

Beyond liberalization III

Reforming universal service

Eli M Noam

At present, transfers within a telecommunications monopoly from some users to others support universal service. With the onset of competition in the USA, a complex system of contributory access charges, revenue pools and other devices has been added. Yet these arrangements are not suitable in a competitive environment. This article therefore develops an alternative system for the financing of universal service that is compatible with a multi-provider world. The proposal is for an accounting system that would debit a carrier's added value and credit its transfers to universal service schemes. It creates a fund to support portable vouchers for the benefited users and credits for low-density areas. It operates on the premise of competitive neutrality – equal rights and equal burdens to all carriers, and customer choice.

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This is the third in a series of three articles by the author to appear in *Telecommunications Policy* on the theme 'Beyond liberalization'. The previous two were 'Beyond liberalization: from the network of networks to a system of systems', Vol 18, No 4, May/June 1994, pp 288–294, and 'Beyond liberalization II: the impending doom of common carriage', Vol 18, No 6, August 1994, pp 435–452. An earlier version of this article has been helped by comments by the participants at the Aspen Institute's Telecommunication Policy Seminar, lead-

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This article proposes a new way to fund universal service. The proposal operates on the premise of competitive neutrality – equal rights and equal burdens to all carriers in the network system. Whether the carriers are traditional or new, they would all contribute financially to the level of universal service support decided upon by society through the political and regulatory system, and they would have full freedom to enter, compete and set prices.

The proposed system is not a transfer mechanism *per se* but a general ledger mechanism to assure a fairness of burden. The existing support system need not be scrapped (though it could be). Existing contributions can be taken into account and credited. Level playing field competition becomes possible. Pricing flexibility can be instituted, together with productivity incentives. Customers, including those that are subsidized, would be able to choose among carriers. All carriers compete for access to the subsidy mechanism by contesting all categories of customers. Competition, innovation and universal service could coexist.

The context for this proposal is the greater urgency to reform universal service financing. In the USA Vice President Gore and the National Telecommunication and Information Administration as well as the Federal Communications Commission have identified the issue as one of priority. Both chambers of Congress have held hearings. Private sector organizations (for example, MCI, Teleport, United States Telephone Association) have advanced proposals, or, in the case of MFS, petitioned the FCC to address the subject.¹ Across the Atlantic, the European Commission has addressed the question in a Green Paper,² and in Japan the government is in the process of revising the payment system for local access with a consideration to universal service.³

What is universal service? A universal telecommunication service goal, simply defined, is a public policy to spread telecommunications to most members of society, and to make available, directly or indirectly, the funds necessary. In the past this has usually been accomplished through the establishment of a monopoly system in the provision of telecommunications, with the monopolist's profits used to support some of its end users, especially residential and rural customers. More recently, competitive inroads into segments of telecommunications

(and, in the USA, the AT&T divestiture) have limited the ability to generate the funds for such internal cross-subsidies. Since the demands for funds for maintaining universal service have not declined, the old system has been propped up with great complexity. Governments have tried to conduct social policy with the tools of industrial structure policy, and have been less and less successful in either. Similarly, their plans for upgrading telecommunications infrastructure have been affected by the question whether some segments of society would fall behind. For the longer term, therefore, the question must be faced squarely: if we want to continue to assure the electronic interconnectivity of all members of society, how will we pay for it in a competitive environment? This is the subject of this article: how to raise revenues for universal service under competition. The allocative question – who gets what – is an equally important but quite distinct issue, and is not addressed here.

Of course, the greater efficiency of competition, new technology, and a narrower targeting of benefits may reduce the magnitude of the necessary funds. But they will not do away with a core of politically mandated support to the rural population or to the poor. One can disagree about the magnitude involved but not that it will be non-zero. Therefore the question still remains: how do we pay for the necessary subsidy? This question will not go away by the invocation of competition, but is actually made more urgent by it since monopoly profits would no longer be available for funding. Food production and distribution are highly competitive and efficient, and yet we support the food prices paid by the poor, by schoolchildren, etc. One should not confuse issues of production and resource efficiencies with those of distributional allocation.

