

Financial Agreements for
Jointly Provided International
Services

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ABSTRACT

Dramatic changes in the structure of the international telecommunications market require that the financial terms and conditions of international agreements be reexamined. Major factors which contribute to this evolution include: competitive entry, technology innovations, and changes in traffic patterns. These market fundamentals have induced changes in the marketing and pricing strategies of service providers. Of particular interest are the implications these changes have for the structure of the international settlements process. In this paper we focus on a discussion of the settlements process and alternatives to current accounting rates policy. Financial terms and conditions which are incentive compatible and better serve the economic interests of all partners in international joint agreements are discussed.

*The authors are respectively District Manager of Market Analysis and Forecasting and District Manager of International Settlements at AT&T. The views and opinions expressed herein are those of the authors and do not necessarily reflect AT&T policy. This is a draft prepared for presentation at the Conference on "Asymmetric Deregulation: The Dynamics of Telecommunications Policies in Europe and the United States", sponsored by the National Science Foundation and the Centre National de la Recherche Scientifique (CNRS), organized by Columbia University, University de Compiègne and OECD, Paris, France, June, 1987. The draft is not to be quoted without permission of the authors.

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I. Introduction

The purpose of this paper is to discuss changes in the market for international voice telecommunications that are having substantial influence on pricing and settlements policies. Traditional international monopoly markets are evolving into competitive ones. In response to customer needs, vendors which once offered a single class of service have begun offering multiple services with several pricing options. These market driven changes in the international telecommunications market imply that service providers and regulatory authorities must re-assess their policies regarding accounting rates. The view that prices should conform to accounting rates must be replaced by the philosophy that accounting rates must reflect the underlying cost structure. The view that accounting rates are somewhat static must be replaced by a willingness to change accounting rates in response to relevant market factors. These considerations lead us to focus on specific options whose implementation would improve the structure of accounting rates.

In Section II we summarize AT&T's philosophy on competition and accounting rates. Section III describes the structure of the international voice telecommunications market and reviews FCC policy. International accounting rate practices are discussed in Section IV. In Section V properties of efficient and incentive compatible settlement rates are derived. Practical impediments to the implementation of efficient accounting rates are discussed in Section VI and suggestions are made for a "reasoned" movement toward incentive compatible and efficient accounting rates. Sections V and VI also give insights regarding the implementation of time of day collection and accounting rates. Section VII gives a summary of principle conclusions.

II. Policy on Accounting Rates and Competition

The tone of AT&T's policy on accounting rates and competition has been articulated by some of its officers in recent public policy forums, see Yates [1985] and Tobias [1985]. The central elements of AT&T's policy position are summarized below:

"In AT&T's view, the institutional challenges to telecommunications competition are: first, to accept its global inevitability -- it cannot and should not, be prevented; second, to manage a swift transition that promotes its growth in an orderly and intelligent way; third, to assure that the full potential of telecommunications productivity is realized.

What we need is a policy environment that will encourage, not inhibit, the development and deployment -- on a worldwide basis -- of various communications services. We need cooperative strategies that promote outcomes in which everyone wins, instead of protectionist strategies that produce win-lose situations. We need to bring international prices in line with costs without shutting out the low-volume, lesser-developed nations from the promise technology has to offer. We need to open international markets to competitive options without jeopardizing local economies or universal telephone service. We need institutional strategies driven by needs for intelligent market-based pricing and innovative services."

III. Structure of the International Switched Voice Market

The international telecommunications marketplace has recently undergone dramatic changes. This is due primarily to forward-looking FCC decisions that encourage and facilitate competition in the international marketplace. The FCC has recognized that "the public interest is best served by removing unnecessary restrictions which bar or inhibit the operation of carriers."¹ The FCC recently issued an Order granting the applications of MCI Telecommunications Corporation (MCI), GTE Sprint Communications Corporations (GTE Sprint) and Satellite Business Systems (SBS) to provide international switched voice services to Canada. This FCC order recognized the importance of extending the benefits of competition to U.S. and Canadian callers; benefits such as

discounted service offerings, broadened customer choice, stimulation of price and service innovation, and creation of incentives for efficient use of resources.²

These initiatives toward creating a competitive international marketplace are well on the way to success. The market for international switched voice services is becoming quite competitive. MCI Telecommunications Corporation (MCI) now provides switched voice services to 44 countries; including some of the heaviest international routes. There are competitive alternatives available in 68% of the top 25 markets. MCI's 1984 annual report stated that, "by the end of 1986, MCI's dial 1 long distance customers could dial direct to over 50 countries, including such major international markets as Japan, France, Italy, Australia, Belgium, Brazil, Canada, Hong Kong, and the United Kingdom."³ GTE Sprint has established service with many of the same nations as MCI. Foreign administrations confronted with new carriers have made a policy decision, based on costs, administrative expense and technology, whether to allow competition. If competition is embraced, then any qualified carrier can be considered for an operating agreement. Therefore, the PTTs have not proven to be a substantial barrier to competitive entry.

In Section 214 applications to establish international switched voice services, MCI and GTE Sprint have repeatedly touted the benefits that competition will bring to American consumers. They have both emphasized that competition will

be beneficial because it will lead to lower prices, will spur innovation and efficiency, lead to more and better services, further stimulate customers demand and usage and lead to price and service innovation by all service providers.⁵

MCI and GTE Sprint have aggressively entered the international voice services market with lower prices than AT&T.⁶ The commission has clearly stated that "rate reductions . . . are obviously beneficial to consumers and precisely the response which we hope competition will produce."⁷ Indeed, the Commission has encouraged such rate reductions and has specifically held that it will "not require efficient firms, even if they are dominant, to maintain prices substantially higher than costs merely to ensure the entry or profitability of less efficient competitors."⁸

IV. International Accounting Rate Practices

Since international calls use jointly owned equipment and facilities of at least two countries, some equitable methods must be negotiated to fairly compensate the partners for the value each adds to the partnership. International service is provisioned on a partnership basis between two administrations. Each provides half the investment, expenses and share of risk. But, because revenue from jointly provided service may not be billed in equal shares by the administrations, a form of revenue sharing through an accounting rate process has been established. Accounting rates can serve this role to the extent that they result in a fair division of two-way revenue between the partners. The United States is represented in accounting agreements with

over 200 countries. Responsibility for transmission of U.S. telecommunications traffic resides with private voice and record carriers. Each of these has its own arrangements for settling international traffic, although the FCC's Uniform Settlement Rates Policy on parallel Routes constrains the freedom of the International Record Carriers (IRCs) to reach separate accounting rates with their correspondents without obtaining an explicit waiver from the Federal Communications Commission. In general, the policy requires an "equal division" of the accounting rate between the U.S. carrier and the foreign PTT. It also specifies that each carrier must use the same accounting rates for like services on parallel routes. Although competition has emerged for voice traffic from the U.S. to other international points, the FCC has determined that the Uniform Settlements Rates Policy also applies to voice carriers.

