Bargaining over Interconnection: The Clear-Telecom Dispute *

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Abstract

We explore the problem of network interconnection in local telecommunications. We develop a model with a competitive business sector and a regulated residential sector. The model is used to analyse the celebrated New Zealand antitrust case between Clear and Telecom. We discuss implications of the model for the eonomics of antitrust, including issues of competition versus efficiency and the use of appropriate economic models. We also examine the implications of some proposed rules for interconnection. In particular, we examine reciprocity, 'bill and keep', and the rule that the courts ultimately endorsed, the Baumol-Willig rule.

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JEL Classification: L11, L41, L96

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*We gratefully acknowledge the helpful comments of Iain Fraser and two anonymous referees. We thank Richard Edlin for outstanding research assistance and the *Centre for Research in Network Economics and Communications* at the University of Auckland for financial support.

I Introduction

Stimulated by technological change and a pervasive deregulatory environment, markets for telecommunications services are being transformed around the world. Two different heritages can be identified. Britain is typical of the situation in many countries, where a former government monopoly has been privatized and competing providers encouraged. The industry is overseen by a specific industry regulator. The United States has a different background. Following the break-up of A, T & T, several independent 'baby-bells' enjoyed monopoly power in their own region and were specifically enjoined from providing interconnection between their networks. Very recent legislation allows for interconnection and competition in local area networks. Compared to the single industry regulator in Britain, telecom providers in the United States are responsible to a host of regulatory bodies at federal and state level.

A different course has been charted in New Zealand.[1] When the national monopoly (Telecom) was privatized in 1990, no specific industry regulator was established. Instead, in the course of wide-ranging deregulation, the government explicitly adopted a policy of 'light-handed regulation', relying on the enforcement of existing antitrust legislation to preclude anti-competitive practices. For network industries, this legislative bulwark was supplemented by detailed disclosure regulations, which required that all interconnection agreements and discounts be made public.

A partial exception was made for telecommunications, where the residential sector remains regulated. When Telecom was privatized, the government retained a single share known as the 'Kiwi share'. This requires Telecom to maintain universal service and to preserve the residential price structure at the time of privatization. Telecom must retain a local free-calling option for all residential customers, although it may offer optional alternative tariff packages.

Following liberalization and privatization, several competitors entered the telecommunications market and appropriate interconnection agreements were made for mobile and long-distance services. Clear Communications, a consortium including MCI Communications, Bell Canada and local interests, entered the long distance market in 1991, and eventually succeeded in capturing approximately 20 percent of that market. However, when Clear tried to enter the local call market, targetting business customers in the central business districts, they were unable to reach an interconnection agreement with Telecom. In the absence of any regulatory agency, Clear's only resort was to commence legal action alleging anticompetitive behaviour.

The ensuing litigation is reported to have cost more than $10 million, involving three courts sitting in three different countries. The final judgment endorsed

[1] Australia followed the British lead, establishing AUSTEL to oversee and regulate telecommunications. This does not significantly alter the fundamental economic problem facing the two networks but it may alter the resolution of the interconnection problem. In particular, the regulator arbitrates any disputes, precluding litigation as occurred in New Zealand. Whether this is preferable to New Zealand's light-handed regulation is a complicated issue outside the scope of this paper. See for example Edlin (1996) and Ergas (1995).

a controversial interconnection pricing principle that has become known as the Baumol-Willig rule. After two years further negotiation and threats of government intervention, the parties eventually signed an interconnection agreement. This agreement was soon breached by Clear and further legal action has recently been initiated by Telecom.

In this paper, we analyse the dispute between Clear and Telecom in the context of a specific model of interconnection. The model incorporates the two essential features:

- each network must purchase services from the other
- there is no regulator and both networks have some market power.

Our model differs from prior models of interconnection (Armstrong 1998, Carter and Wright 1999, Laffont, Rey, and Tirole 1998) in that it includes a separate regulated residential sector in addition to the deregulated business sector. The incumbent, Telecom, enjoys a monopoly in the regulated residential market while competing with Clear in the business market. This model allows us to address the positions taken by Clear and Telecom in the litigation and examine their implications for prices, profits, competition and efficiency. It also allows us to evaluate the implications of proposed regulatory solutions and examine the impact of the Kiwi share regulation.

In Section 2, we outline the litigation. Section 3 describes our model of competing telecommunication networks and Section 4 outlines some results. In Section 5, we comment on the legal judgments in the light of our model. Our conclusions are summarized in Section 6.

II An Overview of the Litigation

Clear and Telecom commenced negotiation on interconnection in 1990. While agreement on a toll bypass network was readily achieved, negotiations on local call interconnection proved much less tractable. Throughout the negotiations, Telecom insisted that Clear's operations were nothing more than a large PABX as operated by any business customer.[2] Accordingly, it proposed to charge Clear its standard business rate (per minute) for every call from the Clear network to Telecom network. Telecom rejected any suggestion of reciprocity — it would not pay Clear for completing calls originating on the Telecom network. If Clear insisted on charging an interconnection fee, this would be passed on to the Telecom caller.

On the other hand, Clear insisted that it was entitled to be treated as an equal. It proposed interconnection on the basis of *bill and keep*. Each network would be responsible for charging and billing its own customers and would retain the resulting revenue. Telecom and Clear would not charge each other

[2] A PABX is a private automatic branch exchange, which enables a customer to service multiple internal telelphone handsets with a limited number of outside lines connected to the public telephone network.

for terminating calls in each others network. When Telecom objected to bill and keep on the basis of the different size of the two networks and the potential imbalance of the direction of calls between the two networks, Clear modified their proposal to allow for a settlement regime based on the imbalance of calls, similar to the bilateral arrangements used in international telecommunications.[3]

By August 1991, it was clear that the parties were deadlocked, with little advance from their opening positions adopted twelve months earlier. After an unsuccessful appeal for government intervention, Clear initiated legal proceedings against Telecom. Before the High Court of New Zealand, Clear alleged that Telecom's pricing demands breached s 36 of the Commerce Act 1986. The relevant part of s 36 provides:

> **36. Use of dominant position in a market** —(1) No person who has a dominant position in a market shall use that position for the purpose of (a) restricting the entry of any person into that or any other market; or (b) preventing of deterring any person from engaging in competitive conduct in that or in any other market; or (c) eliminating any person from that or any other market.

It is important to note that there are three necessary ingredients to establish a breach of s 36. The plaintiff must prove that

1. the defendant is in a **dominant** position
2. it makes **use** of its dominant position
3. for one of the proscribed **purposes**.

