Bargaining Over Fixed-to-Mobile Termination Rates in the Shadow of the Regulator

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I.   Introduction

It has become the conventional wisdom that while many European mobile telephony markets are fairly competitive when it comes to vying for new subscribers, each mobile operator is nevertheless an outright monopolist in the setting of termination rates for calls made to its own network. Thus all over Europe mobile termination rates are subject to zealous regulatory scrutiny, and even outright price regulation.   Although incentives for setting high charges for mobile-to-mobile (M2M, or 'off-net') call termination remain the subject of some economic controversy,[1] it is widely accepted that fixed-to-mobile (F2M) termination "if unregulated, provides an opportunity for mobile operators to exercise market power derived from the termination bottleneck."[2]

In Britain, since the Competition Commission's exhaustive inquiry in 2002-03, each of the four incumbent 2G mobile operators' termination rates have been subject to price regulation by the telecoms and media regulator Ofcom. In Ireland, 2G call termination rates are still unregulated, but the Commission for Communications Regulation (Comreg) asserts that recent falls in M2M and F2M rates have been largely due to "regulatory pressure" rather than market forces.[3] The story in other European countries is similar. The incumbent 2G operators have had finally to accept that once categorised as individual monopolists of call termination on their own networks, regulatory oversight of some sort or other is bound to follow.

The recent entry of Hutchison 3G (H3G) into mobile markets across Europe has reopened this issue, however, and in an interesting way. New European regulations require each country's regulatory authority to define the relevant mobile call termination "markets" and determine whether or not mobile operators have "significant market power" (SMP) in these

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markets.[4]   The conventional wisdom asserts that since each mobile operator is a call termination monopolist on their own network, no matter how small their subscriber base, they will possess significant market power. Thus H3G was found to have SMP in the UK despite having fewer than a million subscribers (compared to an average of 10-15 million subscribers for the incumbent 2G operators), and in Ireland despite the fact that H3G hadn't yet fully rolled out its service and so had almost no subscribers at all!

In arriving at an SMP determination, local regulatory authorities are supposed to consider a number of factors.   These include the companies' market shares, the degree of countervailing buying power they face, the ease of market entry (or absence of potential competition), and any evidence of excessive pricing or profitability. The first and the third of these are straightforward. Each company has a 100% market share on its own network and since entry into the mobile market is strictly controlled by the granting of spectrum licences, entry barriers are near absolute.[5]

The remaining two criteria pose more interesting problems. Neither Ofcom in Britain nor Comreg in Ireland claimed that H3G's call termination rates were excessive. Indeed, in Ireland, H3G has yet to reach an interconnect agreement with the dominant fixed network operator *eircom,* so its termination rates are as yet unknown.   Hence the SMP determinations in call termination excluded any analysis of H3G's prices or profitability, but relied solely on a finding that:

(i)   H3G possesses a 100% market share in wholesale call termination on its own mobile network; and
(ii)   the incumbent fixed telephony operators (i.e. BT in the UK and *eircom* in Ireland*),* lack sufficient countervailing bargaining power to restrain H3G's exercise of monopoly power in this market.

The conclusion that the dominant fixed network operators (FNOs) lack sufficient countervailing bargaining power is significant, since the European Commission's Explanatory Memorandum to its Recommendation on Market Definition expressly allows that this could be the deciding factor.[6] Indeed, the Commission made it clear that small networks facing large buyers with sufficient countervailing bargaining power will not automatically be found to have SMP, despite having a 100% market share in call termination on their networks. The Commission's recommendations would therefore appear to require a careful analysis of any constraints on H3G's ability to set "excessive" termination charges in its interconnection negotiations with incumbent fixed network operators, such as BT and *eircom,* and with other mobile network operators (MNOs).

Neither Ofcom nor Comreg found it necessary to analyze the bargaining situation between

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[4]   Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services (.the Framework Directive). SMP is equivalent to dominance in competition law terms.
[5]   In fact the entry of new competitors, even if possible, would not change matters, since each operator is assumed to have monopoly power over the termination of calls to its own network's subscribers.
[6]   European Commission's Explanatory Memorandum to its Recommendation on Market Definition, pp. 20 and 34.

H3G and the incumbent FNO in any detail, however. Rather, Ofcom disposed of the issue by reasoning as follows:[7]

> "3.32 Countervailing buyer power exists when a particular purchaser (or group of purchasers) of a good or service is sufficiently important to its supplier to influence the price charged for that good or service. In order to constrain the price effectively, the purchaser must be able to bring some pressure to bear on the supplier to prevent a price rise by exerting a credible threat, for example not to purchase or to self provide. 3.34 … In theory, BT might credibly threaten not to purchase termination from an MNO and this would deprive that MNO of the pricing freedom that it derives from its monopoly over termination. In practice, this issue is irrelevant since BT, even if it did have buyer power, has not been able to exert it because of its obligation to complete all calls whatever the terminating network…. That requirement curbs any buyer power that BT may have and leaves the MNOs free to set terminating charges above the competitive level."

And Comreg adopted a similar position in arguing that:[8]

> "Countervailing buyer power exists where large customers have the ability within a reasonable timeframe to resort to credible alternatives, e.g. not to purchase or to retaliate. eircom does not have the alternative not to purchase, as it is obliged to provide interconnection to all operators, nor does it have much scope to retaliate…."

