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Flat-Rate Tariffs and Competitive Entry in Telecommunications Markets

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Abstract

Flat-rate tariffs have become widespread in the sale of broadband services. Although popular amongst network operators, consumers and policy-makers, flat-rate tariffs have been implicated in retarding the rate of substitution from legacy to frontier technologies and distorting competitive entry incentives by imposing a disjunction between the prices charged for and the costs of providing services. Flat-rate tariffs impose mandatory wealth transfers between classes of consumers in a similar manner to universal (equalised) pricing obligations. Low-volume consumers are required to subsidise high-volume users, thereby depressing the rate at which the flat-rated product diffuses relative to one with a tariff that separates the bundle of connection to the network and usage of it. The tariff also induces entry by higher-cost providers when this is not overall efficiency-raising, as long as the entrant can selectively attract only low-volume users (e.g. with a two-part tariff or via selective bundling).

Whilst in theory the entry distortions can be corrected with taxes, in practice this has proved extremely problematic as it necessitates detecting the degree of adverse selection engaged in and accurately assessing its costs. Flat-rate tariffs are also unlikely to prevail in the long-run in competitive markets where individual consumer usage volumes vary substantially, because there is always an incentive for a provider to offer a two-part tariff to selectively attract low-volume consumers. They are likely to prevail only when supported by regulation or collective provider market power, but with attendant welfare consequences. Telecommunications policy-makers should therefore exercise some caution before recommending that such tariffs become widely adopted.

Flat-rate (or ‘unmetered’) tariffs, where a consumer pays a single fee to access and use a network regardless of the volume of usage made of that network, are commonplace in the market for broadband services. OECD (2009) reports that of 631 broadband offers covering all technology types surveyed in 2008, 64% were flat-rate plans (a slight increase from 62% in 2007). Flat-rate plans dominate fibre-to-the-home (FTTH) offerings, with only 8% of plans having explicit data caps[1]. Data caps are much more common amongst wireless plans (55% in 2008, down from 85% in 2007); however the percentage of DSL plans with caps appears to be increasing (36% of plans in 2007, 41% in 2008)[2] . Many reasons have been proffered to explain the popularity of flat-rate tariffs, from the perspective of both consumers and network operators. Notably, the tariffs have attracted considerable support from policy-makers, who have attributed them as being one of the key drivers of the rapid uptake of internet access observed since the technology became available (OECD, 2000; 2009).

However, as flat-rate tariffs embody an implicit subsidy from low-volume users to high volume ones, it is not at all clear that their wide use is consistent with the pursuit of a welfare-maximising policy objective. The welfare consequences apply in both static and dynamic contexts.

The wealth transfer to high-volume users means that, as they do not pay in proportion to the extent of their usage, they will consume up to the point that the marginal benefit from their use is zero. The welfare losses arising from low-volume customers eschewing purchase as a consequence of the very high marginal cost of the first unit of usage under a flat-rate tariff potentially exceed the gains from additional very low-valued usage induced from subsidised high-volume consumers. By reducing total customer numbers relative to a counterfactual of a usage-based tariff, flat-rate tariffs also reduce the spillover welfare gains arising from network effects.

Furthermore, as flat-rate tariffs impose a disjunction between the price paid and the cost of serving consumers with differing demand characteristics, their widespread use interferes with the price signals required to incentivise efficient entry decisions in a dynamic, competitive market. Consistent with the theory of distortions created by the use of geographically-averaged (universal service) prices, where flat-rate tariffs are the norm, a competitor can selectively enter the market by targeting only the low-volume (and hence lower-cost)

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[1] A plan where a fixed fee is charged to access a network, plus the right to make use of the network up to the level specified by the data cap. Usage above the cap is charged separately, often at a very high rate. Instead of charging for the additional data used, some operators degrade service quality after usage reaches the cap. For an example, see Vodafone New Zealand’s plans http://www.vodafone.co.nz/home-phone-and-broadband/broadband/compare-our-plans.jsp.

[2] P 113-4; data available on http://doi.org/10.1787/621158628071

consumers, creating an adverse selection problem for the incumbent(s) who are left with a disproportionate share of the high-cost consumers. Importantly, as occurs in the case of universal service averaged prices, the cost-price differential in the low-cost segment enables selective entry by a provider with potentially higher costs than the incumbent, thereby reducing welfare relative to the counterfactual of no entry occurring (Armstrong, 2001).

This paper explores these dimensions of the consequences of the widespread use of flat rate tariffs in competitive markets. Section one examines the history of flat rate tariffs in broadband markets, and summarises the perceived benefits and costs associated with the tariff. Section two, building upon the model in Armstrong (2001), examines in greater detail the welfare consequences arising from the disjunction between costs and prices as a consequence of the implicit subsidy. By way of illustration, section three then applies the model in the context of the use of flat-rate tariffs for local voice telephony in New Zealand. Section four, by analogy, extends the application to the use of flat-rate tariffs in broadband markets. Section five concludes.

1. Flat-Rate Tariffs: an Overview

Flat-rate tariffs have been popular in the provision of internet services since the late 1990s (Ananaia & Solomon, 2007), and are strongly supported by policy-makers and consumers. Drawing upon early observations of substantially higher volumes of dial-up internet connection and usage in those countries where local calls on the Public Switched Telephone Network (PSTN) were unmetered (OECD, 2000), the OECD has strongly endorsed the use of such tariffs in order to encourage greater use of broadband network infrastructures, and in particular, faster network services such as FTTH[3].

1.1 Reasons for Popularity

Residential consumers in particular may prefer flat-rate tariffs, as they offer insurance against the shock of receiving an unexpectedly large bill for metered usage (Grubb, 2010; Mitomo, Otsuka, Nagai & Nakaba, 2008; Biggs & Kelly, 2006; Mitomo, 2001; McKnight & Boroumand, 2000). The insurance benefit of the tariff is posited to be especially highly valued when the consumer may not be readily aware of how easily measurable and controllable usage metrics (e.g. in minutes or application range) translate into the relevant billing metrics (Ananaia & Solomon, 1997; Nix & Gabel, 1993) (albeit that Miravete (2000)

[3] OECD economist Taylor Reynolds voiced strong support for flat-rate tariffs in an interview with Radio New Zealand on April 19 2010. http://www.radionz.co.nz/audio/national/ntn/2010/04/19/dr_taylor_reynolds_-_the_state_of_nz_telecommunications

demonstrates that when consumers understand the nexus between usage and charging, they are able to select the most cost-effective two-part tariff for their individual usage patterns).