To understand the financial aspects of telephone message accounting, one must consider the following elements, country-by-country:

- 1.) the level of the collection charges to the customer (called "Collection Rates")
- 2.) the level of the accounting charges established between telephone administrations (called "Accounting Rates" and/or "Surcharges")
- 3.) the units of time chosen to record and account for the calling volumes (expressed in seconds, minutes or pulses)

- 4.) the total calling volume of telephone traffic, in each direction, between administrations (expressed in messages and/or minutes)
- 5.) the rates of exchange between national currencies or the medium of exchange used in settlements (called "Exchange Rates")
- 6.) the costs involved in the establishment and maintenance of telephone service (such as circuit and switching costs, access charges or operator handling expenses)

It is the interplay of these six elements which determines the revenue available for settlement.

The Accounting Rate

For every minute of calling, an administration or carrier collects a charge from its customers called the "collection rate". The sum of all charges to its customers is called Total Billed Revenue (TBR). While most of this revenue comes from domestic originating international calls (i.e. "sent paid" messages), additional monies are derived from calls which are "received collect". The accounting rate is a mutually negotiated value for a minute of calling between two countries, to be divided equally between the parties. If two countries have equal collection charges, the accounting rate would normally be set at the same level. In general, the collection rate of the respective countries are not equal. In such cases an accounting rate is usually chosen which falls somewhere between the two collection charges.

By convention and by international agreement the settlement rate, which equals one half the accounting rate, denotes one correspondent's share of revenue for a predetermined measure of usage, generally a minute. A correspondent's retained revenue equals: Collected Revenue Minus Net Settlements; which in turn is defined by the relationship below:

(collection rate minus settlement rate) *Outbound Minutes

Plus

(settlement rate) *Inbound minutes.

This represents a correspondent's share of the two way traffic revenue stream which results from the joint provision of international telephone service. The net financial impact on an administration of the settlements process is determined by the accounting rate and the ratio of outbound to inbound traffic. Obviously, these factors and their rates of growth are very important in the bi-lateral negotiation of the terms and conditions of international joint agreements. The accounting rate is the critical component of these agreements. It's value is determined bilaterally by assessing the key variables in provisioning two-way service, i.e. price, two-way traffic flows, costs, growth rates, volumes, diversification, transit considerations, and competitive alternatives. The international voice switched market, from the U.S. perspective, is a healthy growing business. A key characterization of this market is that the U.S. typically

has more outbound calling than inbound calling. Figure 1 shows the 1984 intercontinental (less Mexico, Canada) traffic between U.S. and international points. U.S. outbound traffic generally represents 65% of two-way traffic minutes. In only 15 of 126 direct service countries is there more inbound minutes than outbound.

Figure 1 also shows the overall market growing at 17%, but the U.S. outbound traffic component grows at 19% and the U.S. inbound component grows at 14%. Figure 2 shows that the result of these trends is a traffic imbalance in 1984 which yields a net settlement payment to partners of \$0.78 billion.

V. Efficient and Incentive Compatible Accounting Rate Policy

In order to better serve customer needs, it is important that international carriers implement market driven pricing strategies. This applies both to domestic and international collection rates as well as international accounting rates. Many considerations are involved in the determination of appropriate market driven prices. We focus on two fundamental considerations that influence the character of market driven accounting rates:

- 1) incentive compatibility; and
- 2) marginal cost based prices.

Incentive compatibility refers to the principle that both parties to an international inter-linking agreement should find the terms and conditions of such agreements

"satisfactory". The negotiation process should allow both

parties to influence the final terms and conditions in such a way that both parties: (a) have an incentive to adhere to the terms of the joint agreement without need for monitoring; and (b) are better off when the joint agreement is implemented. The economic properties of such accounting rates are discussed in Section V-A.

Marginal cost based prices (or incremental cost pricing) have been recognized in the public utility industry as the preferred pricing philosophy. In the international arena, the application of this philosophy means that collection rates must reflect underlying costs, and accounting rates should parallel collection rates. If U.S. international carriers operate in a truly competitive environment natural forces would drive collection rates toward the appropriate marginal cost. Because of the structure of international traffic patterns, this implies that both collection rates and accounting rates should embody a peak/off-peak price structure. Aspects of a peak load structure for collection rates are discussed in Section V-B.

Given the current structure of collection and accounting rates for international calling and regulatory policies of administrations, the immediate implementation of efficient prices in all segments of the market may not be feasible. Never-the-less, it is important that international carriers begin to move in that direction. Section VI provides insights regarding implementation strategies that achieve

some efficiency gains while balancing concerns about disruptions in the cash flows of correspondents.

V-A. Bilateral Contracts for Jointly Provided International Services

In this section we analyze a bilateral model of international accounting rate negotiation which embodies elements of non-cooperative and cooperative strategic decision-making. The results discussed herein summarize the principle insights, as applied to international telecommunications agreements, of Dansby [1987] which is a general economic analysis of incentive compatible joint production contracts. We assume that each international carrier chooses its collection rates independently. Accounting rates are jointly negotiated in discussions between two international carriers.

We assume there to be two firms which respectively face demand curves $q_i(p_i)$, $i=1,2$. The firms are further distinguished by differences in their production technologies. In order to supply international calls to its domestic customers, the domestic carrier must use its own facilities, and must rely on its foreign correspondent to employ its production facilities to complete each international call.

Suppose each international carrier knows the overall demand q_i for its domestic originating calls. However, each firm is uncertain of the proportion, a_i , of calls which have

a foreign destination. Thus, each firm is uncertain about the level of demand which will require use of its facilities and the production facilities of its foreign correspondent. We assume that firms know the distribution of (a_1, a_2) ; the joint distribution of these random parameters is $f(a_1, a_2)$. Firm i observes the parameter a_i but does not observe realizations of the parameter a_j , $j \neq i$. It is also assumed that neither firm can observe the other's aggregate demand. This structure is a fair representation of the international telecommunications demand environment.

Firm i 's cost of production is denoted C_i . We assume that C_i has three arguments. The first is the total quantity, Q_{ii} , of domestic calls; calls which originate and terminate in country i . The second is the quantity, Q_{ij} , of outbound traffic; international calls which originate in country i and terminate in country j . The third is the quantity of inbound traffic; international calls originating in country j and terminating in country i ; Q_{ji} . Thus the cost function for firm i is

$$C_i(Q_{ii}, Q_{ij}, Q_{ji}) = \text{Cost} \begin{matrix} \text{Domestic} \\ \text{(orig., outbound, inbound),} \\ \text{calls calls calls} \end{matrix}$$

The total output produced and the total production cost incurred by each firm, will depend on the arrangements made to gain access to facilities needed to complete international

calls. The focus of this discussion is the use of negotiated production agreements as a mechanism for consummating joint production.