Thus both regulatory authorities took the view that an obligation to interconnect deprived the incumbent FNO *of all of its countervailing buyer power* in its negotiations with H3G, leaving H3G free to act as an unconstrained monopolist in setting FTM termination rates. To paraphrase Comreg, 'in the absence of any legal or practical means of exercising countervailing buyer power, H3G, like all other MNOs, is free to set termination rates at whatever level it chooses.'

Our purpose in this article is to explain why the regulators' reasoning in these statements is erroneous, and how the modern economic theory of bargaining provides us with a tool capable of assessing the relative bargaining power of the negotiating parties, as would seem to be required by the Commission's guidelines. The immediate question is whether the legal obligation to interconnect deprives dominant fixed network operators like BT or *eircom* of their countervailing bargaining power in negotiating termination rates with a new mobile entrant, and consequently endows Hutchison 3G with significant market power. Our answer is that the existence of such an obligation is entirely consistent with Hutchison 3G having no market power at all in respect of termination pricing on its own network.

As we shall show, in the absence of any explicit threat of regulatory intervention beyond that required by the interconnectivity obligation, we would never expect an incumbent fixed network operator to offer a new entrant termination rates which exceed the average rates paid to the incumbent 2G operators, and typically they will offer much less than this. This is because all of the factors which determine the relative bargaining powers of the two

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[7] Ofcom "Wholesale Mobile Voice Call Termination: Proposals for the identification and analysis of markets, determination of market power and setting of SMP conditions." See also Ofcom, "Wholesale Mobile Voice Call Termination: Statement," 1 June 2004, para 3.30.

[8] Comreg *op. cit*. para 4.17.

parties favour the incumbent operators over a new entrant like H3G. The fact that in a number of European countries, including the UK, H3G has achieved termination rates equal to rates paid to 2G operators is probably best explained by an expectation that the regulatory authority would impose such a rate if a dispute were referred to it for adjudication.

II.   Monopoly or Bilateral Monopoly?

It is useful to begin by explaining why use of the term *monopoly power* may be misleading in the context of analyzing the pricing of call termination on mobile networks.

In the classical theory of monopoly, a monopolist is a single seller in a market with a large number of small buyers. Since each buyer is small, no action taken by a single buyer can have more than a negligible affect on market aggregates. Individual buyers therefore have no market power, which is why their aggregate behaviour can be represented by a market demand curve.

The monopolist in the classical theory exercises market power by restricting supply or by fixing the price, depending on the context. In either case, her market power derives from the fact that if she were to increase supply slightly or to lower price a little, there would be competition among the buyers to take advantage of the relaxation in her selling strategy. The degree of such competition is normally represented in economics textbooks by the price elasticity of demand. A monopolist in the classical theory therefore chooses price or quantity to maximize profits subject to the demand curve she faces, where the demand curve represents the (nonstrategic) *price-taking* behaviour of many small purchasers.[9]

In the context of bargaining over H3G's wholesale termination rates, however, we are a long way from a classical monopoly. In the first place, the customers for wholesale call termination on H3G's network are small in number and relatively large in size, consisting of an incumbent fixed network operator and the incumbent 2G mobile network operators. In the absence of regulation, there is no reason to expect that such large buyers would behave as if they had no ability to influence the price paid to H3G for termination on its network, and hence no reason to assume that H3G would be in a position to fix its termination prices 'at whatever level it chooses', i.e. to set prices as if it were a monopolist facing a large number of small buyers.

Even with such a small number of large customers, a monopolist in most markets would still be able to induce competition between them to increase price, although their small numbers and large size would limit the extent to which the potential customers could be exploited in this way. However, such an opportunity for exploiting even this measure of market power is absent in the market for termination, and for two reasons.

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[9]   To see how classical monopoly prices would be calculated in practice in the call termination market, see Oftel, "Termination Charges in the Absence of Regulation," 2002. Similar analyses and results are reported in M. Armstrong *op. cit.* and J. Wright "Access Pricing under Competition: An Application to Cellular Networks" (2002) University of Auckland.

First, H3G *must* have an interconnection arrangement with the incumbent FNO to operate its mobile network at all, so H3G cannot exert bargaining pressure by (implicitly or explicitly) threatening to deal with an alternative operator.

Second, whatever interconnection agreement H3G reaches with an incumbent FNO will be available to all other MNOs, because the MNOs will have the option of routing traffic to H3G's subscribers via the incumbent FNO's network. By doing so, they are guaranteed the same average termination rate as that negotiated by the incumbent FNO, plus a regulated transit charge.[10] Thus, once a deal with the incumbent fixed operator has been reached, any other operator will have the "outside option" - in any future negotiations with H3G – of using the FNO's network to terminate calls to H3G's network. A consequence of this is that the incumbent operators have no incentive to compete for H3G's business. The existence of multiple operators therefore confers no advantage on H3G, because it cannot induce competition among them for its termination business.

This means that H3G's position in its negotiations with an incumbent FNO is essentially one of *bilateral monopoly* in which there is a single buyer and a single seller. A bilateral monopoly is obviously very different from a classical monopoly. The price at which exchange takes place in a bilateral monopoly is not unilaterally set by one party to maximize its profits. Rather, it is determined by the *relative bargaining power* of the two parties. To assess whether the circumstances endow one or both agents with significant market power, it is therefore necessary to investigate the extent to which one party or the other has bargaining strategies available that allow them to force a final deal that favours their own side.