In preparing their defence, Telecom modified their initial position to incorporate the advice of their expert witnesses - William Baumol, Robert Willig and Alfred Kahn. These economists advocated that, where an entrant utilizes the existing network of its incumbent rival, the entrant should reimburse the incumbent for the full opportunity cost, *including any foregone profits*. Baumol and Willig called this principle the *efficient components pricing rule* while Kahn referred to it as the *competitive parity principle*. It has since become widely known as the *Baumol-Willig rule*.[4]

[3] The international settlements regime is discussed in Carter and Wright (1994) and Wright (1999). A mere difference in size of the two networks does not imply an imbalance of calls (Williams 1995). However, if the networks attract a different mix of subscribers, an imbalance may result. For example, telemarketers generate a net flow of calls into the residential market, while the reverse applies to booking agencies. Furthermore, even if the flow of calls is balanced and there is no net transfer, retail prices are dependent upon the interconnection regime (Carter and Wright 1999).

[4] 'The Baumol-Willig rule is not a name given internationally to an established economic doctrine but a description coined during the case to summarise the evidence called for Telecom of two eminent US economists, Professors Baumol and Willig.' *Clear Communications Ltd v Telecom Corporation Ltd* (1993) 4 NZBLC5 TCLR at 416. The Baumol-Willig rule is justified in Baumol and Sidak (1994). Pickford (1996) contains a clear exposition of its place in the Clear-Telecom dispute.

Under the rule, Telecom was entitled to charge Clear for completing a call its normal business rate per minute less any cost savings directly attributable to Clear carrying part of the call.[5] Conversely, Clear was entitled to charge Telecom for any cost savings (to Telecom) due to Clear completing the call.

Clearly, the application of the rule is asymmetric, in that it provides Telecom with a contribution to common costs and profit that is not available to Clear. Although it was stressed by Telecom's experts, and Baumol in particular, that the rule must eventually be applied reciprocally, just what this would entail was never specified. Nor were they explicit as to when reciprocity would be appropriate.

The Baumol-Willig provided Telecom with a more respectable economic rationale for its stance and offered Clear distinct status as a telecommunications supplier in its own right. The appropriateness of the Baumol-Willig rule for determining interconnection charges became the primary issue argued before the High Court and in the subsequent appeals.

In its judgment, the High Court found that adherence to the BW rule did not breach s 36,[6] since Telecom was not using its dominant position for one of the proscribed purposes [(1992) 5 TCLR 217]:

> In the end it is our judgment that implementation of the Rule is more likely than the alternatives to improve efficient competition in New Zealand telecommunications. In that case, Telecom cannot be said to be using its position of dominance for the purpose of preventing or deterring Clear from engaging in competitive conduct in the New Zealand telecommunications market.

In December 1993, the Court of Appeal overturned the judgment of the High Court, finding that any rule which allowed for the charging of monopoly profits to a competitor or that indemnified a monopolist against loss of custom was likely to breach s 36 of the Commerce Act.

Telecom appealed to the Privy Council whose judgment was delivered in June 1994. The Law Lords upheld the appeal. Although they concurred with the decision of the High Court, the Law Lords gave a different rationale. They rejected the view that Telecom did not have an anticompetitive *purpose*. However, they concluded that Telecom did not *use* its dominant position since it proposed the same outcome as in a perfectly contestable market.

Throughout the litigation, the strongest objection to the Baumol-Willig rule was the risk that it would entrench monopoly rents. Their Lordships took the view that [(1994) 6 TCLR 159]:

> . . . apart from the risk of monopoly rents, the Baumol-Willig rule does provide a proper model for demonstrating what would

[5] In addition, Telecom was entitled to charge Clear its normal (business) line rental for every Clear customer, less any costs savings attributable to Clear providing part of the loop.

[6] The Court did find that Telecom breached s 36 in requiring that Telecom customers would have to dial an access code to reach Clear subscribers. They also breached the Act in their refusal to supply interim DDI access to enable Clear to fulfill a contractual obligation with the Department of Justice in Wellington.

be charged by the hypothetical supplier in a perfectly contestable market.

The Privy Council found that Clear had failed to prove the existence of monopoly rents. They also noted the Commerce Act contained other provisions specifically directed to the regulation of prices in markets that are not fully competitive. Having thus disposed (to their satisfaction) of the issue of monopoly rents, the Law Lords concluded that the final position adopted by Telecom based on the Baumol-Willig rule did not breach s 36 since it did not involve the use by Telecom of its dominant position.

Although Clear and Telecom admitted before the Privy Council that their negotiating positions had moved closer together, the expensive litigation had not resolved the impasse between the parties. Having exhausted formal legal channels, Clear resorted to the court of public opinion in an attempt to provoke Government intervention. The Government indicated that it was unwilling to resort to price control, although it regularly bemoaned the 'fact' that consumers were not getting the benefits of competition and urged the two parties to come to some mutual agreement. They instructed the Ministry of Commerce and the Treasury to prepare a discussion paper and seek public submissions to explore whether new measures were required to deal with interconnection. The discussion paper favoured a system of compulsory arbitration and suggested that reciprocity of tariffs was likely to apply.

What finally tipped the balance is unclear, but Telecom and Clear signed an interconnection agreement in March 1996. The agreed interconnection charges were

- Clear would pay Telecom 2 cents per minute. Telecom would pay 1 cent per minute, rising gradually to 2 cents per minute by the year 2000. There would be a 75 percent discount for off-peak calls.
- Clear would pay Telecom an additional charge of 1 cent per minute. The parties agreed to differ on how the payment should be described.
  - Clear described this additional payment as *costs incurred because of the Kiwi share requirements*.
  - Telecom described this payment as a *contribution to fixed and common costs of the Telecom local network*.

Peace did not last. Five months after signing the agreement, Clear attempted to renegotiate its terms. In February 1997, it began withholding ten per cent of the amount due to Telecom in terms of the agreement. In April, Telecom initiated court action against Clear to recover money owing. This action remains to be heard.

III A Model of Interconnection

In this section, we outline a model of interconnection to analyse the Clear-Telecom dispute. Three recent papers present models of interconnection be-

tween unregulated networks - Armstrong (1998), Carter and Wright (1999), and Laffont, Rey and Tirole (1998). The underlying structure of the models used in these papers is similar: each has two networks; the networks charge each other interconnection fees (usually at rates determined through negotiation); based on these interconnection fees the networks set retail prices independently. In each paper, competition is modelled using the Hotelling model of product differentiation.[7] The three papers differ in the extensions to the basic interconnection model that they analyse. Armstrong (1998) considers the case the incumbent, but not the entrant, is regulated; Carter and Wright (1999) allow the possibility that the incumbent may refuse the entrant interconnection, and analyse the subsequent bargaining game allowing for the fact the incumbent enjoys 'brand loyalty'; and Laffont, Rey and Tirole (1998) allow for competition in retail pricing through two-part tariffs.

