rural) and subsequently all operators, including BSNL had shifted to more market or cost oriented tariffs. In the case of rentals for fixed line, these were higher than those mandated by TRAI before the forbearance. This had led to reduction in the total amount of ADC.

TRAI considered the estimates of subscribers and Average Revenue Per User to arrive at total revenues, from which the access deficit as a percentage of total revenue was calculated. Whether all fixed service providers should receive ADC was another contentious issue.

The October 2003 review was amended in January 2005 to incorporate the faster mobile subscriber growth. By this time TRAI received audited accounts and financial results from BSNL and other operators, on which it proposed to base the ADC estimate. The January 2005 amendment was to be followed by a consultation paper in March and a subsequent review. This would be conducted within 3–6 months to take into account the latest traffic data. At the time of writing, TRAI had brought out a consultation paper in March 2005 to consider once again the issues highlighted above.

7. Analysis and lessons learned

7.1. What should be TRAI’s perspective?

TRAI may be viewed as reacting to the changes in environment, instead of being proactive, as exemplified by the repeated consultation processes regarding ADC and its inability to delink IUC and ADC. TRAI’s reactions appeared ad hoc, causing delays in network growth.

TRAI needed to look beyond the present and set trends for future interconnections. Owing to the size and spread of the incumbent’s network, initial regulatory interventions for setting prices and providing an interconnection framework were critical for growth of the sector. Until the present, TRAI had been involved in detailed cost estimations in a context where the underlying data from BSNL itself had serious validity issues. Adopting a simpler model of revenue sharing for contribution to the USO would have been more pragmatic. The concept of access charge as implemented by TRAI was more applicable in more developed countries, where it is a small part of the sector revenue, whereas in India, the quantum of ADC, relative to the sector revenue, was very high and, therefore, contentious.

Although TRAI started with a distortionary, inefficiently priced network providing low coverage and quality, it has meandered its way to a more reasonable network access pricing. While TRAI’s regulatory role
was to facilitate competition and increase growth prospects, its efforts were often thwarted by regulatory capture by BSNL. The decreasing cost of technology and increasing incomes in India and political interventions in regulation have put pressure on TRAI to provide lower interconnection charges. Given the context of regulatory agencies in most developing countries (linkages with the incumbent and political intervention), bringing about drastic changes may be extremely difficult since incremental changes may find greater acceptance. Despite this, TRAI needed to have an overall blueprint within which the incremental changes could be brought about. Thus, it is pragmatic for regulators to start with a “quick and dirty” estimate, provided that they can signal the downward trend in interconnection pricing, rather than wait for the “correct” estimates.

While the quantum of ADC may need to be regulated, interconnection prices may not so require, unless these are bottleneck facilities as in the rural areas where enough competition does not exist. The requirements of RIO also needed clarification. This lack of clarity has led to judicial intervention and deviations from the WTO framework that requires publication of a model RIO.

Now that the Indian telecom sector has a multiplicity of players and services, TRAI should work towards the creation of interconnection exchanges (IE) that could provide a cost effective and feasible solution. All operators could interconnect through IE as shown in Fig. 1. This would greatly simplify the interconnection architecture and reduce the number of interconnection links. IEs could be managed by third parties and operated as clearing houses for settlement between different operators.

In the IE, TRAI’s role should be to provide a framework for dispute resolution between IE and the operators, mandate the costs related to space availability, network equipment, electricity, etc. provide a time table for a transition to a network of IE covering the country. An open interconnect agreement could be the basis of a “standard” package available to all operators. The IE operator could be free to negotiate mutually acceptable terms. TRAI would be responsible for regulating the quality of service from IEs.

7.2. Organizational/policy issues

7.2.1. Independence of regulatory agencies

As the Indian experience shows, merely setting up regulatory agencies is not sufficient. They need to be vested with adequate autonomy, functionality and enforcement powers. Despite its mandate, TRAI could not
manage interconnectivity in a smooth manner possibly due to very little power of enforcement vested with it. Interventions by the minister, judicial bodies and DoT, as illustrated in the case, considerably reduced its credibility.