Without any regulatory intervention at all, it is evident that nearly all the bargaining power in the bilateral monopoly between an incumbent FNO and a new entrant like H3G would be exercised by the FNO, because while H3G needs an interconnection agreement to operate at all, an incumbent FNO will typically have little reason to welcome the entry of an additional competitor in its market. In the absence of an interconnectivity obligation therefore, H3G might well find that it had little prospect of reaching a profitable agreement of any kind with an incumbent FNO.

How does an interconnectivity requirement forcing incumbent FNOs to conclude a deal with H3G alter the distribution of bargaining power? As we will specify more precisely below, it eliminates the incumbent FNOs "outside option" of not concluding a deal at all, so that both the incumbent and H3G are placed on a level playing field in this respect. The incumbent is forced to negotiate by virtue of the interconnectivity requirement imposed on it by regulation; H3G does not have the option of leaving the bargaining table because it cannot launch its mobile network without an agreement.

However, the mere fact that the incumbent's outside option of refusing to negotiate has been eliminated by regulatory intervention should not be expected to have more than a

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[10]   This transit charge is of the order 0.2 ppm in the UK.

negligible affect on the distribution of bargaining power between the two parties. What then matters is the expectation that the two parties have concerning future regulatory interventions - for example, if the incumbent FNO were to attempt to avoid its interconnectivity obligation by delaying an agreement indefinitely.

We follow up these points in the discussion that follows by first considering the factors affecting bilateral negotiations between H3G and incumbent fixed network operators in the absence of any explicit threat of regulatory intervention to enforce the mutual interconnectivity obligation. That is, we suppose that the interconnectivity obligation ensures only that each side is willing to enter into negotiations, but places no other restraint on the bargaining outcome. We subsequently consider the role of the regulator in arbitrating or adjudicating a dispute over termination rates should negotiations between H3G and the incumbent result in an impasse.

III.   What Matters in Bargaining? [11]

What determines who gets how much when two economic agents bargain? The leading strategic factors that determine the nature of the deal we would expect to be agreed by two bilateral monopolists are listed below.

Feasible set: This is the set of all possible agreements available to the two bargainers. From the strategic point of view, all we need to know about each possible agreement is the payoff each agent will receive if the agreement is implemented. The payoff to an agent is usually most conveniently interpreted as the income flow that will accrue to the agent as a consequence of the agreement.[12]

Status quo: This pair of payoffs is also variously called the "disagreement point" or the "deadlock point". Each payoff is the income flow that each agent expects he would receive if the negotiations were prolonged indefinitely without an agreement being reached.[13]

Outside options: These are the income flows that each agent will obtain if one or the other chooses to break off the negotiations unilaterally. They therefore represent the best alternative business opportunities available to each agent if they are unable to settle on a deal that both regard as satisfactory.

Impatience: How important is it to each side that a deal be reached sooner rather than

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[11]   See K. Binmore, *Fun and Games: A Text on Game Theory*, (1992) D.C. Heath and Company and M. Osborne and A. Rubinstein *Bargaining and Markets* (1990) Academic Press, San Diego.

[12]   By an "income flow" we simply mean income, or profit, per unit time.

[13]   Sometimes it is said that the location of the status quo cannot be significant, because rational bargainers will necessarily reach an agreement, and so what would happen if they did not is irrelevant. It is true that ideally rational bargainers with perfect information will reach an agreement immediately, but the particular agreement that they reach depends on *what would have happened* if one or the other had refused to agree. Similarly, people do not cross the road when a car is coming, but their expectation of what would happen if they did try to cross the road in front of a car is not irrelevant, because it determines *when* they choose to cross the road.

later? Forcing delay is a standard bargaining strategy that agents who can afford to be patient use to extract concessions from impatient bargaining partners.

Risk: How risky is it for each side to hold out for a better deal? It is obvious that the more risk averse an agent, the worse he will fare if uncertainty about the future course of the negotiations is increased.

Information: Who knows what? Each side would benefit from knowing the most that the other side would be willing to concede, and so each side seeks to reveal as little as it can about this information.

The first four of these factors are probably the more significant for assessing the bargaining power of H3G relative to an incumbent FNO in negotiations over termination rates. The fourth factor is particularly important in view of the opportunities available to incumbents to use delay as a strategic weapon in extracting concessions from new entrants such as H3G, but we briefly discuss the role of each item on the list before turning to the question of how economists model the use of delay as a strategic weapon in bargaining in more detail.

Risk aversion considerations doubtless act to the disadvantage of H3G, but they are too hard to assess adequately. Asymmetries in information between H3G and incumbent FNOs about each other's payoffs may also be significant, but they also are too hard to assess, so for simplicity we assume that all of the relevant information is common knowledge between the two bargainers.