In this paper, we develop another extension to the basic interconnection model, to more realistically capture the environment in which the Clear-Telecom dispute arose.[8] More specifically we model a duopoly in the business sector, while assuming the incumbent retains a monopoly in the residential market, where its retail price is regulated.

We assume there are a fixed number of business and residential customers in the economy. The number of residential customers is far larger than the number of business customers. However, since the residential sector is regulated, its absolute size is irrelevant. What matters is the relative frequency with which a given business customer calls other business customers rather than residential customers. Let γ denote the proportion of business calls that go to another business when the networks are interconnected, so that $1-\gamma$ is the proportion of business calls that are made to the residential sector.[9]

Each business customer chooses one network to join, but wishes to make calls to subscribers on both business networks as well as the residential network.[10] The choice of which network to join will depend on the retail prices of both networks, the number of subscribers reached, and any brand loyalty towards a particular network. The benefit to a business subscriber in joining network i is

[7] Economides, Lopomo, and Woroch (1996) also analyse interconnection between unregulated networks. However, in their framework market shares are exogenous, since networks do not take account of the implications for market share in determining their retail prices.

[8] Like Carter and Wright (1999) we confine ourselves to modelling simple linear prices and interconnection charges. One justification for studying linear interconnection charges is that they appear common in practice. In fact, Clear and Telecom ultimately agreed upon linear interconnection fees, although two-part tariffs and other pricing schemes were available to them. See also footnote 11.

[9] We assume an isotropic calling pattern between business and residential customers. This means that there are the same number of calls from business to residential customers as there are calls from residential to business customers. Consequently, the total number of calls between business and residential customers is $2(1-\gamma)$. The isotropic assumption is not restrictive, since we allow the length of calls to differ depending on whether they originate in the business or residential sector.

[10] Absent interconnection, businesses may want to join both networks. We assume this is not possible. In fact, businesses did not have this option in New Zealand. One reason for this could be that Telecom strategically restricted customers to choose one or other network through its control of the numbering system.

determined by profits from telephone calls, any network specific benefits they receive, and profits from all other sources.

$$\Pi_i = \gamma\big(R(q_i) - p_i q_i\big)S_i + (1-\gamma)\big(R_{br}(q_{ir}) - p_i q_{ir}\big)S_{ir} + \theta_i + y$$

where Π_i is the profits earned by a business customer that joins network i, $R(q_i)$ denotes returns from business to business calls, q_i is the number of minutes called by a typical network i business customer to other business customers, S_i is the proportion of business callers reachable from business customers on network i, $R_{br}(q_{ir})$ is returns from business to residential calls, q_{ir} is the number of minutes called by a typical network i business customer to residential customers, S_{ir} is the proportion of residential callers reachable from business customers on network i, and p_i is the price per minute charged by network i to its business customers.[11] θ_i represents the other benefits to a firm from belonging to network i and y is the firm's profits from all other sources. The firm chooses the network which offers the most benefits.

We choose a simple quadratic return specification for R

$$\begin{aligned} R(q_i) &= (a - bq_i)q_i \\ R_{br}(q_{ir}) &= (a_{br} - b_{br}q_{ir})q_{ir} \end{aligned}$$

Given business prices of p_i per minute called each business customer chooses q_i and q_{ir} to maximize $\Pi(q_i)$. This implies the demand function for call minutes is

$$\begin{aligned} q_i(p_i) &= \frac{a - p_i}{2b} \\ q_{ir}(p_i) &= \frac{a_{br} - p_i}{2b_{br}} \end{aligned}$$

To determine network profits we also need to know the demand for calls from residential customers to businesses. Using an equivalent specification for residential customers, it is easy to derive that

$$q_{rb}(p_r) = \frac{a_{rb} - p_r}{2b_{rb}}$$

where $q_{rb}(p_r)$ is the number of minutes called by residential customers to businesses and p_r is the regulated residential price.[12]

To specify the other benefits businesses receive from belonging to a particular network (θ_i), we adopt the Hotelling location model of product differentiation.

[11] A more realistic model would have business customers choosing both the number of lines (phones) as well as the number of minutes per-line. Each network would charge a fixed amount per-line, as well as a per-minute amount for calls. This is quite different from the two-part tariff formulation considered by Laffont, Rey and Tirole (1998), where customers make a binary decision to have a line or not. Future work should consider this extension to the basic interconnection model. However, we doubt that incorporating this type of two-part tariff will change our basic results, given interconnection charges are only on a per-minute basis.

[12] The derivation assumes residential customers also have a quadratic utility function over call minutes. See Carter and Wright (1999) for a derivation.

Nontrivial competition between the networks requires some degree of product differentiation. Since telephone services are apparently homogeneous, this requires some justification. One interpretation is that the networks are differentiated by the range of complementary services they provide. Even where the basic services are the same, different firms can offer different credit and billing practices, different degrees of technical support, and different approaches to customer service. An alternative motivation for our model of product differentiation is switching costs. Consumers exhibit loyalty to the incumbent since they find switching networks costly. Once they belong to one network, consumers will not switch to the other network unless the price advantage is sufficient to outweigh the costs of switching (which without number portability includes the cost of changing phone numbers). Since modelling switching is complicated, we follow previous models of network competition and use a simple Hotelling model of product differentiation.

We model differentiated networks by supposing the two telecommunication firms are located at opposite ends of the unit interval, while their business customers are distributed uniformly along the unit interval. A customer of type x will get benefits of αx from joining network 2 and $\alpha(1-x)+\alpha\beta$ from joining network 1. α measures the relative importance of non-price competition. A high value of α means customers care more about the network's 'location' in product space, rather than its price. β measures loyalty of customers to firm 1 relative to firm 2. It may be due to an instrinsic preference for the incumbent or simply reflect the costs of switching between networks.[13] A high value of β means, other things equal, customers prefer network 1 to network 2. Then the number of business customers who use network 1 is just the aggregate of all the callers for which $\Pi(q_1) > \Pi(q_2)$. This is the market share s of network 1. The value of s depends upon whether or not the networks are interconnected.