To date, the preponderance of flat-rate tariffs would appear to suggest that broadband service providers also, on balance, prefer flat-rate tariffs. As the marginal costs of usage to the network operator are near zero (given almost all of the costs of service provision are fixed and most likely sunk), the absence of a need to monitor and bill on a usage basis reduces transaction costs[4]. Providers (especially new entrants with relatively undiversified product offerings compared to incumbents) may also place a high value on the monthly cash flow certainty associated with flat-rate tariffs, especially when consumers can be 'locked in' to extended duration contracts (e.g. 12 and 24 month commitments) (McKnight & Boroumand, 2000). In the initial stages of the internet's diffusion, flat-rate tariffs were also seen as a means whereby competitive entrants could differentiate their services from incumbents offering metered tariffs. Aggressive price-based competition based on flat-rate charging was observed when flat-rate tariffs were first introduced (Enright, 1999). In an expanding market for a new product with low marginal costs, financial success was determined by the achievement of a high market share amongst new customers, lending further encouragement for providers to utilise the insurance elements of flat-rate tariffs to induce new, high-valuing consumers to purchase (Biggs & Kelly, 2006).

From a strategic perspective, providers may also have used the flat rate tariff structure to take advantage of consumers' ignorance of the extent of their likely future usage requirements of a new, unknown technology and fear of unexpectedly large bills (Biggs & Kelly, 2006). The use of flat-rate tariffs to build market share will be most profitable when the average usage per consumer is relatively low and available capacity is large (and hence service levels relatively high), as the marginal effect of each new customer's use of the network on other consumers is negligible.

For most networks offering flat-rate tariffs, a small proportion of consumers typically use a disproportionately large share of network resources (i.e. median usage falls substantially below average usage)[5]. If new consumers are offered only the flat-rate tariff, then they will purchase the connection as long as their combined valuation of both connection and usage exceeds the flat-rate fee. At the early stages of the diffusion of the technology, consumers are quite likely to be unaware of their likely usage extent. Furthermore, as the technology is new,

[4] Noting that ultimately, the relevant marginal cost of use is congestion, which manifests as a cost to the consumer, not the network operator.

[5] Howell (2003) cites figures for New Zealand in 2003 of median usage substantially less than average usage in each of a range of 'buckets' of bandwidth. Such observations are reported as commonplace by network operators in many different markets.

the first purchasers will also be the high-valuing early adopters, with initial average usage volumes likely quite low. As low-volume users purchasing a flat-rate tariff value each unit of their usage (measured in price paid per megabyte) more highly than high-volume users, then ignorance of the extent of how low their demands on the network actually are combined with fear of big bills for exceeding data caps means it is much easier for a retailer to steer such users towards the purchase of higher-priced flat-rate tariffs, even though a two-part tariff (or more specifically, a tariff offering a flat rate for a specified amount of usage and a per megabyte charge thereafter) which may be more cost-effective given the consumer's low volume of usage is available (Grubb, 2009).

1.2 Limitations

Flat-rate tariffs, however, also have both policy and commercial limitations.

1.2.1 Policy Limitations

In the early stages of the diffusion of a new technology, the first consumers to purchase will be those placing highest valuations on the combination of connection and usage. Some may have high usage demands, and others low usage demands but very high valuation for that small volume of usage. Thus, low-volume high-valuing users will purchase even when offered only a flat-rate tariff as they are still left with some surplus due to their high combined valuation. However, as the technology becomes more widely diffused, the remaining potential consumers are predominantly the low-valuing and very likely low-volume laggards. As the flat-rate tariff imposes an implicit subsidy from low-volume users (paying a high implicit usage price per megabyte) to high-volume ones (paying an implicit low usage price per megabyte), the tariff structure imposes an entry barrier to low-valuing potential new consumers. A two-part tariff, with separate charges for connection and usage (for example, in bundles or 'buckets' of megabytes) will prove more attractive to the lower-valuing consumers, as there is no requirement for them to cross-subsidise the connections of high-volume users.

If the objective of broadband policy is to increase the number of consumers purchasing a broadband connection[6], then flat-rate tariffs would appear inimicable to the achievement of this objective. Rather, a range of tariffs which separate the network connection component from the usage component will be more likely to induce later, lower-valuing adopters into purchasing than flat-rate tariffs. The success of such tariffs is evident in the mobile telephony market, where 'prepay' accounts have been remarkably successful in inducing low-value

[6] As appears to be the case given the given the high priority afforded to metrics such as broadband connections per capita in cross-country comparisons of broadband performance (Boyle & Howell, 2008; Ford, Koutsky & Spiwak, 2007).

consumers to purchase connections. Prepaid' plans are the antithesis of flat rate tariffs, as there is no monthly charge at all[7], but a positive price is paid for each call made.

The persistently-espoused policy preference for flat-rate tariffs implies that its advocates believe the welfare generated by extensive (subsidised) use of the network by early adopters is more important than an equivalent amount accrued by an additional low-volume user joining the network. Moreover, upon subscribing to the flat-rate tariff, the low-volume user should immediately begin subsidising higher-volume users (see Appendix 1). This policy logic is at substantial odds with the sentiments underpinning policies to induce widespread diffusion of fixed line and mobile telephony, telephony. For these infrastructures, call prices in excess of cost enabled connections to be subsidised, in order to maximise the benefits of scale economies available from higher connection numbers (Laffont & Ttirole, 2002). By contrast, flat-rate tariffs for a legacy infrastructure delay the rate at which users substitute to a successor, frontier technology (de Ridder, 2008). High-volume, low-valuing users of the legacy technology having their usage subsidised under the flat-rate tariff must derive even greater benefit from the use of the frontier technology than a consumer whose usage is unsubsidised in order to justify expending the additional cost of connecting to the frontier technology. This factor plausibly explains delayed substitution from dial-up to broadband internet access in those countries where flat-rate dial-up access was the norm relative to those where dial-up usage was chargeable (Howell, 2008b).

That flat-rate tariffs are still observed in the broadband market is therefore likely a function of the relatively early state of diffusion of the technology. As the rate of connection growth is slowing, it would appear that the technology is maturing. If more connections are desirable, then there is merit in policy-makers in the seventeen OECD countries where only flat-rate tariffs are offered mandating that some usage-based offers be made to appeal to low-valuing potential adopters.

1.2.2 Commercial Limitations

Flat-rate tariffs require the supplier to bear the risks of demand variation. This risk is very likely to be shafted home on suppliers in the in the case of an embryonic infrastructure such as the internet. As average usage increases (e.g. as new bandwidth-intensive applications become available, or as consumers increase their consumption as individual application learning increases - Howell & Obren, 2002), network congestion increases, requiring investment in additional capacity if network service levels are to be maintained (McKnight &

[7] Albeit that the consumer must purchase a handset (and a sim card) as a one-off expense.

Boroumand, 2000). Flat-rate tariffs, espoused specifically as a means of increasing network usage, accelerate the rate at which these risks crystallise. It is noted that congestion, an external cost borne by consumers as downgraded service levels rather than network operators, is in practice the most significant marginal cost in broadband networks. However, congestion costs may not be taken adequately into account during times of aggressive price-based competition in flat-rate tariffs, (especially by a provider whose market entry is based solely upon reselling usage of another operator's network)[8]. In these cases, to maintain existing service levels, the current flat-rate prices must inevitably rise.

