Numbers to the People: Regulation, Ownership and Local Number Portability

by

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Local number portability (LNP) is a key factor in the promotion of local call competition in telecommunications. By allowing a consumer to retain their number when moving between local telephone providers, LNP reduces customers' switching costs and makes it easier for new providers to compete for customers. But regulators face a number of important choices when implementing LNP – what technology should be chosen, what are the costs of implementing LNP and who should pay? This paper considers how the regulator can implement LNP when there is asymmetric information about the optimal timing, choice and cost of technology and about the value of LNP to individual customers. We show that requiring each carrier to bear their own costs and creating transferable ownership of telephone numbers may allow the regulator to overcome the problems created by asymmetric information. *Journal of Economic Literature* Classification Numbers: D4, L13, L51.

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1. Introduction

The provision of local number portability (LNP) is considered to be a critical step in introducing local telephone call competition. With LNP a customer can retain their telephone number when moving between local telephone companies. Without LNP, a customer must forsake their existing number and receive a new number when changing local telephone providers.[1]

The inability to port a local number when changing companies may limit the scope of local telephone competition and slow its progress. For many business customers, the local telephone number is an asset of their business. This is particularly true for businesses with 'well recognised' numbers. Such businesses may be reluctant to change local telephone companies and forgo their number even if the alternative provider offers better service and/or cheaper rates. Other business customers may also be reluctant to give up their number if it involves incurring expense such as changing stationary or product packaging. Changing telephone numbers increases the risk of 'missing calls' as potential clients ring the old number. Domestic consumers may also prefer to keep their existing number rather than learn a new number and risk missing calls. A 1994 Gallup poll commissioned by MCI Telecommunications suggested that 80 per cent of residential customers and 90 percent of business customers would be unlikely to change their local telephone company if they could not retain their number (Weiss, 1998).

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[1] There are different types of number portability. Service provider portability permits a customer to retain their existing telephone number when changing their local telephone company. Portability may apply to only fixed line local companies or also apply to wireless (mobile) telephone companies. Geographic number portability allows a customer to retain their number when moving outside their current local exchange area. LNP for fixed line carriers is considered the first stage for local telephone competition and will be the focus of our discussion below.

A number of countries have introduced LNP or are rapidly moving to allow LNP. Portability of phone numbers when moving between the two main telephone companies in Britain, BT and Mercury, was introduced in 1996 after a lengthy debate over the allocation of costs. Regulations requiring all carriers in Britain to provide LNP came into force on January 19, 2000 (Oftel, 2000). The Hong Kong Telecommunications Authority directed network operators to provide number portability and established specific 'interface requirements' in 1996 (Hong Kong Telecommunications Authority, 1996). In the United States, the Telecommunications Act of 1996 mandated the introduction of LNP. The Federal Communications Commission (FCC) decided to phase in LNP, beginning in the major metropolitan areas in 1998 (FCC, 1996). Canada has also been phasing in LNP for major cities (Canadian Radio-television and Telecommunications Commission, 1998). In Australia, the telecommunications regulator (the Australian Competition and Consumer Commission (ACCC)), mandated that LNP requirements, already imposed on the two largest local call providers, be extended to other licensed telecommunications carriers (ACCC, 1998). The European Commission in 1998 ruled that LNP should be available in member states by January 1, 2000. A number of European countries, such as Finland, France, Germany, the Netherlands and Sweden had LNP in place in 1999, although these countries adopted different technical approaches for portability (European Economics and Arcome, 1999).

The goal of this paper is to evaluate the regulatory options surrounding the introduction of LNP.[2] Our results caution against regulatory solutions that involve costs being allocated to either customers or to the carrier to whom a customer

[2] The discussion of this paper summarizes the more formal analysis of Gans and King (2000). See also Aoki and Small (1999) for an analysis of the social desirability of mandated LNP.

switches. Such regulatory policies have the potential to undermine the pro-competitive consequences of LNP. In contrast, we demonstrate that by allocating the ownership of phone numbers to current customers, Coasian bargaining may ensure that porting only occurs when it is efficient and that carriers bearing LNP costs will have maximal incentives to choose appropriate technologies.

