

# **Where Have All the Minutes Gone? Asymmetric Telecom Liberalization, Carrier Alliances, and Gaming of International Settlements**

by

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## **Abstract**

Inflated retail prices and termination rates for international telecommunications have spawned traffic re-routing practices, including call turnaround (e.g., callback) and re-origination via third countries. The US and other liberalized countries that allow telecom competition favor such practices, as undermining foreign monopolists. This view is seriously incomplete; re-routing practices ultimately may favor monopolists. Specifically, we show the following: (1) Re-routing practices, especially turnaround, can help foreign monopolists—allied with carriers in the US (or other liberalized markets)—to divert termination payments from nonalliance carriers by gaming the International Settlements Policy; the ISP aims to bolster competitive carriers in dealing with monopolists, by requiring equal termination rates at both ends and “proportional return” (traffic from the monopolist is terminated by US carriers in proportion to their shares of traffic to that country, not at the monopolist’s discretion). (2) Gaming the ISP harms not only other carriers but typically also callers. (3) Proportional return creates distortions even without foreign gaming: it penalizes larger carriers; and because of it, callback from the US can reduce US welfare even when callback is motivated by “innocent” arbitrage. We present a simple linear-pricing alternative to the ISP that eliminates these distortions, yet benefits both countries.

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## I. INTRODUCTION AND OVERVIEW

### A. The IMTS Market, Termination Settlements, and Whipsawing Concerns

International Message Telephone Service (IMTS) is basic telecommunications traffic, such as phone or fax, metered at the carrier's switch ("switched traffic") and billed by the minute. The originating carrier normally collects a retail price from the caller and pays a termination charge to the carrier abroad. While exact revenue data are not available for most countries, worldwide IMTS revenue runs in the tens of billions of dollars; in 1996, IMTS revenues of US carriers alone exceeded \$14 billion, of which \$5.4 billion were net termination payments to foreign carriers (US Federal Communications Commission (FCC), 43.61). Despite the growth of private lines—whereby capacity is leased for a fixed charge regardless of usage—and of Internet telephony, IMTS traffic is projected to remain substantial for some time.<sup>1</sup>

IMTS charges are strikingly above costs, both for sending and for terminating calls. The 1996 average price per minute of international calls from the US was 88¢, but 13.5¢ for US long distance calls, despite minimal cost differences (FCC, 1997a). The 1996 traffic-weighted average termination rate paid by US carriers abroad was 35¢ (*id.*); yet the FCC (1996) estimates foreign carriers' long-run incremental cost of termination at "no more than 6-9¢." Our focus is the inflated termination margins. These reflect the persistence of monopoly in many countries; inflated margins also survive in some liberalized countries, despite the presence of competing carriers, due to anti-whipsawing measures against foreign monopolists, as explained next.

For many years *all* countries had telecom monopolists (state owned except in the US), which negotiated bilateral termination rates that were almost always equal at both ends.<sup>2</sup> Since

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<sup>1</sup> Internet telephony sends traffic as packets, not through dedicated circuits, and avoids access charges under today's technology and regulatory regimes. Estimates vary widely, but generally project the Internet's share of all international voice and fax traffic five years hence at under 30%.

<sup>2</sup> In the parlance of international telecom, the traditional settlements process is called the Accounting Rate Regime. The symmetry feature is called equal division of the "accounting rate," whereby a carrier pays its foreign correspondent a "settlement rate" equal to half their negotiated accounting rate, on the imbalance of traffic. The "settlement rate" is what we will interchangeably call the termination rate; retail prices are also known as "collection rates" (collected from customers).

the 1984 breakup of AT&T, the US allowed competition for IMTS traffic, followed by other countries such as the UK, New Zealand, Finland, and Sweden. However, the US and others recognized the dangers of asymmetric telecom liberalization. Because the foreign link is a vital input, unrestricted foreign monopolists could appropriate much of the gains from US competition (Kwerel, 1984, 1994; Johnson, 1991).<sup>3</sup> By playing off competing US carriers against each other (“whipsawing”), a foreign monopolist could drive US termination rates down to marginal cost, while charging monopoly prices for calls from, and for termination in, its country.

To limit whipsawing, the US adopted a set of measures known as the International Settlements Policy (ISP). Although we shall focus on the US, the analysis is relevant to any liberalized country that has adopted similar policies, such as the UK, or contemplates doing so. The ISP has two provisions: (1) *symmetric termination charges*—the foreign carrier must have the same (negotiated) rates with all US carriers, and the rates must be equal at both ends (maintaining the traditional symmetry arrangements that would otherwise be upset by competition in the US); and (2) *proportional return*—US carriers are required to accept traffic from the foreign carrier for US termination only in exact proportion to their shares of traffic from the US to that country.<sup>4</sup> Proportional return aims to prevent a foreign monopolist from pressuring competing US carriers for concessions—such as to accept a higher (symmetric) termination rate where the net outflow of traffic is from the US—by threatening to divert the highly profitable return traffic from a recalcitrant carrier to others. A key point for our purposes is that by mandating symmetry, the ISP has maintained well above cost the settlement rates paid to US carriers for terminating traffic from numerous monopoly markets.<sup>5</sup>

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<sup>3</sup> We use “monopolist” broadly, to include dominant carriers that face only minimal competition, and will speak of the home countries of such carriers interchangeably as “monopoly” or “closed,” as distinct from ones that are “competitive,” “liberalized,” or “open.”

<sup>4</sup> Other countries that use proportional return include Finland, Sweden, and the UK. The UK incorporates it in the licenses of its international carriers, while the FCC issues formal rules.

<sup>5</sup> The FCC in 1996 relaxed its ISP rules towards countries where there is significant competition, allowing US carriers more flexibility to negotiate individual arrangements. Termination rates and retail prices for traffic between some liberalized countries have fallen dramatically. For example, the settlement rate between the US and Sweden (the lowest rate at the time) has dropped to 8¢ (FCC, 1997a).

Inflated retail prices and termination rates have spawned a host of ingenious practices that re-route traffic, as noted prominently even by the popular press (Cairncross, 1997). These include call *re-origination* (or “refile”)—routing a call from country A to B via an intermediate country C, to make it appear as though it originated in C; and call *turnaround* (or “callback”)—reversing a call from A to B into one that appears to have originated in B and incurs termination charges in A.<sup>6</sup> Liberalized countries generally view such schemes favorably, as arbitrage that undercuts the inflated pricing by foreign monopolists (see e.g., OECD, 1997, which also provides useful background information). Call turnaround is seen as letting callers from monopoly markets pay the lower US retail prices, while also increasing US carriers’ retail revenues; re-origination is seen as exploiting wide differences, which are not cost based, between a destination country’s termination rates with various other countries.<sup>7</sup>

This paper cautions against this benign view. There is a growing risk that the same re-routing practices, especially call turnaround, could be used by dominant foreign carriers—with ally carriers in the US—to manipulate the ISP. The alliance’s gain need not derive from arbitrage; it can derive from reducing the number of minutes which the foreign carrier must terminate with nonalliance US carriers, thereby diverting termination profit from them while still complying with the letter of the ISP rules. Given proportional return, reducing termination profit to US carriers harms also US consumers, by inducing higher prices for calls *from* the US. We also identify distortions created by the ISP’s proportional return rules beyond foreign

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<sup>6</sup> Early callback methods relied on making a short call, and requesting a return call, while modern methods are more sophisticated (see fn. 9). We prefer “turnaround” over “callback” since it connotes that the call direction is reversed for billing (and hence, settlement) purposes and that the methods used go beyond literal callback. But following industry practice, we shall use the terms interchangeably.

<sup>7</sup> Another way to avoid inflated termination charges is by using private lines, which bypass the settlements system entirely. Liberalized countries have recognized the incentives of foreign monopolists to send their IMTS traffic into liberalized markets via private lines, then connect it to the public network for termination as domestic calls—while denying comparable bypass opportunities in the other direction. Liberalized countries have restricted such one-way bypass, e.g., by barring “international simple resale” (sending switched traffic via private lines) from countries that do not allow it to their markets. In contrast, traffic re-routing practices, such as callback and re-origination, have been viewed sympathetically.

manipulation, and discuss policy reforms.

One-sided traffic manipulation via alliances takes on greater urgency today for two reasons. First, the 1997 WTO Agreement on Basic Telecom Services requires any signing country to apply its market-opening commitments equally to all WTO countries, regardless of how open these other markets are. Countries' commitments vary considerably, however, and the pace of implementing these commitments also is likely to vary (Frieden, 1997; Oliver, 1998).<sup>8</sup> During this asymmetric transition to global competition, liberalized countries could become more vulnerable to one-sided gaming of settlements by carriers from closed markets.

Second, the potential for traffic re-routing has grown significantly with recent advances in technology and with widespread participation in re-routing schemes by traditional carriers, not only by independent resellers (Blake, 1997; Scheele, 1997).<sup>9</sup> US-Hong Kong traffic flows, shown in Figure 1, provide a dramatic illustration. Between 1986 and 1992, traffic in both directions grew at about the same rate; between 1992 and 1996, traffic to the US remained essentially flat, while traffic from the US almost quadrupled. The main reason is growth of callback (HKTI, 1997; Lam, 1997). In 1992, US carriers (notably MCI and Sprint) contracted to provide Hong Kong callback operators low-priced wholesale minutes from the US. These Hong Kong operators

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<sup>8</sup> The FCC, among others, recognizes that, even with the WTO Agreement, bringing down monopoly settlement charges through competition will take time. Despite a ground swell of foreign opposition to its 1997 Benchmarks Order, which caps the settlement rates US carriers may pay foreign carriers, the FCC has retained this policy. For at least two reasons, the Benchmarks Order does not negate concerns with gaming of the ISP. First, questions remain about the Order's legal status and operational effectiveness (what happens if US carriers refuse to pay rates above the FCC benchmarks and foreign carriers balk?). Second, the stipulated FCC benchmarks still leave settlement rates to many foreign countries well above costs for a number of years, especially for developing countries—where much of the traffic growth is likely to occur. Moreover, even if effective, the FCC's policy would cover only US carriers, not those from other liberalized countries.

<sup>9</sup> Regarding technology, early callback methods relied on uncompleted call signaling from the foreign country: a subscriber would dial a subscriber-specific US number and hang up, and the US computer would recognize the hang-up and initiate a callback to the subscriber's pre-determined number in the foreign country. In contrast, modern "callback" technologies employ out-of-band signaling, whereby the information pertaining to the desired call (e.g., destination number, caller's account) travels independently from the call itself (e.g., over data networks, the Internet, or private lines). Thus, the callback switch in the US would process the signaling information, and rapidly provide the necessary link(s) from the US with little noticeable difference as compared to a direct call.

deployed computer technologies that virtually eliminated calling delays and made the service seamless to the callers. Callback was used both to reverse US-bound traffic and to link Hong Kong with third countries via two calls from the US—one to the third country, and a “callback” to Hong Kong.<sup>10</sup> A major factor in callback’s growth was the entry in 1995 of three local carriers, who also offered international services in competition with HongKong Telecommunications International (HKTI), the international facilities monopolist, by using the US as a hub and linking to it via callback.

—INSERT FIGURE 1 ABOUT HERE—

The Hong Kong example vividly demonstrates the potential impact of callback and re-origination. To be sure, the example involves traffic re-routing by competitors, not by monopolists against US carriers. But looking ahead, monopolists may turn the tables, and wield these tools to their benefit. In April 1997, HKTI did just that; it launched its own callback service and regained market share (Pan Asian Telecom, 1998). We discuss next how such re-routing practices can benefit monopolists.

## **B. Re-routing by Monopolists to Game Termination Settlements**

We analyze two gaming strategies that do not directly affect the alliance’s retail revenues: call inflation and call turnaround. *Call inflation* involves an increase in the recorded minutes sent by the alliance partner from the US to the foreign country, but not in the minutes useful to consumers. Its sole purpose is to boost the ally carrier’s reported *share* of US-outbound traffic to the monopolist’s country and, hence, under proportional return, the share of the partner’s traffic to the US that may be terminated with the ally.<sup>11</sup> On each such diverted inbound minute, the

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<sup>10</sup> These third-country calls help explain why the surge in US outbound minutes greatly exceeds the fall in inbound minutes. The Hong Kong example and the role of proportional return are discussed further in the Appendix.

<sup>11</sup> Section V.A explains how an alliance facilitates call inflation. Of course, the US ally—or any other carrier—can increase its outbound market share, and hence its share of inbound minutes, also by stimulating useful outbound minutes. Our focus here is on pure manipulation strategies that do not

alliance saves the difference between the termination rate paid to nonalliance carriers and the true marginal cost of US termination. One method of call inflation is re-origination—taking calls from third countries destined to the monopolist’s country and routing them via the US ally and from there to the destination. The role of re-origination here is not arbitrage, but simply to increase the ally’s US-outbound (albeit not US-originating) minutes (arbitrage roles are discussed in Section VI). Another method is generating *new* but useless minutes from the US (e.g., “calls” between a computer of the ally and one of the foreign partner).

*Call turnaround* by the alliance entails taking a call from the monopolist’s country to the US and reversing it for settlements purposes into a call sent from the US by the ally. Unlike callback sponsored by independent operators, here the foreign carrier retains the retail revenue: it charges the same retail price to its customer, but the call is labeled a “callback.”<sup>12</sup> The alliance benefits because fewer of the monopolist’s minutes must be terminated with nonalliance carriers, for two reasons. Like call inflation, turnaround increases the ally’s US-outbound minutes, allowing the ally to terminate a greater share of the US-inbound minutes; in addition, by reversing call direction, turnaround replaces for settlements purposes inbound minutes with outbound ones. Moreover, call turnaround incurs lower costs than call inflation—only the signaling costs to invoke callback (since total traffic between the countries remains the same). Turnaround is therefore more profitable than inflation; indeed, for realistic values of the signaling costs of turnaround, we find that the alliance maximizes profit by turning around *all* US-inbound minutes. And unlike call inflation, turnaround can be profitable even without

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directly affect the retail side. Retail side extensions are discussed in Section V.B.