An alternative to increasing flat-rate tariffs and inevitably reducing customer numbers (and possibly revenues) is for the network operator to replace the flat-rate tariff with a two-part tariff, pricing connection to the network and usage of it separately. Such tariffs require consumers to pay prices that reflect the extent to which usage contributes towards network congestion. Traffic volumes will likely fall as low-valued usage occurring only because of the extent of the subsidy is reduced, enabling network resources to be allocated more efficiently amongst remaining users on the basis of the value they place upon their usage. The time at which it becomes necessary to invest in additional network infrastructure is thus pushed back.

However, the price structure change is not revenue-neutral, as some high-using consumers with very low values for their usage may terminate their connections altogether (and is also extremely unpopular with high-volume users, who are likely to be more vocal than low-volume users who will likely pay less under such tariffs). Furthermore, the negative effect on revenues will be even more marked if usage is not symmetrically distributed, but rather median usage falls significantly below mean usage. The number of customers using less than the average, and paying less than the flat-rate average under two-part pricing, is greater than those high-value users consuming more than the average, and paying a higher fee under the two-part tariff than under the flat-rate tariff. Total revenues will thus fall, making such a pricing change most undesirable to network operators. As it is most likely that internet usage is asymmetrically distributed in this manner, it would be highly unlikely that network operators who have engaged in flat rate tariff-setting will voluntarily switch to usage-based pricing to recover increased investment costs because of the revenue consequences[9]..

[8] It is noted that extensive use of open access regulation, where the regulated prices have not factored in a fair return to the access provider to invest in this increased capacity, actually encourages the use of aggressive price competition by 'hit and run' entrants who have no intention to invest in any network capacity at all, but simply rent the required resources from the incumbent (Hausman & Sifak, 2005; Crandall, Ingraham & Singer, 2004).

[9] Such tariffs may, however, be adopted ultimately on low-cost, low-capability networks if median usage is above average, in order to induce additional purchase by very low-valuing laggard consumers.

Rather than cannibalise revenues by adopting two-part tariffs, network operators might be expected instead to make their new investments in such a way that they can charge a premium for the new infrastructure. One way would be to differentiate the services provided using the new investments (e.g. faster DSLAMs), which are also charged out using flat-rate tariffs. Users valuing internet access and use sufficiently highly (i.e. above the new price) can substitute to the new service. However, it is not at all clear that it will be the resource-intensive high-volume, low-value consumers who will substitute to the newer services. Rather, it is much more likely to be the very high-valuing, (both low- and high-volume) users who will substitute (the price-sensitive ones remaining on the old infrastructure)[10]. This sets in train yet another cycle of asymmetric usage patterns and attendant cross-subsidies, with resource use increasing for the lower-valuing, higher-volume users amongst the substituting proportion as their usage increases in response to the new subsidy on the new resources. Thus, extensive use of flat-rate tariffs and the associated strategic response to the 'problem' of growing congestion may in part explain the observed pattern of intense competition in the provision of ever-faster network capabilities as providers compete to acquire the highest-valuing consumers, regardless of the extent of their usage.

In the absence of a price mechanism to determine how individual users value the service, speed has become an imperfect proxy by which those placing most value on the bundle of connection and usage can be singled out. This contrasts sharply with usage volume as the discriminating metric for identifying high-valuing consumers of metered voice telephony networks. The consequence is very likely that more investment has been made in speed than would have been the case under the counterfactual of usage-based pricing (where more capacity at the same speed may have addressed much of the congestion problem). Almost certainly, investment in faster networks has occurred much earlier than would otherwise have been the case if usage-based pricing had been used to more efficiently allocate lower-speed resources.

2. Flat-Rate Tariffs and the Cost-Price Disjunction

The extensive use of flat-rate tariffs in markets with multiple providers competing against each other raises an interesting enigma. As Farrell (1996) observes, cross-subsidies are antithetic to competition, principally because wherever a provider subsidises one group of consumers at the expense of another group, the provider is exposed to the risk of a competitor selectively targeting the subsidising group. This leaves the first provider with a group of consumers whose costs exceed the revenues they bring, with an inevitable bifurcation of the

[10] This is precisely the pattern observed in New Zealand when Telecom New Zealand introduced ADSL services in 1999 in the face of unmetered dial-up internet access (Howell, 2008).

market between the higher-cost and lower-cost segments. Given the asymmetric nature of bandwidth consumption even within speed tiers, it would appear that such an opportunity exists. Why, then, do flat-rate tariffs persist within broadband markets, albeit graduated across different speed offerings?

Arguably, the ability for all providers to offer flat-rate tariffs across all speed categories is enabled by lack of knowledge amongst users of their exact volume of usage. It is also exacerbated by the continually growing levels of consumption of internet traffic at all speed levels as more applications become available and enter into widespread use. Nonetheless, as illustrated in Australia and New Zealand, usage-based tariffs have been offered in some markets since broadband first became available, and appear to becoming more amongst slower-speed ADSL-based service providers (OECD, 2009). This suggests that, at the margin where providers derive revenues from inducing more consumers to purchase broadband (the lower-priced, lower-capability and arguably more mature networks such as first-generation ADSL), usage-based tariffs are not only becoming more popular, but arguably may be the expected outcome of competition in a market where there has been, as a consequence of the history of flat-rate tariffs, a disjunction between the cost of serving specific customers and the price they pay. Classical economic theory appears to support this contention. However, persistence with flat-rate tariffs will likely lead not only to over-early investment in faster networks, but inefficient entry decisions by providers whose costs are higher than the current providers.

2.1 Costs, Prices and Efficient Competitive Entry

Classical economic theory posits that efficient entry into competitive markets will occur when the incumbent's retail prices send accurate signals to the market of its underlying cost structures (Carlton & Perloff, 2005). The importance of this principle for setting entry incentives in telecommunications markets is evidenced in the concerted efforts of regulatory agencies worldwide to impose cost-based pricing disciplines upon incumbents at both the retail and wholesale level as they seek to induce competitive entry into markets previously dominated by a single (incumbent) provider.

In practice, however, retail prices often differ markedly from costs. Firms set their retail prices using a range of information, of which their own costs are only one component. Firms with market power are presumed to maximise profits by setting prices determined in large part by customer demand elasticity (Carlton & Perloff, 2005). If a regulated firm has large fixed and sunk costs, then Ramsey-Boutieux prices inversely proportional to demand elasticities are both strategically rational (by enabling the firm to recover its fixed and sunk costs over its entire product range) and yield the most socially-beneficial outcome (Laffont & Tirole, 2002).