2. Issues in Implementing LNP

Telecommunications regulators face a number of difficult choices when trying to implement LNP; in particular, when should it be implemented and what technology should be chosen? There are two main ways to introduce LNP.[3] The simplest approach, particularly in the short term, is to use a *call-forwarding* solution. A person calling a ported number will have their call forwarded from the local exchange of the original carrier's network to a point of interconnection with the recipient's new network. Call forwarding will usually occur at what used to be the recipient's local exchange before they changed companies. Because this LNP solution is simply a modification of current call forwarding procedures it may lead to a significant delay in call completion times and some services cannot be supported by a number that is ported in this way. With call forwarding, once a call is connected it remains connected through the forwarded route. This makes each call connection quite costly as calls may have to be forwarded back and forth through points of interconnection between a customer's old and new carrier.[4]

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[3] See Reinke (1998) for a more detailed discussion of these options.

[4] One variant of call-forwarding, call drop-back, allows the call path to be established more directly following an initial call set-up phase.

Alternatively, LNP may be introduced using an '*intelligent network*' (IN) solution. An IN solution requires greater investment in networks by local telephone companies. When someone calls the ported number, the number is interrogated against a database in the originating carrier's network then forwarded to a point of interconnection with the relevant terminating carrier. There are different types of IN portability depending, for example, on where the number is interrogated in the originating network and the protocol for identifying and routing ported calls.[5] Ultimately, however, the call costs are reduced compared with call forwarding because call connections are made along relatively more efficient routes.

These technological options create a problem for the regulator. The regulator is unlikely to know the optimal LNP solution, particularly in the short to medium term. In almost all jurisdictions there is currently a single carrier that dominates local telephony. Often this carrier is a former monopoly. In the short term, as local call competition develops, it may be more efficient to use a call forwarding procedure. However, as competition matures and more customers port their numbers, moving to an IN solution is probably desirable. But how does the regulator know when this technological change should occur?

In the US, the FCC avoided this problem by setting out criteria that LNP had to satisfy (FCC, 1997).[6] These criteria required an IN solution. Even with IN technology, however, there are alternative approaches, and it may be difficult for the regulator to guarantee that the optimal approach is chosen. The regulator cannot simply leave the choice of timing and technology to the dominant incumbent local telephone company. The incumbent carrier will have an incentive to slow the

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5 The US, for example, is introducing Location Routing Number (LRN) for ported numbers.

6 The North American Numbering Council and 'the industry' then chose an LRN solution.

introduction of number portability. Because the lack of portability creates a switching cost for its customers, the incumbent carrier will have an incentive to delay LNP in order to reduce the effectiveness of local telephone competition.[7] If forced to introduce LNP, the incumbent carrier will have an incentive to choose a technology that limits competition. For example, it may choose a call-forwarding solution and delay the introduction of IN technology if this leads to deterioration in call quality for customers who have ported their numbers. If forced to introduce IN technology, the incumbent carrier will have incentives to choose to configure the IN solution to provide the least benefit to its competitors.[8]

Even if the regulator can overcome the issues of technological choice, there remains the critical issue of who pays for LNP. The different technological choices have very different costs and the costs of introducing LNP can be substantial. The cost of replacing or upgrading switches for an IN solution can be more than $70,000 per switch. In the US "[i]mplementing LNP will cost the RBOCs an estimated $3 billion over 5 years or approximately $400 million to $500 million each." (Weiss 1998)

In Britain, the telecommunications regulator, OFTEL, originally ruled that each carrier should pay their own costs of upgrading their network for number portability. This would have placed most of the costs on BT as the incumbent local carrier. When this decision was referred to the Monopolies and Mergers Commission, however, the OFTEL decision was overturned and it was decided that BT could share

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[7] An interesting example of the potential for conflict between an incumbent carrier and a potential local telephone entrant is given by the interchange between Bell Atlantic and AT&T about the progress of LNP in New York. See Bell Atlantic News Release, *Bell Atlantic makes history by providing local number portability to competitors in New York*, January 19, 1998, and AT&T News Release, *AT&T response to Bell Atlantic local number portability*, January 19, 1998.