<sup>12</sup> The direction of a call for settlements purposes traditionally is determined by where the call is billed. In our example, the US ally carrier *a* bills its foreign partner *f* for providing callback minutes from the US and pays settlement charges to *f*. To reduce the scheme’s transparency, the parties could instead contract through a callback provider, *y*. Carrier *f* signals initially to *y*, instructing *y* to purchase a callback from *a*. Thus, *f* pays *y*, and *y* pays *a*. Carrier *a* records the transaction as a sale of outbound minutes to a callback operator. If they wished to prevent such a scheme, regulators would have to identify a callback operator’s ultimate customers—a foreign carrier or “ordinary” end users. The extra step of going through a callback operator should not significantly reduce the profitability of the scheme to the alliance, given competition among callback operators (or ownership of the operator by *a* or *f*).

proportional return, e.g., if instead the foreign carrier were required to terminate with nonalliance carriers some *exogenously* specified share of its traffic to the US.

Call inflation and call turnaround divert termination profits from nonalliance carriers but do not affect US consumers directly. Ultimately, however, retail prices for US-outbound calls are likely to rise, because both strategies typically raise a nonalliance carrier's net marginal cost of foreign termination. Under proportional return, this net marginal cost equals the settlement rate *minus* the carrier's profit gain from increasing its share of US-terminated minutes from that country. Inflation and turnaround by the alliance typically (but not always, as explained shortly) reduce this marginal gain to other carriers from sending outbound minutes: both strategies increase the alliance's share of inbound minutes, leaving less for others; in addition, turnaround reduces the total pool of inbound minutes. Since nonalliance carriers' net marginal costs of sending calls are therefore likely to increase, so are their retail prices.

Our finding that US entry by *dominant* foreign carriers (through alliances or integration) might raise prices, by exacerbating gaming of settlements, is novel. It is well recognized that such entry can yield efficiencies, notably, by alleviating double-marginalization distortions.<sup>13</sup> On the negative side, the concerns have centered on predatory price squeezes or, short of predation, on diversion of US traffic from potentially more efficient US carriers to the ally (who would base its retail prices on the true marginal cost of foreign termination, while nonalliance carriers pay an inflated termination rate). But at least in the short run, even these tactics would reduce prices. In contrast, settlements gaming under proportional return is likely to raise prices.

### **C. Other Distortions from Proportional Return**

A secondary purpose of our paper is to highlight distortions created by proportional return

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<sup>13</sup> If the US retail IMTS market is imperfectly competitive, so that supra-competitive margins are charged at two "vertical" stages (the other being the monopolized foreign termination), the foreign carrier entering the US would have an added incentive, relative to a non-integrated US carrier, to reduce its US retail price in order to boost calling volume to its country and thereby boost its termination profits.

even without traffic manipulation by dominant foreign carriers with US allies.<sup>14</sup> Proportional return is a prototypical case study of a regulation that may appear sensible and innocuous, but in fact produces subtle and perverse effects. First, a carrier whose market share is larger is faced with an artificially higher net marginal cost of foreign termination than is a smaller carrier. The discrepancy arises because a given number of additional outbound minutes sent by a carrier will increase that carrier's market share—and therefore its profitable return minutes—by less, the larger is that carrier's initial market share.

Second, proportional return makes it possible for callback from the US to reduce US welfare even when callback is not initiated by a foreign monopolist but is of the “innocent” variety traditionally (but not always correctly) attributed to retail price arbitrage. Callback contributes to US carriers' large termination deficit—\$5.4 billion in 1996, of which the FCC estimates over 70% are payments above costs. A common reaction is that US carriers nevertheless benefit from callback, because their revenue from selling the US-outbound minutes must outweigh their extra termination payments. This reaction is flawed, since it overlooks the negative externality proportional return creates among US carriers: a carrier's gain from sending outbound minutes (including callback minutes) comes partly from increasing its allotted *share* of valuable return traffic, a gain that is entirely at the expense of other US carriers. Moreover, callback harms other carriers also by reducing total US inbound minutes, since these are allocated in proportion to carriers' outbound market shares; therefore, if the carrier transporting the callback traffic has a relatively small share—as is typically the case—it can benefit from callback, even if not allied with the foreign carrier. US carriers as a group, however, can lose. US carriers also are likely to lose because US carriers' net marginal costs of sending traffic to that country tend to rise, by the same logic as when the foreign carrier initiates callback.<sup>15</sup>

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<sup>14</sup> These distortions have been noted independently by Scanlan (1996, 1997), Einhorn (1997), Galbi (1997) and Schwartz (1997), and have been known to telecom insiders; but they have not been widely appreciated by economists or policy makers. Scanlan and Galbi do not address the manipulation issues that are the focus of our paper, nor to our knowledge do any other papers in the literature.

<sup>15</sup> The welfare effects on the US are likely to be worse, however, when call turnaround is initiated by a foreign dominant carrier gaming the ISP; in such cases there are no gains to US parties from

## D. Remainder of this Paper

Our model abstracts from the demand side and retail competition. We adopt this approach because the incentives to game the ISP, our main focus, stem from the cost side of call termination and will persist in a fuller model. Section II analyzes the incentives of a foreign monopolist and its US ally to engage in call inflation and call turnaround, holding constant in the analysis the US-outbound minutes of nonalliance carriers. The constancy assumption is a natural benchmark given that our call inflation or turnaround schemes have no direct impact on the retail market, as explained earlier. We present results on the profitability of these practices as a function of the alliance partner's market share, the initial levels of inbound and outbound traffic, the settlement rate, and the true cost parameters.

Section III analyzes how gaming affects nonalliance carriers' net marginal costs of sending calls *from* the US, evaluated at these carriers' initial number of outbound minutes. We show that if gaming is large enough, marginal costs are necessarily raised. Surprisingly, for lower levels of gaming the effects on marginal costs are a priori ambiguous, since gaming reduces any nonalliance carrier's market share and—as explained above—proportional return makes a carrier's marginal cost lower the smaller is its market share. But we show that marginal costs must rise for all but the largest carrier, and we provide conditions for its cost also to rise. The rise in marginal costs suggests that nonalliance carriers' retail prices will rise and their outbound traffic will decline. Despite the resulting decrease in the monopolist's termination revenue *from* nonalliance carriers, a revealed preference argument (based on monopolists' *current* conduct) shows that gaming can still be expected to benefit the alliance.

Section IV notes the distortions from proportional return even without foreign manipulation, and discusses reforming the ISP. We present a settlements system that eliminates gaming incentives by foreign monopolists, as well as other proportional-return distortions, and

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arbitrage at the expense of the foreign carrier, gains that otherwise accrue to callback operators (typically US entities) or callers from that country (potentially US companies or traveling nationals). Moreover, because the dominant foreign carrier benefits, it would actively support such schemes, making it more likely that turnaround would then occur, and on a larger scale.

benefits both countries—without requiring lump sum transfers or nonlinear pricing.

Section V elaborates on why an alliance (or integration) by a dominant foreign carrier may facilitate call inflation or turnaround, compared with relying on arm’s length contracting with a US carrier. It also outlines extensions of the analysis to incorporate the retail market, in particular, taking account of double marginalization and of profit shifting in the retail market for US outbound calls. Section VI concludes by noting that, contrary to prevailing views, re-routing practices on balance can favor carriers from monopoly countries, not those from liberalized ones, and discusses policy implications for liberalized countries.

## II. ALLIANCE MANIPULATION OF INTERNATIONAL SETTLEMENTS

### A. Termination Profits under the ISP

Suppose that a foreign monopolist, carrier  $f$ , “enters” the US market: it receives authority, and acquires the capability, to send calls from the US to its home country. Entry could involve various modes: establishing new facilities; acquiring partial or complete ownership in a US facilities-based carrier; or acquiring ownership in an entity that is affiliated with a US facilities-based carrier.<sup>16</sup> For the moment, assume that the objective of the foreign carrier and its US ally, carrier  $a$ , is to maximize their combined profit. This assumption is most appropriate if entry is through complete integration, but it may also be reasonable for other entry modes (see Section V.A). The case in which  $f$  enters entirely through its own new facilities can be analyzed as one in which  $f$ ’s US “ally” initially has zero US outbound traffic to the foreign country.

The total number of US inbound minutes from  $f$  is denoted  $N_f$ . Let  $n_a$  denote  $a$ ’s US outbound minutes. US carriers other than  $a$  (nonalliance carriers) are denoted by  $j = 1, 2, \dots, m$ . The number of outbound minutes of such a carrier is  $n_j$ , and for all nonalliance carriers it is  $n \equiv \sum_{j=1}^m n_j$ . The total number of outbound minutes of all US carriers is therefore  $N_o \equiv n + n_a$ .

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<sup>16</sup> For example, in the Sprint-Telmex joint venture recently authorized by the FCC to operate in the US, wholly owned subsidiaries of Sprint and Telmex each own a 50% share in Telmex/Sprint Communications, an entity that resells services of the facilities-based carrier Sprint.

Outbound market shares are  $s_j \equiv n_j/N_O$  for any carrier  $j$ . Let  $c_d$  be the constant marginal cost per minute to any US carrier of transporting a call from the meet point with the foreign carrier and completing it in the US; for simplicity, assume that  $c_d$  is also the cost of originating a US call and transporting it to the meet point. (Thus,  $c_d$  includes both international transport and domestic costs; in the US, domestic costs include access charges paid to local carriers such as the Bells.) Define  $c_f$  similarly for the foreign carrier. Finally,  $r$  is the settlement rate in both countries.

We put aside retail-side revenues and costs and focus instead on *termination surplus*, a carrier's profit from terminating inbound traffic minus its cost of sending outbound traffic, both its termination payments abroad and its origination costs. We include origination costs for now to clarify the cost implications of call inflation and call turnaround, since both practices affect the number of US-outbound calls. For any US carrier  $j$ , its termination surplus  $T_j$  is given by

$$(1) \quad T_j = (r - c_d)s_j N_I - (r + c_d)n_j = (r - c_d)n_j \frac{N_I}{N_O} - (r + c_d)n_j, \quad j = a, 1, \dots, m.$$

The term  $(r + c_d)n_j$  is the cost of sending the outbound minutes, both origination costs and payments to  $f$ . The profit from terminating inbound minutes is the margin  $(r - c_d)$  multiplied by the number of minutes  $j$  terminates. Under proportional return, this number is  $s_j N_I$ ,  $j$ 's outbound market share multiplied by total inbound minutes. In particular, for the alliance partner  $a$ ,

$$(2) \quad T_a = (r - c_d)s_a N_I - (r + c_d)n_a = (r - c_d)n_a \frac{N_I}{N_O} - (r + c_d)n_a,$$

while for the foreign monopolist  $f$  profits are earned on terminating all the US-outbound minutes,  $N_O \equiv n + n_a$ , and costs are incurred in sending the US-inbound minutes  $N_I$ :

$$(3) \quad T_f = (r - c_f)(n + n_a) - (r + c_f)N_I.$$

The alliance  $A$  of carriers  $a$  and  $f$  therefore earns the termination surplus  $T_A = T_a + T_f$ , or

$$(4) \quad \begin{aligned} T_A &= (r - c_f)(n + n_a) - (r + c_f)N_I + (r - c_d)s_a N_I - (r + c_d)n_a \\ &= (r - c_f)n - (c_f + c_d)(n_a + N_I) - (r - c_d)(1 - s_a)N_I. \end{aligned}$$

In the second line of (4),  $(r - c_f)n$  is  $A$ 's profit on calls from nonalliance carriers to  $f$ ;

$(c_f + c_d)(n_b + N_I)$  is the true resource cost of sending and terminating the alliance's calls in both directions (any payment of  $r$  is just a transfer within the alliance); and  $(r - c_d)(1 - s_a)N_I$  is the additional payment  $f$  incurs because, instead of terminating all its calls in the US at marginal cost  $c_d$  with its partner  $a$ , it pays an additional markup  $(r - c_d)$  on the  $(1 - s_a)N_I$  minutes that it must terminate with nonalliance carriers under proportional return.

The incentives and ways to game the ISP can be grasped by examining the last line of (4), and holding constant the number of outbound minutes of nonalliance carriers,  $n$ . Although  $n$  will change in equilibrium due to the changes in marginal costs, holding  $n$  constant is a natural starting point, since the settlement gaming schemes do not affect the retail market directly (Sections III and V examine indirect effects). The alliance aims to reduce the “surcharge” paid to nonalliance carriers,  $(r - c_d)(1 - s_a)N_I$ . It would prefer simply to terminate all  $N_I$  minutes with  $a$ , but is constrained by proportional return. As explained next, the alliance can relax this constraint through *call inflation*, which raises  $s_a$ , and *call turnaround*, which raises  $s_a$  and lowers  $N_I$ .

## B. Call Inflation by the Alliance

Throughout Section II, we hold constant the initial (pre-gaming) number of US-outbound minutes of carrier  $a$  ( $n_a$ ), the total of all other carriers ( $n$ ), and the initial US-inbound minutes ( $N_I$ ). We first address call inflation that creates new useless (e.g., computer generated) minutes and then discuss inflation via re-origination. Suppose the alliance increases  $a$ 's minutes from the US to  $f$ 's country from  $n_a$  to  $n_a + t$ . This raises  $a$ 's market share by  $\Delta s_a$ , where

$$(5) \quad \Delta s_a = \frac{n_a + t}{N_o + t} - \frac{n_a}{N_o} = \frac{(N_o - n_a)t}{N_o(N_o + t)} = \frac{(1 - s_a)t}{N_o + t}.$$

Observe that, for a given expansion ( $t$ ) in outbound minutes, the resulting increase in the carrier's market share depends on its initial share; specifically,  $\Delta s_a$  is linearly decreasing in the initial share  $s_a$ , a property that will be relevant later. The alliance's termination surplus then becomes

$$\begin{aligned}
T_A|_{\text{inflation}} &= (r - c_f)n - (c_f + c_d)(n_a + t + N_I) - (r - c_d)(1 - s_a - \Delta S_a)N_I \\
(6) \qquad \qquad &= (r - c_f)n - (c_f + c_d)(n_a + N_I) - (r - c_d)(1 - s_a)N_I \\
&\qquad \qquad \qquad + \left[ (r - c_d)(\Delta S_a)N_I - (c_f + c_d)t \right]
\end{aligned}$$

where the final term in brackets depicts the profitability of call inflation. The alliance's cost of call inflation is simply the resource cost of sending and terminating the  $t$  outbound minutes,  $(c_f + c_d)t$ . The benefit  $(r - c_d)N_I\Delta S_a$  arises because, under proportional return, the expansion in  $a$ 's outbound market share by  $\Delta S_a$  diverts  $N_I\Delta S_a$  inbound minutes from nonalliance carriers to  $a$ , and on each diverted minute the alliance saves  $(r - c_d)$ .