IV.   The Players' Payoffs

When players sit down to bargain, the payoffs they would receive in a number of scenarios, or contingencies, are relevant to the deal they can be expected to reach:

1. The income flow each agent will receive after an agreement. We refer to as these income flows as the *agreement payoffs*.
2. The income flow each agent expects to receive if the negotiations were prolonged indefinitely. We refer to these income flows as the *status quo payoffs*.[14]
3. The income flow each agent expects to receive if someone voluntarily and irrevocably ends the negotiations to take up their next best alternative. We refer to these income flows as the *outside option payoffs*.[15]

In many bargaining situations, the agents' outside options are crucial in determining the final agreement. This would be the case in the absence of any regulatory intervention in the negotiations between an incumbent FNO and H3G, since H3G would then have no choice

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[14] They are also called 'deadlock' or 'disagreement payoffs.' A. Muthoo, *Bargaining Theory With Applications* (1999) Cambridge University Press calls them 'inside options.'

[15] Sometimes they are said to be the players' 'breakdown payoffs.'

but to offer the incumbent whatever it takes to prevent the latter refusing to deal at all.

However, in negotiations over H3G's termination rates outside options cease to be relevant, because neither H3G nor the incumbent FNO are free to leave the bargaining table without a deal. H3G cannot leave the table without a deal, because an agreement over termination rates is necessary for it to launch its 3G business.[16] The incumbent cannot leave the bargaining table because this would contravene its interconnectivity obligation.

Both the incumbent and H3G formally have the option of calling upon the regulator to intervene in the event of a sustained disagreement, but such an appeal to the regulator does not count as the exercise of an outside option in the sense that this term is used in bargaining theory. In a fully strategic situation, whichever bargainer is most advantaged by the availability of this option would exercise it at the earliest opportunity. Negotiations would then continue while the regulator considered whether it should respond to the appeal to intervene. In the interim, each bargainer would write his expectation of the uncertain result of the regulator's deliberations into its *current* income flow.

The two parties will therefore assess the role of the regulator in their bargaining problem by taking account of the likelihood of further regulatory intervention in their estimate of their *status quo* payoffs. In a stationary situation, which we will consider here, they would attach a small probability ρ to the regulator intervening on any given day. If an agent's income on any given day that passes without an agreement or an intervention by the regulator is q, and the agent's estimate of his income flow after an intervention is e, then the expected income flow that represents his status quo payoff is $(1-\rho)q + \rho e$.

We return to the issue of locating the players' status quo payoffs in the presence of the regulator in Section VI. Our immediate purpose has been to clarify why the bargaining situation between an incumbent FNO and H3G is simpler than would normally be the case, because we can neglect the qualifications on the range of validity of our analysis that the existence of realistic outside options would normally require.

We now turn to the assessment of the parties' agreement payoffs. H3G's agreement payoff will necessarily consist of two elements. First, the direct flow of net revenues or profits it will receive from terminating calls on its network at the agreed termination price, and secondly, the flow of indirect revenues or profits it will receive from being able to launch its 3G mobile business (i.e. nontermination revenues). That is, since H3G cannot launch its business without a prior interconnection agreement with the incumbent FNO, *the entire flow of profits to its 3G business is relevant to its bargaining position.*

The incumbent FNO's agreement payoff also potentially consists of two elements. First, the flow of (typically regulated) profits it will receive from originating calls on its network for termination on H3G's network, and secondly, the negative externality it will potentially suffer from facilitating the early entry of another competitor into its market. This negative

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[16]   And it has already been explained why it cannot hope to play off other incumbent operators (i.e. MNOs) against the incumbent FNO.

externality can derive, for instance, from the direct effect of losing fixed line subscribers (or call volumes) to H3G, or from the fact that the mobile market will become more competitive and the incumbent may have intentions to enter this market, or both.

The two parties *status quo* or *disagreement* payoffs will be considered in more detail immediately below. It seems clear that H3G's disagreement payoff will be (at most) zero, as H3G will receive no revenues, but incur some costs, before the launch of its 3G business. The incumbent's disagreement payoff will depend upon the (expected) number of H3G's subscribers who did not previously own a mobile phone. If the mobile telephony market is *saturated*, then calls to H3G's network from the incumbent's subscribers will simply represent calls that would otherwise have been made to another mobile network, for which the incumbent would have received call revenues. In this case, which we consider realistic for a new mobile entrant such as H3G, the incumbent's status quo payoff will be the flow of net revenues it will receive from terminating those calls on 2G networks which will subsequently (i.e. post-agreement) be terminated on H3G's network.

V.   Bargaining Over a Pie of Fixed Size: An Example

To obtain a feel for how the structure of payoffs for the two bargainers can affect the bargaining outcome, we will first take an unrealistically simple example. Consider two bargainers who are negotiating on how to share a daily pie of size 1. Neither bargainer has an outside option, and on each day that passes without an agreement each bargainer receives an income of zero.

The first thing to note is that a threat to leave the bargaining table will carry no weight in this situation. No rational bargainer would be influenced by a threat to terminate bargaining when it is common knowledge that a mutually profitable agreement can be reached. So a regulatory requirement to negotiate and reach an agreement has no effect on this bargaining problem.