the costs with other carriers.[9] In the US, the FCC decided that all carriers should share the common costs of establishing regional databases for number portability. The sharing rule is based on the revenues earned by a carrier. However, each carrier will be responsible for their own direct costs of LNP, such as upgrading their own network (FCC, 1998).[10]

In Australia, the ACCC expressed its view that each carrier should bear the costs incurred in their own network in providing LNP (ACCC, 1999).[11]

Allocating the costs of LNP involves both equity and efficiency considerations. To the extent that the main beneficiaries of LNP are new entrants to local telephony, it might seem unfair to require that the dominant incumbent carrier bear all the cost of upgrading their network to make LNP available. In essence, the incumbent carrier is forced to provide and pay for a service that will increase competition and lower its own profits. At the same time, requiring new carriers to bear a substantial proportion of the costs of LNP may create a significant barrier to entry. This will mute competition and harm consumers.

If the costs of LNP are to be shared, then the cost allocation rule may effect competition. For example, a simple once off or annual payment by a new local telephone company may limit entry. But a charge that is calculated per customer or on the basis of local-call revenue may dampen the competitive fervour of a new entrant.

8 For example, the choice of location of common regional databases under an LRN approach for ported numbers may effect firm costs. See for example the complaint by Cincinnati Bell Telephone at paragraph 19 of FCC (1997).

9 See BT News Release, *BT welcomes MMC report on number portability*, December 14, 1995.

10 In Australia, the Australian Competition and Consumer Commission (ACCC, 1999) has indicated that it will favour each carrier bearing their own LNP costs; including common costs. In the US, the FCC has allowed local telephone companies to recover some of their LNP costs from *all* customers over five years. But the setting of these charges has led to considerable controversy. See FCC, 1999.

11 This included the costs of upgrading their network, any additional call conveyance costs and the costs of customer transfer.

When the new competitor gains a customer they are penalised by a higher payment to the incumbent carrier.

The allocation rules may also send important cost signals to new telecommunications companies and, potentially, to consumers. LNP costs may be divided into two broad categories. First, there are customer-unrelated costs. This includes the once-off cost of upgrading the network to provide LNP. LNP might also impose ongoing network maintenance costs regardless of the number of customers using LNP. Second, there will be customer-related costs. When a customer decides to switch local telephone providers and to port their number, there is a cost of establishing portability for that specific number. This can involve updating the information database analysed by switches in the network. There may also be on going costs associated with porting a number. For example, with a call forwarding solution, ported numbers can increase the likelihood of congestion in the network.

To the extent that these costs of LNP are not passed on to either the new carrier or to customers, then these parties will not have the correct incentives. This is clear for the customer-related costs. If neither the new carrier nor the customer pay any of the cost of LNP then a customer will wish to retain their number when switching carriers no matter how lowly they value porting. Customers who value the service at less than its cost may use LNP.

When combined, the issues of technological choice and cost allocation provide the potential for anticompetitive game-playing by incumbent carriers. For example, suppose the regulator is concerned about the customer specific costs of LNP and decides that these should be passed on to the carrier who gains a customer with a ported number. If this carrier passes these costs onto the customer, this will reduce the possibility of excessive porting of numbers. However, to the degree that the

incumbent carrier can choose different LNP technologies with different customer specific costs, the incumbent carrier will find it profitable to choose a technology with high per customer charges, even if this is not the most efficient choice. If these high charges are borne by new entrants then they will act as a barrier to entry and a disincentive to competition. If the new entrants pass these costs onto the customers who port their number then some customers will be dissuaded from changing carriers even though they would have been willing to pay a lower LNP charge under an efficient technological choice. The inefficient choice of LNP technology will tend to mute competition.

In summary, the regulator faces two key issues with LNP: (1) what is the optimal technological choice over time and (2) who should pay for LNP? The regulator will be constrained in its ability to effectively answer these questions by asymmetric information. First, the incumbent carrier is likely to have significantly better knowledge about the appropriate choice and timing of LNP decisions, but has little incentive to reveal this information. Secondly, the regulator does not know the value of LNP to individual customers. These two information problems will tend to interact. If the regulator tries to expose customers to the costs of their LNP decision then this will give the incumbent carrier an incentive to distort the choice of LNP technology.