(i) Interconnection

Where the networks are interconnected, each customer has access to both networks. Since each customer can call every other customer, $S_1 = S_2 = S_{1r} = S_{2r} = 1$. Furthermore, because consumers are distributed uniformly on the interval [0,1], the market share of network 1 is determined by the customer who is just indifferent between the two networks. That is, s solves

$$\begin{aligned}\Pi_1 &= \gamma\big(R(q_1) - p_1 q_1\big) + (1-\gamma)\big(R_{br}(q_{1r}) - p_1 q_{1r}\big) + \alpha(1-s) + \alpha\beta + y \\ &= \gamma\big(R(q_2) - p_2 q_2\big) + (1-\gamma)\big(R_{br}(q_{2r}) - p_2 q_{2r}\big) + \alpha s + y = \Pi_2\end{aligned}$$

Substituting in the return functions $R(q_i)$ and $R_{br}(q_{ir})$ and the demand functions q_1, q_{1r}, q_2 and q_{2r} and solving for network 1's market share we get

$$s = \frac{1}{2} + \frac{\beta}{2} + \gamma\left(\frac{(a-p_1)^2 - (a-p_2)^2}{8\alpha b}\right) + (1-\gamma)\left(\frac{(a_{br}-p_1)^2 - (a_{br}-p_2)^2}{8\alpha b_{br}}\right)$$

[13] By assuming values for α and β, we are implicitly assuming that each network has already committed to a particular bundle of services, and taking this as given we analyse the impact of the networks' interconnection and pricing decisions.

The profit of firm 1 (Telecom) is

$$\begin{aligned}\pi_1 &= \gamma\big(s(p_1-c_1)q_1(p_1)+s(1-s)((t_1-d_1)q_2(p_2)-t_2q_1(p_1))\big)\\ &\quad+(1-\gamma)\big(s(p_1-c_1)q_{1r}(p_1)+(1-s)((t_1-d_1)q_{2r}(p_2)-t_2q_{rb}(p_r))\big)+R\end{aligned}$$

and the profit of firm 2 (Clear) is

$$\begin{aligned}\pi_2 &= \gamma\big((1-s)(p_2-c_2)q_2(p_2)+(1-s)s((t_2-d_2)q_1(p_1)-t_1q_2(p_2))\big)\\ &\quad+(1-\gamma)\big((1-s)((p_2-c_2)q_{2r}(p_2)+(t_2-d_2)q_{rb}(p_r)-t_1q_{2r}(p_2))\big)\end{aligned}$$

where c_i is the marginal cost of each outgoing business call for firm i, d_i is the marginal cost of interconnection to firm i's network, and t_i is the interconnection fee charged by firm i to firm j for each call made by a customer of firm j to a customer of firm i.

Table 1 elaborates the structure of the profit function with interconnection. It shows that each network's profit function can be disaggregated into retail and wholesale profit components, and shows how each of these components relates to the different types of calls between the two networks. The profit functions can be further interpreted by considering the case where business customers do not call residential customers and vice-versa ($\gamma = 1$). In this case, the first component of the profit function is the profit that arises absent interconnection charges and costs, while the second component is the net profit on interconnection arising from incoming and outgoing calls. With a residential sector ($\gamma < 1$), some profits arise to each network in the retail market from calls made between business and residential customers. In this case, Telecom receives interconnection fees from Clear when Clear's business customers call residential customers, but pays Clear interconnection fees when residential customers call the Clear business network.

The term R in Telecom's profit function is the retail profit from the residential sector, which does not depend on either firms tariffs or business prices. It is determined by regulation, and so can be treated as an exogenous parameter. Note that we are assuming that Clear charges the same interconnection fee for calls requiring the use of its network regardless of whether the calls originate in the business or residential sectors. This is consistent with the agreement between Clear and Telecom.

(ii) No-Interconnection

Without interconnection between the two networks, Telecom callers can still make calls between the business and residential sectors although Clear customers cannot. This implies $S_1 = s$, $S_2 = (1-s)$, $S_{1r} = 1$, $S_{2r} = 0$. s now solves

$$\begin{aligned}\Pi_1 &= \gamma\big(R(q_1)-p_1q_1\big)s+(1-\gamma)\big(R_{br}(q_{1r})-p_1q_{1r}\big)+\alpha(1-s)+\alpha\beta+y\\ &= \gamma\big(R(q_2)-p_2q_2\big)(1-s)+\alpha s+y=\Pi_2\end{aligned}$$

Table 1: Components of the profit function with interconnection

Calls from	Calls to	T Retail Profit	C Retail Profit
T Bus	T Bus	$\gamma s^2(p_1 - c_1)q_1(p_1)$	
T Bus	C Bus	$\gamma s(1-s)(p_1 - c_1)q_1(p_1)$	
T Bus	T Res	$(1-\gamma)s(p_1 - c_1)q_{1r}(p_1)$	
C Bus	T Bus		$\gamma(1-s)s(p_2 - c_2)q_2(p_2)$
C Bus	C Bus		$\gamma(1-s)^2(p_2 - c_2)q_2(p_2)$
C Bus	T Res		$(1-\gamma)(1-s)(p_2 - c_2)q_{2r}(p_2)$
T Res	T Bus	Component of R	
T Res	C Bus	Component of R	
T Res	T Res	Component of R	

Calls from	Calls to	T Wholesale Profit	C Wholesale Profit
T Bus	T Bus		
T Bus	C Bus	$-\gamma s(1-s)t_2 q_1(p_1)$	$\gamma(1-s)s(t_2 - d_2)q_1(p_1)$
T Bus	T Res		
C Bus	T Bus	$\gamma s(1-s)(t_1 - d_1)q_2(p_2)$	$-\gamma(1-s)st_1 q_2(p_2)$
C Bus	C Bus		
C Bus	T Res	$(1-\gamma)(1-s)(t_1 - d_1)q_{2r}(p_2)$	$-(1-\gamma)(1-s)t_1 q_{2r}(p_2)$
T Res	T Bus		
T Res	C Bus	$-(1-\gamma)(1-s)t_2 q_{rb}(p_r)$	$(1-\gamma)(1-s)(t_2 - d_2)q_{rb}(p_r)$
T Res	T Res		

T=Telecom (Firm 1), C=Clear (Firm 2)

Substituting the return and demand functions into the previous equation and solving for s, we get

$$s = \frac{\alpha(1+\beta) - \gamma\frac{(a-p_2)^2}{4b} + (1-\gamma)\frac{(a_{br}-p_1)^2}{4b_{br}}}{2\alpha - \gamma(\frac{(a-p_1)^2}{4b} + \frac{(a-p_2)^2}{4b})}$$

The profit of firm 1 is derived from calls within its own business network, calls from its business network to the residential network, plus profit originating in the residential network. That is,

$$\pi_1 = \gamma s^2(p_1 - c_1)q_1(p_1) + (1-\gamma)s(p_1 - c_1)q_{1r}(p_1) + R$$

The profit of firm 2 arises solely from calls within its own business network, namely

$$\pi_2 = \gamma(1-s)^2(p_2 - c_2)q_2(p_2)$$

(iii) Characterizing the equilibrium

Presuming interconnection, the model is a sequential game in which

- the networks agree on interconnection charges t_i.