The second thing to note is that if one player, Bargainer 1 say, could emulate a classical monopolist by being able to make a binding, take-it-or-leave-it offer, he would demand the whole pie. Bargainer 2 would then be forced to accept or end up with nothing, since he has no 'countervailing bargaining power.'[17]

However, when the two players are *bilateral monopolists*, neither can credibly make such a take-it-or-leave-it offer.[18] Nash bargaining theory, as further developed in the 1980s (see the literature cited above), is the only fully developed theory for analyzing these situations. The Nash bargaining solution to this problem is found by maximizing the product of the daily gains to each player over the status quo. The bargainers' shares will therefore be x* and 1-x*, where x* is the value of x that maximizes the Nash product x(1-x). Since this

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[17]   Bargainer 1 might make an offer just slightly less than 1 to break Bargainer 2's indifference

[18]   They could try, but what would they do when the offer was rejected? Refuse to hear a counteroffer? Again, no rational bargainer would leave the table when such an offer was refused, so a threat to do so will have no effect on the bargaining outcome.

product is maximized when x=1/2, the pie will therefore be split equally in this simple case.[19]

Moving from a situation in which Bargainer 1 is a "classical monopolist" to a situation of bilateral monopoly therefore deprives Bargainer 1 of half of the pie in this example. We would certainly have to say that Bargainer 1 faces some "countervailing bargaining power" from Bargainer 2, although he still retains some (roughly speaking, half) of his "market power."

But this observation is merely the beginning, and not the end, of the analysis. The question then is, how much countervailing bargaining power does Bargainer 2 have? The answer will depend upon the structure of the players' payoffs and any other relevant asymmetries between the bargainers. We leave discussion of some of these issues until Section VII. In the current section, we continue by complicating our simple model in another relevant direction.

First, assume that Bargainer 1 can obtain a second daily pie (e.g. exploit another business opportunity) - but only *after* an agreement over the division of the first daily pie has been reached. If his additional payoff from the second pie is X, then the new product of gains over the status quo is $(X+x)(1-x)$, which is maximized when Bargainer 1's share of the first pie is $(1-X)/2$, and the second bargainer's share is $(1+X)/2$. That is, the *total* surplus of $1+X$ is now split equally between the two bargainers. The reason is that Bargainer 2 has just as much 'bargaining power' over the second pie as the first, since Bargainer 1 cannot obtain it without a prior agreement over the division of the first pie.[20]

We now complicate the simple model further by imposing a negative externality on Bargainer 2 if he reaches an agreement with Bargainer 1. This negative externality is modelled as his *losing* a third pie of size Y<1. The new product of gains over the status quo is then $(X+x)(1-x-Y)$, which is maximized when the first bargainer gets $(1-X-Y)/2$ and the second bargainer gets $(1+X+Y)/2$. That is, the total surplus of $1+X-Y$ is now split equally between the two bargainers. Bargainer 2 not only acquires half of any positive externality accruing from the deal to Bargainer 1, he is also able to unload half of any negative externality of his own.

These factors are intended to model, in a stylized way, two effects that would appear to be relevant to the negotiations between H3G and incumbent FNOs over termination rates. That is, the fact that H3G cannot launch its business until an agreement is reached, and that the incumbent FNO may suffer a loss in future profits from the entry of an additional competitor into its market. Both of these factors can be expected to have a significant effect on the outcome of negotiations between H3G and an incumbent FNO.

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[19] See Binmore *op. cit.* Chapter 5 for the derivation of the Nash bargaining solution we are using here.
[20] The result would, of course, seem mysterious to an onlooker who failed to take account of the existence of the second pie - especially if X>1, so that Bargainer 1 seemingly bribes Bargainer 2 to take the entire first pie.

VI. Bargaining over Termination Rates

To consider the effects described above in more detail, we now describe a more realistic model of H3G's and an incumbent FNO's payoffs when negotiating H3G's termination rate. Fixed-to-mobile retail prices are regulated in slightly different ways in different countries. e*ircom's* FTM retail prices, for example, are regulated by a price cap, so we may consider this price as fixed for our purposes. BT's retail prices, on the other hand, are unregulated, but the margin (or 'retention') made by BT on each FTM call is regulated. Rather than attempt to encompass all of these possibilities in a simple model, we assume that FTM retail prices are fixed by regulation, implying that the quantity of fixed-to-mobile calls may be treated as being independent of the termination rate agreed between H3G and the incumbent operator. The consequence of relaxing this assumption is to complicate the analysis while not significantly affecting the results.

We denote the incumbent's regulated fixed-to-mobile retail price by P and its (regulated) origination cost by C_0 . Assume without loss of generality that the total quantity of FTM minutes purchased *per subscriber* per period at this price is one and let *s* denote H3G's (expected) total number of subscribers. The incumbent's profits from agreeing a termination rate a_T with H3G (i.e. its agreement payoff) may then be written,

$$\Pi_I = s(P - a_T - C_0),$$

while H3G's profits from an agreement are given by,

$$\Pi_3 = s(a_T - c_T)$$

where c_T is H3G's marginal or incremental termination costs.[21]

Since H3G receives no income in the absence of an agreement, its status quo payoff, denoted by Π^d_3 , will be zero. The incumbent's status quo payoff, Π^d_I , will depend upon the degree to which H3G's entry can be expected to attract new mobile subscribers, or the market is already 'saturated'. We consider the two polar cases of a saturated and nonsaturated mobile market in turn.