We will begin with a theoretical discussion of universal service. This is followed by a section outlining today's system of financing universal service. The reader in a hurry can skip these two sections and proceed directly to the third section, in which a reform proposal is developed.

A theory of universal service⁴

Why universal service policy in telecommunications?

Universal service goals exist in every developed country. This suggests that similar benefits for a widespread interconnectivity are perceived around the world, usually independently of the political party in power.⁵

What is the mechanism leading to such similarity? Perhaps the best way to look at a network is as a *cost-sharing arrangement* among several users. In telecommunications, fixed costs are high, marginal costs low, and a new participant C helps the incumbents A and B to lower their cost.

Subscribers will find it attractive to join a well-sized network, because the high fixed costs of the network can be shared by many, making average costs low. At the same time, the number of subscribers n adds to positive utility, because the more people can be reached, the more useful is the network. This can be seen in Figure 1, where the utility of joining a network rises at first. The horizontal axis shows the number of network subscribers; the vertical axis depicts average cost (ie price) and utility, in dollars. Conversely, where the network is small, average cost is high and externalities small. In that range, below a 'critical mass' point n_1 , a network will not be feasible, unless subsidized by external sources. To reach n_1 requires a subsidy of sorts, either by government or

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ing to an earlier proposal, *Reforming the Financial Support System for Universal Service in Telecommunications*, that is considerably improved and modified here, in particular in the credit mechanism. Further comments were received at the joint conference of the Columbia Institute for Tele-Information and the Benton Foundation. I have benefited from comments by William Adler, Andrew Blau, Russel Blau, Glenn Brown, Richard Calkins, Mark Cooper, Ron Cowles, Ellen Craig, Ron Cross, Bruce Egan, Michael Einhorn, Robert Entman, Charles Firestone, Henry Geller, James Graf, Karen Grossman, Frank Gumper, Dale Hatfield, John Hopley, Gene Kimmelman, Andrew Lipman, Ed Lowry, Sheila Mahoney, Jeff Masoner, Donald McClellan, Scott McClellan, David Moulton, Sharon Nelson, Richard Neustadt, Aine NiShuilleabhain, Joel Lubin, Michael Pelcovits, Robert Pepper, Scott Rafferty, Steve Rifkin, Paul Schauer, Lee Schmidt, Cindy Schonhaut, Gail Garfield Schwartz, Gerald Salemme, Larry Strickling, Dennis Weller, Alex Wolfson and Don Vial.

¹Petition of MFS Communications Company Inc for a Notice of Inquiry and En Banc Hearing in the matter of *Inquiry into Policies and Programs to Assure Universal Telephone Service in a Competitive Market Environment*, filed 1 November 1993

²Communication from the Commission to the Council, *European Parliament and the Economic and Social Committee Developing Universal Service for Telecommunications in a Competitive Environment* COM (93) 543 final, 15 November 1993

³Hayashi, Koichiro *Universal Service* Chuokoron-Sha, Tokyo (1994)

⁴The model is developed in Noam, Eli 'A theory for the instability of public telecommunications systems' in Antonelli, Cristiano (ed) *The Economics of Information Networks* Elsevier (1992) 107–128.

⁵Exceptions were some of the Communist countries of old, which wanted their societies both technologically modern and politically controlled, and failed in both.