It is also instructive to examine the alliance's *marginal* cost and marginal benefit of call inflation. The marginal cost is simply  $(c_d + c_f)$ . Using (5) and (6), and noting that  $t$  enters (6) as a benefit only through its effect on the change in market share  $\Delta S_a$ , the marginal benefit is

$$(7) \qquad MB|_{\text{inflation}} = (r - c_d)N_I \frac{\partial \Delta S_a}{\partial t} = (r - c_d)N_I \frac{n}{(N_O + t)^2} = (r - c_d)(1 - s_a) \frac{N_O N_I}{(N_O + t)^2}.$$

Marginal benefit is diminishing, because equal increases in  $a$ 's minutes yield successively smaller increases in its market share and therefore in the number of inbound minutes diverted to it. Equations (5), (6), and (7) can be used to prove the following results regarding the profitability of call inflation for the alliance.

**PROPOSITION 1:**

(A) A given amount of call inflation becomes more profitable for the alliance as:

- (A.1) the US ally has a smaller initial share ( $s_a$ ) of the given outbound traffic ( $N_O$ );
- (A.2) the level of inbound traffic ( $N_I$ ) is higher, or the level of outbound traffic ( $N_O$ ) is lower, given firm  $a$ 's share ( $s_a$ );
- (A.3) termination costs (both  $c_d$  and  $c_f$ ) are lower or the settlement rate ( $r$ ) is higher.

(B) Some call inflation ( $t > 0$ ) is profitable for the alliance if and only if

$$(r - C_d)(1 - s_a) > \left( \frac{N_o}{N_i} \right) (C_f + C_d).$$

(C) If the condition in (B) is met, the alliance's optimal level of call inflation is  $t^*$ , where

$$\frac{t^*}{N_o} = \sqrt{(1 - s_a) \left( \frac{N_i}{N_o} \right) \left( \frac{r - C_d}{C_d + C_f} \right)} - 1.$$

—INSERT FIGURE 2 ABOUT HERE—

The results in part (A) of Proposition 1 follow by examining how the variables mentioned affect the final bracketed term in (6), which shows the effect on profit due to call inflation. Parts (B) and (C) are illustrated in Figure 2. The profit-maximizing level of call inflation reported in (C) is found where  $MB = MC$ .

Part (B) follows because call inflation becomes profitable if and only if the vertical intercept of  $MB$  exceeds  $MC$ , or as phrased in (B):  $(r - c_d)(1 - s_a) > (N_o/N_i)(c_d + c_f)$ . The intuition is as follows. Suppose traffic is balanced ( $N_o = N_i$ ) and the alliance initially has no US outbound traffic ( $s_a = 0$ , as occurs if the foreign carrier enters de novo or allies with a US carrier not initially serving that route). Some call inflation is then profitable if  $r - C_d > C_d + C_f$  because sending an additional minute costs the alliance  $c_d + c_f$ , but diverts (approximately) one US inbound minute to  $a$  from other carriers, saving the alliance  $r - C_d$ . If  $N_o = N_i$  but  $s_a > 0$ , then the increase in  $a$ 's market share of outbound minutes will be less than in the previous case, hence so too is the diversion in minutes from nonalliance carriers; thus, call inflation is now profitable only if  $r - C_d$  is sufficiently greater than  $c_d + c_f$ . Similar logic applies if, instead, outbound traffic is initially greater than inbound ( $N_o > N_i$ ). In short, a greater  $s_a$  and a greater imbalance of traffic due to higher  $N_i$  or lower  $N_o$  worsens the tradeoff to the alliance from call inflation, by requiring a larger number of additional outbound minutes to divert a given number of inbound minutes.

***Inflation via re-origination.*** Proposition 1 assumed that call inflation takes the form of generating new (but useless) US minutes. The results must be modified to reflect the different costs incurred when, instead, call inflation involves re-origination through the US of calls to  $f$ 's country from a third country. The *total* number of minutes terminating abroad is the same, so  $f$

avoids the cost  $tc_f$ . But one must add the extra costs of re-routing the call via the US and subtract any reduced termination revenue to  $f$  if its settlement rate is lower with the US than with the country in which the call originated. Of course, if  $f$  is orchestrating re-origination to maximize alliance profit, it will select countries with which its settlement rates are not higher than that with the US.<sup>17</sup> This contrasts sharply with cases where re-origination of calls into the monopolist's country is driven by arbitrage of differences in its settlement rates with different countries.<sup>18</sup>

Observe that call inflation—whatever the particular underlying strategy that generates it—will show up as an increase in the alliance's outbound minutes and appear as a pro-competitive expansion of US output. However, this is illusory, as the “expansion” does not represent useful minutes for US consumers.

Finally, note that the essence of call inflation is to manipulate proportional return. If the allocation of inbound minutes were divorced from a carrier's share of outbound minutes, then

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<sup>17</sup> Call inflation through re-origination could be more profitable than when new useless minutes are created, as assumed for Proposition 1. As noted, the alliance will seek to re-originate from countries whose settlement rates are no lower than with the US. And the costs of re-routing through the US can be low compared to the avoided  $tc_f$ ; access charges to local phone companies are not paid if the call is merely in transit, and transmission costs between international gateways are quite low relative to network costs incurred in originating or terminating within a country. Observe also that these cost-side modifications do not affect the comparative static results established for  $1 - S_a$ ,  $r$ , or  $N_o / N_I$ , which depended only on the marginal benefit.

<sup>18</sup> Call re-origination in general involves a carrier in country 1, say, sending a call to country 2 indirectly, through country 3. The usual purpose of this and other so-called “least-cost routing” practices is to arbitrage differences in settlement rates or retail prices. Such differences are often large and are generally not cost based, since the costs of sending or terminating international traffic are largely insensitive to distance. For example, the FCC (1997a) identifies three sets of facilities used in completing international calls: (a) international transmission, (b) international switching, and (c) domestic transport and termination. Only international transmission varies with distance and route density, but its cost has become quite low with the advent of high capacity fiber optic cables and compression technologies.

Call re-origination from a monopoly country can be used to arbitrage differences in the monopolist's retail prices (or to undercut all its prices using callback coupled with another outgoing call to the destination, both from an outside hub—see the Hong Kong example in Section I). Re-origination into the monopolist's country can arbitrage differentials in its settlement rates for terminating traffic from various countries. The monopolist typically frowns on such practices. In our case, the alliance's purpose in re-originating calls through the US obviously is not to arbitrage  $f$ 's termination rates; rather, it is to increase  $a$ 's market share of minutes from the US to  $f$ 's country and therefore the share of minutes that  $f$  may in turn terminate at cost with  $a$  instead of paying the higher settlement rate  $r$  to nonalliance carriers.

increasing  $a$ 's share of outbound minutes would not affect the minutes that  $f$  may terminate with  $a$  rather than through nonalliance carriers. Thus, call inflation is a creature of proportional return (other distortions created by proportional return are discussed in Section IV.A). Call turnaround, however, can be profitable even without a proportional return system, as shown next.

### C. Call Turnaround by the Alliance

Suppose the alliance turns around a call of  $t$  minutes from  $f$ 's country to the US into a call of  $t$  minutes completed by carrier  $a$  from the US to the foreign caller. Sophisticated electronic methods have recently emerged that implement call turnaround seamlessly. The scheme can work as follows. Instead of completing the call directly to the US, carrier  $f$  transmits only the signaling information (notably, the caller's and recipient's phone numbers) to its partner  $a$ , who in turn opens two voice channels: one to the US party and one to the foreign caller. Carrier  $f$  continues to bill the original caller the same price it would have paid for a direct call, but simply labels the call a "callback." Carrier  $a$  bills  $f$  for providing a callback and pays termination charges to  $f$ . Thus, for settlements purposes  $a$  registers  $t$  additional US outbound minutes while US inbound minutes fall by  $t$ . Note that the alliance has not lost any retail revenue.

Now examine the alliance's termination account. Unlike the call inflation addressed in Proposition 1, turnaround does not increase the total number of minutes and therefore avoids the extra costs  $(c_f + c_d)t$  of inflation. Instead, signaling costs are incurred to initiate the call reversal. Signaling costs vary mainly with the number of calls not minutes—because a cost is incurred only in setting up a call. As an approximation, however, we represent the cost of signaling as a constant  $x$  per minute, by spreading the signaling cost over the expected duration of a call. One justification for this averaging is that call duration is not known ex ante, when the alliance must decide whether the benefits from turnaround will cover the fixed cost of signaling.

The alliance's new surplus is found from (4) as follows: recompute  $T_A$  to reflect the increase in  $a$ 's outbound minutes from  $n_a$  to  $n_a + t$  and the decrease in inbound minutes from  $N_I$  to  $N_I - t$ , and then subtract the signaling costs  $xt$ . As before, hold constant  $n$ , the outbound minutes of nonalliance carriers, and let  $\Delta s_a$  from (5) denote the increase in  $a$ 's market share from sending

the  $t$  additional outbound minutes. The alliance's termination surplus is therefore

$$\begin{aligned}
 T_A|_{\text{turnaround}} &= (r - C_f)n - (C_f + C_d)(n_a + N_l) - (r - C_d)(1 - s_a - \Delta s_a)(N_l - t) - tx \\
 (8) \qquad \qquad &= (r - C_f)n - (C_f + C_d)(n_a + N_l) - (r - C_d)(1 - s_a)N_l \\
 &\quad + \left[ (r - C_d)N_l\Delta s_a + (r - C_d)(1 - s_a - \Delta s_a)t - tx \right].
 \end{aligned}$$

The effect of call turnaround is depicted in the final bracketed term of (8), which can be decomposed into a diversion effect,  $(r - C_d)N_l\Delta s_a$ ; a replacement effect,  $(r - C_d)(1 - s_a - \Delta s_a)t$ ; and the signaling cost,  $tx$ . The diversion and replacement effects are understood as follows. Think of turnaround as first increasing  $a$ 's outbound minutes, then reducing total inbound minutes. Under proportional return, the increase in  $a$ 's outbound minutes lets  $f$  divert  $N_l\Delta s_a$  inbound minutes from nonalliance carriers and terminate them instead with  $a$ , saving the alliance  $(r - C_d)N_l\Delta s_a$ . This "diversion benefit" is equivalent to that from call inflation. Now consider the replacement effect. For settlement purposes, turnaround converts  $t$  inbound minutes into  $t$  outbound ones. Of these,  $(1 - s_a - \Delta s_a)t$  would have terminated with nonalliance carriers under proportional return, since  $(1 - s_a - \Delta s_a)$  is their collective outbound market share following the increase in  $a$ 's outbound minutes and hence market share. Thus, for  $(1 - s_a - \Delta s_a)t$  minutes, turnaround replaces US termination by nonalliance carriers with foreign termination; on each such minute, the alliance again saves the profit margin charged by nonalliance carriers,  $r - C_d$  ( $c_d$  is still incurred, since turnaround only changes the direction of calling, and we have assumed that the cost of originating from and terminating in the US are both  $c_d$ ).

Comparing (8) with the alliance's surplus under call inflation given in (6) shows:

$$(9) \qquad T_A|_{\text{turnaround}} = T_A|_{\text{inflation}} + (r - C_d)(1 - s_a - \Delta s_a)t + (C_d + C_f - x)t.$$

Call turnaround is therefore more profitable than inflation because of the added replacement benefit (middle term), and the cost savings (last term—recall that the cost of signaling to set up a call reversal ( $x$ ) is likely to be low relative to the costs of actually generating a new call). We can

also compare the *marginal* cost and benefit of turnaround, to obtain Proposition 2 below. The marginal cost is simply  $x$  (compared to  $c_d + c_f$  for inflation). The marginal benefit is

$$\begin{aligned}
 MB|_{\text{turnaround}} &= MB|_{\text{inflation}} + \frac{\partial}{\partial t} [(r - c_d)(1 - s_a - \Delta s_a)t] \\
 (10) \qquad \qquad &= MB|_{\text{inflation}} + \left( \frac{N_o}{N_o + t} \right)^2 (1 - s_a)(r - c_d) \\
 &= \frac{N_o(N_i + N_o)}{(N_o + t)^2} (1 - s_a)(r - c_d),
 \end{aligned}$$

using expression (5) for  $\Delta s_a$ . Using equations (5) and (6) in (9), Proposition 2 provides results for call turnaround analogous to those in Proposition 1 for call inflation.

**PROPOSITION 2:**

(A) A given amount of call turnaround becomes more profitable for the alliance as:

- (A.1) the US ally has a smaller initial share ( $s_a$ ) of the given outbound traffic ( $N_o$ );
- (A.2) the level of inbound traffic ( $N_i$ ) is higher, or the level of outbound traffic ( $N_o$ ) is lower, given firm  $a$ 's share ( $s_a$ );
- (A.3) the domestic termination cost ( $c_d$ ) and the signaling cost ( $x$ ) are smaller or the settlement rate ( $r$ ) is larger.

(B) Some call turnaround ( $t > 0$ ) is profitable for the alliance if and only if

$$(r - c_d)(1 - s_a) > \left( \frac{N_o}{N_o + N_i} \right) x.$$

(C) Turnaround of all inbound traffic ( $t = N_i$ ) is optimal for the alliance if and only if

$$(r - c_d)(1 - s_a) > \left( \frac{N_o + N_i}{N_o} \right) x.$$

(D) If some, but not all, turnaround of inbound traffic is optimal, then the alliance's optimal

level of call turnaround,  $t^*$ , satisfies

$$\frac{t^*}{N_I} = \sqrt{(1-s_a) \left( \frac{N_O}{N_I} \right) \left( 1 + \frac{N_O}{N_I} \right) \left( \frac{r - C_d}{x} \right)} - \frac{N_O}{N_I}.$$

**No proportional return.** Call turnaround is profitable to the alliance under more general conditions than is call inflation, because it yields the same diversion benefit (and at lower cost) but also replaces inbound minutes with outbound ones. Whereas incentives for call inflation hinge on the linkage that proportional return creates between outbound market shares and shares of inbound termination, call turnaround incentives do not hinge on such linkage. For example, an alternative to proportional return that still denies the monopolist discretion over which US carriers terminate its traffic is to require that various carriers terminate *pre-specified* shares.

**PROPOSITION 3:** Suppose there is no proportional return, but the foreign monopolist  $f$  is required to terminate exogenously fixed shares  $\{z_i\}_i$  of its minutes with the various US carriers. Holding constant the outbound minutes of nonalliance carriers, the alliance of  $f$  and  $a$  maximizes profit by turning around *all* US inbound minutes  $N_I$  if  $(r - C_d)(1 - z_a) > x$ , and zero minutes otherwise. Thus, if turnaround occurs, the alliance's profit is  $N_I [(r - C_d)(1 - z_a) - x]$ .