If the firms do not enter into a joint production agreement, and have access only to their own domestic production facilities, then each will only be able to accommodate $(1-a_i)$ percent of its total demand. Hence, in the absence of a joint production agreement or additional investment in production facilities, the firms will earn profits given by $\Pi_i = (1-a_i)P_i Q_i - C_i((1-a_i)Q_i, 0, 0)$. In this case firm i 's optimal pricing strategy is a contingent price schedule which maximizes profit in each state a_i ;

$$P_i(a_i) = \frac{C_i((1-a_i)q_i, 0, 0)}{Q_{ij}} \left[\begin{array}{c} E_i \\ \dots \\ E_i - 1 \end{array} \right]$$

where E_i is the price elasticity of demand.

If firm i implements its optimal contingent price schedule then its profits will be a non-increasing function of a_i . If the demand q_i is perfectly elastic the optimal profits are unaffected by changes in the proportion of international calls. If the market is not purely competitive then optimal profits will decrease as the proportion of international calls increase. Therefore firm i has greater

incentive to secure access to the correspondent's facilities as realizations of high values of a_i become more likely.

Though realizations of a_j do not affect the profits II_i^* of firm i , absent a joint production agreement, a_j does influence firm i 's incentive to enter into a joint agreement. If q_j is not perfectly elastic then firm j suffers declining profits as a_j increases. Thus firm j 's optimal profit using the contingent price schedule and only its own production facilities will be small if large values of a_j are realized. To this extent a_j affects firm i 's incentive to enter a joint production agreement; firm i will be in a stronger bargaining position if large values of a_j are more likely.

The bargaining power of an administration is influenced by the ratio of its outbound to domestic traffic.

As an example, a small country that has high international revenue versus domestic revenues will have less flexibility and bargaining power in dealing with its international partners. A small change in the accounting rate may have a major impact on overall profitability. The diminished bargain power is reflected in a tendency to maintain the status quo on accounting rates and not to adopt accounting rate policy changes that may place international revenues at risk.

The incentives of international carriers to enter a

joint production agreement are better understood by an examination of their profits in that regime. Let II_i denote the profits of firm i when it operates under a joint agreement. The joint production agreement is a contract which specifies that each carrier makes an irrevocable commitment to cooperate in the joint completion of international calls which originate (terminate) in the respective countries. The joint production agreement provides that firm i supply facilities and service to complete inbound calls, Q_{ji} , and will gain access to its correspondent's facilities and service to complete Q_{ij} of its outbound international calls. The joint production agreement also establishes a set of accounting/settlement rates. Without loss of generality, we let T_i denote firm i 's net payments. The net payments of firm i are assumed to depend on the level of outbound and inbound calls, i.e.

$T_i = T_i(Q_{ij}, Q_{ji})$. If firm i 's collection rate is P_i then profits from its international operations, will be

$II_i = P_i q_i(P_i) - C_i(Q_{ij}, Q_{ji}) - T_i(Q_{ij}, Q_{ji})$
when the joint production agreement is operative.

Contract Negotiation

The firms have an interest in negotiating the terms T of the joint production agreement so as to be incentive compatible. The process by which the terms are negotiated must reflect the firms' independent discretion in the choice of their respective collection rates. Therefore we assume the

negotiation process to have two stages. In the first stage each firm independently selects an optimal contingent price schedule assuming a given value of its potential correspondent's outbound calls. This calculation yields an optimal payoff function and price reaction function for each specification of the contract's terms. In the second state this data is used as the basis for bargaining on contract terms.

Thus, if the market demand for firm i is perfectly elastic, its optimal contingent pricing schedule would set its collection rate equal to the marginal cost of producing its own output, plus the marginal net payments made under the joint production agreement. Price would be set above marginal total cost if demand is not perfectly elastic. The deviation of price from marginal total cost is influenced by the proportion of inbound to outbound calls. More precisely, the optimal collection rate P_i^* equals the elasticity factor $E_i/(E_i-1)$ times:

- 1) the marginal cost of total domestic originating calls; plus
- 2) the proportion of outbound calls times the marginal net cost of international calls. (the net cost of such calls equals production cost plus net outpayments.)

Optimal collection rates are intrinsically related to
and dependent on marginal (incremental) accounting
rates.

When the optimal contingent prices P_i^* are substituted into the profit functions II_i we obtain, for each firm, a function which describes its "best" payoff if the contract terms are T_i . The best response payoff functions are the basis for negotiation in the second stage. Each firm enters this second stage knowing the greatest profits, II_i^* , can achieve for various inbound and outbound call levels and for any proposed net payment schedule. Negotiation in the second stage will result in the specification of a net payment schedule, T_i .

Bilateral Accounting Rates

A general characterization of the incentive compatible net payment schedule is that: the marginal settlement rate for outbound calls plus the marginal settlement rate for inbound calls must be equal to the marginal cost of its firm j 's outbound calls minus the marginal cost of firm i 's outbound calls.

This relationship arises because optimal accounting rates impact optimal collection rates which in turn are based marginal cost. Hence if the marginal cost of the joint outputs Q_{ij} is constant for both firms then the joint

production agreement is incentive compatible if and only if the settlements schedule is given by

$$T_i(Q_{ij}, Q_{ji}) = (\partial C_j / \partial Q_{ji}) Q_{ji} - (\partial C_i / \partial Q_{ij}) Q_{ij}.$$

When incentive compatible accounting rates are employed, collection rates will have the least deviation from marginal production cost and will be efficient.

Another important property of incentive compatible net payment schedules is that there exists an incentive compatible joint production agreement only if the total marginal cost of outbound calls is invariant to changes in the level of inbound calls. Hence incentive compatible contract terms are always achievable if both firms have strictly linear cost functions. However, incentive compatible joint production agreements will not exist if both firms have production technologies which exhibit economies of scope or weak production complementarities in the joint production of inbound and outbound calls. The more likely case is that the cost functions may exhibit economies of scope over some limited range of output.

V-B. Peak Load Prices for the Overseas Market: The Simplest Model

This section discusses a generalization of the Boiteux-Steiner Model of Peak Load Pricing which incorporates the principal aspects of the overseas telecommunications

market. This is a summary of results in [Dansby, 1983]. The principal considerations relevant to developing peak load prices for the overseas market may be summarized as follows:

1. Capacity decisions regarding certain components of the overseas network are made exogenous to the domestic pricing process and several types of capacity, with different cost characteristics, are used to provide service;
2. Prices may have no impact on a portion of the demand on the system, or prices may have an asymmetric impact on domestic and foreign originating demands;
3. Revenues must be divided according to a separations formula that affects pricing incentives; and
4. Profits from the service must satisfy regulatory constraints.

The traditional peak load pricing literature provides guidance concerning pricing impacts of the fourth consideration; but none of the other three considerations are encompassed by existing literature. Consequently, Dansby [1983] generalized the traditional peak load models in order to prescribe optimal peak load prices for the overseas market. This section describes the simplest model which incorporates these considerations and analyzes their impact on the optimal peak load prices. The simplest model is one of bilateral trade; one in which there is assumed to be only one foreign region. In this basic model we first examine the

impact of foreign demands and the settlements process on optimal peak load prices.