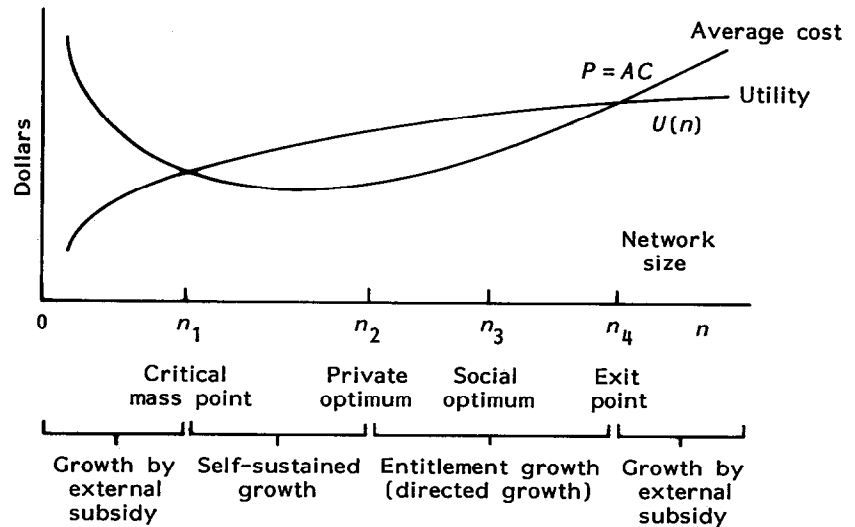


Figure 1. Average cost and utility of a telecommunications network, plotted against increasing numbers of subscribers.

by the network operator’s willingness to accept losses in the early growth phases of operations.⁶

But beyond that point the network will grow on its own. Through this phase of network growth, which can be called the ‘cost-sharing’ phase, the network users can lower their cost by adding members. However, at some point average costs increase, and utility plateaus. The optimum point is n_2 . Left to themselves, the existing subscribers of the network would not accept members beyond that private optimum.

From a societal point of view, however, the optimal network size in an equal-price system may diverge from the private optimum. Social welfare still increases at n_2 , because the positive utility to additional network users is not considered by the existing network participants when they stop expanding at n_2 . The insiders do not take the outsiders into account. If the benefits are added, the social optimum n_3 lies between n_2 and n_4 . n_4 is the point beyond which the net benefits of the network will be negative. Beyond that point the network would again need outside support to exist.

What is the implication? Left to itself and with costs equally shared the network association will cease to grow beyond n_2 . The socially optimal size n_3 will therefore not be reached by itself, but by some external governmental direction through required expansion, and/or by a differentiated pricing scheme, or through some internal politics of expansion.

This analysis serves to clarify the often-asked question, from an economic welfare perspective, for which services should universal service be extended? It is to those services which

- have reached, through self-sustained growth, a private optimum, beyond which further growth is not internally generated because *marginal* average net benefits are zero, but where
- average net benefits are positive (and therefore encourage demand for entry), and
- the number of those excluded is sufficiently large to lead to an opening by political means.

Political price setting, redistribution and expansion

We have so far assumed that universal service is something imposed

⁶The strategic problem is to identify in advance a situation in which such a break-even point n_1 will be reached within the range $n < N$, where N = total population. Possibly, such a point does not exist, and subsidies would have to be permanent in order to keep the network from imploding.

externally by government. But it can be shown that the *internal* dynamics of network members will take the network towards universal service – and also towards its own disintegration.

As discussed, a network will cease to grow on its own after private optimum n_2 . This conclusion was based on a pricing scheme of equal cost shares. Yet there is no reason why such equality of cost shares would persist if prices are allocated through a decision mechanism that permits the majority of network users to impose higher cost shares on the minority. If prices are set in such a fashion, a political majority will lower the prices to itself by raising it for others.

But with internal redistribution, several things happen. First, the minority will seek a way to exit and join in another network, provided only it is large enough to reach economies of scale that leave them better off than in the previous network where they provided the subsidies. Such 'exit' would deprive the network majority of the source of its subsidy, and is therefore undesirable to it. The main way for the majority to prevent this is to try to prevent the establishment of another network.