The scope and powers of regulatory agencies should clearly specify their oversight and enforcement scope to cover the incumbent. Otherwise, the regulatory agency is unlikely to be able to “regulate” it. TRAI has found it difficult to deal with the incumbent, given the latter’s political clout and interlinkages with the ministry. In a contrasting example, in the UK, the Telecommunications Act of 1984 clearly stipulated the regulating role of OFTEL (now OFCOM) to cover British Telecom (BT). Also as part of its license, BT was mandated to follow OFTEL’s regulations. Such clarity did not exist in the Indian telecom sector. DoT was the policy maker, part regulator and operator until 2000 when it was corporatized.

7.3. Regulatory capacity

Regulatory agencies may not have the requisite technical background and mindset to adopt new models. This has been clearly shown in the Indian case. TRAI continued to focus on ADC and USO funding through fixed line networks, while wireless technologies were growing very fast. Also, it was slow to give up the historical cost model, as it was driven by the need to protect DoT/BSNL, rather than facilitating sector growth.

7.3.1. Setting access charges

Efficient access prices should depend on both cost and demand. This means that the more elastic the demand, the less should be the access price. However, such usage-based rules conflict with non-discriminatory rules that are a part of the Indian regulatory environment as well as the WTO framework. The European Open Network Provision and the United States Telecommunications Act of 1996 also mandate non-discrimination. Uniform access pricing deprives the incumbent of its ability to offer a customized menu of tariffs. Access charges should also be allowed to vary to reflect the costs of congestion according to the time of day. This is important, as new entrants cannot possibly compete with the incumbent if it offered off-peak prices to its customers but not to the entrants. However, if such prices are to be regulated, the regulator should have an understanding of the incumbent’s demand patterns.

The other issue is “cream skimming”. Theory suggests that the incumbent be allowed to charge higher prices in a situation where the entrant is motivated to steal the incumbent’s customers and lower access charges for new businesses (Laffont & Tirole, 2000, p. 109). However, this assumes that there are clearly new business segments that the entrant can enter into and are not available to the incumbent by regulation.

7.3.2. Choice of models

TRAI has been advocating forward looking long run incremental costs in order to set access prices. Before adopting any model, it would be best to see the context of its usage and the assumptions under which it operates.

Forward looking cost models were considered by Oftel in 1995, the US Telecommunications Act of 1996, and the European Union. In all the countries, there are well spread out networks with teledensity of more than 40%. In India, the teledensity in fixed line is just 4–5%. Operators including the incumbent should be encouraged to invest so that they can recoup their investment. While the forward looking cost model provides better incentives for static cost efficiency, its impact on dynamic efficiency (investments, innovation) is limited. This approach also requires detailed cost estimates and discretionary powers to the regulator. Moreover, since it precludes the incumbent from making profits in the access business, it provides incentives to exclude competitors. This could lead to a regulatory lobbying, which goes against the “light handed” approach to regulation (King & Maddock, 1999). However, this does not suggest that regulators should accept historical cost models either. The pragmatic approach adopted by TRAI appears to be more acceptable. Such explicit analysis and perspective are missing in TRAI’s documents.
7.3.3. Availability of data

The TRAI has spent more than 2 years arriving at ADC amounts. Obviously, the amounts are likely to be contested both by the incumbent and the private operators. For example, since BSNL had not implemented commercial accounting systems separating several lines of businesses, the basis of ADC computation is open to question. Even with the availability of audited data, allocation of specific cost elements to the calculation of interconnect costs may still be contentious as illustrated in the case. Therefore, TRAI needed to recognize this limitation and validate its approach using a variety of models. Also, specifying a quick review period would have led to greater acceptance and adoption of TRAI based charges.

By adopting a simplistic methodology without a sound basis (bundling all types of services including cellular for calculation of capex), TRAI’s first assessment of ADC in 2003 was very large. There was no need to adopt inappropriate models if TRAI had taken into account developments in economic theory that suggest how costs may be arrived at for access charges. Such considerations could include a rich basis for modelling including social optimality in costs, business stealing by the incumbent, market power of the entrant, etc. (Laffont & Tirole, 2000, p. 104).