3. The Problem of Who Should Pay

By requiring telecommunication companies to bear their own costs of upgrading their networks for LNP, the regulator can effectively solve the problem of inefficient technology choice. In other words, the regulator simply requires that LNP be made available and allows network owners to determine their own choice of

technology and adoption timing, subject to compatibility between owners' choices. In most circumstances, where there is a dominant local telephone provider, this essentially means that this provider determines the LNP technology and pays for its adoption. Given that they are paying all costs, the incumbent carrier will have strong incentives to choose the technology and adoption pattern that minimises cost over time.

The solution, that each carrier bears its own costs of LNP, is the standard approach of principal-agent problems when the agent (in this case the incumbent carrier) is risk neutral (Baron, 1989).[12] The regulator will still be required to establish quality standards for LNP and monitor the implementation to guarantee that the incumbent carrier does not artificially delay LNP, but these are standard issues for local telephone competition.[13]

This solution, however, does not solve the problem of customer choice. To the extent that neither a new carrier nor the relevant customer face the costs that number portability impose on the incumbent carrier, too many consumers will port their number. But, as noted above, if the incumbent carrier is allowed to pass on the customer specific cost of LNP, then it will have an incentive to artificially raise these costs. It may do this by choosing an inefficient LNP technology.

To see the problem, suppose a customer receives a net gain of G if they change local telephone companies and can retain their current number. This gain might represent lower call charges, better quality of service, better billing or more convenient payment procedures. The gain is net of any costs of transferring between local telephone companies except for the costs of number portability. If the customer

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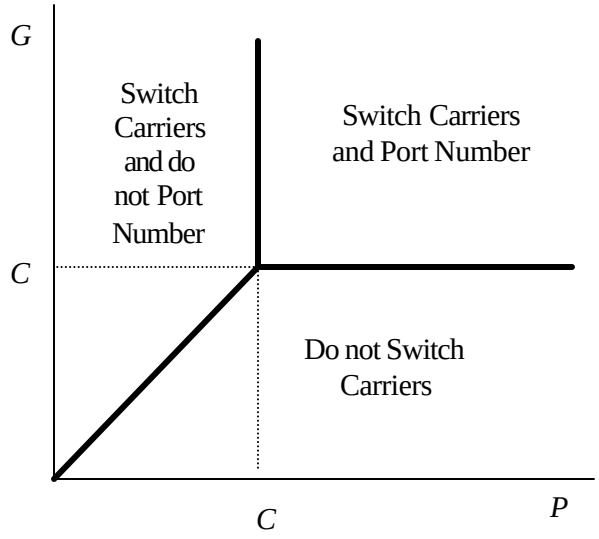
[12] Given that the incumbent carriers are often large publicly listed or government owned companies, the assumption of risk neutrality appears reasonable.

is unable to port their number then these gains are reduced by an amount P. The socially efficient LNP technology choice will depend on the expected number of ported numbers and the extent of local call competition. Given this choice, let C represent the customer specific costs of porting a number. Finally, suppose that the consumer can face a charge of T if they change carriers and choose to retain their own number.

Figure One: Socially Optimal Porting



The desired social outcomes are depicted in Figure One. Notice that it is only socially desirable for a customer to switch carriers if G is relatively high; that is if either $G - P > 0$ or if $G - C > 0$. The left-hand-side of the first inequality is the social gain if the customer changes carriers and does not retain their number. The left-hand-side of the second inequality is the social gain if the customer changes carriers and retains their original number. Socially efficient porting is given by the comparison of these benefits. If $P > C$ and $G - C > 0$ then it is socially desirable for the customer to

[13] For example, the regulator must also monitor quality of interconnection and check that one carrier does not artificially delay interconnection to its own advantage.

change carriers and port their number. If $P < C$ and $G - P > 0$ then to maximise efficiency, the customer should change carriers but not retain their number. If both $G - P$ and $G - C$ are negative, then it is inefficient for the customer to change carriers.