Second, the network will expand beyond n_2 . For the majority there will normally be additional utility from added network members, especially if most of its cost is borne by the minority. They will therefore seek expansion. As this process of expansion takes place, the minority is growing too. The likelihood rises that its size increases beyond the point of critical mass n_1 . Eventually the benefits of exit become strong enough, the first network 'tips', and an additional network is created.

The process of unravelling of the existing network commences even earlier if a new network has the right to interconnect into the previous one, because in that case it would enjoy the externality benefits of a larger reach of interconnected subscribers, while not being subject to redistributory burden. This is the reason why interconnection has always been the main battleground between new entrants and incumbents.

Social welfare and multiple networks

The traditional fear is that the loss of some cost sharing and externalities brought by a second network would reduce social welfare. This is not necessarily true. First, the cost curves are likely to shift downwards with competition, because of greater stress on efficiency, even if economies of scale exist. More fundamentally, the welfare implications of the formation of collective consumption and production arrangements may be positive. This is something analyzed in so-called club theory.⁷ The analysis, applied to networks, can show that it is generally not 'Pareto-efficient' to attempt income transfer by integrating diverse groups and imposing varying cost shares according to some equity criteria. It is more efficient to allow sub-groups to develop and then redistribute among them by imposing charges on some groups and distribute to others.⁸ User group separation with direct transfer is more efficient than the indirect method of enforced togetherness with different cost shares. In other words, differentiated networks plus taxation (or another system of revenue shifting) will be more efficient than monopoly and internal redistribution.

Conclusion

The analysis of the model shows that a network, left to itself under an

⁷Schelling, Thomas C *Models of Segregation* Rand, Santa Monica, CA (1969); Buchanan, James M 'An economic theory of clubs' *Economics* 1965 32 (125) 1–14; Tullock, Gordon 'Public decisions as public goods' *Journal of Political Economy* 1971 79 (4) 913–918; Rothenberg, Jerome 'Inadvertent distributional impacts in the provision of public services to individuals' in Grieson, Ronald (ed) *Public and Urban Economics* Lexington Books, Lexington, MA (1976); Tiebout, Charles 'A pure theory of local expenditures' *Journal of Political Economy* 1956 64 (5) 414–424; McGuire, Martin 'Private good clubs and public good clubs: economic models of group formation' *Swedish Journal of Economics* 1972 74 (1) 84–99

⁸The set of possible utility distributions among separate groups dominates (weakly) the set of such distributions among integrated groups.

equal-price system, will be smaller than socially optimal, and will require a directed growth to include more participants. On the other hand, under a majority-rule system of price setting, the network would expand beyond the size that would hold under rules of equal treatment of each subscriber. Such an arrangement can be stable only as long as arbitrage is prevented, as long as the minority cannot exercise political power in other ways, and, most importantly, as long as it has no choice but to stay within the restrictive network arrangement. Thus a redistributory universal service policy is connected to a market structure policy, so when the latter changes, the former must adjust too.

Financing the universal service system

The existing system

In the USA the elements of financing universal service include a motley collection of contributory elements.⁹ There are interindustry transfers such as access charges by interexchange and mobile carriers into local exchange networks. There are high-cost funds, toll pools, long-term support agreements, lifeline contributions and universal service funds. Major intercustomer transfer mechanisms also exist, such as 'contributory' charges on business customer services, special rates averaged across customers and geography, etc. And there are some direct governmental credit contributions, primarily by Rural Electrification Administration loan guarantees.¹⁰

These and a myriad of other state and federal pricing and allocation arrangements create a system of such aggregate bewildering complexity that it is intelligible only to specialized accountants – at best. Society at large, including its policy makers, has long lost the ability to see the big picture or to judge the present system by some criteria of fairness or efficiency. As competition increases, this system is coming under major strains. It has to change. But how?