Suppose that Q_j and \hat{Q}_j are respectively the U.S. originating and foreign originating demands in period j between the U.S. and the foreign region. Let P_j and \hat{P}_j respectively denote the marginal price per call in period j for calls between the U.S. and the foreign region. It is assumed that Q_j and \hat{Q}_j depend on P_j and \hat{P}_j . However, in keeping with the Boiteux-Steiner framework, the cross elasticities of demand Q_j and \hat{Q}_j with respect to prices in other periods are assumed to equal zero.

For a single bilateral market, with two pricing periods, the public utility's profit from trade with a foreign correspondent during the two periods is

$$II = [P_1 - b]q_1 + [P_2 - b]q_2 - b[\hat{q}_1 + \hat{q}_2] - [T][(q_1 + q_2) - (\hat{q}_1 + \hat{q}_2)] - BK.$$

Here we assume that the settlement rate for calls to the foreign region is a uniform rate T . Thus, the quantity $[T][(q_1 + q_2) - (\hat{q}_1 + \hat{q}_2)]$ is the net settlements that must be paid to the communication concern of the foreign region, since $[T][\hat{q}_1 + \hat{q}_2]$ is received from the region and $[T][q_1 + q_2]$ must be paid to them. The domestic public utility incurs and operating cost $b[q_1 + q_2]$ when serving the foreign originating demands. It is assumed that B is the marginal capital (capacity) cost of the domestic public utility; B includes

the marginal cost of both cable and switching capacity since these facilities are assumed to be expanded in fixed proportion. Any costs associated with the transmission of overseas calls through the domestic network are assumed to be included in the marginal operating cost.

The optimal peak load prices and capacity of the overseas carrier are assumed to maximize welfare which equals profit plus consumer surplus subject to a constraint that demand not exceed capacity. Using standard methods, it is found that the optimal peak load prices and capacity are characterized by

$$P_1^* = [b + B+T] + [b + B-T] \left\{ \frac{\partial \hat{q}_1}{\partial P_1} / \frac{\partial q_1}{\partial P_1} \right\}$$

$$P_2^* = [b + T] + [b - T] \left\{ \frac{\partial \hat{q}_2}{\partial P_2} / \frac{\partial q_2}{\partial P_2} \right\}$$

and

$$K^* = q_1(P_1^*, \hat{P}_1) + \hat{q}_1(\hat{P}_1, P_1^*)$$

where period 1 is taken to be the peak period.

These results show that the optimal peak period price depends on marginal operating and capacity cost but also on the accounting rate and the relative repression of foreign and domestic originating demands, i.e. the ratio R_j of Q_j / P_j to \hat{Q}_j / \hat{P}_j . This ratio appears in the pricing formula because it gauges the impact of a price change on total traffic in a particular period. A price increase will cause total usage in a period to: (1) decrease if the ratio is

greater than minus one; (2) remain unchanged, though the percentage of foreign originating demand increases, if the ratio equals minus one; and (3) increase if the ratio is less than minus one. Note, however, that total usage increases only if the foreign originating demand increases with respect to an increase in the domestic price P_j . Therefore, the ratio R_j reflects the adjustments in prices that must be made in response to foreign originating demands. The optimal off-peak price also depends on R_j . The optimal peak and off-peak prices depend in the same way on the accounting rate, i.e. both prices are functions of $[T] (1-R_j)$, $j=1,2$. This quantity may be viewed as the price adjustment induced by the settlements process. Hence, a lower accounting rate: (1) leads to lower optimal collection rates if $R_j < 1$; (2) leads to higher optimal collection rates if $R_j > 1$; and (3) has no impact on the optimal collection rates if $R_j = 1$. In the case being considered, the incentive compatible accounting rate would equal: (a) marginal operating cost in the off-peak period; and (b) marginal operating plus marginal capacity cost in the peak period.

If marginal production costs are constant, then incentive compatible accounting rates will have a peak/off-peak structure and the associated peak/off-peak collection rates will be efficient in the Boiteux Steiner sense.

Consequently, when settlements rates are not incentive compatible, the optimal peak and off-peak prices may be significantly different from the Boiteux-Steiner prices. The optimal prices for this simple bilateral trade model are equal to the Boiteux-Steiner prices if and only if $T+[b+B-T]R_1=0$ in the peak period, and $T+[b-T]R_2=0$ in the off-peak period; this implies that the prices are equal only if $b/(b+B)=(R_2-1)/(R_1-1)$. However, the optimal capacity level satisfies the Boiteux-Steiner rule that capacity be equal to demand in the peak period.

To illustrate the potential magnitude of the price differences, we consider some special cases. Suppose that any U.S. price change has no affect on total usage in either period, i.e., $r_j=-1$ for $j=1,2$. Then the optimal peak and off-peak prices are respectively $P_1^*=T$ and $P_2^*=T$. Hence, if prices do not affect total inbound plus outbound usage, even though price increases may reduce U.S. originating demands in each period, the optimal pricing strategy is to charge the accounting rate. If the foreign originating demands are unaffected by U.S. prices, then the optimal peak and off-peak prices equal the Boiteux-Steiner prices plus the accounting rate, i.e. if $R_j=0$, $j=1,2$, then $P_1^*=(b+B)+T$ and $P_2^*=b+T$. In this case the Boiteux-Steiner prices are always less than the optimal prices P_1^* and P_2^* . If the foreign originating demands respond in exactly the same way to U.S. price changes as U.S.

originating demands, then the optimal prices are exactly twice the Boiteux-Steiner prices, i.e. if $R_j=1$, $j=1,2$, then $P_1^*=2(b+B)$ and $P_2^*=2b$.

The optimal prices may also be stated in terms of the ratio r_j of foreign originating to domestic originating demand in each period, if the ratio of foreign to domestic demand in period j is invariant to the price level. This would be consistent with the widely discussed view that "every domestic originating call begets a certain number of foreign originating calls. Consequently, if the "every call begets a call" hypothesis is empirically true, then the optimal pricing rules may be empirically evaluated using the formulas

$$P_1^*=(b+B)(1+r_1)+[T](1-r_1)$$

$$P_2^*=b(1+r_2)+[T](1-r_2).$$

An important implication of these results is that if $T > b+B$, then the optimal peak and off-peak prices increase as the fraction of foreign to domestic demand decreases. This again emphasizes the need for incentive compatible accounting rates and collection rates which have the "correct" economic relationship.

VI. Innovative Accounting Rate Policy

Some aspects of the efficient/incentive compatible settlement rate structures discussed above may not be practical to implement in the short run. For example, the FCC's Uniform Settlements Policy for Parallel International

Communications Routes (cc Docket No. 85-204) requires "all carriers providing the same service to the same foreign point to have the same accounting, settlement, and division of tolls arrangements with the foreign administration". Our examination of efficient settlement schedules have shown that the rates should be related to the marginal cost of the correspondents because accounting rates should reflect the structure of collection rates. The latter of course should be related to marginal costs.