The reasoning is straightforward. The marginal cost of turnaround is the signaling cost  $x$ ; the savings on overcharge payments to nonalliance carriers from replacing an inbound by an outbound minute is  $(r - C_d)(1 - z_a)$ . Since  $x$  is likely to be small (a few cents at most), while the margin  $r - c_d$  is typically high (often well over ten cents, see Section II.D below), complete turnaround would be chosen even if the alliance partner's entitled share  $z_a$  were quite large.

Remark 1 summarizes some relevant findings of Propositions 1, 2 and 3 regarding the profitability of traffic manipulation for purposes of gaming the settlements process.

**Remark 1:** With proportional return, call inflation and call turnaround are more profitable to the alliance when (1) the settlement rate  $r$  is higher, and (2) nonalliance carriers' initial share of outbound minutes  $(1 - s_a)$  is higher. Without proportional return, manipulation can only occur

through call turnaround (not inflation), and it is more profitable when  $r$  is higher and when nonalliance carriers' exogenously fixed allocated share of inbound minutes  $(1 - z_a)$  is greater.

Remark 1 has two policy implications. First, it suggests an argument for reducing the (symmetric) settlement rate as a condition for approving participation by dominant foreign carriers, through integration or alliances, in the US market. Lowering the settlement rate reduces the foreign carrier's incentives for using its entry/alliance to game the settlements process, and mitigates the harm imposed by any residual gaming.

Second, it cautions against automatically viewing as pro-competitive an alliance with a small US carrier. The potential gain to the foreign monopolist  $f$  from reducing its termination payments to nonalliance carriers (and the resulting harm to them) is maximized by allying with the carrier that initially terminates the fewest minutes from  $f$  (assuming the ally has, or can rapidly acquire, capacity to expand its termination and origination volume); under proportional return, this is the carrier with the smallest outbound market share. (A similar result holds in the no-proportional-return case of Remark 1, if one assumes that the allocation of fixed shares of inbound minutes is correlated with carriers' initial outbound shares.) Therefore, the risk that the alliance will be used to divert termination profits from other carriers by gaming the settlements process is greater when the monopolist partners with a small rather than a large US carrier.

#### **D. Empirical Magnitudes**

Table 1 considers eight countries accounting for significant shares of US-inbound traffic and with settlement rates above 20¢/minute. For each route, we consider an alliance between the dominant foreign carrier and a US carrier with zero initial market share on that route ( $s_a = 0$ ); this assumption overstates only modestly the alliance's gain relative to partnering instead with the smallest of the major US carriers (AT&T, MCI, Sprint, and WorldCom) active on the particular route, since the smallest of these (Sprint to India, and WorldCom elsewhere) always had a market share below ten percent. The last four columns report the alliance's preferred amount of call inflation as a percent of initial outbound minutes,  $(t^*/N_O) \cdot 100$ , and the resulting profit diversion

from nonalliance carriers,  $(r - c_d)N_I\Delta s_a$ , under two assumptions about domestic and foreign origination and termination costs.

**—INSERT TABLE 1 ABOUT HERE—**

The first case has  $c_d = 7\text{¢}/\text{min}$ ,  $c_f = 8\text{¢}/\text{min}$ . The  $7\text{¢}$  figure is based on AT&T's 1996 estimate that its cost of terminating calls in the US was  $7.5\text{¢}$  (FCC, 1997a) and noting that access charges paid by international US carriers to local US phone companies, included in the  $7.5\text{¢}$  figure, have declined since then. The  $8\text{¢}$  figure is in the  $6\text{¢}$ - $9\text{¢}$  range of the FCC's (1996) estimate of termination costs abroad (the US and Sweden, for example, have a *settlement* rate of only  $8\text{¢}$ , suggesting that the cost is even lower; however, the figure could be higher in less developed countries). Table 1 shows that to all countries except China and Israel, call inflation that entails creating new minutes, and thus incurs costs of  $c_d + c_f$  per minute, is unprofitable ( $t^*/N_O = 0$ ). A major reason is that in all cases the US already receives far fewer minutes than it sends ( $N_I/N_O$  is well below 1). The second case,  $c_f = 0$ , approximates the scenario where call inflation increases the ally's US outbound minutes by letting it re-originate from the US existing third-country traffic destined to the monopolist's country, so that total traffic terminated abroad does not increase, hence neither do foreign termination costs. In that case, call inflation is profitable to all countries but Hong Kong, and the total diversion of termination profit from nonalliance US carriers is \$135 million.

Table 2 considers the same eight countries as in Table 1 (and, as before, an ally carrier with  $s_a = 0$ ), but reports profit diversion,  $(r - c_d)(N_I\Delta s_a + t(1 - s_a - \Delta s_a))$ , from various amounts  $t$  of call turnaround;  $t$  is set at 10%, 20%, 30%, 40%, or 100% of the initial inbound minutes  $N_I$ . The last column reports the highest signaling cost  $x^*$  for which the alliance would prefer 100% turnaround (see Proposition 2 (C)). In all cases, the value of  $x^*$  exceeds plausible estimates of  $x$  (of only a few cents). Thus, left unconstrained, the alliance would turn around all US inbound traffic, thereby reducing nonalliance carriers' termination profits by over half a billion dollars annually. The other columns show what happens if the alliance is constrained—perhaps by fear of regulatory reaction—to lower percentages of turnaround. Even if only 30% of US inbound

minutes are turned around, the annual harm to nonalliance carriers exceeds \$200 million.<sup>19</sup>

—INSERT TABLE 2 ABOUT HERE—

Comparing Tables 1 and 2, one sees that call turnaround is a far more significant issue than pure call inflation; even with inflation through re-origination, which avoids added foreign termination costs, the alliance's preferred degree of call inflation results in profit diversion of less than one quarter of what obtains under the preferred degree (100%) of turnaround. Note also that here we are considering only the US and only a subset of routes; the total potential impact of turnaround on all liberalized countries is considerably larger.

### III. IMPACT ON COSTS OF NONALLIANCE CARRIERS

#### A. Average and Marginal Costs of Outbound Traffic under Proportional Return

The termination surplus of any US carrier  $j$  was defined in expression (1) as  $T_j = (r - c_d)s_j N_I - rn_j - c_d n_j$ . This is  $j$ 's profit from terminating inbound calls minus its costs of sending calls—its termination payments  $rn_j$  to  $f$ , plus its own origination costs  $c_d n_j$ ; the latter was included to track the alliance's costs as the US partner increased its outbound minutes with inflation or turnaround. This section focuses on nonalliance carriers. To simplify notation, we therefore suppress origination costs and instead examine a carrier's net profit from termination excluding its origination costs,  $(T_j + c_d n_j) \equiv (r - c_d)s_j N_I - rn_j$ . Thus, carrier  $j$ 's net average and marginal *costs* of terminating its outbound minutes are

$$(11) \quad AC_j \equiv - \frac{(T_j + c_d n_j)}{n_j} = r - (r - c_d) \frac{N_I}{N_O}$$

and

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<sup>19</sup> The profit diversion increases less than proportionately with the percentage of inbound minutes turned around because the call inflation component of turnaround exhibits diminishing returns (from the standpoint of the ally carrier), as does any call inflation (see Section II.B).

$$(12) \quad MC_j \equiv - \frac{\partial(T_j + c_d n_j)}{\partial n_j} = r - (r - c_d) \left( \frac{N_o - n_j}{N_o} \right) \frac{N_i}{N_o} = r - (r - c_d)(1 - s_j) \frac{N_i}{N_o}.$$

Several properties deserve mention. First, both  $AC_j$  and  $MC_j$  are less than the settlement rate  $r$ , because of the profit from proportional return. Their deviation from  $r$  increases with the termination margin  $(r - c_d)$  and with the ratio of inbound-to-outbound traffic  $(N_i / N_o)$ .

Second, holding inbound minutes and other carriers' outbound minutes constant,  $AC_j$  increases with  $n_j$ , because total outbound minutes  $N_o$  also increase; intuitively, the given total profit from inbound termination—which is what keeps  $AC$  below  $r$ —is spread over a larger outbound volume. Observe, however, that proportional return equates  $AC_j$  across carriers, regardless of their outbound market shares.

Third, the first expression for  $MC_j$  shows that marginal cost also increases with  $n_j$ . This arises because equal successive increases in carrier  $j$ 's minutes yield successively smaller gains in its market share and, hence, divert to  $j$  fewer inbound minutes for profitable termination. Unlike average cost, marginal cost does depend on a firm's initial market share, as shown by the second expression for  $MC_j$  in (12). For given levels of inbound and outbound traffic, carriers with higher market shares face higher net marginal costs of foreign termination—because the increase in a carrier's market share and, hence, in its allocation of inbound minutes, is smaller the larger is its initial share (see expression (5)).<sup>20</sup> (Carriers' market shares can differ due to factors outside our model, e.g., heterogeneity in retailing costs or in demand characteristics). The subtle role of market shares is important for analyzing how alliance settlements gaming affects the marginal costs of nonalliance carriers.

—INSERT FIGURE 3 ABOUT HERE—

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<sup>20</sup> The fact that larger carriers face higher marginal costs even though proportional return equalizes average costs is understood as follows. An increase  $t$  in outbound minutes by any carrier yields the same increase in average cost,  $\Delta AC = AC_1 - AC_0$ . The resulting increase in *total* cost for the carrier  $j$  that sends the  $t$  minutes is  $tAC_1 + n_j\Delta AC$ , where  $n_j$  denotes  $j$ 's initial outbound minutes. This cost increase is greater the larger is  $n_j$  and, thus, the greater is  $j$ 's initial market share of the given initial industry minutes ( $N_o$ ).

Based on (11) and (12), Figure 3 shows average and marginal costs for any carrier as a function of its initial market share.<sup>21</sup> Here  $k$  denotes the initial ratio  $N_I / N_O$  across all carriers;  $k'$ , which will become relevant shortly, denotes another level, where  $N_I$  has been reduced or  $N_O$  has been increased (thus,  $k' < k$ ; in this paper “primes” do *not* denote derivatives). The curves  $AC$  and  $MC$  represent “cross-sectional” comparisons, holding constant the number of total outbound minutes  $N_O$ ; increasing  $N_O$  or reducing  $N_I$  will shift up the  $AC$  curve. Whereas average cost is unaffected by share, marginal cost equals average cost if share is 0, increases linearly with share, and equals  $r$  if the share is 1 ( $MC_j = r$  if  $s_j = 1$  since a monopolist cannot increase its termination profits by increasing its market share, so sending an additional outbound minute increases its net termination costs by the full settlement rate  $r$ ).

## **B. Alliance Traffic Manipulation and Marginal Costs of Nonalliance Carriers**

We now consider the effect of call inflation or call turnaround by the alliance on the average and marginal costs of nonalliance carriers, evaluated throughout at their initial number of outbound minutes. Observe that both practices reduce the ratio  $N_I / N_O$ . Call inflation of  $t$  minutes increases  $N_O$  by  $t$  minutes; call turnaround of  $t$  minutes does likewise, and reduces  $N_I$  by  $t$  minutes. Figure 3 illustrates inflation or turnaround which reduces  $N_I / N_O$  from some initial level  $k$  to a lower level  $k'$ . As  $N_I / N_O$  drops,  $AC$  shifts up in parallel;  $MC$  rotates clockwise to  $MC'$ —it remains at  $r$  for  $s_j = 1$ , and rises towards  $r$  at all  $s_j < 1$ .

Alliance gaming therefore unambiguously increases the (common) average cost of nonalliance carriers. The effects on marginal costs are more complex. There are two opposing forces, seen in expression (12): (a) the drop in  $N_I / N_O$  increases any carrier’s marginal cost at its initial market share; but (b) for any nonalliance carrier, the market share decreases (since its

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<sup>21</sup> In Figure 3, the fact that marginal cost is rising and lies above average cost, yet average cost is shown as constant, is an artifact of our representing costs as a function of shares, given  $N_I$  and  $N_O$ . If these costs were written instead as functions of a firm’s *minutes*, then marginal cost and average cost would both be increasing, with marginal cost exceeding average cost, and both having cost  $r$  as an asymptote.

minutes are held constant while the ally carrier's minutes increase due to gaming), an effect which lowers marginal cost. In Figure 3, effect (a) is the rotation from  $MC$  to  $MC'$ , while (b) is a move down along  $MC'$ . Surprisingly, (b) can dominate; hence, a nonalliance carrier's marginal cost can decrease at its initial outbound minutes. This occurs in Figure 3 if the carrier's share falls from  $s_j$  to  $s_j'$ . However, because of the subtlety of the relationship between the rotation of the  $MC$  curve and the change in market share, the "picture proof" depicted in Figure 3 is not sufficient. The following example demonstrates that such a case indeed can occur.

**Example: call turnaround can reduce marginal cost.** Suppose there are only two US carriers,  $a$  and 1, and initially  $N_I = 50$ ,  $n_a = 10$ ,  $n_1 = 90$ . Then  $s_1 = 0.9$ , so  $MC_1 = r - (r - c_d)(.1)(.5) = .95r + .05c_d$ , from (12). The alliance of  $f$  and  $a$  then turns around 20 minutes, yielding  $N_I = 30$ ,  $n_a = 30$ ,  $n_1 = 90$ . Carrier 1's share of outbound traffic falls to  $s_1 = 0.75$  and its marginal cost, at 90 minutes, becomes  $MC_1 = .9375r + .0625c_d$ . Therefore,  $\Delta MC_1 = -.0125r + .0125c_d < 0$ , given  $r > c_d$ ; that is, call turnaround can cause a large nonalliance carrier's marginal cost to fall. It follows that marginal cost can fall also with call inflation, because the drop in  $N_I/N_O$ , which is the source of upward pressure on costs, is less under inflation of  $t$  minutes than under turnaround of  $t$  minutes (turnaround encompasses inflation, as well as a reduction in  $N_I$ ).

A priori, therefore, the impact of alliance traffic manipulation on other carriers' marginal costs is uncertain. The following propositions address the effects more systematically.

**PROPOSITION 4:** Given any positive number of initial inbound minutes ( $N_I > 0$ ), a large enough amount of call inflation or of call turnaround will raise the marginal cost of any nonalliance carrier with an initial market share less than 1.