Principles for a reformed universal service

Any new type of revenue-raising measure should meet the following criteria as closely as possible. First, a set of seven 'neutralities':

- 1 *Competitive neutrality.* A new financing system should not skew the relative market strength of any carrier or of consumers' choice.
- 2 *Structural neutrality.*¹¹ It should not favor or disfavor integrated or unbundled provision of a service.
- 3 *Technological neutrality.* It should not favor any type of transmission technology over others.
- 4 *Applications and content neutrality.* It should not favor any particular use of telecommunications or type of message.
- 5 *Geographical neutrality.* It should not burden any parts of the country disproportionately.
- 6 *Transitional neutrality.* There should be no shocks or windfalls to any participants due to transition to a new system.¹²
- 7 *Jurisdictional neutrality.* The new system should be integrable into the federal–state regulatory system.

Other criteria for a successful revenue-raising system are the following five 'friendlinesses'.

- 1 *Political friendliness.* For acceptability, there should be no rate shocks, windfalls or unilateral advantages to some competitors.

⁹It should be noted that no two participants in the communications environment can seem to agree on the nature of the financial flows, including their size, direction or beneficiaries. It is not the purpose of the present article to settle those questions, but rather to reform them out of existence. One quantification is Weinhaus, Carol, Makeeff, Sandra, Copeland, Peter *et al*, *Telecommunications Industries Analysis Project: What is the Price of Universal Service? Impact of Deaveraging Nationwide Urban/Rural Rates* Telecommunications Industries Analysis Project, Cambridge, MA (1993).

¹⁰The Rural Electrification Division of the Department of Agriculture provides three types of loans: (1) standard (3 subscribers or less per sq mile): 5% interest loan; (2) higher interest (greater than 3 subscribers per sq mile): 5% plus premium based on ability to pay. Local service provider must have 1.5 interest coverage ratio or better to qualify; (3) guaranteed loans by Federal Financing Bank: serves remainder of rural LECs. Interest rates vary depending upon financial condition of rural LEC.

¹¹An example of how non-neutrality affects industry structure may be AT&T's attempt to acquire the McCaw Cellular company. Wall Street believes this deal to be significantly affected by AT&T's desire to reduce access charges it is paying to LECs by establishing an alternate access route to users.

¹²This should not suggest a commitment to protect the status quo on prices and revenues. Such changes, eg price rebalancing, are possible, but are a separate matter.

- 2 *Collection friendliness*. There should be stability in generating the targeted revenues.
- 3 *Administrative and user friendliness*. Keeping things simple is a key requirement.
- 4 *Integrability friendliness*. Existing universal service schemes need not be overturned first.
- 5 *Productivity friendliness*. There should be incentives to production efficiencies.

Realistically speaking, one does not begin with a clean slate, but must improve upon an existing institutional system. This suggests that a new system is unlikely to find approval if it entails major disruptions, price changes or shifts of financial burden among companies, customer classes, industry segments and regions of the country. There is no implication that these present burdens and benefits are balanced. But changes in them are a separate matter from a reform of universal service finance.

In the USA any plan also requires acceptability to state and local governments which play a significant role in particular in local communications and in the maintenance of universal service schemes such as lifeline programs. The state public utility commissions would oppose a national uniformity that pre-empted them from a traditional area of involvement. For any new system to be acceptable to the states it must leave them the flexibility to fashion their own variations.

Options for reform

In structuring a system of contributions towards universal service, these are, broadly speaking, the alternatives:

Protect the system of internal cross-subsidization within the major carriers. This is the traditional arrangement under a monopoly system. In a competitive system it is not sustainable since it exposes the subsidizing customers to cream-skimming entry by new entrants.

Expand above-cost charges on access to the public network. This strategy presupposes access to 'the' public network, an increasingly tenuous construct. In a multicarrier local environment there would be uneconomic incentives for carriers to avoid interconnection. The access charge approach violates several neutralities, and does not provide much incentive to cost-cutting.¹³

Increase subscriber line charges. All local lines would be assessed a flat charge. The problem here is that what works in the single-LEC world will not work in a future of mobility, portability, bandwidth-on-demand, private networks and matrix architecture. The concept of a well-defined 'subscriber line' will become quaint and unworkable even if it is extended beyond the LECs, which it inevitably must.