Consequently, it may be efficient and incentive compatible for two U.S. carriers to have different accounting rates with a foreign correspondent if the U.S. carriers have different cost structures. The desire to promote competition would in fact be consistent with the implementation of different settlement rates if the firms have different costs. In the long run, as competitive pressures drive out high cost providers, all firms might be expected to have similar costs. But certainly this could not be expected in the short run. As a result of these considerations, it is clear that current regulations of the FCC and of foreign administrations may limit the ability of international carriers to adopt fully efficient, and incentive compatible pricing structures (as applied to collection and accounting rates). It is important therefore that international carriers identify pricing strategies that improve the status quo while continuing to move toward market driven price structures.

Various international carriers have begun to implement time of day collection rate structures. The results in previous sections indicate that efficiency requires that a time of day structure also be implemented for accounting rates. Since time of day accounting rates will depend on traffic patterns, it is clear that these may differ among carrier pairs. None-the-less this departure from status quo practices appears appropriate. Since settlement rates should reflect the underlying marginal costs incurred by parties to the joint agreement. Implementation of incentive compatible settlement rate structures would also require departure from status quo accounting rate practices. Typically the settlement rates for partners to a joint agreement are identical. That is, the settlement rates applied to inbound and outbound calls are the same. As indicated in Section V-B, incentive compatibility may require that different settlements rates be applied to inbound and outbound calls. The extent of any differential treatment will depend on the relative marginal costs of the partners. Perhaps even more problematic is the fact that incentive compatible settlement rates themselves may change as the levels of inbound and outbound traffic changes. This will occur if the cost functions of the partners exhibit increasing returns to scale. Finally, existing settlement rates generate levels of revenue for correspondents which foreign PTTs may be reluctant to give up.

Some of these impediments to changes in the structure of settlement rates may require enactment of FCC and Foreign Administration policy changes. However, some movement toward incentive compatible, efficient, settlement rates can be achieved within the current regulatory framework. Strategies that warrant consideration are the implementation of accounting rates which are more efficient but which preserve status quo profit levels of correspondents. The implications of such policies are discussed below.

Towards Implementation

The challenge that the industry faces is in adopting efficient financial arrangements between the two partners that reflect the changes that have taken place in our industry and can take advantage of the opportunities available in the future. The international telecommunications market has evolved from a monopoly environment providing only a basic switched service to a highly competitive global market with multiple suppliers providing a range of services and multiple pricing options. The nature of today's global economy makes it necessary that all administrations move toward a market focused orientation, even in countries where there is no conventional alternative supplier. For the large multinationals, global information management has become a necessity. These customers already have alternatives to the established carriers either through building their own dedicated international networks or by

relocating their information based operations to countries with efficient and flexible international telecommunications networks. In addition, as telecommunication technology continues to drive down the unit costs of communications, administrations need to pass these benefits to the international users and eliminate cross subsidies with other telecommunication services and programs.

The accounting rate level, and structure, needs to evolve to match the new competitive environment. Without a change, the current structure and levels of accounting rates will become a major factor in retarding the development of efficient, low cost international telecommunications that meet the needs of a global economy.

Accounting rates are established as a revenue sharing mechanism whereby the accounting rate level was set at a level approximately equal to the collection rate that each administration charged. The initial flat rate structure of the accounting rate was consistent with the flat rate collection rate structure that administrations initially used for international services. The relationship of the accounting rate to the underlying unit cost of provisioning international service was closely aligned when the initial accounting rate levels were set. For a monopoly environment, this philosophy was appropriate and equitable and insured a financial commitment by both partners. For a competitive,

marketing oriented environment the guiding principles should be to:

- o Establish accounting rate levels that reflect the character of the underlying cost of provisioning the international.
- o Establish accounting rate levels and structures that create financial incentives for both partners to stimulate and grow their respective markets profitably. Each transaction should be incrementally profitable.
- o Establish accounting rates that provide fair compensation to the partner terminating the imbalance of traffic.

Establish Accounting Rates Based on Underlying Costs

The international market has enjoyed the advantage of continuous cost reduction. During the last fifteen years, the cost of Intelsat lease satellite facilities has declined eight fold from an average cost of \$32,000 per year in 1965 to \$4,680 by 1981. The annual cost for cable facilities has followed a similar pattern with reductions from TAT-3 annual charges of \$49,000 in 1963 to projected annual cost of \$2,500 for TAT-8 in 1988. Network efficiencies have also improved over this period, due to more efficient routing and larger trunk group sizes. This has resulted in savings and efficiencies for each administration which were translated

into lower collection rates for international calling.

As collection rates decline, it is necessary that accounting rates be adjusted in order to maintain the efficiency of pricing relationships in the international market. Efficiency in the market can only be attained if collection rates and accounting rates bear the correct economic relationship. The nature of these relationships can be illustrated using the peak load prices discussed in Section V-B. In this simple case, the optimal peak/off-peak collection rates were shown to be dependent on marginal production costs, the accounting rates, and the ratio of foreign to domestic originating demands in a particular period.

Efficient peak/off-peak collection rates should be equal to marginal cost in the respective periods. The relationship between collection rates and accounting rates can be seen by comparing both to the efficient collection rates. In any peak/off-peak period, it follows from the discussion on page 24 that

$$\frac{\text{Collection Rate}}{\text{Efficient Collection Rate}} = \left[1 + \frac{\text{Foreign Org. Demand}}{\text{Domestic Org. Demand}} \right] + \left[\frac{\text{Accounting Rate}}{\text{Eff. Coll. Rate}} \right] \left[1 - \frac{\text{Foreign Org. Demand}}{\text{Dom. Orig. Demand}} \right]$$

This relationship holds for a given period for

international calls originating in a given pair of countries.

This shows that as the collection rate deviates from the

efficient collection rates the optimal collection rate must also deviate from the efficient collection rates; and vice versa. Hence, the downward adjustment of collection rates in response to declines in the cost of providing international service dictates that accounting rates also be reduced if the market is to remain efficient. When accounting rates are set equal to the efficient collection rates, the most profitable arrangement is to then set efficient collection rates, irrespective of the ratio of inbound to outbound traffic. However, when accounting rates are not equal to the efficient collection rates, then the ratio of inbound to outbound traffic has a substantial influence on the most profitable collection rate. These relationships are illustrated in Figure 3. Any specific line shows the relation between the most profitable collection rates and accounting rates for a given ratio of inbound to outbound traffic. Figure 3 shows that if $r < 1$ then the accounting rate should be reduced as the collection rate declines. If $r > 1$ then the accounting rate should be increased as the collection rate declines. In any bilateral market, the ratio of inbound to outbound traffic will be greater than one for one partner and less than one for the other partner; the only exception being the case of balanced traffic. Consequently, the implementation of more efficient accounting rates may require further adjustments in collection rates.

If one administration continues to reflect the economies of lower facility costs in lower collection rates and the other does not, then typically, the additionally stimulated traffic causes an even greater imbalance in the two-way traffic between countries. The decision to not lower collection rates in the country of origination as facility costs are lowered, is a national issue. However, by not lowering the accounting rate over time to reflect the changes in costs, an administration can effectively prevent the other partner from reducing their collection rates since to do so will result in reduced profitability and thus hinder overall growth of market. Thus, accounting rates which deviate from the efficient level create serious disincentives that retard the development of low cost, efficient international services.