The proof consists of simply observing that sufficient call inflation or call turnaround will drive the ratio  $N_I/N_O$  arbitrarily close to 0, raising each nonalliance carrier's marginal cost arbitrarily close to  $r$ , which exceeds the marginal cost of any carrier with initial share less than 1.

For lesser degrees of inflation or turnaround, however, the earlier example showed that the marginal cost of a nonalliance carrier can fall. But as Figure 3 suggests, this can occur only if

the nonalliance carrier's initial market share is sufficiently large. Proposition 5 provides a *necessary and sufficient* condition for a nonalliance carrier's marginal cost to increase under call inflation (the proof is in the Appendix).

**PROPOSITION 5:** Any amount of call inflation by the alliance will increase nonalliance carrier  $j$ 's marginal cost, evaluated at  $j$ 's initial outbound minutes, if and only if  $s_j + s'_j < 1$ , where  $s_j$  is  $j$ 's share of outbound minutes before call inflation, and  $s'_j$  is its share after.

The following are *sufficient* conditions for marginal costs of nonalliance carriers to increase under either call inflation *or* call turnaround.

**PROPOSITION 6:** Consider the marginal costs of nonalliance carriers, evaluated at their initial outbound minutes. Both call turnaround and call inflation will raise the marginal cost of

- a) any carrier, except possibly the largest;
- b.i) the largest carrier if its initial market share is less than 1/2;
- b.ii) the largest carrier if the sum of its initial and new market shares is less than 1.

The proof of Proposition 6 is straightforward given Proposition 5. First, recall that turnaround is equivalent to inflation plus a drop in inbound minutes—an effect that further raises marginal costs; thus, whenever call inflation raises marginal cost, so does turnaround. Next, observe that both inflation and turnaround reduce the outbound market share of any nonalliance carrier,  $s'_j < s_j$ ; hence,  $s_j < 1/2$  ensures  $s'_j + s_j < 1$ . Parts b.i) and b.ii) of Proposition 6—which covers also turnaround as well as inflation—now follow immediately from Proposition 5.

The conclusion from Proposition 6 is that ISP manipulation by the alliance typically increases the marginal costs of nonalliance carriers for sending outbound minutes, evaluated at their initial minutes. This creates upward pressure on carriers' retail prices for outbound calls. If we were dealing with a monopolist US carrier, an increase in its marginal cost would suffice to establish that its price would rise (Tirole, 1988). In our oligopoly setting, however, there are two

complications. First, a carrier's marginal cost depends also on others carriers' traffic—because under proportional return, marginal cost depends on market share. Second, a carrier's pricing will depend not only on its marginal cost schedule but also on others' retail prices. Thus, based solely on the cost-side findings, we cannot rule out that some price(s) may fall; to obtain more definitive results we would have to solve for the full equilibrium of the model, incorporating also the demand side. Nevertheless, Proposition 6 strongly suggests that ISP manipulation will raise nonalliance carriers' prices, thereby harming consumers.

### C. Profitability of Manipulation Despite a Drop in Nonalliance Carriers' Traffic

The rise in nonalliance carriers' marginal costs (except, perhaps, for the largest carrier) raises the question: after incorporating the likely reduction in these carriers' outbound minutes,  $n$ , will call inflation and turnaround still be profitable to the alliance? Expressions (6) and (8) showed the alliance's gain (from call inflation and turnaround, respectively) due to savings on  $f$ 's termination payments to nonalliance carriers, holding  $n$  constant; if  $n$  falls, so will  $f$ 's profit from terminating nonalliance traffic, the term  $(r - c_f)n$  in (4). A revealed preference argument indicates that ISP gaming indeed will remain profitable. The logic is as follows.

Most foreign monopolists would raise their (symmetric) US settlement rates, were it not for FCC pressures and the need to bargain with US carriers.<sup>22</sup> That is, a monopolist typically expects that raising  $r$  would increase its termination revenue on the remaining US traffic by enough to outweigh its loss from the induced drop in US traffic and from the rise in its marginal cost of terminating in the US. Now instead of  $f$  increasing  $r$  by a given  $\Delta r$ , consider the alliance gaming the ISP to the following degree: at the initial traffic levels from  $f$  to the US ( $N_I$ ) and from US nonalliance carriers to  $f$  ( $n$ ), gaming increases nonalliance carriers' average cost,  $AC$  in (11), by the same amount as would  $\Delta r$ . We show next that if raising  $r$  is profitable to the monopolist (as suggested by revealed preference), then some gaming will be profitable to the alliance.

For a given  $n$ , both schemes yield the same increase in net termination payments by US

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<sup>22</sup> For example, in the 1997 round of negotiations, the Mexican incumbent carrier Telmex requested a 25% increase in settlement rates, from 39.5¢ to around 50¢. And a myriad of foreign carriers have objected strongly to the FCC's (1997a) Benchmarks Order that aims to reduce settlement rates.

nonalliance carriers since, by construction, both yield the same increase in their  $AC$  (only the channel differs—raising  $r$  forces nonalliance carriers to pay more to  $f$  on the unchanged traffic imbalance; ISP gaming lets  $f$  pay them less because of the reduction in its traffic terminated with them). However, relative to raising  $r$ , ISP gaming is likely to cause a smaller drop in nonalliance carriers’ outbound minutes,  $n$  (and, thus, in termination profit abroad), because the increase in *marginal cost of any nonalliance carrier*, evaluated at its initial outbound minutes, will be less. This result is established in Proposition 7.

**PROPOSITION 7:** Consider (i) call inflation or call turnaround that reduces the ratio of inbound to outbound minutes  $N_i/N_o$  from  $k$  to  $k'$  and therefore increases average cost from  $AC = r - (r - c_d)k$  to  $AC' = r - (r - c_d)k'$ ; and (ii) a rise in the settlement rate from  $r$  to  $r'$  that causes the same increase in average cost (thus,  $AC' = r' - (r' - c_d)k$ ). For any nonalliance carrier  $j$ , its marginal cost evaluated at its initial level of outbound minutes,  $n_j > 0$ , is lower in (i) than in (ii):  $MC|_{r,k',n_j} < MC|_{r',k,n_j}$ .

The intuition behind this result can be grasped from Figure 4 (a proof is in the Appendix). The relevant marginal cost curves are drawn as functions of market share. The  $MC$  curve for case (i), i.e., inflation or turnaround, is indicated by  $k'$  (middle curve) and lies below that for case (ii), denoted by the higher settlement rate  $r'$ . Thus, for a given initial market share, a nonalliance carrier’s marginal cost rises less (relative to the bottom curve) in case (i). Moreover, market shares remain constant in case (ii), but in case (i) carrier  $a$ ’s market share increases (with inflation or turnaround), so the share of any nonalliance carrier decreases—implying a move left and down along the middle  $MC$  curve. Therefore, marginal cost evaluated at a carrier’s initial number of outbound *minutes* rises by less in case (i).

—INSERT FIGURE 4 ABOUT HERE—

Thus, compared to raising  $r$ , gaming the ISP is likely to yield a superior tradeoff between increased termination profits on remaining traffic from nonalliance carriers and the extent of their traffic that is lost. Moreover, unlike raising the symmetric  $r$ , ISP gaming does not increase the

monopolist's cost of sending its traffic. Finally, gaming via the alliance has added advantages over raising  $r$ , stemming from the ally's participation in the retail market (see Section V.B). The sole disadvantage of ISP gaming versus raising  $r$  is the alliance's cost of implementing inflation or turnaround; but this cost is relatively low, especially for turnaround (which requires only minor signaling costs). Therefore, given that foreign monopolists expect that raising  $r$  would be profitable, ISP gaming by a monopolist's alliance is likely to be profitable too.

#### **IV. REFORMING THE SETTLEMENTS SYSTEM**

There are good reasons to reform the ISP, both because of the incentives it breeds for foreign manipulation, discussed above, and because of distortions created by proportional return even absent such manipulation. We first take stock of these distortions and then discuss reforms.

##### **A. Proportional Return Distortions Aside from Foreign Manipulation**

One distortion is that carriers with larger initial market shares face artificially higher net marginal costs of foreign termination than do smaller carriers, because the proportional-return gain from a given increase in outbound minutes is decreasing in the carrier's initial market share (see Section III.A). Larger carriers are therefore placed at an artificial disadvantage in competing for outbound traffic.<sup>23</sup> Observe that this bias is likely to run opposite from what is needed for efficiency. At least in non-cooperative oligopoly models, larger market shares result from lower marginal costs (e.g., on the retailing side) or advantages in demand (brand names, etc.), and these attributes imply that in equilibrium larger carriers earn higher price-cost margins than do smaller carriers. Since consumers ignore these margins in their purchase decisions (they only consider product characteristics and prices), the industry output mix is wrong: larger firms produce too

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<sup>23</sup> This poses an interesting contrast with the analysis by Laffont and Tirole (1998, Part V, based on joint work with Patrick Rey) of competition between domestic carriers, where marginal costs of sending traffic also depend on market shares. They show that if termination rates are symmetrically above costs and any carrier cannot charge different retail prices according to whether calls terminate on its network or on the rival's, then a carrier's average marginal cost of sending calls is *decreasing* in its market share of subscribers—because a larger fraction of its subscribers' calls also terminate on its network, thereby avoiding the rival's termination margin. But in our case, proportional return causes marginal cost to *increase* with market share.

little relative to smaller ones. Proportional return aggravates this bias.

A second distortion is that proportional return excessively encourages US carriers to supply US-outbound minutes to independent callback operators (as distinct from alliance call turnaround) who reverse the direction of foreign calls destined to the US. Due to the externalities created by proportional return, such callback can harm US carriers (and consumers) and benefit the foreign carrier—even though US carriers individually supply voluntarily the US-outbound callback minutes. This is seen as follows (for more details, see the Appendix).

A US carrier whose market share is sufficiently small can profit by selling outbound minutes to callback operators at a wholesale price  $w$  equal to the settlement rate  $r$  plus the origination cost  $c_d$ . It breaks even on the outbound sale after paying  $r$  abroad, but expands its share of inbound terminating traffic by expanding its outbound market share. (This share expansion effect outweighs the carrier's loss from the drop in total US inbound minutes due to callback, if its initial share is small enough. See Section V.A.) The carrier's participation in callback, however, lowers termination profits to other carriers, in two ways: the increase in its share of inbound minutes imposes an equal decrease in their total share; and the reduction in US inbound minutes caused by callback is borne by all carriers (in proportion to their market shares). Specifically, the change in profit to carriers as a group is  $w - 2r$ , since net profit on the outbound minute is  $w - r - c_d$  but inbound termination profit falls by  $r - c_d$ . Thus,  $w \leq r$  ensures that callback is excessive for carriers as a group. Such below-cost pricing of callback minutes is not uncommon. For example, in the early 1990s prices for wholesale minutes to callback operators from the US to Hong Kong fell to half the settlement rate (HKTI, 1997; see also the Appendix for further discussion).

Below-cost pricing of US outbound minutes for callback that implements pure call reversal reflects proportional-return driven competition for shares of inbound traffic, which dissipates US termination profits.<sup>24</sup> US callers are likely to lose from callback. The discounted

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<sup>24</sup> If the IMTS market is imperfectly competitive, proportional return need not drive retail prices for outbound calls below the true marginal cost and, indeed, by helping to offset the overpricing distortion created by imperfect competition it can increase welfare (Galbi, 1997). However, the welfare implications of proportional return are different in the case of callback. First, the added outbound

callback minutes are not supplied to them but to callers abroad (indeed US carriers may be willing to discount callback minutes aggressively partly because they can capture the benefits of proportional return without directly undermining their retail revenues); and the induced fall in the ratio of US inbound-to-outbound traffic is likely to raise carriers' marginal costs of supplying outbound calls and therefore raise US retail prices (Section III.B).<sup>25</sup> Thus, proportional return makes it possible even for nonalliance callback to reduce US welfare.<sup>26</sup>

Contrary to common perceptions, a foreign monopolist can benefit from callback even where callback is initiated by independent operators and deprives the monopolist of the retail price  $p_f$ . A sufficient condition for the monopolist to gain is  $p_f < 2r$ .<sup>27</sup> Where the monopolist

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minutes are not originated by US callers. Second, callback reduces US inbound minutes, thereby reducing termination profits to US carriers—which typically raises the marginal costs of sending outbound minutes, thereby harming US callers. The difference between callback and genuine US originating minutes can be seen as follows. The level of genuine minutes would be socially efficient for the US if the retail price of such minutes were equal to the marginal resource cost plus the foreign settlement rate (but excluding any profit from return traffic, which is a pure transfer from other carriers). By contrast, if the (wholesale) price of outbound minutes for callback were equal to the same marginal cost, callback would be excessive: reducing one such minute would benefit US carriers by increasing the profitable US-terminated minutes (assuming the call is still made, but now as a regular US inbound call) without harming US consumers.

<sup>25</sup> The rise in US prices implies that consumers will lose, assuming that they derive utility only from calls they originate. Relaxing this assumption can introduce offsetting considerations, in cases where callback arbitrages a foreign monopolist's retail prices and therefore lowers the price to foreign callers. This price reduction can benefit US consumers directly, if they value the price reduction enjoyed by foreign callers such as family members, or indirectly, if total calling volume increases and US consumers value receiving (not just making) calls. Observe, however, that these potentially offsetting effects are absent in the case of *alliance* call turnaround, since foreign retail prices then do not fall.

<sup>26</sup> Insofar as proportional return not only promotes callback but also helps mitigate the overpricing of genuine calls from the US resulting from imperfect competition among US carriers, a superior solution is to address this distortion directly, by increasing US competition. This task is a considerably more manageable than mandating increased competition abroad, because the US lacks jurisdiction over foreign nations whereas it already has a legal and policy commitment (1996 Telecommunications Act, FCC rules) to promoting competition domestically. Observe that eliminating proportional return would make it unprofitable for US carriers to sell below-cost callback minutes used purely to reverse calls from the foreign country to the US. However, callback could still be used to arbitrage differences in retail prices in the two directions; to undercut a foreign monopolist's retail prices to third countries by using two outgoing calls from the US (a callback to the foreign country, patched together with a US call to the third country; see Section I); and to provide advanced services not offered by incumbents.

<sup>27</sup> If callback leaves total traffic unchanged, the monopolist's change in profit is  $2r - p_f = (r - c_f) - (p_f - c_f - r)$ , the termination margin on the additional inbound call minus the retail margin on the lost outbound call. Incorporating the fact that callback may increase calling volume by lowering the price to

retains the retail revenue, as with alliance turnaround discussed in Section II.C, no arbitrage of its retail pricing occurs; therefore, the alliance necessarily gains from instituting callback provided the associated signaling cost ( $x$ ) is sufficiently low (Proposition 2). Foreign carriers are catching on; as noted, in 1997 HKTI launched its own callback operation.