Rate rebalancing. Since a major position of universal service is based on internal distribution within companies, one can target the existing rate structure. 'Rebalancing' means to increase residential rates and to lower business-oriented and long-distance services, given a competitive environment with its prices that are cost based. By itself, rebalancing is not a method of raising revenues for universal service but of shrinking the existing burden. The two are closely related. But whatever universal

¹³It may create, in the words of MCI's Michael Pelcovits, a 'bottomless slush fund'.

service subsidy remains must still be raised in some way. Rebalancing is therefore a starting-point rather than a solution to the question of alternative financing methods. Cutting a budget does not answer the question of how to pay for the remainder.

Public financing: general tax revenue. Funds to support universal service could be raised by the income tax, general sales tax, etc. This system would be the most neutral, and be as equitable as the tax which would be levied (progressive for income tax, regressive for sales tax), but in the present budget environment it is not a realistic proposition.

A telecommunications sales or ad-valorem tax. This would be levied on customers' telephone bills of LECs and of other carriers. This system, too, would suffer from the political difficulty of raising a new tax. It would have to deal with difficult borderline issues of what and who would be included in the definition of telecommunications: Equipment? Computers? Software? Information and entertainment services? It would not be neutral with respect to competition, structure and application. And it would not account for already existing universal service mechanisms. This is discussed later in this article.¹⁴

A tax on telecommunications equipment. Such a tax, too, would raise difficult borderline questions: Would computer and TV equipment be included? Several neutralities would be violated.

Property taxes on carriers. The advantage would be that they tax fixed rather than variable costs, and therefore distort operations the least. However, the practical problems would be serious and there would be a disincentive to investments and quality.¹⁵ This might suggest a Henry George inspired land tax on carrier properties. A land tax excludes improvements on the land, such as structures. But the land tax would have to be fairly high, and it would distort technology choice and intercarrier competition.

A surcharge on long-distance revenues. By targeting one particular service such a tax would be non-neutral.

A comprehensive telecommunications value-added tax. A telecommunications VAT would be levied on all carriers, services (including enhanced services, equipment, etc). It would be the most neutral of all telecommunications-specific levies, but it would raise the political problem of a new tax, plus border drawing questions and enhanced service issues that will be discussed below.

A sectoral telecommunications value-added account system that allocates burdens neutrally on all carriers, integrates existing universal service schemes, and provides credits for universal service performance. I call this a *NetTrans Account System*. It is the recommended system. We will develop its elements below.

The value-added approach

A value-added tax is a form of a general sales tax. In contrast to a sales tax, however, it is neutral with respect to the nature of internal integration. With a sales tax, a company pays taxes on inputs, and these

¹⁴Egan, Bruce and Wildman, Steven *Funding the Public Telecommunications Infrastructure Working Paper 657*, Columbia Institute for Tele-Information (1994); forthcoming in *Telematics and Informatics*. There is, at present, a 3% federal excise tax on telephone bills; the revenue goes into the general budget and is not earmarked for telecommunications.

¹⁵Einhorn, Michael A *Recovering Network Subsidies Without Distortion Working Paper 690*, Columbia Institute for Tele-Information (1994)

inputs in turn may include tax payments on *their* inputs. It is therefore advantageous to integrate as many operations as possible within the same entity. A VAT, in contrast, gives credit for tax payments made earlier in the chain of production and distribution. It is therefore proportional to the 'value added' by each producer of goods and services, with a constant tax rate imposed at each stage on the sales revenues net of purchases.