Suppose that the incumbent carrier bears all the costs of number portability so that T is set equal to zero. This leads to two potential sources of inefficiency. First, from the customer's perspective, porting their existing number is free, so the customer will change carriers so long as $G > 0$ (covering all points on Figure One). This means that some consumers will switch carriers even though it is socially undesirable to do so. In other words, consumers who have $G > 0$ but both $G - C < 0$ and $G - P < 0$ may switch local telephone companies even though this is inefficient.[14] From an economic perspective, there will be excessive changing of local telephone companies. Secondly, customers who have $G - P > 0$ but $P < C$ will choose to switch carriers and retain their number. While their choice of changing carriers is efficient, retaining their number is inefficient.

To align the social incentives for efficient choice of carrier and porting with the customer's private incentives, requires that $T = C$. The customer should face the true costs of retaining their number when they change local telephone companies. The consumer will only change carriers in these circumstances if either $G - P > 0$ or $G - T = G - C > 0$. Further, the consumer will only retain their number when changing carriers if $P > T = C$.

However, allowing the incumbent carrier to charge either the customer or the new local carrier a charge of $T = C$ for porting the number means that the incumbent carrier can control the cost of a customer switching to a competing firm. This creates

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[14] In practice, G may also change in these circumstances as the incumbent adjusts its call prices in order to keep customers (Gans and King, 2000).

two regulatory problems. First, the incumbent carrier will have an incentive to choose a LNP technology with a relatively high cost per customer. To the degree that technologies with a high cost per customer have lower fixed costs this reduces the incumbent's costs of LNP. Further, even if the high cost per customer is not offset by lower fixed costs, raising C will tend to make the incumbent's competitors appear less desirable to customers. The incumbent will choose a technology that tends to raise the cost per customer in order to protect its dominant market position. In each case, of course, the incumbent may be choosing an inefficient technology.

Secondly, the regulator may only have limited information about the value of C. When setting the customer charge for LNP, the regulator will have to rely, at least in part, on information provided by the incumbent carrier. To the extent that the incumbent carrier is able to exaggerate the costs of LNP per customer, this leads to a higher value of T and mutes competition. In other words, asymmetric information between the incumbent and the regulator about the value of C can make it difficult for the regulator to avoid setting T above the true value of C.[15]

To the extent that either of the above outcomes results in a value of T that exceeds the socially efficient value of C, inefficiency will occur. There will be too little switching of telecommunications carriers. Some customers, who would gain by switching customers and retaining their telephone numbers, will choose not to do so because of the distorted cost of LNP. In other words, it is socially desirable for a customer with $G - C > 0$, but $G - P < 0$, to change local telephone providers. But if $T > C$, so that $G - T < 0$, then this customer will choose not to switch companies.

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[15] This type of problem of asymmetric information in regulation has been extensively dealt with in economics. See, for example, Baron (1989) and Laffont and Tirole (1993).

Efficient local telephone competition is reduced. Of course, this is the driving incentive behind the incumbent's incentive to raise the reported value of C.

If $T > C$ then there will also be inefficiently low number portability. If a consumer has $G - P > 0$ and $T > P > C$, then the consumer will choose to change local call companies. But they will not to retain their number even though it is efficient for them to do so.

Overall, the regulator is in a bind. To make the incumbent carrier choose the efficient LNP technology, that firm should face the costs of LNP. To make the consumer face the correct incentives both for efficient switching of carriers and efficient porting, the customer needs to face the costs of LNP that are directly associated with them retaining their own number. But these two outcomes appear to be mutually exclusive.

4. Efficient LNP and the 'Ownership' of Phone Numbers

An alternative approach is to use the clear assignment of property rights to encourage agents to achieve efficient results. We demonstrate here that the LNP issue is particularly amenable to a Coasian (1960) solution that effectively resolves the conflict between efficient porting and efficient technology choice.[16] Rather than analysing the charge, T, that an individual customer needs to face to align private and social incentives, suppose the regulator initially vest ownership of the number with one of the parties. In particular, for (fixed line) service provider portability, suppose that the regulator gives ownership of the number to the customer who is the current subscriber on the relevant line. For non-geographic portability, this ownership would

transfer with the ownership of the relevant premises – it would be part of the 'goods and chattels' of the property. With geographic portability, the customer themselves could retain the number even if they move premises.