To have a broader basis of acceptance, regulators also need to rely on a number of models (such as top down and bottom up variants) to arrive at indicative costs that can be corroborated. For example, BT’s interconnection pricing review is based on management costs (top down) as well as an engineering approach that examines the cost of a hypothetical telecom network of a specified capacity. The top down model incorporates the actual costs involved and provides a check on the bottom up model on what is achievable in practice. In Chile, the access charges for rural operators were determined through a model that reflected the operations of an efficient firm. One of the critical success factors in the deployment of the Telecommunications Development Fund for supporting rural services was the model based on charges that allowed for an efficient assessment when the cost data was not in place (Wellenius, 2002). This is an illustration of using a model in a non-western context. Later developments include aspects related to the asymmetric nature of information that obliges the regulator to “give up an information rent” to efficient firms are econometric tools such as LECOM (Laffont & Triole, 2000). Refinements have led to the development of a cost proxy model (Gasmi, Kennet, Laffont, & Sharkey, 2002, pp. 15–36).

7.4. Technology neutrality

While TRAI professed to be technologically neutral, its perspective that “POTS through wireline is best for a country like India” did not reflect this view. However, during the review, the anomaly in IUC charges for different calls was taken care of and made broadly similar. It is difficult for a regulator to move towards technology neutrality in a single step, either due to a legacy regulatory framework or change of mindsets that such a step entails.

As an example, TRAI did not question BSNL’s deployment of fixed lines for rural areas, despite the existence of commercial availability in the country. In a scenario where a large part of the growth would come from mobile/wireless services, it was important for TRAI to recognize the changing cost and traffic pattern and not base its IUC on the fixed line network of the incumbent.

8. Using IUC for managing the access deficit

“...Much, therefore, depends on the flexibilities available in the existing set of tariffs, i.e. those relating to the NLD and ILD sectors for rebalancing. The current paper would need to factor in changed competitive conditions as well as the feasibility and desirability of using IUC as a means to address the issue of access deficit.” After stating this, the TRAI in its consultation paper of 2003 does not discuss the alternatives for managing AD. It assumes that IUC is the best mechanism to manage AD. There must be deliberations on whether it is indeed so.

USO as a better mechanism to fund AD:

(i) While the review process in October 2003 recognized the inappropriateness of bundling IUC and ADC, their continuation was justified on the grounds that the amounts computed for ADC were now
substantially lower and could be covered by contributions made by service providers to USF. Access pricing is decided in the context of competition, so that the owner of a bottleneck facility can invest in it. Using access prices to manage access deficit is not going to help achieve the goal as specific instruments should focus on different goals of USO. Past experience suggests that urban to rural subsidies may still prove to be a powerful tool for the financing of universal service under competition, where the cost of public funds may be higher than a specified level (Gasmi, Laffont, & Sharkey, 2000). However, this model assumes that there is competition for USO provision, which was not the case in India and hence there was limited applicability of such a model.

(ii) In TTO 2003, the loading of ADC implied that subscribers of all networks that interconnected to the BSNL/MTNL network, in effect, subsidized all subscribers including commercial and urban subscribers of the BSNL/MTNL network.

(iii) While the USO mechanism imposes a cap on subsidy that is based on revenues, the IUC (loaded with ADC) was determined on the basis of “subsidy” that had already been “decided”. BSNL’s valuation at the time of corporatization was historic and hence the gross block and depreciation were historic costs. The review in October 2003 attempted to address this issue in a pragmatic way by using the current audited data of BSNL. The private operators could not provide TRAI with audited data. Consultations and public discussions helped to bring to the fore issues in data availability and TRAI’s adoption of a pragmatic approach.

9. Compliance with WTO guidelines

The WTO guidelines for interconnection do not specify models and mechanisms to set interconnection prices on a fair and transparent basis, although the guidelines mention the use of cost based prices. However, TRAI’s bundling of ADC with USO and relating them only to fixed line connections/operators violates the guidelines since the mechanism to collect ADC is not fair and transparent. Moreover, although the IUC is cost based, its veracity is doubtful, as it is based on BSNL data that had not adopted commercial accounting practices.

TRAI had mandated the publication of the RIO, as per the WTO guidelines, but in practice, it was still under appeal in the courts and hence could not be applied. Moreover, by requiring the publication of the RIO on an unbundled element cost basis, when even the underlying costs were not verifiable (owing to the consolidation of accounts for various lines of businesses), the WTO guideline itself would have been rendered meaningless.