A VAT can be imposed on either buyers or sellers. There is no economic difference, since the actual burden – the economic incidence – of any type of sales tax is not based on the nominal payer but on the relative demand and supply elasticities of consumers, producers, workers and suppliers of capital.¹⁶

Any VAT is embroiled in at least two major debates. First is the problem of new taxes. Second is the comparison to other forms of general taxes, in particular the income tax or the expenditure tax.¹⁷ Whereas these can be set at progressive marginal rates, permitting a higher proportional taxation of high-income individuals, a VAT is basically proportional to consumption,¹⁸ and since consumption tends to decline as a proportion of income as income rises, a consumption-based tax will tend to be regressive. This has therefore led, in the USA, to a broad opposition against the idea of a value-added tax: the political right does not like taxes, and the left does not like regressivity. Yet it is essential to differentiate.

- Using the value-added tax approach, telecommunications, as proposed in this article, is not an *additional tax*, or suggested new expenditure, but it is an *accounting mechanism* to substitute for the existing internal system of *de facto* taxation of some customers to support other customers, a system that stands in the way of competition and hence of deregulation. It can be calibrated so as not to be higher in the aggregate than the system that would be replaced. Conservatives should appreciate this.
- A value-added funding mechanism on telecommunications is a way to let a system of universal service subsidies survive, if one so decides, even while competition takes place. Raising the funds by way of a general income tax may be more progressive, but it is not a realistic option for most countries' budget and tax situations. Second, the distribution of the revenue would almost certainly be progressive, and hence the net effect of the VAT/universal service should be progressive. Indeed, one study of VAT around the world concludes that electricity and telecommunication services should *not* be exempt from a general VAT, in order to *protect* progressivity.¹⁹ The political left as well as supporters of rural customers should appreciate this.
- By making the subsidy system transparent, in both its taxation and allocation aspects, it would make the system politically more accountable, less subject to manipulation, and more susceptible to a targeting to the highest needs and greatest benefit. And it would distribute burdens equally. Good government advocates should appreciate this.

Given the advantages of the value-added concept in terms of neutrality, one should maintain as much of it as possible within a telecommunications-specific framework, which is the most likely source for the funding of its own redistributory mechanism.²⁰ We will therefore use the value-added concept as a starting point, and fashion a telecommunications-specific application. We will proceed to describe

¹⁶See Christian, Ernest S, Jr 'If, when you say "value-added tax," you mean ...' in Weidenbaum, Murray L, Raboy, David G and Christian, Ernest S (eds) *The Value Added Tax: Orthodoxy and New Thinking* Kluwer Academic Publishers, Cambridge, MA (1989).

¹⁷Not to be confused with a sales tax. An expenditure tax is basically a tax on income minus investments, and can be progressive.

¹⁸Progressivity in the actual incidence of the tax could exist if demand and supply elasticities shift the tax to suppliers of capital and sellers of goods and services, and assuming that those are higher income.

¹⁹Tait, Alan A *Value Added Tax: International Practice and Problems* IMF, Washington, DC (1988)

²⁰A major advantage is that demand for telecommunications is fairly inelastic. In consequence, any charge against it would not distort consumption decisions much. This is a desirable attribute for a tax.

the proposed new system, and call it the *Net Transmission Account System* or *NetTrans Accounts*.

The NetTrans Account System

At their most basic, NetTrans Accounts are not primarily a new form of *transferring* money. They are rather a way of *keeping score* that all carriers pay a proportionately similar share to the maintenance of that type of universal service which the political process has decided upon. Only insofar as some carriers may be contributing less than others would the NetTrans accounting result in transfers to and from the accounts. This system also means, importantly, that one need not (though one could) eliminate or change existing contribution programs. They are simply taken into account and credited in the process.

The system would be initiated with full local competition and complete interconnection and arrangements.²¹ Full pricing flexibility would be instituted for competing services. The system would also be tied to a cost-reduction mechanism of competition so that inefficient carriers could not shift their costs to more efficient ones.

The proposed system can be described in a nutshell:

In an independently administered account system, all carriers are *debited* a flat percentage of their transmission revenues, net of payments to other carriers. They are *credited* for net transfer outlays and for providing service to all users in low-density regions. Benefited customers receive 'virtual vouchers' usable at any carrier as a credit to its account.