- given the interconnection charges t_i, the networks then determine their retail prices p_i independently.

Given retail prices, customers choose which network to belong to and the volume of calls, determining the profits of the two networks.

In the second stage, the firms are engaged in a standard duopoly with differentiated products, and we assume that the firms play the Bertrand equilibrium. For the most part, we assume that access prices are determined by negotiation while retail prices are set noncooperatively. Our justification for this distinction is that antitrust law prohibits collusion over retail prices, while negotiation over interconnection is permitted and indeed encouraged.

Interconnection presents the networks with a classic bargaining problem, in which the parties' interests are partially aligned. There are mutual gains to be exploited, although the parties differ on the sharing of those gains. Game theoretic analysis (Osborne and Rubinstein 1990) usually assumes that the parties will not readily forgo potential mutual gains. However, the agreement will depend upon the outcome if they fail to agree. This *disagreement point* plays a major role in determining the final outcome. In our model, the relevant disagreement point is the outcome in the absence of any interconnection agreement. In principle, there are two possibilities

- Telecom and Clear operate separate disjoint networks serving their own subscribers
- one network (Telecom) services the entire market and Clear's entry is blockaded.

The first alternative is made possible by product differentiation. If Clear's product is sufficiently distinct, it may attract a portion of subscribers who are content to be limited to calling only one another in return for other benefits offered by Clear. The second possibility arises from a *network effect*. If one network succeeds in attracting a majority of the customers, it creates an added incentive to join the larger network. By limit pricing, a firm may be able to corner the entire market. In practice, the initial advantage lies with the incumbent (Telecom). Consequently, we ignore potential equilibria in which Clear corners the market. Whether two disjoint networks emerge in the absence of interconnection, or a single network persists, depends largely on the degree of product differentiation α. We assume that products are not too differentiated so that network effects exist in the absence of interconnection.[14]

[14] Our framework easily encompasses alternative disagreement points. For example, a government specified interconnection agreement has been suggested as the appropriate disagreement point. We did not consider this a credible alternative because of the New Zealand government's apparent reluctance to resort to regulation, although it would be appropriate for modelling interconnection in Australia.

IV Results

In this section we calibrate our model to analyse the Clear-Telecom dispute. We choose the following parameter values: $\beta = 0.5, \gamma = 10/11, \alpha = 40, a = a_{br} = a_{rb} = 10, b = b_{br} = b_{rb} = 0.5, c_1 = c_2 = 1$, $d_1 = d_2 = 0$ and $p_r = 0$. The positive value of β reflects brand loyalty to the incumbent Telecom, possibly resulting from switching costs. The value $\beta = 0.5$ implies that Clear will capture 25 percent of the market if both networks set the same retail price. A value of $\gamma < 1$ says that business customers have some likelihood of calling residential customers. The value of 10/11 for γ was chosen by assuming, under interconnection, that for any call involving a business customer the chances are 5 to 1 that the other party is also a business customer. This implies that $\gamma = 5 \times 2(1 - \gamma)$ or $\gamma = 10/11$. The value of α was chosen to be small enough so that Telecom captures the whole market when there is no interconnection. This seems to represent the reality of the Clear-Telecom dispute. The parameters of the demand functions (the a and b parameters) are chosen so that all callers have demand functions that are identical[15], $q_{ir}(p_i) = q_i(p_i) = 10 - p_i$. This implies that the monopoly price is 5.5. We assume no marginal costs of interconnection while marginal costs of outgoing calls are equal to one for both Clear and Telecom. Finally, the price for residential calls is zero as regulated by Kiwi share requirements.

The parameters are chosen to be reasonable in that they generate network effects, that there is some customer loyalty to Telecom, and that on average businesses are likely to spend more time talking to each other than to residential customers. However, the exact specification is clearly arbitrary. It is important that our story and any conclusions drawn from it do not heavily rely on the particular parameter values chosen. We have simulated the results for a number of other parameter values, without significant changes in the results. This sensitivity analysis is documented in Carter and Wright (1997). In Carter and Wright (1999), we prove analytically some of these results, assuming only that the firms are symmetric. While symmetry is unreasonable for the Clear-Telecom story, it is reassuring that our major results are true in this case.

Putting aside the issue of the robustness of our simulation results, we think they are helpful in other ways too. We could view the simulated model as a way of checking the internal consistency of our story of the Clear-Telecom dispute. We also use the simulations to provide counter-examples to assertions

[15] Note that instead of assuming business customers call each other more often than they call residential customers we could have made an equivalent assumption on the relative length of calls between businesses and residential customers. The assumptions on γ, b and b_{br} mean that, assuming interconnection, for any call involving a business there are 5 times as many minutes spent with other businesses than with residential customers ($\gamma/b = 5 \times 2(1-\gamma)/b_{br}$). If we assume, under interconnection, that for any call involving a business customer the chances are 1 to 1 that the other party is also a business customer (so $\gamma = 2/3$ as $\gamma = 2(1 - \gamma)$) but that business customers call each other for longer than they call residential customers ($b = 0.22, b_{br} = 1.1$) then we obtain identical profit functions and results. In practice we suspect business customers call each other more often as well as for longer than they call residential customers. This is easily captured in our model. For instance, $\gamma = 4/5$ and $b = 0.44, b_{br} = 1.1$ has this property and is equivalent to our parameterization.

that are often made, and claimed to be general or obvious. Table 1 illustrates the outcomes of different interconnection agreements, listed in order of decreasing total surplus.[16] We discuss each outcome in turn.

Table 2: The benchmark case

	t_1	t_2	p_1	p_2	s	π_T	π_C	CS	TS
Max total surplus	-18.7	-19.6	1.5	0.3	0.61	0.0	0.0	82.0	82.0
Zero tariffs	0.0	0.0	4.5	3.5	0.67	13.0	5.3	59.3	77.6
No connection	n.a.	n.a.	3.7	n.a.	1.00	16.9	n.a.	60.0	76.9
Reciprocal tariffs	5.5	5.5	5.3	5.0	0.73	14.4	5.7	54.0	74.1
NBS	3.8	0.1	5.1	5.7	0.79	18.5	1.6	53.8	73.9
Baumol Willig rule	4.4	0.0	5.2	6.3	0.81	18.9	1.1	53.2	73.3
Joint profit max	8.0	9.0	5.5	5.5	0.75	13.1	7.1	52.6	72.9
PABX rule	5.4	0.0	5.4	7.1	0.83	19.1	0.8	51.6	71.4

t_i=tariff charged by network i for use by network j.
p_i=consumer price for network i
π_i=profits of network i.
s= market share
CS=consumer surplus. TS=total surplus (consumer+producer surplus).