Telecommunications firms have long been subject to many additional retail pricing obligations in order to further the social distribution agendas of politicians, regulators or other strong stakeholding groups. The most common example is universal service pricing, where the incumbent telephone operator (usually initially a government-mandated monopoly or a government-owned entity) is required to charge equalised retail prices to high-cost rural subscribers and low-cost urban subscribers (Laffont & Tirole, 2002). In these circumstances, prices above cost in one market segment or product category do not necessarily signal the presence of economic profits if the surpluses accrued are applied to offset losses incurred in serving other market segments or product categories where retail prices are below cost (Armstrong, 2001; Baumol, 1999; Baumol, Ordover & Willig, 1997).

If the direct nexus between incumbents' costs and retail prices is broken, then inevitably there is a disjunction between the social and private incentives facing entrants to the market. In the market segments where retail prices are higher than the incumbent's costs, firms with higher costs or offering lower utility than the incumbent can enter when it would be more efficient if they did not; conversely efficiency-raising entry by firms with lower costs or offering higher utility than the incumbent does not occur in the high-cost, low-price segments if the prevailing retail price does not enable the entrant to cover actual costs outlaid.

In theory, when retail prices are out of line with costs, efficient entry incentives can be restored by imposing a tax upon entrants (which may be either positive or negative, depending upon the direction of the cost/price relationship). The appropriate incentives for efficient entry are provided when the tax is levied as a retail level instrument rather than incorporated into an access charge, thereby overcoming residual distortions when the entrant can choose between purchasing a necessary element from the incumbent and bypassing the incumbent's network by constructing a second network (Armstrong, 2001; Armstrong, 2008). In practice, the tax paid in respect of subscribers induced to switch from the incumbent to the entrant in the low-cost segments can be used to compensate the incumbent for lost revenues otherwise used to subsidise loss-making services provided in high-cost segments (or more generally, all providers serving low-cost segments can contribute to a 'universal service fund' from which subsidies are provided to whichever provider services the high-cost segment), regardless of whether the services are provided on the incumbent's or a separate network.

In telecommunications markets, however, universal service obligations are not the only retail price regulations or commonly-utilised pricing structures with the potential to induce inefficient entry decisions. Flat-rate tariffs, which have become the most common means of charging for broadband internet connections (e.g. Ananaia & Solomon, 1997; OECD, 2008), similarly impose a disjunction between the costs of service provision and the prices charged to consumers at the retail level, as the fee paid does not vary in proportion to cost-causing utilisation factors such as the volume of information transferred or the extent to which the timing of the transfer demands affect the performance of the network (i.e. congestion). Notably, in four OECD countries (New Zealand, Australia, Canada and the United States), local PSTN voice service charges have traditionally been 'unmetered' – that is, no per-minute charges have been levied[11] (OECD, 2000). Thus it appears that flat-rate tariffs (either mandatorily imposed by regulators or voluntarily adopted by network operators for strategic reasons) might also pose impediments to the pursuit of efficiency-raising outcomes when incumbents (and first providers of new technologies offered initially at flat-rate tariffs) are subject to competitive entry.

Armstrong's (2001) methodology can be expanded to explore the challenges that flat-rate pricing structures pose to the pursuit of socially efficient entry in telecommunications markets. Whilst originally developed to explain flat-rate tariffs for local calling on PSTN networks, the same principles will apply also in respect of broadband networks. For the purposes of this section of the paper, the efficiency implications of a flat-rate tariff being imposed in the first place are put to one side. The relevant question is whether, given that the tariff has been imposed (or has been selected as the tariff charged by a first participant in a market), is it plausible that socially inefficient entry will occur? Furthermore, is it feasible to address the issues of either incentive realignment or increased efficiency from entry via a tax in the same manner as has been undertaken in markets where universal service pricing at the retail level has been retained?

2.1 The Basic Model

Armstrong (2001) assumes an incumbent provider M offers a retail package to a homogeneous subscriber group with inelastic demands for a service as long as they have non-negative net utility. M incurs a cost of C per subscriber served, which generates gross per-consumer utility U. The price for M's service (determined by a separateprocess, either regulatory or strategic) is P per subscriber. Subscriber net utility is thus $(U – P)$. A potential entrant E can supply a substitute service costing c and generating gross utility of u per

[11] Although in all but New Zealand a per call charge has been routinely imposed.

subscriber. Welfare per subscriber, measured as the sum of consumer utility and profits, is $(u - c)$ if E serves the subscriber and $(U - C)$ if M retains the market.

Successful entry is socially desirable if $C \geq c + [U - u]$. Given M's price, E can attract subscribers provided its own price p satisfies $u - p \geq U - P$. E will enter when the maximum price it can charge covers costs – that is, $P \geq c + [U - u]$. When $P \neq C$, private and social entry incentives differ. If the sector is profitable for M, $P > C$ and $P \geq c + [U - u] \geq C$. Entry occurs when it is socially undesirable, as E has either higher costs or lower service quality than M. Alternatively, if $P < C$, when $P \leq c + [U - u] \leq C$ it is socially desirable for entry to take place, yet it is not privately profitable.

Theoretically, the divergence can be corrected and efficiency restored if the incumbent pays an "output tax" $t = P - C$ per subscriber (positive or negative depending upon the form of regulation). E finds it possible to attract a subscriber provided $u - c - t \geq U - P$ (that is, whenever $u - c \geq U - C$). Armstrong illustrates with an example of a tax to correct the incentives associated with universal service pricing, whereby the incumbent is required to charge an equalised price for both high-cost rural subscribers and low-cost urban subscribers.

2.2 Application to (Mandated) Flat-Rate Tariffs

The concepts underpinning Armstrong's universal service analysis apply equally to the case where the incumbent charges a single flat-rate tariff to all subscribers (either voluntarily or as required by regulation). Flat-rate tariffs require all costs of usage to be met from a single monthly connection fee: that is, all subscribers pay a fee that is independent of the actual costs of usage that they incur. Those making more or longer calls or calls at peak times incur higher costs, but pay the same fee as those making fewer or shorter calls or calls at off-peak times. The subsequent discussion focuses upon the issue of call minute volumes, but can be easily generalised to call number volumes and congestion costs.

Extending Armstrong's model, the incumbent's price P is the price per subscriber paid to M to supply the services consumed by N subscribers who each consume one connection and a number of call minutes (variable cost) distributed around a mean $\bar{X}$ minutes per subscriber at average cost of C per subscriber, comprised of fixed costs FC per connection and variable costs VC per minute (the analysis is robust to asymmetric distributions as long as call volumes are stable as it assumes the price has been set using average costs given the distribution has been observed). At price P, M breaks even over its entire subscriber base.