10. Conclusions

The tremendous growth of cellular services and the accompanying competitive challenges to fixed line operators (usually the incumbent) have bought interconnection issues to the forefront. This paper has discussed the role of regulatory agencies in the context of developing countries through a case study of India. While the Indian government set up TRAI as an independent body, its role was limited when it could not enforce interconnections. Besides independence, it is important to vest enforcement powers in the regulatory agency for it to be credible. As a consequence, judicial and political intervention in India has played a critical role in settling contentious issues. This has often delayed the regulatory process.

While TRAI followed a transparent process in “form” through consultation papers and reviews, it needed to augment this by transparency in “processes” (for example, in choosing the basis of cost allocation). This would require more regulatory capability and dependence on expertise in specific areas (such as appropriate cost models). Incorporating the WTO interconnection guidelines within a developing country context has implications for network growth and poses challenges to the regulatory processes.

Although TRAI started with a distortionary, inefficiently priced network providing low coverage and quality, it has meandered its way to a more reasonable network access pricing. The decreasing cost of technology and increasing incomes in India, and political interventions in regulation have put pressure on TRAI to provide lower interconnection charges and faster telecom growth. Thus, it is pragmatic for regulators...
to start with a “quick and dirty” estimate, provided that they can signal the downward trend in interconnection pricing, rather than wait for the “correct” estimates.

Adoption of future looking strategies (IEs), use of a variety of formal models and strengthening of regulatory capacity are necessary steps in fostering a competitive environment. Interconnection regimes set up early in the reform process require review. For successful competition, effective dispute resolution mechanisms and institutions are required.

Appendix A

A significant amount of theoretical and empirical work exists on interconnection pricing and charging (ACCC, 1997; Armstrong, 1998; Gasmi, Laffont, & Sharkey, 1997; Laffont & Tirole, 1994, 1996, 2000; Laffont, Rey, & Tirole, 1997; Michie, 1998).

Some of the regulatory approaches have been rate of return (King, 1997), price caps (Laffont & Tirole, 1996), deaveraged costs (Maher, 1999), and long range incremental costs (Salinger, 1998). Various models have been proposed for “efficient interconnection pricing” (Cave, 1997; Joskow & Tirole, 1998). The setting of access prices to preclude inefficient entry is through the Efficient Component Pricing Rule (ECPR) [Baumol–Willig rule] (Baumol, Ordover, & Willig, 1997; Baumol & Sidak, 1994a; Baumol & Willig, 1987), a variant of the long-run incremental cost plus contribution approach (Economides & White, 1995; Ergas & Ralph, 1996). Interconnection prices using price caps, as practised by Oftel in UK for British Telecommunications interconnection regulation is discussed by Armstrong, Cowan, and Vickers (1994), Cave (1997) and Valletti (1998). The issue of unbundling in the presence of long run incremental costing approach, as mandated by the US Telecommunications Act, 1996, is presented in Crandall (1997), Harris and Kraft (1997), Jackson (2002), Kahn, Tardiff, and Weisman (1999), Kaserman and Mayo (1997), Lapuerta and Tye (1999), Miller (1999) and Sidak and Spulber (1997). Competitiveness in setting MTCs is an issue that has gained significance owing to the rapid growth of mobile services and the need to connect them to fixed services (Crocioli & Veljanovski, 1999; Doyle & Smith, 1998; Wright, 2002).

The paper by Chang, Koshi, and Majumdar (2003) analyses the relationship of infrastructure investments with the regulatory and policy changes in Europe and US. Its extension to a case study in the Netherlands (Cave & Vogelsang, 2003) suggests that competition has facilitated new entry by decreasing interconnection pricing. Further, the entrant’s strategy is influenced by the degree of investment required to be eligible to purchase wholesale interconnection services. The implications of cost based prices for interconnection in relation to other operators not subjected to this requirement in the context of current Europe Union legislation is discussed in Peitz (2003).

Achievement of optimality in access pricing by considering issues of product differentiation, bypass and substitutability are presented by Armstrong, Doyle, and Vickers (1995) and its extension for retail price deregulation to show that level of access pricing rather than margin leads to higher welfare is provided by Armstrong and Vickers (1998). Two way interconnection price setting as a mechanism to bring in efficiency (Haring & Rohlfis, 1997; Laffont et al., 1997) and presence of collusion to set prices at monopoly level are presented by Armstrong (1998), Carter and Wright (1999), and Laffont, Rey, and Tirole (1998a, b). Prices to be charged to a competitor for interconnection are considered in De Fraja (1999), Sibley and Weisman (1998) and Baumol and Sidak (1994b).