Saturated mobile market
If the mobile market is 'saturated', H3G's entry will generate no new mobile subscribers, so H3G's subscribers will all have previously been subscribers to a 2G network. The incumbent's status quo payoff is then simply the termination profits it will receive from H3G's future subscribers before any agreement with H3G is reached, or,

$$\Pi^d_I = s(P - \tilde{a}_T - C_0),$$

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[21]   Since these agreements are for long-term contracts it may make sense to follow Ofcom in modelling H3G's termination costs as long-run incremental costs. See, for example, Ofcom, "Termination Charges in the Absence of Regulation," (2002).

where $\tilde{a}_T$ is the average termination rate paid to the incumbent 2G operators. The incumbent's net payoff from a termination agreement with H3G is then:

$$\Pi_I - \Pi^d_I = s(\tilde{a}_T - a_T)$$

and depends only upon H3G's expected number of subscribers and the difference in the average termination rate paid to 2G operators and the termination rate agreed with H3G. H3G's disagreement payoff is zero, so the Nash bargaining solution yields the termination rate,

$$a^*_T = \frac{\tilde{a}_T + c_T}{2}.$$

Note that this bargaining solution will satisfy

$$\tilde{a}_T > a^*_T > c_T,$$

so long as H3G's termination costs are less than the average 2G termination rate ($c_T < \tilde{a}_T$). Thus H3G's termination rate will never exceed the average 2G termination rate, since agreeing to such a rate will always result in a net loss for the incumbent FNO.

If H3G's termination costs exceed the average 2G termination rate ($c_T > \tilde{a}_T$) then no agreement is possible in the absence of the 'external' payoff factors described above, since H3G will make negative profits from agreeing to a termination rate below its own costs. We let π_3 denote the positive externality that accrues to H3G as a consequence of reaching a termination rate agreement with the incumbent (i.e. the flow of indirect, nontermination profits which result from an interconnection agreement), and π_I the corresponding negative externality of the incumbent (i.e. the expected loss in future profits as a result of the mobile market becoming more competitive). When we take account of these payoffs in the bargaining problem, the Nash bargaining solution then yields the termination rate,

$$a^*_T = \frac{s(\tilde{a}_T + c_T) - \pi_3 - \pi_I}{2s},$$

which is always less than $\tilde{a}_T$ and hence always less than H3G's termination costs whenever $c_T > \tilde{a}_T$. It is also frequently less than c_T even when $c_T < \tilde{a}_T$.[22]

Hence the incumbent's countervailing bargaining power will force H3G's termination rate below the average rate paid to the other 2G operators rate and in many cases below its own termination costs. It is profitable for H3G to agree to a rate which earns negative termination profits because this enables it to earn profits (π_3) from providing other services to its subscribers. A totally unregulated termination agreement will share these additional

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[22]   In order to ensure that a mutually profitable agreement is always possible at a positive termination rate, we need to assume that $s\tilde{a}_T > \pi_I$ and $sc_T < \pi_3$.

profits between H3G and the incumbent, as well as compensating the incumbent for the negative effects on its profits from H3G's entry into the telephony market.

Non-saturated market

We now make the opposite assumption from that of the previous section, and consider the case in which none of H3G's subscribers previously subscribed to a 2G network. This implies that both bargainers status quo payoffs will be equal to zero (i.e. the incumbent suffers no loss in termination profits from 2G operators when H3G enters the market). The bargaining problem then has the solution:

$$a_T^* = \frac{s(P - C + c_T) - \pi_3 - \pi_I}{2s}$$

If both of the externalities π_3 and π_e were equal to zero, the Nash bargaining solution results in a termination rate half way between the "monopoly price" $P\text{-}C_0$ and H3G's termination costs c_T. The effect of the payoff externalities is to reduce this rate, potentially to a price below H3G's costs, so long as its payoff from an agreement remains positive.[23]

Whether or not the mobile telephony market is 'saturated' for the purposes of assessing the negotiations between an incumbent FNO and an MNO is presumably what distinguishes negotiations with an established 2G operator, with a large, pre-existing subscriber base, and those with a new entrant such as H3G, with no pre-agreement subscribers at all. That is, an incumbent 2G operator brings a large termination business 'pie' to the bargaining table, from which it obtains a share of the benefits, while a new entrant brings no such 'pie' at all, since nearly all of its future subscribers will come from existing 2G networks. For the remainder of this article we consider only the saturated market case, as this would appear to be the more relevant to the case of new entry.

VII.   Impatience and Risk Aversion in Nash Bargaining Theory

If there are no problems with asymmetric information and outside options are absent, the Nash bargaining solution predicts the outcome of rational bargaining. In the simple set-up considered in Section VI above, we assumed that the only relevant determinants of an agreement between the bargainers were their agreement and their status quo (or disagreement) payoffs. Other potentially relevant asymmetries between the bargainers, such as differing discount rates (i.e. costs of capital), or levels of risk aversion, were ignored. Even then it was possible to predict that, in the absence of direct regulatory intervention, an agreement between the incumbent and H3G would always result in H3G's termination rate being no more than the average rate paid by the incumbent to the 2G operators, and in most relevant circumstances it would be lower than this, and possibly below its own termination costs.