Subscribers consuming fewer than $\bar{X}$ minutes pay more than it costs for services received, and those consuming more than $\bar{X}$ minutes pay less than cost for their services, in the same manner as urban subscribers pay above cost and rural subscribers pay less than cost for services received under mandated universal service regimes. Assume for simplicity that all consumers receive the same gross utility for the services provided (*U* if *M* supplies, *u* if *E* supplies), comprised of unique connection and usage values varying across the consumer base. The cost per consumer of entrant *E* supplying $\bar{X}$ minutes is *c*.

If substitution of consumers from *M* to *E* is truly random (i.e. determined solely by prices and utility offered), then both the average minutes of usage and the distribution of that usage for the subset of consumers substituting to *E* will be statistically equivalent to that of *M*'s pre-entry customer base. Entry will occur only if *E*'s average cost is lower than *M*'s or the utility offered is higher. However, if information exists enabling either the entrant or the incumbent to strategically target consumers based upon their average minutes of usage, then a classic case of adverse selection becomes feasible. Specifically, a higher-cost entrant may selectively recruit low-volume users, leaving the incumbent with a disproportionately large share of the high-volume users and unable to recover its costs at the prevailing (regulated) price *P*. Likewise, a higher-cost incumbent may use strategic pricing or, if it is bound by price controls, non-price mechanisms to retain a disproportionately large share of low-volume consumers. In both cases, efficiency-lowering entry behaviour will likely ensue.

More formally: a group of individual consumers whose average usage demand for call minutes $\bar{\gamma}$ is less than $\bar{X}$ imposes on *M* an average cost per consumer of $\bar{C} < C$. The average cost of the entrant servicing these consumers is $\bar{c}$ per subscriber. Strictly paralleling universal service, $P > \bar{C}$. If $P \geq \bar{c} + [U - u] \geq \bar{C}$ then if $[U - u] = 0$, $\bar{c} > \bar{C}$. An entrant with higher costs (or lower utility) than the incumbent can profitably enter by selectively targeting those consumers with below mean usage volumes who are paying a fee less than the cost of services consumed. If the entrant is not subject to mandatory flat-rate tariffs, one simple mechanism via which low-volume consumers might be easily identified and inefficient entry by a high-cost entrant could be facilitated is when the entrant offers a two-part tariff under which a significant number of low-volume users pay less than *P*. Likewise, if $\bar{\gamma} > \bar{X}$, then $P < \bar{C}$. If $P \leq \bar{c} + [U - u] \leq \bar{C}$, it is socially desirable for entry by a lower-cost provider to take place, yet it is not privately profitable.

In practice, it is quite feasible for an entrant with higher costs than the incumbent to enter the market profitably by offering a two-part tariff, regardless of whether it is the fixed or variable costs that are higher than the incumbent's. Low-volume users for whom the entrant's two-part tariff offers higher individual surplus than the incumbent's flat-rate price P will substitute, but high-volume users for whom the two-part tariff is more expensive will remain with the incumbent. As the incumbent is bound to charge only a flat-rate tariff, it cannot respond to an offer that would enable it to retain the low-volume users. Even if it did, it would fail to recover sufficient revenues to continue subsidising the high-volume users paying P. The consequent increase in the incumbent's average usage per remaining user necessitates raising the flat-rate price to $P' > P$ in order to avoid making a loss. Total welfare is therefore necessarily reduced as a consequence of entry that is profitable for both the entrant and its customers.

In the universal service case, an optimal tax $t = P - C$ is set. It is theoretically feasible to restore efficient entry incentives in the case of a flat-rate tariff by imposing a tax that reflects the difference in the incumbent's prices and costs: that is, $t = P - \bar{C}$. As the cost of service delivery has both a fixed and variable component, this equates to $t = P - [FC + \bar{\gamma} VC]$. As with universal service, the calculation of the efficient tax remains a function of only the incumbent's costs, so its size can theoretically be signalled ex ante in order to deter inefficient entry. Likewise, if entry does occur, the tax is payable only in respect of that proportion of consumers who actually substitute. If $\bar{\gamma} < \bar{X}$, E pays M; if $\bar{\gamma} > \bar{X}$ the direction of payment is reversed. As with Armstrong (2001), if the tax is levied at the retail level, efficient entry incentives are preserved for an entrant either using elements of the incumbent's network or bypassing via its own infrastructure provided the incumbent's elements accessed by the entrant are priced at cost.

Whereas levying and enforcement of the liability incurred from substitution under a universal service tax is relatively straightforward, as the identity of substituting users is easily verified by their physical location (respective firm connection numbers and market shares in urban and rural locations respectively - albeit recognising that in practice there is likely to be a range of costs associated with different scales of exchange), levying and enforcing payment of the appropriate tax is problematic for flat-rate tariffs. Independent verification of each substituting user and usage volumes both before and after substitution is required in order to compute liability. Substantially more information is therefore required by the regulator, increasing both the complexity and transaction costs of the task and the opportunities for obfuscation and dispute.

Furthermore, the flat rate tariff tax is dependent upon the level of adverse selection actually engaged in. As entrants are unlikely to voluntarily reveal the extent to which they will engage in such activities, the likely costs cannot be reliably assessed and signalled by a regulator ex ante, as is theoretically feasible with a universal service tax. The (averaged) per subscriber tax can only be levied ex post. Any benefit of the signal of a likely tax liability to deter inefficient entry ex ante as occurs in respect of universal service (e.g. a per-customer tax contributed to a universal service fund irrespective of the identity of the provider – incumbent or entrant) is forfeited. Thus, it is inevitable that, even if the efficient tax is actually levied ex post, socially undesirable entry will occur. The greater the extent of adverse selection occurring, and the longer the time between entry and the levying of the tax, the greater the losses from inefficient entry decisions will be.

When a number of cost-price distortions are combined in the same retail pricing structure (e.g. both universal service and flat-rate tariffs), unless separate tax liabilities are levied, the effects of inefficient entry across all relevant markets (i.e. geographic and calling) will inevitably ensue. Clearly, 'bundled' taxes cannot be relied upon to induce socially optimal behaviour in each underlying market. 'Bundled' taxes assessed and levied ex post will thus incur the maximum level of inefficient entry. Whilst monetary taxes can be levied, if inefficient entry has occurred and already resulted in a net loss of welfare, compensation cannot in fact be paid as there are no proceeds from which it can be collected.

The practical implications of levying and collecting taxes to correct for entry distortions draw into question the wisdom of imposing mandatory flat-rate tariffs in markets where simultaneously a policy of inducing more competitive entry prevails. Whilst an unregulated firm may voluntarily choose to adopt such a structure for a variety of strategic reasons (discussed subsequently), the regulatory mandating of such a tariff structure adds a substantial level of complexity, cost and risk that may quite likely exceed the benefits assumed to prevail from its imposition in the first place. Careful consideration of the relative costs and benefits is required. It may be both simpler, and more likely that appropriate incentives will be provided, if there is no mandating of flat-rate retail tariffs (i.e. leaving it up to the participants to select tariff structures) or even mandating that the incumbent charge only cost-based two-part retail tariffs[12].