Ownership would create limited resale rights. The customer, if they choose, can sell the number back to the incumbent telephone company. Ownership of the number would give the customer the limited right to resell the number back to the telephone company that provides the relevant fixed line connection.

To see how ownership with limited sale rights provides the correct incentives for porting, suppose that $T = 0$, and the customer has stated that they will change telecommunications providers. Further, suppose that the customer (or the new carrier) has requested LNP. The property right means that the incumbent carrier must supply LNP to the customer at no cost to the customer. But the carrier may also, if it so chooses, offer to make a payment to the customer if they switch carriers and do not port their number. Put simply, the incumbent supplier can offer to buy the relevant number back from the customer.

If C represents the true customer cost of number portability, then the carrier will be willing to offer up to C to 'buy back' the number and avoid LNP. If $P < C$ then there will be potential gains from trade between the customer and the incumbent carrier. They both will have incentives to reach a mutually agreeable price for the number between P, the value of LNP to the customer, and C, the cost of LNP to the carrier. If negotiations between the customer and the carrier are efficient, then the customer will 'sell' their number back to the incumbent carrier if $P < C$. If it is inefficient to port the number then the customer and carrier will reach an agreement

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[16] Coase noted that changing property rights in bargaining may retain an efficient outcome, although altering the relative gain achieved by the parties.

that avoids LNP. If, however, $P > C$, then the carrier will not be willing to offer a price that convinces the customer not to port their number. And this is the efficient outcome.

Allowing the customer to 'own' their number and to 'sell it back' to the incumbent carrier when switching local phone providers leads to an efficient outcome. The relevant carrier bears all the cost of LNP. This gives them a strong incentive to choose the most efficient LNP technology. Further, the option of 'selling' the number gives the carrier the incentive to correctly reveal the true customer specific costs of LNP and allows the customer to face these costs. This occurs, not because the customer pays the carrier for LNP but rather because the customer forgoes the money they could have received from the incumbent carrier when they insist on LNP. In this way, creating limited property rights over the number and vesting these rights with the current customer avoids the incentive problems created by a regulatory solution to LNP.

5. Qualifications and Complications

The LNP solution presented above is both simple and efficient. In this section, we explore some of the potential complications with this solution in more depth.

Can the customers 'game' ownership of their number?

Customers may be able to use their ownership of a telephone number to gain a once-off payment from the incumbent carrier. Suppose that a customer is not intending to switch carriers, but claims that they will switch carriers in order to be able to sell their number back to the incumbent carrier. Rules for the issuing of new

numbers can guarantee that this only occurs once. These rules are discussed below. However, the customer can play this game once.

To see this, suppose both $G - P < 0$ and $G - C < 0$, making it inefficient for the customer to change carriers. Further, suppose that the benefit to the customer of retaining their own number and not changing carriers, P, is low. In particular, $P < C$. Then the customer could threaten to switch carriers and gain a payment of between P and C from the incumbent carrier. The customer could then simply withdraw their request to switch carriers and request a new number.

An initial response to this problem might be to require that a customer could only receive payment for their number if they actually switch carriers. However, this would be inefficient. To see this, denote the negotiated payment for the number by N. If $G - P < 0$ but $G - P + N > 0$, then it will pay the customer to *inefficiently* switch carriers in order to be allowed to sell their number.

The possibility that a customer may seek to sell their numbers back to the incumbent carrier even though they do not want to switch carriers is simply a result of vesting ownership with the customers. It will create a once-off loss for the incumbent carrier. However, to the degree that this loss is a transfer from the incumbent carrier to customers, it does not represent inefficiency.

Who owns a new number?

To avoid the problem of on-going gaming by consumers, it is important that the relevant carrier own any new number issued to a customer. However, to allow for the potential for efficient switching at a later date, when a number is first issued to a customer, that customer should have the right to buy ownership of the number at a price negotiated between the carrier and the customer. If the customer values highly

the option of being able to retain their number in the future, even if they switch carriers, then they should be able to buy this option, in the form of ownership of the number, from the issuing carrier.