Matching Accounting Rates with Collection Rate Structures

One of the largest disparities that exists with the settlement arrangement is the flat rate structure of the accounting rate. The original concept of the accounting rate reflected revenue sharing by establishing an accounting rate level that was typically the average between the two collection rates charges by both administrations. Those initial collection rates were also flat rate, and not time-of-day sensitive. As time-of-day rates were introduced in the domestic collection rate plans of each administration, they

were naturally extended into international calling. Thus , reflecting the principles of creating efficient utilization of investment by shifting traffic to off-peak periods. The savings that accrued to each administration from lower facility costs and network efficiencies were the basis for lower collection rates to the consumer. However, in most cases the accounting rate agreements were not changed to reflect the time-of-day nature of the collection rates. The time-of-day collection rate structures have proven to be efficient pricing strategies that have not only moved traffic away from the peak periods but also have stimulated additional call volumes in the off-peak periods. The flat rate nature of the accounting rate now creates diseconomics for promoting and stimulating traffic.

As an example, the following is a comparison of two different accounting rate structures for the U.S. to Japan and U.S. to U.K. markets. The U.S. - Japan market is characterized by a financial arrangement which has a flat rate accounting rate. Combining this with a collection rate plan that is time-of-day sensitive creates significant diseconomics for stimulating and expanding this market. The revenue margin (Collection Rate less 1/2 Accounting Rate) available to U.S. in this example shows that to stimulate additional incremental calls through either promotion, stimulation, or pricing alternatives will yield unacceptable returns once operating expenses are deducted.

| <u>Rate period</u> <u>Dial traffic</u> | <u>Average Price*</u> <u>per Minute</u> | <u>One half</u> <u>Accounting Rate</u> | <u>Revenue</u> <u>Margin</u> |
|---|--|---|---------------------------------|
| Standard | \$1.58 | 1.17 | \$.40 |
| Discount | 1.20 | 1.17 | .03 |
| Economy | .95 | 1.17 | -.22 |

The impact of the flat rate accounting rate is such that the revenue margins, before the originating operating cost are deducted, have negative incremental margins in the off-peak periods have negative incremental margins. This structure prevents the expenditure on any additional stimulation or promotion plans to this market to increase off-peak outbound calling for the U.S.

In contrast, the U.S to U.K. market has a time-of-day accounting rate structure of \$1.06 peak and \$.76 off-peak. the traffic imbalance for this traffic stream is such that the U.S. sends more traffic to the U.K. than it receives. The revenue margin for this traffic from the U.S. perspective is the following:

| <u>Rate period</u> <u>Dial traffic</u> | <u>Average Price⁹</u> <u>per Minute</u> | <u>One half</u> <u>Accounting Rate</u> | <u>Revenue</u> <u>Margin</u> |
|---|---|---|---------------------------------|
| Standard | \$1.06 | \$.53 | \$.53 |
| Discount | .80 | .53 | .27 |
| Economy | .64 | .38 | .26 |

The accounting rate structure has created an efficient and strong financial incentives to stimulate incremental calling for each rate period for this market.

Moving the accounting rate to a time-of-day structure should be the preferred accounting rate structure where collection rates are time-of-day sensitive. This is in

keeping with a revenue sharing concept that would reflect lower accounting rates where lower collection rates are deemed appropriate. The principle that should be followed is that the accounting rate should parallel the structure of the collection rate. Implementation of both lower accounting rates and time-of-day structure are the most appropriate steps for aligning the financial arrangements between partners.

Recognize the Need to Transition

Another factor that weighs heavily in the decision to move to a more efficient financial arrangement is the impact of reducing the net settlement amount. For a two-way traffic stream that is relatively balanced, moving to a peak/off-peak structure results in small net changes in the net settlement. As the traffic stream becomes heavily imbalanced (i.e. one partner generating more than 60% of the two-way traffic) then a change in the accounting rate to time-of-day will significantly change the net settlement. In a growing traffic stream this impact can be mitigated by recognizing the need to make a gradual transition to the appropriate structure and establish several interim rate steps over a two or three year horizon to reach the end objective. Moving away from the conventional application of a 50/50 flat rate accounting rate structure should also be considered, if it can achieve a more market oriented financial structure. One accounting rate structure recently agreed to in the U.S. was a growth based accounting rate structure. This would have a two tier accounting rate of for example \$2.50 and \$1.50. The current accounting rate level of \$2.50 would be maintained

for a predetermined historical level such as year 1986. All future traffic up to the 1986 level uses the \$2.50 accounting rate. Growth traffic from either administration above that level would be settled at the lower accounting rate of \$1.50. This approach would provide a combination of both achieving settlement stability and provide attractive incentives for both partners to stimulate additional traffic profitably.

VII. Summary

In summary, the accounting rate level and structure play an important part in collection rate policies in both administrations. Fundamental changes need to take place in these financial arrangements, especially in those markets heavily competing in a global economy. The recommended actions would include:

- o A general lowering of accounting rate levels to reflect the lower unit cost in provisioning international services;
- o Developing accounting rate structures that match the collection rate structure of the two-way market; and
- o Recognize the transitional problems of achieving an efficient settlement structure by adopting where necessary non-conventional financial arrangements that provide incentive for both partners to grow and stimulate two-way traffic.

Notes

1. Overseas Communications Services, 92 F.C.C.2d 641, 653 (1982), recon. denied, FCC 83-492, released October 28, 1983. Other recent decisions in which the FCC has sought to promote free and open competition in the international communications marketplace include:

Modifications of Policy on Ownership and Operation of U.S. Earth Stations That Operate with the INTELSAT Global Communications Satellite System, CC Docket No. 82-540, Report and Order, FCC 84-705 released December 18, 1984 (Earth Station Ownership); Proposed Modification of the Commission's Authorized User Policy Concerning Access to the International Satellite Services of the Communications Satellite Corporation, CC Docket No. 80-170, Second Report and Order, FCC 84-633, released January 11, 1985 (Authorized User III); Changes in the Corporate Structure and Operations of the Communications Satellite Corporation, 97 F.C.C.2d 145 (1984) (Comsat Structure); and Regulatory Policies Concerning Direct Access to INTELSAT Space Segment for the U.S. International Service Carriers (Direct Access), CC Docket No. 82-548, FCC 84-129, released April 24, 1984.

2. Order, Authorization and Certificate, File Nos. I-P-C-83-052, I-P-C-84-158 and I-P-C-84-160, released April 16, 1985, para. 8 ("April 16 Order"). Allnet Communications Services, Inc. has announced that it will extend its services to Canada Telecommunications Reports, May 20, 1985, Volume 51, No. 20, p. 40.