## **B. A Pareto Superior Settlements System**

Abandoning proportional return would remove the above distortions, as well as incentives for foreign manipulation via call inflation. But if proportional return is abandoned, what replaces it? Granting foreign monopolists unfettered discretion over who terminates their US traffic would give them increased leverage over competing US carriers—the very whipsawing concerns that prompted adoption of the ISP. One alternative to proportional return that still removes discretion is to require that pre-specified shares of its traffic must terminate with various US carriers (reflecting, perhaps, these carriers' *historical* shares of outbound traffic). By decoupling the allocation of inbound minutes from outbound traffic, this would eliminate incentives for call inflation in outbound minutes.

Such exogenous allocation of inbound minutes raises the question of how to treat new US carriers; if new carriers are entitled to a share of inbound minutes, an element of proportional return is reinstated (this time, by inducing excessive entry of carriers). One approach might be to grandfather the allocation of inbound minutes among existing carriers. This would endow them with rents; but it would avoid wasteful competition for such rents and would not disadvantage new carriers in competing for outbound traffic, since incumbents' fixed termination profits would provide no marginal incentive to increase their outbound minutes. The more serious issue would be a foreign monopolist's remaining incentives to engage in alliance call turnaround of calls from its country to the US. Such turnaround incentives will persist as long as the US settlement rate with that country remains above marginal cost (Proposition 3). And, of course, unilaterally cutting only the US settlement rate to marginal cost would impose substantial losses

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foreign callers, and hence increase the monopolist's profit from termination, Scanlan (1996) shows that the monopolist can benefit even if  $p_f > 2r$ .

on US carriers and consumers.

We propose a reform that eliminates foreign incentives for both call inflation and call turnaround, and benefits both countries. Instead of the ISP, which mandates equal settlement rates and proportional return allocation of US-inbound traffic, consider the following asymmetric system: cut the US rate to marginal cost; and cut the foreign rate to the net average termination cost,  $AC$ , of US carriers given in (11). Thus, in (13) below,  $r_d$  denotes the termination rate paid to US carriers, and  $r_f$  denotes the rate paid to the foreign carrier:

$$(13) \quad \text{Asymmetric Settlements System:} \quad r_d = c_d \quad \text{and} \quad r_f = r - (r - c_d)(N_I / N_O).$$

**PROPOSITION 8:** Compared to the ISP, the Asymmetric Settlements System in (13) has the following properties:

- A) It eliminates incentives for call inflation or turnaround by the monopolist and its US ally.
- B) It eliminates the other distortions from proportional return (bias against larger carriers and excessive callback).
- C) At initial traffic levels, it is profit-neutral for *all* carriers.
- D) At initial traffic levels, it reduces the marginal cost of sending minutes for *all* carriers.

**Proof:** Parts A) and B) follow immediately because setting the US rate at  $r_d = c_d$  eliminates rents to any US carrier from terminating inbound traffic. Part C) follows by comparing the termination surplus (net of origination costs)  $G$  of the foreign carrier  $f$  and any US carrier  $i$  under the ISP and under the proposed system (denoted by \*), evaluated at the ISP levels of  $N_O$ ,  $N_I$  and  $s_i$ :

$$\begin{aligned} \text{Foreign carrier:} \quad & G_f = (r - c_f)N_O - rN_I; & G_f^* &= (r_f - c_f)N_O - r_dN_I \\ \text{Any US carrier:} \quad & G_i = s_i[(r - c_d)N_I - rN_O]; & G_i^* &= s_i[(r_d - c_d)N_I - r_fN_O]. \end{aligned}$$

Substituting for  $r_d$  and  $r_f$  from (13) shows  $G_f = G_f^*$  and  $G_i = G_i^*$ . Part D) follows for the foreign carrier, because its marginal cost drops to  $c_d$  from  $r$  (it is  $r$  under the ISP because the monopolist

does not encounter a proportional return effect—it terminates all traffic into its country regardless of how much traffic it sends). For any US carrier  $i$  with positive initial minutes  $n_i > 0$ , expressions (11) and (12) showed that under the ISP,  $MC_i(n_i) > AC$ ; whereas under the new system, any carrier  $i$  attains  $MC_i(n_i) = r_f = AC$ . *Q.E.D.*

The profit-neutrality of our system at initial traffic levels can alternatively be seen as follows. Since traffic levels are held constant, costs are unchanged. Now consider revenues. Re-express  $r_f$  as  $r_f = (N_i/N_o)C_d + (1 - N_i/N_o)r$ . Then  $f$ 's termination revenue from US carriers, under the new scheme, is  $r_f N_o = N_o(N_i/N_o)C_d + N_o(1 - N_i/N_o)r$ . The first term is simply  $N_i C_d$ , which cancels the payment that  $f$  would make to US carriers, at initial traffic levels, under the new asymmetric scheme. The second term,  $(N_o - N_i)r$ , equals  $f$ 's net termination revenue under today's symmetric termination rates  $r$ . Consequently, at initial traffic levels, termination profit for  $f$  remains unchanged. A similar calculation shows profit neutrality for US carriers.

Next consider the asymmetric system's efficiency advantages over the ISP. These can be grouped into two categories: savings on resource and regulatory costs, stemming from properties A) and B); and traffic expansion, stemming from D). Regarding A), eliminating US termination profits removes incentives for gaming by foreign carriers—which economizes on the resource costs of traffic re-routing. Incentives would remain for US carriers to turn around or re-originate calls destined to the foreign market. Our model abstracted from these incentives by assuming a foreign monopolist with complete control over termination into and callback out of its country. However, stepping beyond the model, the asymmetric system reduces US gaming incentives as well, since it also cuts the settlement rate abroad. Regarding B), by eliminating the profit margin on US terminated traffic, the new system removes the other distortions created by proportional return. Also, eliminating inbound termination profit renders proportional return obsolete, and therefore permits savings of regulatory costs by discarding this policy.

The other source of gains in efficiency is stimulation of traffic in both directions. The marginal cost falls for any US carrier at its present level of outbound minutes. This, in turn, should result in lower US retail prices and increased outbound minutes, benefiting consumers.

The increase in total output, coupled with removing the output-mix bias against large carriers, means that US welfare also should rise—because at initial traffic levels the US is no worse off. The foreign carrier’s marginal cost also falls, from  $r$  to  $c_d$ , inducing it to cut prices for calls from its country (since the monopoly price is decreasing in marginal cost; Tirole, 1988). Foreign callers therefore benefit. The foreign carrier also benefits. Under the settlement rates of system (13) its profit is unchanged at initial traffic levels; however, these lower settlement rates benefit the monopolist by increasing traffic in both directions.

The basic idea behind the asymmetric system (13) is to deliver the same net payment from US carriers to the foreign carrier,  $r(N_O - N_I)$ , in a less distorting manner.<sup>28</sup> Whereas today’s symmetric rate yields profit only on the traffic imbalance, the new system would let the foreign carrier earn profit on all US outbound minutes ( $N_O$ ), while paying only the US marginal cost on minutes it sends; this permits reducing the foreign settlement rate to the aforementioned  $r_f$  while preserving the same profit inflow at initial traffic levels. The advantage, of course, is that lowering the marginal settlement rates will reduce the marginal costs of sending traffic and therefore should stimulate traffic in both directions.

Table 3 illustrates the impact of replacing the ISP with system (13). Observe that the ISP renders the net marginal costs of foreign termination higher for carriers with larger market shares, with the largest carrier, AT&T, having the highest termination costs; for example, at today’s traffic levels to Mexico, AT&T’s marginal cost is 34¢ compared to 27¢ for WorldCom, a 21% difference. Adopting system (13) would reduce *all* US carriers’ marginal costs to the *same* constant level, equal to today’s average cost, thereby eliminating the artificial disparity in costs, while also bringing all costs lower.

—INSERT TABLE 3 ABOUT HERE—

The asymmetric system (13) is not first best, as it leaves  $r_f > c_f$ . Its appeal lies in yielding

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<sup>28</sup> The fact that the US has a settlements deficit ( $N_I < N_O$ ) with virtually every non-liberalized country ensures that  $r_f$  would be positive in our proposed system for each such country (thereby obviating concerns that US carriers might send out traffic purely to receive payments from the foreign carrier).

a Pareto improvement, at least at the level of countries (some US carriers may lose, especially smaller ones). Foreign carriers have protested vociferously that the FCC's (1997a) Benchmarks policy, which lowers symmetric settlement rates, reduces their profits on the traffic imbalance. The asymmetric scheme here is immune to this criticism since foreign carriers would benefit.

Moreover, one could modify the particular value of  $r_f$  to achieve profit neutrality at other projected levels of traffic or termination rates, not necessarily those prevailing today, while maintaining the aforementioned incentives to expand traffic by reducing marginal costs. First, suppose that outbound traffic for the next period is expected to grow to  $N'_O$ , and inbound traffic is expected to grow to  $N'_I$ . One could modify our scheme to use the specified  $r_f$  for the current period, and then revising  $r_f$  in the next period to equal  $r_f = r - (r - c_d)(N'_I/N'_O)$ . In the meantime,  $r_d$  would equal  $c_d$ . If traffic turns out as predicted ( $N'_O$  outbound and  $N'_I$  inbound), then in the next period, foreign and US carriers earn the same termination surplus under the new rates as they would have earned under the old symmetric rate  $r$  and the new traffic levels. Notice that if outbound and inbound traffic are expected to grow at the same rates under the old ISP plan, then no revision in  $r_f$  is called for beyond the initial specification in (13). Next, suppose a future benchmark rate  $r'$  is expected to yield traffic levels  $N'_I$  and  $N'_O$ . One could define a new foreign settlement rate  $r'_f$  as in (13) that would keep profits unchanged at the predicted benchmark traffic levels  $N'_I$  and  $N'_O$ , but induces traffic expansion:  $r'_f = r' - (r' - c_d)(N'_I/N'_O)$ .

***A sliding scale system.*** Consider a variation on system (13), that eliminates entirely the foreign pricing distortion by bringing the marginal foreign settlement rate down to marginal cost: as before, cut the US settlement rate to marginal cost; but replace the uniform rate  $r$  charged to US carriers by a sliding scale, with the rate dropping to foreign marginal cost  $c_f$  for all minutes beyond a certain threshold (unlike the FCC's proposed capping of settlement rates, which would reduce foreign carriers' profits also on inframarginal minutes). The threshold would be carrier-specific, not industry wide, to avoid a race-to-be-last among US carriers (each waiting for others to send the high-priced minutes, and trigger the lower rate for all). The first part of the sliding scale serves effectively as a fixed fee that transfers profit to the foreign carrier without distorting marginal decisions by US carriers for outbound traffic. To prevent the foreign carrier from

losing, given that today it earns profits on the traffic imbalance into its country, one could charge  $r_f$  as in (13) for a carrier's minutes up to its initial level  $n_j$ , and  $c_f$  thereafter.

The sliding-scale system, however, requires choosing the thresholds for various carriers—each will clamor for a lower threshold at which it qualifies for the lower foreign settlement rate. This could be a thorny issue, especially as carriers' market shares change over time and new carriers enter, because different carriers could end up facing differing marginal rates. System (13) avoids this problem, by setting the new uniform rate  $r_f$  to all US carriers.

## **V. A CLOSER LOOK AT ALLIANCE ROLES**

### **A. How Alliance Relationships Can Facilitate Settlements Manipulation**

Gaming the ISP as described in Section II requires cooperation between the foreign monopolist and a US carrier. That carrier provides the facilities for sending the added US outbound minutes created by call inflation or turnaround and as a result obtains an increased share of US inbound minutes (for proportional return purposes, outbound minutes sold by callback operators and other resellers are credited to the carrier on whose facilities the calls travel). Cooperation is needed because, as shown below, call inflation or turnaround can increase the partners' overall profit but harm one of them.

Thus far we have assumed that cooperation is tight enough that the goal of the alliance is to maximize its partners' joint profit. This assumption is natural when the "alliance" entails integration between the carriers; but even for less cohesive arrangements, such as joint ventures, joint maximization can still be a useful benchmark. It is hard to be more precise about alliances in general. The details of an alliance will matter, as will the feasibility of complex contracts that might substitute for structural alliances; in a world of complete contracts, integration or other governance modes would be redundant—their advantages hinge on the particular economic and legal constraints on feasible contracts (see, e.g., Mathewson and Winter, 1984; Holmstrom and Tirole, 1989; Milgrom and Roberts, 1992). Without attempting a taxonomy, one can nevertheless identify several channels through which alliance arrangements that tighten joint ownership and

control can advance joint profit maximization through settlements manipulation.<sup>29</sup>

**Possible alliance roles.** A joint venture formed ostensibly for legitimate purposes such as joint marketing (indeed, efficiency and gaming motives can coexist) could help disguise traffic manipulation, where the legality of manipulation is a gray area. For example, a spike in the US outbound minutes of the ally carrier due to call inflation or call turnaround might be attributed to increased marketing and promotion by alliance that boost “legitimate” minutes.

Alliance relations could reduce the costs of resolving disputes, e.g., by establishing procedures to economize on costly bargaining or by granting the parties mutual auditing rights. Alliances also could be especially helpful for harmonizing the parties’ incentives, by offering a vehicle for direct profit sharing or one where financial transfers can be made in a manner less detectable to regulators. For example, the foreign and US carriers could share profit through co-ownership of a joint venture; and they could use such a venture to help disguise financial transfers from one carrier to the other by having the former undertake a disproportional contribution towards covering the venture’s marketing or other costs. As explained next, the need for such profit sharing or compensation arises because traffic manipulation can harm one of the partners even while increasing their combined profit.

**The need for compensation.** Consider first a case where the direction of compensation would be from the US ally  $a$  to the foreign monopolist  $f$ . Suppose that call inflation by  $a$  takes the form of *re-originating* through the US some traffic from a third country, X, destined to  $f$ . Suppose that  $f$ ’s (symmetric) termination rate is higher with X than with the US. Provided the difference in rates is not too great (and the extra transport cost of re-routing is not too high), the alliance as a whole can gain from re-originating some such traffic through the US—by increasing  $a$ ’s share of the traffic from  $f$  at the expense of nonalliance carriers. However,  $f$  would lose from

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<sup>29</sup> Although nonlinear contracts might substitute for integration or alliances in certain circumstances, such contracts have their limitations; otherwise, they could also be used to attain any efficiency functions which carriers cite for integration/alliances when petitioning for approval of such arrangements. Because joint ownership and control typically do make a difference, antitrust and regulatory agencies in the US have typically scrutinized such arrangements, when at least one of the parties possesses significant market power, under a tougher standard than that governing looser relations.

such re-routing, since the termination rate from the US is lower than from X. In such a case,  $f$  supports the re-origination only if it can share in  $a$ 's increased profit.