3. Application: The New Zealand Experience

Flat-rate tariffs for local residential calls have prevailed in New Zealand since telephony began in 1879. The country's incumbent Superintendent of Telegraphs decided that it was too costly for telephonists to record call activity occurring within the new, government-owned (Post Office) monopoly local exchanges, so the metering of local calls and any subsequent per call charging was eschewed. Equalised universal service tariffs have also prevailed since the beginning of the industry, as the Post Office was bound to provide all of its services (communications (post, telegraphs and telephony) and banking) at the same prices to all consumers. Over time, both universal service and flat-rate residential local calling tariffs have become entrenched as politically-protected artefacts of the New Zealand telecommunications industry (Wilson, 1994). For the past seventy years at least, local calling areas have been determined largely by political and strategic factors[13] rather than telephone exchange economics, resulting in New Zealand having some of the OECD's geographically largest local calling areas (Howell, 2008).

Liberalisation of New Zealand's telecommunications sector began with the Telecommunications Act 1987, which removed all legislative protections for the government's telecommunications monopoly. Concomitantly, telecommunications provision was separated from other Post Office services in 1987, corporatised in 1989 and sold to private interests in 1990. As a condition of sale, the private owners were bound by a contractual obligation to the Crown (known initially as the 'Kiwi Share') to provide geographically equalised ("universal") tariffs and continue to offer residential subscriptions with flat-rate local calling tariffs ("free local calling"). Retail price control on the combined universal residential retail subscription and calling bundle was also imposed, preventing price increases beyond the level of the price at the time of sale adjusted for the consumer price index without Ministerial approval (Boles de Boer & Evans, 1996).

When competitive entry occurred in 1991, a high-profile court case ensued between an entrant (Clear) and the incumbent (Telecom) over the ability for the incumbent to charge

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[12] It is noted that the problem of taxing is also made core complex if the two-part tariff is not cost-based but rather is designed so that subsidies from calling to connection increase the subscriber base thereby allowing the appropriation of greater network effects.

[13] An entrant (TelstraClear) specifically differentiates its voice telephony product from the incumbent's (Telecom) by offering geographically larger "free local calling" areas. http://www.telstraclear.co.nz/residential/inhome/calling-plans/big-back-yard.cfm

interconnection prices that differed from its costs. After three years and three court cases, the highest court, the Privy Council, found that consistent with Baumol, Ordover & Willig (1997) and Baumol (1999), Telecom could legitimately include in its interconnection prices a component to recover revenues lost as a consequence of being required as part of its regulatory obligations to charge retail prices substantially different from its costs (the "Efficient Component Pricing Rule" or "ECPR"). Contemporaneous commentary identified the potential inefficiencies of imposing regulated cost-based wholesale prices without taking into account the costs of the social obligations (Blanchard, 1994a; 1994b; 1995; Economides and White, 1995), but there were no immediate changes made to either the regulatory regime or the 'Kiwi Share' terms (Howell, 2008a).

Disputes continued, however, between Telecom, entrants and policy-makers as to the 'fairness' of the interconnection prices charged and the efficacy of alternative instruments to enable the incumbent to recover its costs in the face of substantial competitive entry in both the connection and calling markets. Following a Ministerial Inquiry in 2000, the Telecommunications Act 2001 established that, consistent with Armstrong (2001), Telecom should charge cost-based (Total Service Long Run Incremental Cost – TSLRIC) prices for those regulated elements it provided to entrants (initially principally interconnection, but subsequently connections sold under bitstream and full local loop unbundling)[14], but that losses incurred from meeting its social obligations would be recovered from industry participants via an annual tax, the Telecommunications Service Order (TSO). The TSO tax was levied by the Telecommunications Commissioner (regulator) on all market participants on the basis of information provided, with the entrants' share being paid directly to Telecom as compensation for losses incurred in meeting the mandatory social obligations (Howell, 2008a).

In principle, the 'TSO' arrangements should enable efficient entry to occur regardless of whether entrants utilise elements of Telecom's network (access and calling) or bypass it with their own infrastructure (connection and calling). In practice, however, its implementation has been significantly compromised by the requirement to recover the costs of both universal service and (inter alia) flat-rate local residential tariffs ex post via a single bundled tax instrument. With no ex ante signal of the level of liability, it is inevitable that inefficient entry behaviour has ensued. The informational complexity and tensions associated with the process are illustrated by the length of time it has taken the regulator to reach annual determinations (some have been delivered up to three years after the year to which the tax

[14] Despite having no regulatory obligation to do so, the incumbent has charged universal prices for its DSL broadband services as well as voice telephony (Howell, 2003).

applies) and the intensity of dispute engendered over the magnitude of the cost and its allocation (especially amongst entrants with their own infrastructures – e.g. Vodafone mobile - who strongly resent having to pay Telecom to maintain unprofitable PSTN lines in regions that they believe they can more efficiently service using their alternative technologies) (Howell, 2008a).

The extent and ongoing nature of the disputes led to a recent ministerially-commissioned inquiry into the TSO, undertaken by the Telecommunications Carriers' Forum (TCF)[15]. As a consequence of the brief specifying that Telecom's free local calling obligation must remain unchanged, only the universal service component of the TSO was examined. The Forum recommended that Telecom be allowed to vary its prices by geographical region. In order to ensure that rural prices did not become 'unaffordable', the Forum proposed that a taxpayer-funded subsidy be provided to whichever provider could successfully bid for the right to provide services in regions where the socially desirable price fell below actual cost (TCF, 2008). The social cost of universal service would thus become a charge on the government rather than the industry, with the lowest-cost provider winning the 'right' to service high-cost geographical areas under a tendering arrangement.

If the only regulated retail price-cost distortion facing the New Zealand industry was the universal service obligation, then the TCF proposal would successfully dispense with the 'TSO tax' and its associated complex, time-consuming and contentious processes as a charge on the industry. However, as demonstrated above, if the free local calling obligation is to be retained, a revised 'TSO tax' must continue to be levied on industry participants in order to preserve appropriate entry incentives. Without such a charge, both entry incentives and the incumbent's ongoing financial viability are exposed to the strategic actions of entrants with higher costs than Telecom's 'cherry-picking' the most lucrative (i.e. Telecom's lowest usage volume PSTN) customers, leaving Telecom with the most costly (i.e. highest-volume) customers.

As the transaction cost efficiency gains that underpinned the establishment of the flat-rate pricing convention in 1879 are almost certainly no longer relevant in the current industry, it begs the question of what economic or social distribution purpose the flat-rate tariff obligation is designed to achieve in the ongoing New Zealand telecommunication industry policy environment? If the economic consequence of its presence is substantial distortion in entry incentives that can only be partially and imperfectly addressed by a complex, time-consuming

[15] A co-operative industry association comprised of all sector participants operating their own networks, irrespective of whether they have full national or sonly local coverage. .

and costly process that has been the source of much discontent amongst industry participants, it may be more prudent to remove the “free local calling” obligation at the same time as any change is made to the “universal service” obligation.