In the absence of any anti-competitive motive by the carrier, the carrier would be willing to sell the number to the customer so long as the price exceeded the expected future cost of porting. This said the relevant carrier might have an anti-competitive incentive to raise the price of the number when it is issued. To the extent that selling the number makes it easier for the customer to change carriers at a future date, the carrier would prefer to raise the current cost of the number to deter some customers from buying their numbers. However, this problem is likely to be small. First, it only applies to newly issued numbers. Second, when choosing both a carrier and a number, there will be competition for the customer. This competition will include the price that the customer has to pay for their number. Customers who value highly the option of retaining their number in the future will seek out a carrier who is willing to provide them with the best package of prices for local service, including number ownership.

Will bargaining over the price of a phone number be efficient?

In general, we would not expect the bargaining over phone numbers to be perfectly efficient. But this holds for almost every market. The incumbent carrier will probably find it too costly to negotiate with each customer who wishes to sell his or her number. Rather, the carrier is likely to simply set a take-it-or-leave-it price, especially for residential customers. This may lead to some inefficiency. But this is still likely to be more efficient than if a regulator has to set a customer charge T for LNP.

Suppose that the regulator and the incumbent carrier both had identical information about customer specific costs of LNP and the distribution of values that a typical customer might place on retaining their number. The carrier will still set a different take-it-or-leave-it price for LNP than would the regulator. This reflects their different objectives. The regulator would (presumably) want to maximise the expected gains from number portability. But the carrier wishes to minimise the expected costs of either buying back the number or allowing LNP. For example, the carrier might 'shade' the take-it-or-leave-it price below the true cost of LNP if they believe that many customers place a low value on LNP. 'Shading' the price might lead to some inefficient porting but would save the carrier by reducing the payment to most consumers.

Unfortunately, the regulator does not have the same information as the incumbent carrier. The incumbent carrier will often have significantly better information about the relevant values of C for different classes of customer. The carrier is in a better position to tailor the offer to each customer. Further, as we noted above, any attempt by the regulator to set a transfer based on the incumbent carrier's costs of LNP will lead to regulatory distortion and inefficient choice of LNP technology. Some inefficiency in bargaining over the value of the price of a number might be a small price to pay to avoid these regulatory problems.

Is the scheme equitable?

As noted above, it might be viewed as unfair or unreasonable to require the incumbent carrier to pay for LNP. While this issue is strictly beyond the bounds of economic analysis, we have some sympathy for this view. The regulator might be able to partially offset this bias by requiring any new entrants to local telephony to pay a

once-off licence fee that would include a transfer for number portability. This transfer should not be based on the reported costs of LNP or on any customer-related variable such as market share or revenue, to avoid manipulation by the incumbent carrier. A fee that shares the cost of LNP can have an economic cost. To the extent that the fee creates a barrier to entry, it can reduce entry and limit competition.

6. Conclusion

In this paper, we have proposed that regulators should view the LNP problem not as a traditional cost allocation/technological choice problem but as a problem in the clear assignment of property rights. By giving consumers ownership of their phone number and a right to LNP, this encourages participants to search for and achieve socially efficient outcomes. Given the various uncertainties associated with the value of LNP and alternative LNP technologies, this solution frees the regulator from making such difficult assessments as they would in a more heavy-handed approach. Finally, by assigning ownership to consumers, the outcome is politically attractive in that consumers are the main beneficiaries of the flow of social rents while incentives for maximal network competition remain.

To be sure, the schemes adopted in many jurisdictions do not rule out a Coasian solution. For example, in Australia, where 'losing' carriers are favoured as bearing all LNP costs but no strict technologies are mandated, there is scope for the incumbent carrier to 'buy back' phone numbers from consumers or, alternatively, side contract with 'winning' carriers to do this on their behalf. But where technologies are already being mandated and LNP costs are shared among carriers (such as in the US), arriving at a Coasian outcome will be more difficult.

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