Now consider three examples where compensation would be needed from  $f$  to  $a$ . First, modify the previous example of call inflation through re-origination, by assuming that  $f$ 's termination rate with country X is lower than with the US. As before, call inflation diverts termination profit from nonalliance carriers to  $a$ , thus raising the alliance's overall profit. But now  $f$  benefits, while  $a$  may lose despite the diversion—because it incurs the differential between the higher termination rate from the US than from country X. (The differential is what matters, because the carrier in X would pay  $a$  for the termination payments it otherwise would make to  $f$ .) If so, re-origination becomes mutually profitable only if  $f$  compensates  $a$ .

Second, consider call inflation through a net expansion of useless (e.g., computer generated) minutes. The alliance as a whole can benefit (Proposition 1); but  $a$  loses unless compensated for the increased termination payments it makes to  $f$  for the additional minutes.

The third and probably most important example where compensation would be needed from  $f$  to  $a$  involves call *turnaround*. Suppose  $t > 0$  minutes are turned around and added to  $a$ 's outbound minutes. We investigate the need for compensation by exploring the limits of linear contracts between  $f$  and  $a$ . Specifically, suppose that for each of the  $t$  minutes  $a$  is offered by  $f$  a linear price equal to  $a$ 's origination cost ( $c_d$ ) plus  $a$ 's net marginal cost of termination from (12), evaluated at  $a$ 's higher, post-turnaround level of minutes.<sup>30</sup> Would the arrangement leave  $a$  no worse off than if it rejects the offer?

The tradeoff facing  $a$  can be visualized as follows (for a formal treatment see the proof of Proposition 9 in the Appendix): (i) the reduction in inbound minutes harms  $a$  by shifting up its marginal cost function of sending outbound minutes; but (ii)  $a$  benefits by sending the additional minutes, because its new  $MC$  function—which incorporates both the effect of fewer inbound minutes and the proportional return gain from expanding  $a$ 's outbound minutes—is rising, and

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<sup>30</sup> This experiment assumes that the carrier continues to supply the same number of outbound minutes in the retail (i.e., non-turnaround) market.

for all the  $t$  minutes  $a$  receives a price equal to its higher marginal cost,  $MC_a(n_a + t; N_I - t)$ . The arrangement will be profitable to  $a$  if its initial outbound share ( $s_a$ ) is sufficiently small. To see this, observe that  $a$ 's loss from the drop in inbound minutes, effect (i), is  $(r - c_d)ts_a$ , which goes to zero for any  $t$  as  $s_a$  goes to 0 (carriers other than  $a$  were terminating most of the lost minutes).

However, the scheme is clearly unprofitable to  $a$  if its initial share is sufficiently large. The loss term  $(r - c_d)ts_a$  is then relatively large. In contrast, the gain effect, (ii), becomes arbitrarily small as  $s_a$  approaches 1. Because marginal cost is continuously increasing, the gain (ii) is no bigger than  $t$  multiplied by the change in marginal cost; since marginal cost increases *continuously* and equals  $r$  for  $s_a = 1$ , this change in marginal cost goes to zero as  $a$ 's market share approaches 1. Intuitively,  $a$ 's maximal gain from diverting inbound minutes from other carriers is small if it is already getting most of these minutes on account of its initially high share. How large can  $s_a$  be before  $a$  rejects any call turnaround under the proposed linear compensation? The Appendix establishes the following result.

**PROPOSITION 9:** Suppose that turnaround reverses  $t$  inbound minutes into  $t$  outbound ones sent by the US ally carrier  $a$ , and  $f$  pays  $a$  for each of the  $t$  minutes a price equal to  $a$ 's marginal cost of sending outbound minutes evaluated at  $a$ 's post turnaround level of minutes. Then carrier  $a$  prefers zero turnaround ( $t = 0$ ) over any positive amount if its initial market share  $s_a$  exceeds  $s_{\max}^* = \left[ N_I / (2N_O + N_I) \right]^2$ . In particular, if initially outbound traffic exceeds inbound ( $N_O \geq N_I$ ), then under the hypothesized linear pricing arrangement, carrier  $a$  would find turnaround of any minutes unprofitable if its initial market share is above 1/9, or approximately 11%.

Two comments are in order. First, the threshold market share  $s_{\max}^*$  will be even lower than 1/9 if initially  $N_O$  strictly exceeds  $N_I$ , as is the case between the US and most countries. For example, between the US and Mexico  $N_O = 2.4N_I$ , so  $s_{\max}^*$  is only 3%.

Second, if  $a$ 's initial share exceeds  $s_{\max}^*$  then, under the linear pricing scheme,  $a$  would reject *any* turnaround; but even for  $s_a < s_{\max}^*$ ,  $a$  would reject turnaround beyond a certain fraction of inbound traffic. In particular, the Appendix shows that a US carrier will reject turnaround of

any given fraction  $\rho$  of inbound traffic ( $\rho = t/N_i$ ) if its initial outbound market share exceeds  $s^* = \rho(1-\rho)\left[(\rho + N_o/N_i)^2 + \rho(1-\rho)\right]^1$ . Note that  $a$  would always reject complete turnaround ( $\rho = 1$ ). Complete turnaround would eliminate all profit from inbound termination; and since  $a$ 's marginal cost of outbound traffic would become constant (equal to  $r$ , as the proportional-return gain disappears once all inbound traffic has been turned around),  $a$  would earn no offsetting profit on the outbound traffic. For the US-Mexico case, the Appendix derives for any level of turnaround, the highest initial  $s_a$  for which  $a$  would accept that turnaround level.

## B. Retail Market Extensions

Thus far we have consciously provided only a partial analysis—of the termination cost side and the implied traffic manipulation motives for alliances. Developing a more complete understanding of both the positive and normative aspects of alliances requires studying the demand side explicitly and, related to this, incorporating efficiency motives for alliances. These can include joint marketing; providing seamless, one-stop global service; and, an issue discussed next, mitigation of double-marginalization distortions in the pricing of calls to the monopoly market when retail competition in the liberalized country is imperfect.

An interesting extension would be to introduce retail side competition (in prices with differentiated products) and consider two motives for an alliance: gaming the settlements process, and addressing double marginalization. Recall that the foreign carrier would seek to ally with a *small* US carrier if the alliance's purpose is to divert profit from US carriers through manipulating the ISP (see Section II.C, Remark 1).<sup>31</sup> In contrast, if the alliance is aimed at reducing double marginalization, one would expect the foreign carrier to affiliate with a larger rather than a smaller US carrier. Doing so allows it to offer a price reduction directly to more subscribers than if the affiliation were with a small carrier, an ability that is valuable, for example, if services of different carriers are imperfect substitutes in the eyes of consumers.

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<sup>31</sup> More generally, the likelihood that an investment in an oligopoly setting is motivated by profit diversion is greatest when the investing firm is small rather than large. See, for example, Schwartz (1989), especially Remark 3.

The two alliance motives thus yield opposite predictions about the preferred alliance partner. They also have different welfare implications.

Consider first the gaming motive. One issue is whether retail market effects dampen or magnify the alliance's gains from call inflation or turnaround compared with our expressions (6) and (8), which hold constant retail prices and nonalliance carriers' outbound minutes. There are conflicting forces. Gaming under proportional return increases the marginal costs of nonalliance carriers for outbound minutes, which tends to raise their prices and reduce total industry minutes terminating abroad. This effect decreases the alliance's gain. However, raising nonalliance carriers' marginal costs diverts retail market profits to the ally—which increases the alliance's gain.<sup>32</sup> A priori, incorporating these retail market effects could make the alliance's gains from traffic manipulation smaller *or larger* than those identified in the paper. Moreover, with the standard assumption that retail prices are strategic complements, the rise in nonalliance carriers' prices will raise the price that maximizes the ally carrier's retail market profit. Thus, the gaming motive suggests that all prices will rise, even after considering retail market conduct.

But an opposing factor is the alliance's role in alleviating double marginalization. The ally carrier now internalizes the vertical pricing externality—it recognizes that lowering its price will typically increase total industry outbound minutes, and thus its foreign partner's termination profit. Anticipating that the ally carrier's optimal price is lower than if it were maximizing only its profit, nonalliance carriers cut their prices. Thus, the net effect on prices when both alliance motives are admitted—settlements gaming and double marginalization—appears ambiguous.

One modeling approach to these issues would be to assume an exogenous constraint—reflecting technology or regulation—on the degree of traffic manipulation. For varying levels of

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<sup>32</sup> This effect in the retail market for US-outbound calls is reminiscent of raising rivals' costs (Salop and Scheffman, 1983). But there are two wrinkles: here, the perpetrator loses as input supplier—of foreign termination to the nonalliance carriers; however, the “investment” in raising rivals' costs, which can render usual RRC strategies unprofitable, in our case directly increases the perpetrator's profit (by reducing the termination payments to nonalliance carriers for US-inbound calls). Indeed, in our paper, the purpose of manipulating the ISP is to reduce these termination payments; the impact on nonalliance carriers' marginal costs of outbound calls arises as an indirect consequence, due to the linkage created by proportional return.

this constraint, one might ask: Would the monopolist prefer to partner with a small or large carrier, taking into account double marginalization, diversion of termination and retail profits from nonalliance carriers, and that raising nonalliance carriers' marginal costs for outbound traffic permits an increase in the ally's retail price?<sup>33</sup> What are the overall welfare effects, and the effects on particular groups (nonalliance carriers, consumers)? How will the monopolist's entry via the alliance into the liberalized market affect its retail pricing incentives for calls from its country, given that its partner collects some termination profit in the liberalized market?

## VI. CONCLUSION

International call termination, a vital input for telecommunications services, is typically priced well above cost. In many countries, the overpricing is due to the persistence of monopoly carriers. In certain liberalized countries, it is due to measures adopted to prevent foreign monopolists from whipsawing their competitive carriers, such as the ISP in the US, by mandating, *inter alia*, equal termination rates at home and abroad. This mandated symmetry potentially benefits the US (more generally, the liberalized country) in two ways: it limits the foreign monopolist's ability to extract US carriers' termination profits on its traffic, while continuing to profit on theirs; and it reduces the monopolist's gain from seeking a higher rate in its own country, since that rate would apply also to its traffic abroad. Thus, anti-whipsawing measures attempt to restore some symmetry in bargaining power, in the face of highly asymmetric competitive conditions for call termination.

The ultimate cure for monopoly pricing, and its associated wasteful circumvention practices and regulatory distortions, is for ubiquitous competition to develop in all countries. But countries' transition to competition will take time, and its pace will be uneven. During the

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<sup>33</sup> Raising the retail price to US callers can be profitable as a substitute for raising the foreign termination rate, which is constrained. Since the gain from raising the retail price is greater for a larger carrier, this effect might push the monopolist to partner with a *large* carrier (whereas the profit diversion motives—for both retail sales and termination profit—call for partnering with a small carrier).

asymmetric transition, traffic re-routing practices—the focus of our paper—are commonly viewed as serving pro-competitive arbitrage roles. While this view may have been accurate historically, looking ahead the situation can be quite different. The belief that re-routing practices benefit liberalized countries rests on implicit, but questionable, assumptions that monopolists will not re-balance their rates and, more importantly, will not use the very same practices against competitive carriers. We argue next that, on balance, re-routing practices are likely to favor the monopolists; then we discuss policy implications for liberalized countries.

#### **A. Do Re-routing Practices Favor Liberalized Countries?**

Even when used by competitive carriers, re-routing practices have significant limitations against carriers who hold monopoly control over international termination in and facilities from their countries. Callback from a liberalized country can be used to arbitrage differences between the monopolist's retail price and the price from the other country; callback, however, does not discipline the monopolist's termination rate—for the simple reason that callback traffic incurs termination charges. As for re-origination, it is often lauded as pro-competitive arbitrage of a monopolist's differing termination rates with various countries. This view, however, presumes that the monopolist will leave its settlement rates unchanged or will cut its higher rates to foil arbitrage. Instead, the monopolist might seek an intermediate uniform rate, which entails raising some rate(s). If some rates do rise, the effect on overall (global) welfare and on consumers is ambiguous, tracking the general welfare ambiguity of third-degree price discrimination relative to uniform monopoly pricing.<sup>34</sup>

The preceding shows the limitations of callback and re-origination when used by competitive carriers. The point of our paper was to go further and show how these same tools can

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<sup>34</sup> Malueg and Schwartz (1994) analyze this welfare ambiguity in the context of policies towards gray market (“parallel”) imports. A difference in international telecom is that a carrier typically cannot raise its settlement rate unilaterally, since it negotiates rates with foreign correspondent carriers. If a monopolist subject to re-origination arbitrage cannot raise the lower of its settlement rate(s), arbitrage indeed will push prices systematically lower. This outcome, however, depends on the monopolist's assumed inability to raise its lower rate(s). And in the absence of policy intervention by liberalized countries, carriers from monopoly markets would be in a strong position to dictate settlement rates.

be used by monopolists against liberalized countries, especially if the monopolists are allied with carriers in such countries. We focused on gaming of the US's ISP, abstracting from arbitrage. The main danger is call turnaround. A monopolist could retain the retail revenue from US-destined calls originating in its country, but reverse these calls for settlements purposes into US-outbound calls carried by its US ally. Such call turnaround opportunities can be highly asymmetric. The monopolist can exploit the existence of competing providers of US facilities vying to be its partner. In contrast, US carriers could not use turnaround to avoid the monopolist's termination overcharges because, by assumption, the monopolist controls all outbound facilities from (and termination in) its country.

Re-origination entered our analysis as a method of call inflation, not arbitrage; re-origination from the US of third-country calls destined to the monopolist's country is one way to artificially boost the ally's recorded traffic from the US and, hence, the share of traffic from the monopolist that the ally may terminate under proportional return rules. Stepping beyond our model, however, re-origination also can be used for arbitrage—but disproportionately by monopolists. Re-origination opportunities can be asymmetric for the following reasons.