No connection In the absence of an interconnection agreement, Telecom retains the whole market and Clear's entry is effectively blockaded. However, Telecom's ability to exploit its monopoly is constrained by the ability of Clear to create a separate network catering to a subset of subscribers.[17] The no connection outcome is reasonably efficient relative to some of the other interconnection agreements canvassed. It gives consumers access to the entire network while keeping retail prices restrained (3.7) compared with the monopoly price (5.5).[18]

Nash bargaining solution (NBS) Figure 1 depicts the opportunities available to the two networks. Each point in the feasible set shows the profits that can be earned if the networks set appropriate interconnections charges t_i. The initial no connection point is labelled NC. Clearly, there are mutual gains to be

[16]Our measure of consumer surplus is indirect utility. It measures not just the surplus on calls made, but also the other benefits of belonging to a particular network (θ).

[17]This conclusion is subject to the usual criticism regarding the rationality of limit pricing. We implicitly assume that Telecom's price structure cannot be changed rapidly enough to counter Clear's entry. The constraint on retail prices also depends on the degree of product differentiation. With less product differentiation, network effects assume greater importance, and Clear finds it more difficult to attract a subset of subscribers. In fact, with sufficiently little product differentiation the incumbent can corner the whole market at the monopoly price.

[18]This no connection equilibrium would also have efficiency gains if there were substantial costs of physically interconnnecting two networks or if competition required duplication of network resources.

had by entering into an interconnection agreement. Interconnection enables the two networks to collude in extracting monopoly rents. Telecom and Clear have a mutual interest in achieving some point on the profit frontier. However, along the frontier, their interests are strictly opposed. Telecom favours moving down and to the right, whereas Clear would like to move up and to the left.

A plausible outcome to the bargaining problem is the Nash bargaining solution, where the potential gains are shared in accordance with certain axioms (Nash 1950). Using the no-connection point as the disagreement point, the Nash bargaining solution is labelled NBS in Figure 1. Telecom retains 79 per cent of the market, conceding the rest to Clear. Telecom retains a higher market share because the disagreement point favours Telecom. Retail prices increase from 3.7 to 5.1 for Telecom and 5.7 for Clear. Since the monopoly price is 5.5, this underlines the extent to which the networks can use interconnection charges to exploit market power.

Given the incumbency bias in favour of Telecom, why does Clear charge the higher price? The answer lies in the difference between their respective access charges. Telecom charges Clear 3.8 for completing a call, whereas it pays Clear virtually nothing ($t_2 = 0.1$) for completing calls in the reverse direction. This difference reflects the superior bargaining position of Telecom, stemming from

- product loyalty to Telecom
- the fact that it starts from the position of incumbency

Given marginal costs of 1, Clear's net margin per call is only 0.9, compared to Telecom's 4.0. The combined effect of market share and profitability is reflected in the fact that Nash bargaining solution earns Telecom more than ten times the profit of Clear.

Despite the increase in retail price, some consumers would benefit from Clear's entry (at NBS) because it enables them to purchase a package better tailored to their needs. However, on balance, the resulting increase in retail price outweighs the increased product diversity, and aggregate consumer surplus falls. In fact, the reduction in consumer surplus exceeds the increase in network profits, so that total surplus falls. Interconnection at the Nash bargaining solution is less efficient overall than maintaining a single network with limit pricing. In general, interconnection involves a conflict between the benefits of increased product diversity and the use of interconnection charges to exploit market power.

Joint profit maximum At the Nash bargaining solution, the networks fail to fully exploit their monopoly power. They could do better by acting as a single monopoly, each charging the monopoly price of 5.5. It yields a combined profit of 20.3 compared to 20.1 at the Nash bargaining solution. Although it entails a lower absolute profit for Telecom than the Nash bargaining solution, this could be compensated by an appropriate side-payment or transfer, which could be dressed-up as a contribution to the costs of Telecom's residential network.

The important point is that this happy outcome does not require any collusion on the final retail prices. All that is required is the levying of appropriate interconnection charges. In fact, the appropriate access charges exceed the retail prices, so that each network apparently makes a loss on interconnected calls. However, this is more than offset by the revenue from interconnection. Not surprisingly, this is not a happy outcome for the average consumer, compared to no connection, although some consumers will benefit from the increased product choice.

PABX rule Telecom's original proposal, the PABX rule, leads Telecom to charge a high overall tariff and price. This produces an outcome that is heavily skewed in Telecom's favour, although Clear would be able to make a small profit (0.8) by better catering to its end of the market. This outcome is the worst from an efficiency viewpoint. This outcome is labelled PABX in Figure 1.

The Baumol-Willig rule Since Clear is assumed to have no cost advantage, the Baumol-Willig rule allows Telecom to charge Clear for traffic but not vice-versa. It produces an outcome that is not greatly different to the PABX rule. In effect, it mimics the PABX rule, but with a reduction in tariffs to offset Telecom's cost savings from Clear handling part of the calls. Retail prices are lower and so it it better for consumers. It offers Clear a higher profit at the expense of Telecom. The rule provided Telecom with a more respectable economic rationale for its stance without sacrificing significant profit. The outcome under the Baumol-Willig rule is labelled BW in Figure 1.

Bill and keep Bill and keep amounts to setting zero tariffs, which achieves the point labelled ZT in Figure 1. Telecom's price (4.5) is significantly higher than Clear's (3.5). This reflects Telecom's brand loyalty ($\beta > 0$). However, competing on price, Clear is able to capture 33 percent of the market. In this case, all Clear customers benefit from Clear's entry. They benefit both from product diversity and a small decrease in price. However, Telecom customers are worse off relative to no connection, since they face higher prices. Overall, consumer surplus falls slightly. However, this is outweighed by the increase in network profits, so total surplus increases.

The large increase in Clear's profit compared with the Baumol-Willig rule comes at the expense of Telecom. This results because the tariff charged by Telecom falls from 4.4 to 0. This highlights the conflict at the heart of Clear-Telecom dispute: given Telecom's initial refusual to consider paying any interconnection fee to Clear, Clear favoured a low charge and Telecom a high one.

Reciprocal tariffs A frequent policy recommendation is reciprocal (that is, equal) tariffs.[19] In our model, the consequences of reciprocal tariffs depends

[19] For example, the recent US *Telecommunications Act* provides for reciprocity. Reciprocity is also a common assumption in models of interconnection (Armstrong 1998, Laffont, Rey, and Tirole 1998)

upon whether the parties are also compelled to reach an agreement. If the parties are forced to interconnect *and* restricted to reciprocal tariffs, the bargaining problem is largely avoided and they both prefer a high common tariff. Reciprocal tariffs lead to an outcome close to the frontier (for example point RT in Figure 1), which means that firms are exploiting most of their monopoly power, giving an outcome that is bad for consumers. On the other hand, if there is no compulsion to reach an agreement, it is likely that reciprocity alone will eliminate any incentive for the incumbent to reach an agreement.