It is noted that in March 2010, the Minister of Communications rejected the TCF proposal, and instead announced that in future, Telecom alone would be required to cover the cost of the serving unprofitable customers alone. The firm is now exposed to extreme cases of adverse selection in respect of both its voice and internet customers, whilst being simultaneously bound to continue to provide an option for consumers, once having switched to another network provider, to reconnect to the Telecom network. This adds yet another further cost that drives a wedge between the firm’s costs of serving its customers and the costs faced by its competitors, even in respect of wholesale customers connected to identical exchanges. Whilst Telecom must provide universal prices and unmetered calling, its competitors have complete freedom to decide both its customer base and pricing structure (Heatley & Howell, 2010).

4. Extension to Broadband Tariffs

Whilst it might be argued that PSTN voice services are based upon a technology that is rapidly being replaced by newer internet protocol-based services, the implications of flat-rate tariffs upon competitive entry in other markets must also be considered. For example, the potential exists for similar entry incentive distortions to occur in the flat-rate tariff segments of the broadband market. Higher-cost entrants can potentially cherry-pick low-volume consumers of the flat-rate providers by offering two-part tariffs, reducing welfare even though their entry has decreased market concentration.

Efficient entry incentives may be restored if the flat-rate providers respond with their own two-part tariffs, but not without some redistribution of surplus from high-volume users receiving subsidies under the flat-rate tariffs to the previously-subsidising low-volume users who pay lower prices under the two-part tariffs (and potentially from the broadband provider to consumers if the flat rate price exceeded average cost in the first place). Yet as discussed in Section 1, this has not occurred to date, as a consequence of the risk to revenues and the options of investing in faster services, albeit still charged at flat-rate. Arguably, this has been possible because of consumer ignorance of their actual demands on the network and the still-growing consumption of network resources as new applications become available.

However, it begs the question of whether two-part tariffs will become more common in at least some parts of the market? For both competitive and strategic reasons, it appears that the ability to segment consumers based upon their usage patterns will indeed lead to the conclusion that in the long run, flat-rate tariffs for broadband services are not sustainable. Even if all providers have the same average costs and derive no net economic surplus from pricing at the average flat rate cost, there is always an incentive for at least one provider to deviate from the flat-rate tariff by offering a two-part tariff that enables if to acquire profits from sales to low-volume consumers. As long as consumer demand is distributed around the mean $\bar{X}$, there will always be consumers with usage demands less than $\bar{X}$ who will find it worthwhile to defect to the two-part tariff. The greater the variance of the distribution, the more desirable a two-part tariff becomes. The two-part tariff is potentially most attractive in the case of an asymmetric distribution where median demand is less than $\bar{X}$, as the number of consumers with lower-than-average demands (and hence the scope for profits from defection from flat-rate tariffs) exceeds that of above-average demanders. Moreover, even if demand is increasing, the two-part tariff-provider stands to benefit from the pricing strategy, as revenues will increase with volumes, unlike the flat-rate provider, whose revenues are stable even though demand (and hence costs) increase.

Segmenting of the broadband market is already occurring in some countries, where packages with lower flat-rate fees and specific usage caps (megabytes) in a manner similar to that observed in the mobile telephony market where various fixed price plans with differing numbers of ‘free’ call minutes have become the norm. It is not at all clear that all of the providers offering such packages will lower costs than the incumbent(s) from whom they have attracted their subscribers. Arguably, if the entrant is purchasing all elements from the incumbent(s) under wholesale arrangements (e.g. bitstream unbundling), it is quite likely that total costs will indeed be higher due to the duplication of many of the fixed costs of market entry that would not be incurred if the incumbent(s) serviced the same customers. Even though such entry may impose price competition upon the incumbent, net welfare is lowered unless taxes can be imposed to deter such activity.

4.1 OECD Tariff Evidence to Date

In October 2009, segmenting of the broadband market by the use of data caps was occurring in 13 of the 30 OECD countries[16]. On October 2003, capped plans were reported in 14 countries (OECD, 2004). Eleven of the countries with capped plans in the 2009 data were

[16] http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html

offering caps in 2003[17]. By 2009, capped plans have been added as features of the broadband market in the United Kingdom (40% of plans surveyed), Spain (10%) and Turkey (37%). The four countries ceasing to offer capped plans (Austria, Germany, the Netherlands and Norway) all had cable providers offering uncapped offerings in competition to the incumbent telecommunications provider in 2003. Of the eleven countries with capped plans in both 2003 and 2009, four (Belgium, Canada, Ireland and the Slovak Republic) had competition from cable providers offering unlimited competition in 2003. Of these, only Belgium (82%) and Canada (100%) still have a significant number of capped offers in 2009. The percentage of capped plans observed in 2003 in each of these countries was much lower – 25% in Belgium (all DSL plans in 2003were capped) and 65% in Canada. The percentages of capped plans in Ireland and the Slovak Republic in 2009 were 22% and 15% respectively. It is noted that both the cable and DSL providers in Canada and Belgium were offering capped plans in 2003; none of the cable providers in Ireland and the Slovak Republic were offering capped plans at the same time. Of the remaining seven countries still offering capped plans in 2009, all had cable providers offering capped plans in 2003.

These data are consistent with the hypothesis that those countries initially offering capped tariffs are still offering such tariffs, but that the tariff form does not appear to be emerging in those countries where flat rates have been the dominant form of tariff offering (the major exception being the United Kingdom) . Importantly, however, capped plans seem to be more likely to prevail in countries where cable providers also offered capped plans in the early days of broadband availability. Capped plans appear to be excluded in those countries where cable plans were initially uncapped. If the strategic impetus for at least one provider to offer a flat-rate tariff is as compelling as indicated above, then the absence of any capped plans in seventeen of the OECD countries is puzzling. It may be that, as demand is still growing, there is still room to compete on the basis of the provision of ever-faster networks. But eventually, the willingness of high-valuing users to pay even more for faster services will likely be exhausted, and two-part-tariffs will become more prevalent. This feature warrants further future observation.

4.2 Bundling Implications

It is also noted that service bundling also provides an opportunity for adverse selection to occur. A particular opportunity pertains to the bundling of PSTN voice services with broadband services. Specifically, internet service providers (ISPs) can utilise information about usage of the incumbent's PSTN by their customers for dial-up internet access to target

[17] Australia, Belgium, Canada, Hungary, Iceland, Ireland, Luzembourg, New Zealand, Portugal, and the Slovak Republic.

offers of bundled voice and broadband services in such a way that exposes the incumbent to being left with a disproportionately large number of high-volume flat-rate PSTN users.