3. MCI Communications Corporation, Report to Stockholders for the Twelve Months Ended December 31, 1986, p. 10.

4. The rapid inroads of competition in the voice market result from factors which are generating a strong influence on even the most reluctant of foreign administrations. As the Commission's former General Counsel characterizes the current situation:

There are...stirrings and changes afoot in many parts of the world outside the U.S. Telecommunications administrations are responding to common pressures created by new technologies, the demands of users for access to the latest information services, and a keen concern about stimulating the development of new high technology industrial sectors.

Prepared Statement of Robert E. Bruce before the Subcommittee on International Operations and International Economic Policy and Trade of the Committee on Foreign Affairs, U.S. House of Representatives, March 6, 1985, p. 20. Mr. Bruce was General Counsel of the FCC from 1977 to 1981. Now in private law practice, he is conducting a seven-country study of telecommunications policies under the auspices of the International Institute of Communications. Mr. Bruce emphasized: "[I]t overstates the case," "to argue that, on the other side of the Atlantic and the Pacific, there is a cartel of postal, telegraph and telecommunications

administrations (PTTs) that are monolithically and predictably resistant to new competitive initiatives."

5. MCI Application to provide its authorized services, including switched voice services, between the U.S. and Canada, File No. I-T-C-83-052, filed March 30, 1983, p. 10; GTE Sprint Application to provide international switched voice service between the United States and the United Kingdom, File No. I-T-C-85-016, filed October 17, 1984, pp. 4-5.
6. Following its consistent, domestic pricing strategy, MCI has priced its international services to the countries it presently serves at savings of 5% to 30% off AT&T's prices. GTE Sprint plans to offer straight discounts of 10% to 15% from AT&T rates. If and when AT&T lowers its rates, GTE Sprint has indicated it will respond with even lower rates in response, keeping the 10% to 15% margin.
7. In the Matter of AT&T Communications Revisions to F.C.C. No. 263, Transmittal Nos. 204 and 263, released January 3, 1985, para. 11.
8. Id.
9. Based on an average 10 minute call.

Bibliography

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Dansby, Robert E., "Negotiated Production Agreements", Working Paper, February, 1987.

Tobias, R. L., "Future Prospects of Global Telecommunications", World Telecommunications Conference, London, England, December 4, 1985.

Yates, C. E., "The Institutional Challenges to Competition", Interlevants 85, Cannes, France, September 23, 1985.

FIGURE 1

- U.S. BILLS MORE MINUTES IN SWITCHED VOICE SERVICES THAN FOREIGN PARTNERS IN 111 OUT OF 126 DIRECT SERVICE COUNTRIES.

1984 INTERCONTINENTAL

BILLED MINUTES

| | |
|-------------------------|------------|
| U.S. OUTBOUND | 1.79B |
| PT&T OUTBOUND (TO U.S.) | 1.04B |
| IMBALANCE | <hr/> .75B |