Maximum total surplus The final outcome listed in Table 2 is the one that maximizes total surplus, subject to profits being nonnegative. This is achieved by mandating large negative tariffs, which induces the networks to price as close as possible to marginal cost while keeping profits nonnegative.

We note that total welfare increases as we move to the right along the frontier (Figure 1). Aggregate profits remain relatively constant along the frontier. However, consumer surplus increases as the outcome shifts along the frontier. Moving to the right, Telecom charges a relatively lower price and obtains a bigger share of the market, resulting in a higher consumer surplus.

V Comments on the legal judgments

The litigation between Clear and Telecom highlighted some fundamental issues in competition law and policy, which we now discuss in the light of our results.

(i) Competition versus efficiency

There is significant disagreement around the world regarding the ultimate goal of competition policy and in particular the balance between competition and efficiency. Efficiency has three aspects — allocative, productive and dynamic. Typically, competition is believed to promote allocative efficiency. Where there are significant economies of scale, this may come at the expense of productive efficiency. The tradeoff for competition policy then is between competition and allocative efficiency on the one hand and productive efficiency on the other.[20]

The dilemma is intensified in network industries, since the need for interconnection severs the link between competition and allocative efficiency. Competition does not necessarily promote allocative efficiency in network industries, since the networks can use interconnection charges as instruments of collusion to exploit their joint monopoly power. Consequently, in our model, the initial position of a single incumbent constrained by the threat of potential entry may be more (allocatively) efficient than two competing networks. Where there are also aspects of declining average costs (natural monopoly), introducing competition may also lead to productive inefficiency.

[20] In our view, the relationship between market structure and dynamic efficiency is ambiguous.

Since it was designed for regulated industries, the Baumol-Willig rule sidesteps this dilemma, focusing exclusively on static productive efficiency. It encourages entry if and only if the entrant is a more efficient producer than the incumbent. This emphasis appeared appropriate to the High Court [(1992) 5 TCLR 217]:

> Arguably, [the presence of monopoly rents] might lead us to conclude that resort to the Baumol-Willig rule is fraught with too great risk: that the resulting price to Clear for entry could be so high as to frustrate its competition in local business, even if Clear were just as efficient or more efficient than Telecom. Yet failure to use [such] a pricing rule would — not might — foster the development of uneconomic bypass and the proliferation of uneconomic operators. In the end it is our judgment that implementation of the Rule is more likely than the alternatives to improve efficient competition in New Zealand telecommunications. . . There is an improvement in competition when there is an enhancement of an efficient competitive process.

This narrow view did not find favour with the Court of Appeal [(1993) 5 TCLR 436]:

> This suggests that so long as there is overall some improvement in the competitive process there can be no breach of s 36. However, if, but for the conduct in question, there would have been significantly greater enhancement of the competitive process the conduct may well contravene the section.

Nevertheless, we find that the tradeoff between competition and efficiency was not adequately delineated in the litigation, in particular because the fundamental issue became the legality of the Baumol-Willig rule, with its narrow focus on productive efficiency to the exclusion of all other issues.

(ii) Moving the disagreement point

Only two (NBS and Joint profit max) of the interconnection agreements that we discussed lie on the profit frontier. In particular, the explicit proposals of the two parties — PABX rule, Baumol-Willig and bill and keep — would leave some unexploited mutual gains. One of the most effective tactics in negotiation is to attempt to shift the disagreement point by developing outside options and alternative fallback positions. It is therefore plausible to interpret the proposals as attempts to shift the disagreement point rather than as final proposals. Presumably, once Telecom received legal sanction for the Baumol-Willig rule, it would be in a favourable position in any subsequent negotiations which attempted to move towards the profit frontier. Similarly, if Clear established the legitimacy of bill and keep (ZT), it could then negotiate a mutual improvement that was more to its advantage than the original NBS. This possibility was

recognised by the Court of Appeal '[Telecom put forward] the Baumol-Willig rule as the basis on which it was prepared to negotiate' [(1993) 5 TCLR 416], but the distinction between agreed outcomes and disagreement points appeared to play no significant role in the litigation.

The Court of Appeal dismissed the benign possibility, judging that Telecom was attempting to promote disagreement, thus forestalling any interconnection agreement [(1993) 5 TCLR 416]:

> ...(T)he rule would seem obviously anti-competitive and in breach of section 36 of the Commerce Act. It would amount to allowing a new entry into a market on condition only that the competitor indemnify the monopolist against any loss of custom. This would be at once an unreasonable use of monopoly power, a restriction on entry, and prevention or deterrence of competitive conduct . . . it seems to me that a substantial purpose of the monopolist in laying down such a condition is to restrict competition so as to preserve its own position as far as possible.

The alternative view is that Telecom was seeking an agreement, but trying not unnaturally to twist the terms in favour of itself. The Court of Appeal judgment, supported by much contemporaneous comment, overlooks the potential gains to Telecom through any agreement, through product differentiation and the potential for collusion. Is it too farfetched to believe that Telecom's ultimate goal was an agreement on the profit frontier, but one more towards its favoured end? If so, it is perhaps harsh to presume that Telecom's advocacy of the Baumol-Willig rule obviously had the *purpose* of deterring competition.

(iii) The use of appropriate economic models

Crucial to their judgment was the Privy Council's assessment that [(1994) 6 TCLR 155]:

> (I)f the terms Telecom were seeking to extract were no higher than those which a hypothetical firm would seek in a perfectly contestble market, Telecom was not *using* its dominant position. In order to discover what [might be appropriate terms] it is inevitable that the parties and the Court must have recourse to expert economic advice. *The Baumol-Willig rule is a closely reasoned economic model* which seeks to show how the hypothetical firm would conduct itself.

As economists, we would naturally endorse the second sentence but have grave reservations about the last. Their Lordships appear to lend authority to the Baumol-Willig rule on the basis of its inherent consistency rather than its appropriateness. In our view, the Baumol-Willig rule is entirely the wrong model to deal with the issue of local call interconnection in New Zealand.[21]

[21] Other critiques of the Baumol-Willig rule include Economides and White (1995) and Tye and Lapuerta (1996).

Baumol and Willig developed their model to deal with railways in the United States. This application has two important differences to the problem of local call interconnection in New Zealand. Firstly, retail prices are regulated in the railway sector in the US. Secondly, interconnection is one-way. The entrant requires access to the network of the incumbent, but there is no requirement of reciprocal access by incumbent of the entrant's network. For both reasons, the railway network in the US is a far cry from the local call network in New Zealand.