In order to consider how these other asymmetries may affect the bargaining situation, and

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[23]   To ensure that a mutually profitable agreement is always possible at a positive termination rate we now assume that $s(P\text{-}C_0)>\pi_I$ and $sc_T<\pi_3$.

the potential for the use of delay as a strategic weapon, it is necessary to apply a version of the bargaining model first studied by Ariel Rubinstein.[24]   In Rubinstein's model, two bargainers alternate in making proposals on how to split some surplus until a proposal is accepted. If they did not care when they reached agreement, then it obviously would not matter whether they reached an agreement at all. It is therefore necessary to suppose that each bargainer prefers an early agreement to a later agreement on the same deal. Usually it is assumed that each bargainer discounts time at a constant rate (although the theory can accommodate a variety of other timing assumptions). Rubinstein then showed that there is a unique (subgame-perfect) equilibrium that provides a prediction of the deal on which rational bargainers would agree. This prediction approximates a generalized form of the Nash bargaining solution when the interval between successive proposals is sufficiently small.

How does the theory work in practice? As before, it is first necessary to identify a pair of *status quo* payoffs which are the expected income flows that each bargainer will enjoy while the negotiations are taking place. The outcome predicted by the Nash bargaining solution will then again be a pair of income flows representing a gain for both players over their payoffs at the status quo. The relative size of their gains - and hence their relative "bargaining power"- depends on two things: (i) how risk averse each bargainer is; and, (ii) how impatient each bargainer is.

The example of bargaining over a pie considered in Section V can be used to illustrate how simple it can sometimes be to apply the theory.   Accordingly, consider as before two risk neutral bargainers who are negotiating on how to share a daily pie of size 1. Neither bargainer has an outside option, and each bargainer's status quo payoff is assumed to be zero. If one of the bargainers discounts future payoffs at a rate four times faster than the other, then the less impatient bargainer will end up with 80% of the pie and the more impatient bargainer with 20%. The reason the more impatient bargainer ends up with less is that the less impatient bargainer can credibly threaten to delay an agreement unless the more impatient bargainer makes concessions. In a similar, but less easily explained manner, the more risk averse of two bargainers will end up with a relatively smaller gain. In this case, the less risk-averse bargainer can credibly threaten the more risk-averse bargainer that he will make his life more risky unless he makes concessions.[25]

The effect of impatience can be incorporated into the formulation of the Nash bargaining solution by writing the generalised Nash bargaining solution using the 'split the difference' rule:

$$\Pi_1 = \Pi_1^d + \alpha(1 - \Pi_1^d - \Pi_2^d)$$

and

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[24]   Chapter 5 of Binmore *op.cit.* contains a simple but adequate account of the necessary theory. A more technical exposition can be found in Osborne and Rubinstein *op. cit.*

[25]   This model applies, for instance, when there is an exogenous risk that bargaining may break down permanently. See K. Binmore, A. Rubinstein and A. Wolinsky, "The Nash Bargaining Solution in Economic Modelling" (1986) 17 *Rand Journal of Economics*, 176-188.

$$\Pi_2 = \Pi_2{}^d + \beta(1 - \Pi_I{}^d - \Pi_2{}^d)$$

where Π_i is the agreement payoff of bargainer i, $\Pi_i{}^d$ the disagreement payoff, and the size of the pie is 1 as in our simple example. The numbers α and β, each between zero and one, reflect the relevant asymmetries between the bargainers. If $\beta > \alpha$, Bargainer 2 has more "bargaining power" than Bargainer 1, and obtains a correspondingly greater share of the pie. Thus the generalized Nash bargaining solution gives each bargainer their disagreement payoff plus a fraction α or β of what is left of the pie after the players' status quo payoffs have been netted off.

VIII. Bargaining over Termination Rates with Different Costs of Capital

We return to our model from Section VI of bargaining between H3G and the incumbent FNO, but now suppose that each company's cost of capital (i.e. the rate at which they discount future income streams) is given by r_3 and r_I respectively. There are reasons for assuming that as a new 3G entrant, H3G's cost of capital will exceed the incumbent's. The asymmetric Nash bargaining solution is therefore relevant, and results in an agreed termination rate of:

$$a_T^* = \frac{s(\alpha \tilde{a}_T + \beta c_T) - \beta \pi_3 - \alpha \pi_I}{s}$$

where $\alpha = \dfrac{r_I}{r_3 + r_I}$ and $\beta = \dfrac{r_3}{r_3 + r_I}$.

So, for example, when $\pi_e = \pi_I = 0$, if $\beta = 0$ (H3G has no bargaining power) we get $a^*_T = c_T$ and if $\beta = 1$ (the incumbent has no bargaining power) we obtain, $a^*_T = \tilde{a}_T$.[26] Since we assume that $r_3 > r_I$ (i.e. H3G's cost of capital exceeds the incumbent's), we will have $\alpha < \frac{1}{2} < \beta$. Hence the result of allowing for differing costs of capital or time preference in the bargaining problem is to reduce the agreed termination rate even further, and allocate more of the gains from trade to the more patient bargainer, the incumbent.

IX. Regulatory Intervention

So far we have modelled bargaining between H3G and the incumbent FNO in the absence of any direct regulatory intervention. Since we have been considering bargaining situations in which it has been common knowledge between the parties that a mutually profitable agreement exists, the role of an interconnectivity obligation which simply requires that the parties negotiate (but sets no time limit nor determines a price) has played no role at all in the discussion. In such circumstances, a threat to break off negotiations by either party would have no effect on the bargaining outcome.

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[26] These cases correspond to the incumbent or H3G making a take-it-or-leave-it-offer respectively.