Under flat-rate tariffs, dial-up internet users face no additional charge for their PSTN usage, so are likely to consume a substantial amount of PSTN-based dial-up internet access. Howell (2008) indicates that at the peak in 2003, New Zealand's dial-up internet account holders were consuming on average 35 hours per month of PSTN usage for internet access, and that over two thirds of local PSTN traffic was internet-related[18]. A consumer substituting from dial-up to broadband almost certainly goes from being a high-volume PSTN user to a low-volume one. If entrants target the incumbent's existing broadband consumers by offering a pure bundle of voice telephony and broadband internet access, then it is almost certain that the pool of substituting customers will be low-volume PSTN users, as they are not consuming any dial-up internet access. They will necessarily be in the consumer group where $\bar{\gamma} < \bar{X}$, but are still paying $P > \bar{C}$. The entrant now stands to gain the share of surplus that would otherwise contribute towards offsetting the higher costs of the incumbent's remaining high-volume PSTN consumers.

Irrespective of the economics of the entrant's broadband offering, an entrant with higher costs in the PSTN component may be able to enter in this manner using a pure bundle of voice and broadband at a lower price than the incumbent by targeting only low-volume PSTN consumers. As argued above, these may be precisely the arbitrage-based circumstances in which an entrant using only wholesale elements provided by the incumbent in both the PSTN and broadband segments can profitably enter and compete with the incumbent despite having sunk additional costs in market entry activity (e.g. marketing, customer account services) that would not have been incurred if the incumbent alone provided both services. Competitive rivalry in these circumstances is based not upon competition for the consumer's broadband business *per se*, but for the PSTN voice business (albeit using broadband custom via the pure bundle as the defining element). The same strategy can also be employed by competitors with their own higher-cost PSTN networks. In either case, the incumbent is left with a disproportionately large share of the PSTN heavy-use market – namely those consumers still using dial-up internet access – to the detriment of total welfare unless a tax is levied on the entrants to compensate the incumbent for the consequences of their adverse selection.

[18] Indeed, only 20% of PSTN traffic at this time was able to be charged to customers.

In a related, but slightly different, strategy an ISP providing the ISP-related component of dial-up internet access sourced by the customer over the incumbent's network has information enabling it to ascertain the dial-up usage volume of its own customers. This information may allow it to selectively market its broadband services via a bundle to potential substituters in such a manner that it gains a disproportionate share of the new substituters relative to the incumbent (which may or may not have its own ISP via which such activity can occur – if the incumbent is a vertically-separated network provider, then such adverse selection certainly can occur). For example, dial-up users with increasing usage over time are more likely to substitute to broadband (increasing use of existing and new applications) than consumers with static usage volumes (static application patterns) (Howell, 2008b). Once again, the result is a bias in the patterns of substitution that leaves the incumbent potentially unable to recover all of the costs imposed by the mandatory flat-rate PSTN tariff obligation.

5. Conclusion

The preceding discussion has illustrated that mandatory flat-rate tariffs impose welfare limitations and distortions upon entry incentives in telecommunications markets a similar manner to mandatory universal service obligations as they impose a disjunction between the prices charged for services and the costs of providing those services. The most likely outcome is lower levels of diffusion of the technology, over-early investment in high-speed networks and market entry by higher-cost providers when this is not overall efficiency-raising, as long as the entrant can selectively attract only low-volume users (e.g. with a two-part tariff or via selective bundling). Whilst in theory the entry distortions can be corrected with taxes, in practice this has proved extremely problematic due to the difficulties in detecting the degree of adverse selection engaged in and accurately assessing its costs.

In the New Zealand example, the complexity of the bundled TSO tax recovering both universal service and flat-rate tariff obligations from entrants has proved both time-consuming and conflict-ridden. Whilst it may be feasible to restructure the obligations by removing the universal service component and replacing it with geographically-specific prices, the ongoing requirement for the incumbent to offer flat-rate residential tariffs means that efficient entry incentives will be provided only if a tax to address this element is retained. In order to avoid the complexities and tensions so far evidenced, it would appear prudent for the flat-rate tariff obligation to be abandoned at the same time as the universal service obligation. Under these circumstances, the incumbent will be able to respond to strategic tariff-based competition in the same manner as any other firm with the freedom to structure its own tariffs uninhibited by regulatory obligations, and thereby remove some of the potential inefficiencies arising from the regulatory obligation.

The paper has also illustrated that flat-rate tariffs are unlikely to prevail in the long-run in competitive markets where individual consumer usage volumes vary substantially, because there is always an incentive for a provider to offer a two-part tariff to selectively attract low-volume consumers. Whilst such tariffs have been popular in the early stages of broadband markets, they are unlikely to persist in the long-run because the potential to segment the market based upon usage volumes impacts upon the ability of the flat-rate providers to recover the costs incurred by remaining high-volume consumers without raising prices. Thus, it would appear that flat-rate tariffs are sustainable in the long-run only when supported by regulation or collective provider market power. In the face of competition, persistence with such tariffs results inevitably in distorted entry incentives that will likely reduce welfare, as it is too complex to correct the distortion with taxes. Telecommunications policy-makers should thus refrain from recommending that such tariffs be widely adopted.

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Appendix 1. Welfare Effects of Flat-Rate Tariffs

Assume a homogeneous customer group with different expected volumes of consumption values usage of the internet at f per megabyte. There is a small positive cost c per unit of usage (leaving fixed costs to one side for the moment). At a flat fee of F per month, only those customers whose anticipated monthly usage exceeds a threshold of M will purchase internet connections. Those consumers whose anticipated usage is less than M will not purchase. Potential consumer surplus represented by the entire dotted triangle is sacrificed (panel A).

If marginal cost pricing prevailed, then welfare to the extent of the sum of the red and blue dotted areas would be gained. If another tariff was offered, with a fixed price B and a cap of M megabytes per month, those consumers with usage between M1 and M will now purchase. Welfare increases by the extent of the blue dotted area.

In practice, rather than being constant, an individual's marginal valuation of additional megabytes of consumption will decrease as the quantity consumed increases. This leads to a downward-sloping marginal benefit curve (Panel B). In the absence of cost-sensitive pricing, consumers will not stop consuming at the point where their marginal benefit curve cuts the marginal cost curve (the efficiency-maximising quantity Q), but instead will consume to the point Z where the marginal benefit of consuming equals zero. This results in a loss of welfare, measured by the green dotted triangle.

If the potential total welfare losses from Panel A exceed the additional benefits of additional usage accrued across those consumers purchasing flat-rate tariffs in Panel B, then the flat-rate tariff has a net negative effect on welfare relative to marginal cost pricing. Whilst not perfectly efficient, a menu of tariffs with different flat fees and data caps will likely be less harmful to total welfare than a single flat-rate tariff (as illustrated in Panel A).

Figure 1: Welfare Effects of Flat-rate Tariffs