Recognizing that the regulator would have very little information on the incumbent, theoretical aspects of setting interconnection prices in the presence of asymmetric information is dealt with by Laffont and Tirole (2000). The regulator’s behaviour in setting prices and revealing information in the presence of unregulated downstream regulation is dealt with in Lewis and Sappington (1999).

Appendix B

Growth of the telecom sector (Table A1).
Appendix C. Calculation of ADC

TRAI argued that ADC was applicable only to fixed service providers as rentals and call charges for cellular and WLL (LM) were to be set by market forces and had not been kept below cost by regulation, [http://www.trai.gov.in/consul25.htm, page 8, point 8].

"Cost-based" rental was assessed on the net block (i.e. the asset value based on historical costs) and investments made during the year which were allocated over the short distance charging centre (SDCC) (the point of applicability of local calls. This had a value of Rs 5120 a year or Rs 424 a month. Ninety-five per cent of the employees’ remuneration and administrative costs were divided by total Direct Exchange Lines (DELs) to arrive at the opex per line. Table A2 gives the capex and opex calculations in detail. Table A3 provides the allocation of capex and opex over the different network segments.

The average recovery of BSNL on the rentals was Rs 165–175 a month. TRAI suggested that the access deficit on rentals resulting from the difference of the cost based rental of Rs 424 and the recovery on rentals of Rs 249–259 be through ADC. To calculate the amount, free calls and “below cost” 300 metered call units provided in rural areas as part of government mandated rural telecom service were factored in. ADC also incorporated the difference in cost based local call charges and regulated charges. The base for computation was on the existing subscribers, a quarterly annual growth of 25% for January–March 2003, and an annual growth rate of 70% over the period April 2003–March 2004 (Table A4).

---

**Table A1**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GDPb (US $ billion)</td>
<td>—</td>
<td>465</td>
<td>484</td>
<td>510</td>
<td>601</td>
<td>691</td>
<td>—</td>
<td>10.41</td>
</tr>
<tr>
<td>Fixed line subscribers (in millions)</td>
<td>17.80</td>
<td>26.65</td>
<td>32.71</td>
<td>38.33</td>
<td>41.48</td>
<td>42.84</td>
<td>46.19</td>
<td>12.66</td>
</tr>
<tr>
<td>Cellular subscribers (in millions)</td>
<td>0.88</td>
<td>1.90</td>
<td>3.58</td>
<td>6.54</td>
<td>13.00</td>
<td>33.69</td>
<td>52.22</td>
<td>66.60</td>
</tr>
<tr>
<td>Tele density per 100 population</td>
<td>1.90</td>
<td>2.81</td>
<td>3.52</td>
<td>4.25</td>
<td>5.10</td>
<td>7.04</td>
<td>9.11</td>
<td>21.65</td>
</tr>
</tbody>
</table>


*Refers to figures as of April 1.

bRefers to figures as of December 31.

**Table A2**

Calculations of capex, depreciation and opex components per DEL based BSNL cost data for year 2001–2002