First, as the sole provider of termination, the monopolist may be able to pressure foreign carriers it suspects of re-originating traffic into its country, whereas it can whipsaw competitive carriers into accepting re-originated traffic into their countries. Second, a monopolist is immune to inbound arbitrage if its rates with all countries are uniformly high. Whereas if liberalized countries adopt uniformly high (symmetric) rates with a monopolist but low rates for their bilateral traffic, the monopolist could route its traffic into a liberalized country as transit traffic through another and exploit their lower bilateral rate.<sup>35</sup> In effect, the monopolist whipsaws

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<sup>35</sup> Suppose the US and Canada adopt a low settlement rate,  $\underline{r}$ , and consider a monopoly country, M, which has a higher common settlement rate  $r > \underline{r}$  with both. The monopolist is not vulnerable to arbitrage on traffic to its country. However, it could profitably re-route its traffic to the US through Canada, because a Canadian carrier would recognize this traffic as not terminating in Canada and thus accept far less than  $r$  for re-originated minutes. Even if US carriers recognize that the increased “Canadian” traffic is really re-origination by M and therefore, under proportional return, harms US carriers as a group, the competing US carriers—especially smaller ones—would willingly terminate some such minutes.

carriers in different liberalized countries instead of competitive carriers in a given country. This could become a serious issue for EU countries, for example, as they reduce settlement rates for intra-EU traffic towards costs but retain high rates with less liberalized countries.

By insulating monopolists from paying high termination charges in liberalized countries, while they collect high rates on traffic from such countries, asymmetric re-routing opportunities enable monopolists to negate the anti-whipsawing measures of liberalized countries, which aim to ensure that termination rates paid are equal in both directions. Not only do liberalized countries lose termination profits on inbound traffic, they also risk paying higher rates for their outbound traffic. The latter follows because monopolists' ability to avoid paying high rates for terminating their own traffic—despite the nominal symmetry of settlement rates—will prompt them to seek higher rates for traffic into their countries.

As a limiting case, consider the following thought experiment. Suppose a monopolist could unilaterally set uniform (and symmetric) settlement rates for traffic between its country and all others. This would end re-routing by competitive carriers to arbitrage its settlement rates. Callback from a competitive market might still constrain a monopolist's outbound retail price. However, the monopolist could raise the price of callback by raising the (symmetric) settlement rate; it can then collect its profit through retail prices for outbound calls or termination charges for inbound callback. The monopolist avoids the higher symmetric rate for its traffic abroad if all such traffic has been turned around (by the monopolist or by independents). Complete turnaround also nullifies any effect on callback prices from proportional return where the liberalized country uses such rules.<sup>36</sup> Thus, unrestricted turnaround, coupled with an ability to raise settlement rates,

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<sup>36</sup> With complete turnaround, the net marginal cost to carriers in the competitive country of termination in the monopoly country rises to the settlement rate. With incomplete turnaround, proportional return—while it reduces whipsawing discretion and therefore might limit a monopolist's power to extract an asymmetrically lower settlement rate abroad—reduces the monopolist's loss from raising the symmetric rate. The reason is that an increase in the monopolist's termination payments will, under proportional return, induce competitive carriers in that country to try to expand their shares of this profit pool—by sending more outbound minutes in an attempt (futile overall) to expand their outbound market shares. The ensuing increase in outbound traffic increases the monopolist's termination profit, thereby undoing some of the loss from having to pay more for terminating its own calls abroad.

would restore much of a monopolist's power—even if rates must be equal at both ends.<sup>37</sup> Of course, in practice a monopolist cannot raise settlement rates unilaterally, as rates are negotiated with carriers abroad. Our point, however, is that some such constraint is needed; re-routing practices alone cannot force down a monopolist's uniform settlement rates.

## **B. Policy Implications for Liberalized Countries**

We identified a simple alternative settlements system to the ISP that removes gaming incentives by a foreign carrier, yet benefits both countries and has other attractive properties. The system adopts unequal settlement rates. It cuts the US rate to marginal cost, and cuts the foreign rate to equal US carriers' current net *average* cost of termination abroad (net of their inbound termination profit). At current traffic levels, nothing changes. But the marginal cost of sending calls falls for any US carrier and for the foreign carrier; traffic is thereby stimulated to both countries—which increases overall US welfare and that of consumers, and benefits the foreign carrier. Moreover, by eliminating profits on US termination, this system removes the distortions spawned by today's proportional-return rules beyond foreign manipulation, including the bias against larger carriers, and the excessive incentives to send outbound calls, including ones not useful to US consumers (e.g., discounted sales to callback operators).

If the ISP is not reformed, however, and US settlement rates stay above cost, incentives will remain for foreign monopolists to use traffic re-routing (turnaround and re-origination) to reduce their termination payments to US carriers. We have argued that the risk of this occurring on a large scale is exacerbated if the monopolists own transmission facilities in the US or form

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<sup>37</sup> Consider a monopolist who can unilaterally set any settlement rates to its country, controls all transmission facilities from its country, and can engage in unlimited turnaround of its outbound traffic. Even if subject to perfect arbitrage, such a monopolist could exploit the following market power: for incoming calls, it could set any uniform settlement rate, while eliminating its own termination outpayments via turnaround; for outgoing calls by its subscribers (calls that are turned around for settlement purposes), it could set any uniform retail price below the price floor on callback *to* its country equal to its settlement rate plus the origination cost. Competitive carriers' re-routing practices therefore impose only limited discipline on such a monopolist: they prevent it from charging *discriminatory* settlement rates or retail prices between countries, or a higher retail margin on outgoing calls than the settlement margin on incoming ones. Scanlan (1996) offers similar insights.

alliances with US carriers; and that alliances involving small rather than large US carriers may pose the greater danger of helping monopolists to divert termination profits from nonalliance carriers. Thus, there is a basis for scrutinizing market participation (directly or via alliances) by dominant foreign carriers. Moreover, since regulatory policing against gaming of settlements can be difficult, especially distinguishing when re-routing practices are used for gaming or for pro-competitive arbitrage, reducing incentives for gaming can play a key role. Cutting the settlement rate between two countries will reduce such incentives (Remark 1), as well as mitigate the harm from any gaming that does occur. Thus, a case can be made for conditioning approval of US “entry” by a dominant foreign carrier (directly or through an alliance) on its accepting a decrease in its settlement rate with the US.

There are, however, offsetting considerations that caution against imposing such entry conditions. First and foremost, our analysis consciously left out efficiency motives for foreign carriers’ entry, whether directly or through alliances. Second, actions by liberalized countries individually may be ineffective. Suppose the US restricts participation by a foreign monopolist  $f$  but another liberalized country,  $L$ , does not. If traffic can move at low cost between the US and  $L$  (through private lines or low bilateral settlement rates), then  $f$  can use  $L$  as a hub from which to turn around its US-destined traffic or to re-file its traffic into the US. Foiling such schemes would require coordination among liberalized countries on policies towards dealings between their carriers and foreign monopolists.

The 1997 WTO Telecom Agreement makes issues of entry by dominant carriers into liberalized markets more pressing and more complex. By lowering market barriers it fosters substantial interest in cross-country entry. However, while the Agreement is undoubtedly a milestone toward replacing monopoly with competition worldwide, some countries will liberalize much slower than others. During this asymmetric transition, less open countries might try to limit practices that reduce termination revenue to their carriers, while their carriers exploit

such practices in liberalized countries.<sup>38</sup> Countering such one-sided gaming of international settlements is complicated by WTO rules, which require non-discrimination among all WTO members and therefore require liberalized countries to open their markets equally to each other's carriers as to dominant carriers from closed markets.<sup>39</sup> Thus, a key challenge will be to devise non-discriminatory competitive safeguards (which *are* permissible under the WTO Agreement) against traffic manipulation. Another challenge will be to coordinate policies, since carriers from closed markets could circumvent restrictions imposed by liberalized countries individually.

Not surprisingly, there are no easy answers. The central message of this paper, however, is to warn against relying on traffic re-routing to discipline monopolists. Indeed, re-routing practices can defeat anti-whipsawing measures adopted by liberalized countries. Pending the arrival of ubiquitous competition, monopolistic pricing of international termination must be tackled in other ways.

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<sup>38</sup> Asymmetric liberalization raises other competitive issues not analyzed here, such as ensuring that carriers from liberalized countries are not seriously handicapped relative to carriers from closed markets by being denied adequate market access and hence capabilities to offer global one-stop service.

<sup>39</sup> For example, the FCC had conditioned dominant foreign carriers' participation in the US market on their markets being comparably open to US carriers (Effective Competitive Opportunities or "ECO" test), but abandoned this test in its order implementing the WTO Agreement (FCC, 1997b). From January to May 1998, the FCC approved twenty six applications from foreign carriers to enter the US; thirteen of these were from carriers possessing market power in their home market, and previously would have been subject to a lengthy ECO test analysis ("FCC Grants Over 200 International Service Applications in First 90 Days of New Foreign Participation Rules," FCC, Public Notice, released May 14, 1998).

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**Table 1: Call Inflation**

Country	Settlement Rate (¢/min.)	US Inbound min. $N_I$ (million)	In/Out min. $N_I/N_O$	Cost Assumptions (¢/min.) $c_d = 7, c_f = 8$		Cost Assumptions (¢/min.) $c_d = 7, c_f = 0$	
				$r^*/N_O$ as %	Diverted Profit (\$ million)	$r^*/N_O$ as %	Diverted Profit (\$ million)
Mexico	39.5	948.1	0.40	0.00%	\$0.0	35.97%	\$81.5
Brazil	42.5	123.5	0.33	0.00%	\$0.0	29.88%	\$10.1
Dom. Rep.	40.0	112.9	0.27	0.00%	\$0.0	13.05%	\$4.3

Hong Kong	39.3	96.3	0.18	0.00%	\$0.0	0.00%	\$0.0
Israel	59.0	78.9	0.33	7.12%	\$2.7	56.81%	\$14.9
China	88.6	58.3	0.20	3.14%	\$1.4	50.98%	\$16.1
Singapore	42.0	53.5	0.36	0.00%	\$0.0	34.13%	\$4.8
India	79.0	49.1	0.12	0.00%	\$0.0	10.41%	\$3.3
TOTAL	n.a.	n.a.	n.a.	n.a.	\$4.1	n.a.	\$135.0

Notes: 1) Traffic data and settlement rates are for 1996 (FCC, 43.61 Reports).

2) Assuming the US ally carrier has zero initial market share to that country ( $s_a = 0$ ).

3)  $t^*/N_0$  is alliance's preferred level of inflation, from Proposition 1, which assumes inflation is via creating new minutes (instead of re-originating existing ones).

4) The case  $c_f = 0$  approximates inflation through re-origination (where total minutes terminating abroad do not increase).

**Table 2: Call Turnaround**

Country	Settle ment Rate $r$ (¢/mi n.)	US Inboun d min. $N_I$ (millio n)	In/Out min. $N_I/N_O$	Profit Diversion From Various % of Call Turnaround (\$ million)					$x^*$ (¢/min.)
				10%	20%	30%	40%	100%	
Mexico	39.5	948.1	0.40	\$41.4	\$79.8	\$114.8	\$148.7	\$308.1	23.2

Brazil	42.5	123.5	0.33	\$5.7	\$11.0	\$ 1 0.6 5. 9	\$2	\$43.8	26.6
Dom. Rep.	40.0	112.9	0.27	\$4.6	\$9.0	\$ 1 7.1 3. 1	\$1	\$37.2	26.0
Hong Kong	39.3	96.3	0.18	\$3.6	\$7.1	\$ 1 3.7 0. 4	\$1	\$31.1	27.4
Israel	59.0	78.9	0.33	\$5.3	\$10.2	\$ 1 9.3 4. 9	\$1	\$41.0	39.1

China	88.6	58.3	0.20	\$5.6	\$10.9	\$	\$2	\$47.5	68.3
						1	1.1		
						6.			
						1			
Singapore	42.0	53.5	0.36	\$2.5	\$4.7	\$	\$8.	\$18.7	25.7
						6.	9		
						9			
India	79.0	49.1	0.12	\$3.9	\$7.7	\$	\$1	\$35.4	64.4
						1	5.1		
						1.			
						5			
TOTAL	n.a	n.a.	n.a.	\$72.6	\$140.4		\$204.3	\$264.5	\$562.8
									n.a.

Notes: 1) Traffic data and settlement rates are for 1996 (FCC, 43.61 Reports).

2)  $c_d = 7\phi/\text{min}$ .

3) Assuming the US ally carrier has zero initial market share to that country ( $s_a = 0$ ).

4) For any value of the signalling cost  $x$  below the value of  $x^*$  above, the alliance prefers complete (100%) turnaround (see Proposition 2 (C)).

**Table 3: Average and Marginal Costs**

Country	Settl. Rate <i>r</i> (¢/min.)	Average Cost <b>AC</b> (¢/min.)	Marginal Costs and % Reduction			
			AT&T	MCI	Sprint	WorldCo m
Mexico	39.50	26.56	34.04 (21.97%)	29.53 (10.05%)	27.90 (4.82%)	27.07 (1.90%)
Brazil	42.50	30.69	36.19 (15.20%)	33.15 (7.41%)	33.11 (7.31%)	32.08 (4.33%)
Dom. Rep.	40.00	31.05	33.14 (6.29%)	33.76 (8.01%)	31.47 (1.33%)	32.38 (4.11%)
Hong Kong	39.30	33.53	34.68 (3.31%)	35.83 (6.42%)	35.59 (5.78%)	33.77 (0.69%)
Israel	59.00	41.79	51.21 (18.39%)	46.16 (9.47%)	43.95 (4.93%)	42.87 (2.53%)
China	88.60	72.64	81.30 (10.65%)	76.95 (5.59%)	74.57 (2.59%)	73.62 (1.33%)
Singapore	42.00	29.41	33.69	34.26	31.57	30.59

			(12.72%)	(14.17%)	(6.85%)	(3.88%)
India	79.00	70.47	74.20	74.20	71.51	70.47
			(5.03%)	(5.03%)	(1.45%)	(0.01%)

Notes: 1) Traffic data and settlement rates are for 1996 (FCC, 43.61 Reports).

2)  $c_d = 7\phi/\text{min}$ .

3) Figures in parentheses denote  $[(MC_j - AC)/MC_j] \times 100$ : the percentage drop in carrier  $j$ 's marginal cost from moving to the Asymmetric Settlements System, (13), which makes each carrier's new marginal cost equal to today's average cost ( $MC_j = AC$ , for all  $j$ ).