Comreg's interconnectivity guidelines allow either party in the negotiations to initiate an investigation of a dispute and to request Comreg to make a determination within four months. Comreg may decide not to initiate an investigation where it is satisfied that other means of resolving the dispute in a timely manner remain available to the parties.[27] Ofcom's guidelines on end-to-end connectivity, on the other hand, provide no clear dispute resolution procedure.[28]

Since, as we have shown, when the market is saturated H3G's termination rate will never exceed the rate paid to 2G operators, and may well be less than both this and its own termination costs, it seems unlikely that the incumbent would be the first to request regulatory intervention, while H3G's interest is likely to be to initiate an investigation as soon as possible. As observed in Section VI, we may model further potential intervention by the regulator as an alteration of the status quo points of the players in the original bargaining game. That is, if the probability that the regulator will intervene at any moment is $\rho > 0$, and the regulator would then determine a termination rate a^R, then H3G's status quo payoff becomes,

$$\Pi^I_3 = \rho[s(a^R - c_T) + \pi_3]$$

and the incumbent's status quo payoff becomes

$$\Pi^I_I = s(P - (1-\rho)\,\tilde{a}_T + \rho a^R - C_0) - \rho\pi_I.$$

The symmetric Nash bargaining outcome yields the termination rate,

$$a_T^* = \frac{s[(1-\rho)(\tilde{a}_T + c_T) + 2\rho a^R] - (1-\rho)\pi_3 - (1-\rho)\pi_I}{2s}$$

Two natural candidates for a^R are $a^R = \tilde{a}_T$ or $a^R = c_T$. If it is viewed as highly likely, for instance, that the regulator would quickly intervene to impose a solution $a^R = \tilde{a}_T$, then the parties will agree on a termination rate close to, but less than, $\tilde{a}_T$ immediately. If, on the other hand, $c_T > \tilde{a}_T$, as appears likely, and the regulator would impose $a^R = c_T$ with high probability, then the parties will agree to a rate between $\tilde{a}_T$ and c_T immediately, as appears to have occurred in bargaining between H3G and BT in the UK.

Thus regulatory intervention in these cases can serve to prevent the incumbent from extracting a significant fraction of H3G's nontermination profits π_3 as part of a deal over termination rates. However, the fact that H3G still receives at best, a termination rate slightly less than the average rate of the 2G operators, or slightly less than its own costs, could hardly be characterized as an exercise of significant market power, particularly where the 2G operators rates have already been reduced towards their incremental costs by direct

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[27] See S. I. No. 307 of 2003, European communities (electronic communications networks and services)(framework) regulations 2003, para 31.

[28] Ofcom (2003), "End-to-end connectivity: Guidance issued by the Director General of Telecommunications."

or indirect regulatory intervention.

X.   Conclusion

We have argued that the negotiation of fixed-to-mobile termination rates is best viewed as a problem of bilateral monopoly rather than the unfettered exercise of monopoly power, as suggested by regulatory authorities such as Ofcom and Comreg. The issue of whether Hutchinson 3G is likely to enjoy significant market power in setting termination rates then reduces to assessing its bargaining power when negotiating with the incumbent fixed network operator. Neither party will have any outside option in such a negotiation. Aside from their assessment of the regulator's intentions if the negotiations are prolonged, the relative bargaining power of the parties will therefore depend on the structure of their payoffs, and how impatient or risk averse they are. Since it appears likely that it is Hutchinson 3G who is affected adversely by these determinants of bargaining power, it seems perverse to attribute significant market power to Hutchinson 3G in this arena. Our simple models predict that incumbent fixed network operators will never agree to pay H3G a termination rate which exceeds that paid to 2G operators,[29] and in the absence of any threat of regulatory intervention, they would typically offer (and pay) much less than this.

Experience of negotiating termination rates in a number of European countries tends to confirm these conclusions. In the UK, BT refused to pay H3G more than the rate it was already paying to the smaller 2G network operators, despite H3G's initial demand for a higher rate. In Ireland, *eircom* appears to be taking a similar approach. And the regulatory authority in Sweden intervened to impose a finding of SMP on H3G, and then *increased* its termination rate over that being offered by an incumbent operator!

If H3G were able to act as an unrestrained monopolist, as claimed by both Comreg and Ofcom, then its profit-maximizing termination rates would be determined in the manner suggested by Ofcom for the 2G operators.[30] While estimates of monopoly termination rates depend sensitively on the elasticity of demand assumed, even the most conservative estimates result in termination rates which are two to three times higher than those achieved by H3G in its bilateral negotiations with fixed network operators. This fact alone would appear to refute the suggestion that an interconnectivity obligation on incumbent fixed network operators has more than a negligible effect on their ability to exercise significant countervailing bargaining power in negotiating mobile termination rates.

While an obligation to interconnect may deprive incumbent FNOs of the outside option of refusing to deal at all, all of the other determinants of bargaining power tend to favour the incumbent operators over H3G. Given the structure of the bargainers' payoffs and other plausible asymmetries in the bargaining situation described in this paper, it appears likely that H3G's ability to obtain termination rates similar to those paid to other 2G operators rests as much upon an implicit or explicit threat of regulatory intervention as upon any

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[29]   At least in the saturated market case, which would appear to be the most relevant.
[30]   See Oftel, *Termination Charges in the Absence of Regulation*, (2002).

putative market power it may possess in bargaining with incumbent FNOs.