<table>
<thead>
<tr>
<th>Total number of DELs as on 31.3.2002</th>
<th>33,218,498</th>
</tr>
</thead>
<tbody>
<tr>
<td>As per BSNL audited figures on 31.3.2002 (Rs millions)</td>
<td>87,460</td>
</tr>
<tr>
<td>Depreciation charged during the year</td>
<td>26,321</td>
</tr>
<tr>
<td>Depreciation per line (Rs)</td>
<td>589,220</td>
</tr>
<tr>
<td>Capital works in progress</td>
<td>108,260</td>
</tr>
<tr>
<td>Current assets</td>
<td>170,830</td>
</tr>
<tr>
<td>Current liability</td>
<td>203,690</td>
</tr>
<tr>
<td>Pre-tax weighted allocation of capital</td>
<td>664,620</td>
</tr>
<tr>
<td>Pre-tax weighted allocation of capital percentage (%)</td>
<td>13.8</td>
</tr>
<tr>
<td>Capex component</td>
<td>9158</td>
</tr>
<tr>
<td>Capex component per line (Rs)</td>
<td>2757</td>
</tr>
<tr>
<td>(Capex + depreciation) per line (Rs)</td>
<td>5390</td>
</tr>
<tr>
<td>(Capex + depreciation) per line attributable to telephone services (95%) (Rs)</td>
<td>5120</td>
</tr>
<tr>
<td>Opex</td>
<td>3848</td>
</tr>
<tr>
<td>Employees remuneration</td>
<td>3995</td>
</tr>
<tr>
<td>Administration</td>
<td>7844</td>
</tr>
<tr>
<td>Total Opex</td>
<td>2361</td>
</tr>
<tr>
<td>Opex per line (Rs)</td>
<td>2243</td>
</tr>
</tbody>
</table>

Local call charges were taken on the opex for the network up to SDCC (typically, a sub-district) across the MOU based on the principle of relevant costs. The same principle was used for computing the long distance charges. In this case, the distribution of MOU was done on the portion of the network beyond SDCC. Both originating and terminating charges for fixed to fixed calls were taken as same. Opex was based on annual audited data of 25 metro and circle operators. The usage of 220 min was expected to go up to 250 min.

**Appendix D**

Illustrative IUC charges and prevailing tariff for different type of calls (in Rs; Table A5).

**Appendix E**

The ADC charge per minute of the call after October 2003 review (Rs/min; Table A6).
### Table A5

<table>
<thead>
<tr>
<th>Distance</th>
<th>Inter-circle</th>
<th>Intra-circle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IUC+ADC under uniform ADC regime</td>
<td>Market-based tariffs</td>
</tr>
<tr>
<td></td>
<td>5.10</td>
<td>3.60</td>
</tr>
<tr>
<td></td>
<td>4.80</td>
<td>3.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table A6

<table>
<thead>
<tr>
<th>Access deficit charges</th>
<th>Local</th>
<th>Intra-circle calls</th>
<th>Inter-circle calls</th>
<th>ILD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>0–50 km</strong></td>
<td><strong>&gt; 50 km</strong></td>
<td></td>
</tr>
<tr>
<td>Fixed–fixed</td>
<td>0.00</td>
<td>0.00</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Fixed–WLL (M)</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Fixed–cellular</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>WLL (M)–fixed</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>WLL(M)–WLL(M)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>WLL (M)–cellular</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cellular–fixed</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Cellular–WLL (M)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cellular–cellular</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>


Websites


Glossary

1. ADC: Access Deficit Charges
2. BSNL: Bharat Sanchar Nigam Limited (Incumbent government owned service provider for India, other than for Mumbai and Delhi)
3. BT: British Telecom
4. Capex: Capital expenditure
5. CDMA: Code Division Multiple Access
6. CDR: Call Detail Record
7. CMSP: Cellular mobile service provider
8. CPP: Calling Party Pays
9. DoT: The Department of Telecom
10. FLLRIC: Forward Looking Long Range Incremental Costs
11. FSP: Fixed line service provider
12. GFI: General Framework for Interconnection
13. IE: Interconnection Exchanges
14. ILD: International Long Distance
15. IUC: Interconnection Usage Charges
16. MOU: Minutes of Usage
17. MTC: Mobile Termination Charge
18. MTNL: Mahanagar Telephone Nigam Limited (Incumbent government owned service provider for Mumbai and Delhi)
19. NLD: National Long Distance
20. NTP: National Telecom Policy
21. OFCOM: Office of Communications
22. OFTEL: Office of Telecommunications
23. Opex: Operational expenditure
24. PSTN: Public Switched Telephone Network
25. RIO: Reference Interconnect Offer
26. TDSAT: Telecom Dispute Settlement Appellate Tribunal
27. TRAI: Telecom Regulatory Authority of India
28. TTO: Telecom Tariff Order
29. USF: Universal Service Fund
30. USO: Universal Service Obligations
31. VSNL: Videsh Sanchar Nigam Limited (incumbent partially government owned service provider for international services)
32. WLL (LM): Wireless in the Local Loop with Limited Mobility
33. WTO: World Trade Organization