U.S. - FOREIGN MINUTE IMBALANCE

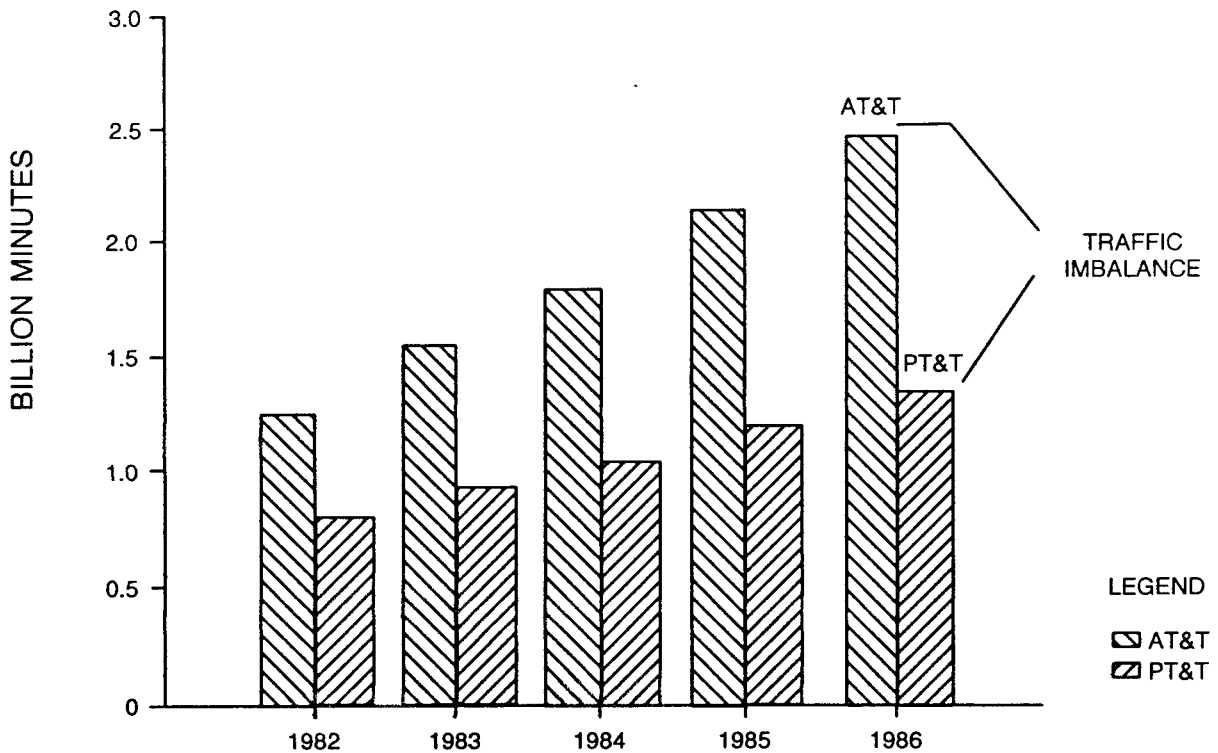


FIGURE 2

INTERCONTINENTAL TRAFFIC

1984

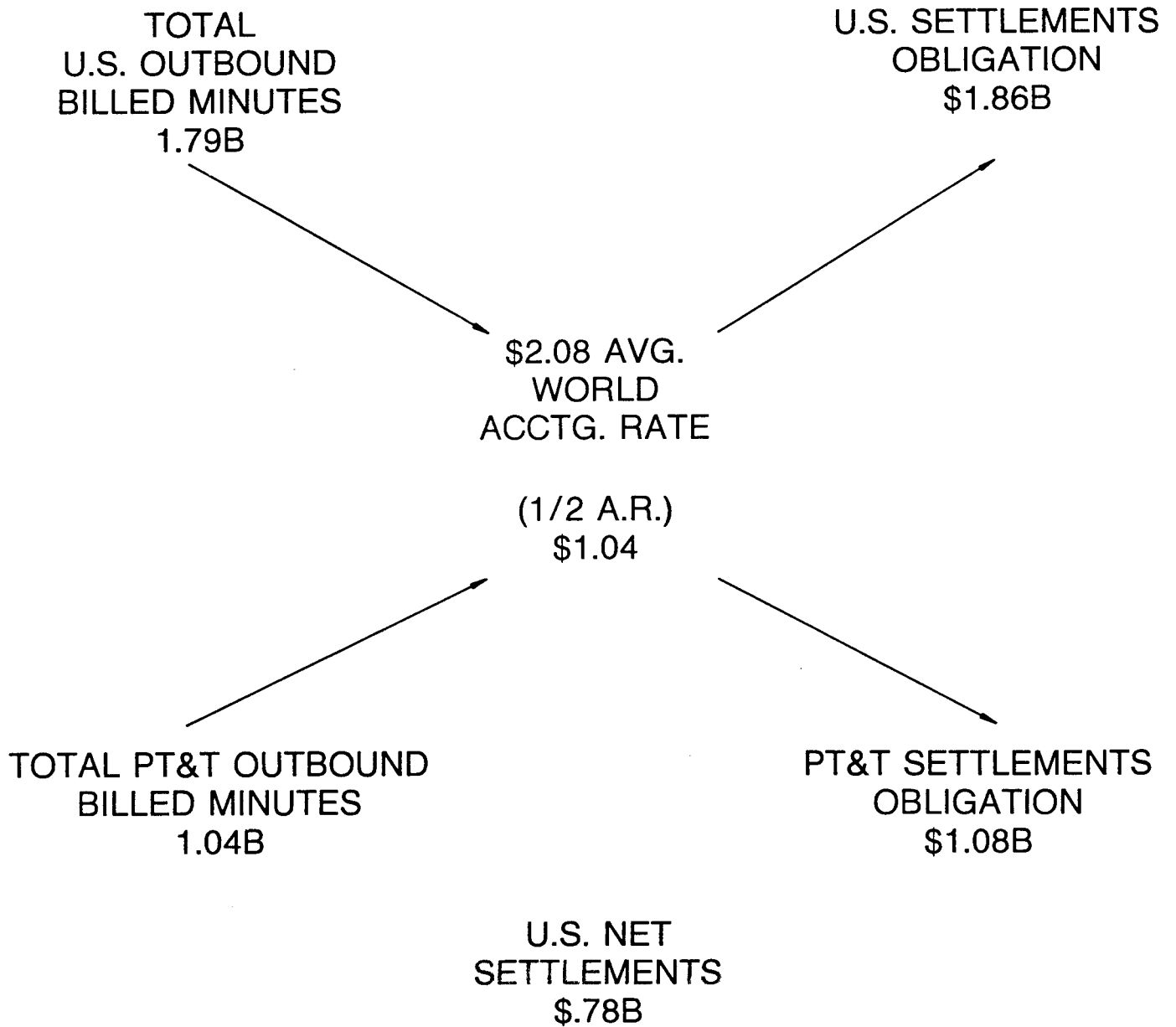
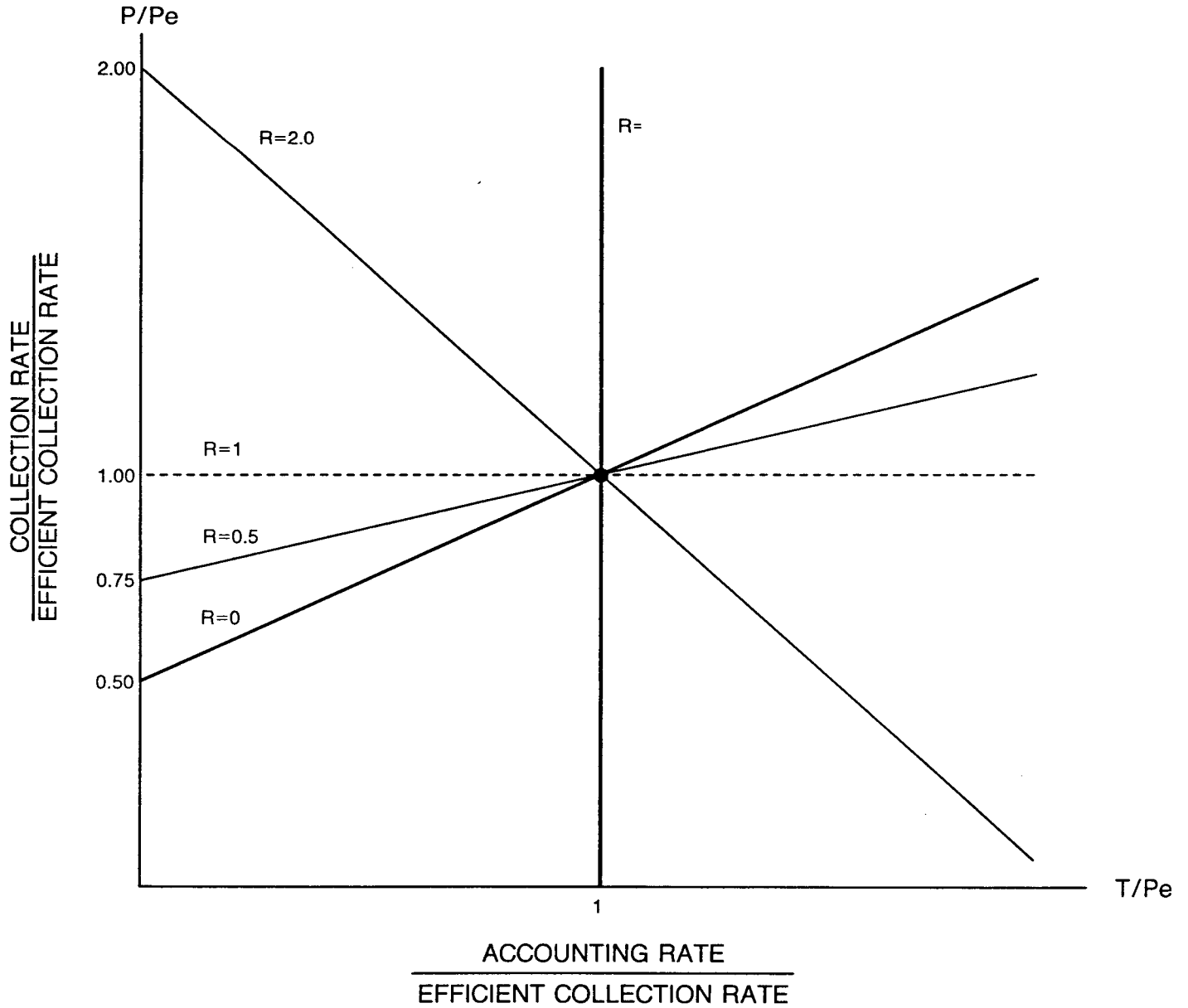


FIGURE 3

DEVIATIONS FROM EFFICIENT
PEAK/OFF PEAK PRICES



$$R = \frac{\text{INBOUND MINUTES}}{\text{OUTBOUND MINUTES}}$$

$$\frac{P}{P_e} = \left(\frac{1+R}{2} \right) + \frac{T}{P_e} \left(\frac{1-R}{2} \right)$$