The Court of Appeal baulked at the first difference, Justice Gault perceptively noting [(1993) 5 TCLR 433]:

> That the employment of the perfectly contestable standard can lead to a price incorporating monopoly profits suggests to me a contradiction. In a perfectly contestable market I would not expect any monopoly profits to be chargeable. I therefore do not see how monopoly profits legitimately can be included in any opportunity cost. That they can be in Professor Baumol's model invites a conclusion that the model is imperfect."

The dilemma was conceded by Baumol. His solution was to change the world rather than the model. 'All this is true, but the villain is not the (Baumol-Willig) rule. The real problem is [the lack of regulation in the output market]. . . The error, therefore, is the failure to impose the stand-alone cost ceiling on the final-product price, not the use of the (Baumol-Willig) rule.' (Baumol and Sidak 1994, p. 196)

This statement was drawn to the attention of the Privy Council by counsel for Clear, arguing that it amounted to recantation by Baumol of his earlier testimony. The Law Lords perceived no such recantation. They remarked that Baumol had accepted throughout that the rule will initially perpetuate monopoly rents until they are competed out by Clear competition or removed by regulatory action (as provided in the Commerce Act). Obviously, the New Zealand government's repudiation of detailed regulation did not appeal to Baumol and escaped the Privy Council, who placed significant weight on the regulatory powers reserved in the Commerce Act.

The other distinction between railway and telephone networks, the need for reciprocal access, was largely overlooked in the litigation. It was acknowledged in the High Court, especially by Baumol, that the model must eventually be applied reciprocally. But precisely what this means was left unspecified. Some preliminary analysis we have undertaken suggests that reciprocity undermines the 'beautiful dynamics' which captured the attention of the High Court and persuaded it that the Baumol-Willig rule was pro- rather than anti-competitive.

VI Conclusion

In this paper, we explored the problem of network interconnection with a regulated residential sector and used the model to analyse the celebrated Clear-

Telecom dispute. The regulated residential sector does not significantly impede the ability of the networks to use interconnection fees as instruments of collusion. The residential sector does serve to highten the tension between the parties. On the one hand, it enhances the need for Clear to obtain interconnection and strengthens Telecom's opposition to paying any interconnection fee to Clear. On the other hand, it reduces the elasticity of demand for incoming calls perceived by Clear, leading it to seek a higher level of interconnection fee from Telecom.

Our model sheds new light on the *Clear v. Telecom* litigation. Ultimately, the Courts endorsed the Baumol-Willig rule, which was derived to deal with one-way interconnection with a regulated retail price. We argue that this is an inappropriate economic model for dealing with two-way interconnection in a unregulated environment. Applied unilaterally, it produces an outcome that unduly favours the incumbent, and is likely to erect a significant barrier to entry. The implications of applying the Baumol-Willig rule reciprocally have not yet been adequately explored. In particular, we have doubts that the 'beautiful dynamics' of the unilateral Baumol-Willig rule will survive the extension to reciprocal application.

Our framework underlines the distinction between competition and efficiency. It is clear that competition does not imply efficiency. The fact that a new entrant succeeds in capturing a significant market share does not automatically ensure that consumers are better off. The model also emphasizes the importance of the disagreement point or fall back position in determining the final outcome. The legal sanction awarded to the Baumol-Willig rule significantly bolstered Telecom's bargaining position. That the final agreement was favourable to Telecom seems apparent in hindsight, since Clear repudiated the agreement after only five months. On the other hand, we can speculate that regulatory bodies would be likely to lean towards simple rules of thumb, such as bill and keep or reciprocal tariffs. Consequently, had the Ministry of Commerce's proposal of compulsory arbitration been adopted, we believe that this would have moved the disagreement point in favour of Clear.

Our analysis throws some doubt on the ability of light-handed regulation and competition to achieve efficient outcomes in network industries. The real difficulty is not that the competitors find it difficult to reach an agreement, but rather that their agreement is likely to be damaging to consumers. Interconnection fees provide the networks with a legitimate instrument of collusion. Collusion over retail prices (price-fixing) is illegal *per se* (in most jurisdictions). However, collusion (negotiation) over the setting of interconnection fees is expected and indeed encouraged. The networks can use interconnection fees to effectively exploit their monopoly power and vicariously collude on final retail prices.[22]

This leaves us with a considerable dilemma. By and large, we are sympathetic to the goals of light-handed regulation. However, our analysis suggests

[22] Furthermore, restricting this collusion is not desirable. Acting independently, firms would be inclined to set higher access charges. Since retail prices are increasing in access charges, this would lead to even higher prices and less efficiency (Carter and Wright 1999).

that it is inadequate to solve interconnection problems. The first best regulatory solution would be to impose those tariffs that would lead to marginal cost pricing, in effect regulating retail prices by proxy. However, the usual problems of determining the appropriate regulated tariffs are particularly acute in network industries.

The second best regulatory solution would involve placing some restraints on negotiated tariffs. Some plausible restraints are in fact dangerous. For example, requiring reciprocal (equal) tariffs does not limit firms' ability to collude over tariffs and push up retail prices. In fact, by eliminating the conflict of interest between the firms, it may make it easier for the firms to exploit their joint monopoly power at the expense of consumers. Bill and keep has much to recommend it as a second best regulatory solution. If the marginal costs of providing interconnection are significant, bill and keep is equivalent in our framework to levying negative tariffs. Excluding detailed regulation, this is as close as we are likely to get to the first best optimum. Moreover, it has the additional advantage of having low transaction costs, eliminating the need for accounting and billing between the networks. Unfortunately, imposing bill and keep raises a difficult legal and ethical issue in dealing with a privatised incumbent. Their existing network is a private asset — imposing bill and keep requires them to extend free use of their network to a rival, which seems tantamount to a form of expropriation.

Any regulatory solution entails costs, both the direct pecuniary costs of the regulatory authority and the economic costs of any resulting distortions. Appropriate policy needs to carefully weigh these costs against the distortion resulting from the exercise of market power.[23] Recognizing that estimates of the costs of monopoly distortion are seldom huge, we remain agnostic as to the most efficient regime for the management of network industries. However, we do believe our model provides an appropriate framework for evaluating these issues.

[23] Boles de Boer and Evans (1996) estimate that the benefits to consumers of the changes introduced by the new privatized Telecom exceeded the sale price of the corporation. Comparing outcomes in Australia and New Zealand (which have different regulatory regimes), Edlin (1996) found that Australia had better allocative efficiency (reflecting the vigorous competition between Optus and Telstra) but that improvements in productive efficiency appeared stronger in New Zealand.

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