The elements of this plan as applied to the US situation are now developed stepwise.²²

'Carriers'

Who and what is included in the system? Entities that provide transmission services to third parties for compensation. Included are all facilities-based two-way transmission carriers with an FCC carrier identification code (CIC) that are subject to the FCC's Title II regulation (or its state equivalents), including local exchange companies, interexchange carriers, international carriers, alternative access providers, providers of private lines to third parties, mobile, satellite and trunkline carriers.

Not included are enhanced service providers (ESPs), information providers (IPs), intraorganizational private networks, equipment manufacturers, and cable and broadcast operators (except for their two-way telecommunications transmission services). This will be explained below.

Telecommunications hardware? To levy a charge on telecommunications equipment would either require continuous line-drawing problems, or it would reach far into the computer and video industries. This would be politically unpalatable, and would go far beyond the goal of reorganizing the existing subsidy system *within* the telecommunication sector.²³

Upper-level, enhanced and information services? To include these types of services would create major problems. It could be considered a levy on information and speech (voice, text, image and video) and as such

²¹Where local competitors are still restricted in some fashion, their revenues and hence their contribution would be small. In that sense the system is self-correcting.

²²It goes without saying that each element could be modified for administrative ease or other reasons.

²³Where 'Part 68' registered equipment is reached, there will be incentives to unbundle such equipment. Eg modems would be sold separately rather than as an integrated part of a computer. Where a company such as AT&T would try to combine equipment and services, it would have to exclude the equipment from NetTrans, with unbundled prices that are available to other customers. This would undermine efforts at gaming the system and shifting revenue to the 'untaxed' equipment. Of course, each approach has its own line-drawing problems.

constitutionally suspect.²⁴ It would vastly increase the number of entities subject to the account system and thus increase its complexity. And it would lead to complicated questions of what is counted as enhanced services revenues. For example, if a travel agency provides an on-line reservation ticket purchasing service, without a charge, ie paid for through the ticketing commission, what is the ESP revenue it would be liable for? Or, how would an AIDS hotline that is funded by a government grant be treated? Should there be exemptions for non-profit and charitable organizations? Would a teenager's computer bulletin board system be subject to periodic filing? These questions can be resolved, but should one bother? One can reach all of these activities much easier indirectly. They all use underlying telecommunications transmission, and thus a charge on such transmission would be passed on to them. This assumes a relative inelasticity of demand for transmission services, which is a reasonable assumption given that the charge would be on all forms of transmission and could thus not be avoided by switching transmission modes. What would be free of the charges would be the ESP's own value added. To omit it creates a bit of a distortion, but it also reduces an opposite distortion to equipment, which can provide some of the functions of ESP services, and which would be exempt, as has been argued above. For these reasons, a blanket tax on all customer telephone bills, including ESP services, would be simple only in theory.

Intra-organizational private networks? Intra-organizational networks are an important part of the telecommunications environment. They come in two basic types: (1) using their own physical transmission facilities, ie privately owned and used transmission facilities, or (2) using the transmission facilities of outside carriers, either (a) dedicated leased lines, or (b) with 'virtual' use of the carriers' network. In each case it would be difficult to impute a revenue measure to the private network, since it serves the firm (and sometimes its suppliers and customers) internally, rather than an explicit market price. Even where such a charge is made for internal accounting purposes, it could be significantly manipulated in order to reduce the NetTrans charge. In addition, there are the same problems that were mentioned for ESPs: large number of entities, administrative problems, definitional problem, and the need for fundamental legislation if system is widened.

In consequence, such private networks might be treated similarly to ESPs, which they frequently resemble. Where they use other carriers' facilities, they would contribute indirectly through the charges levied against the carrier facilities. Their demand elasticity is probably such that they would be subject to the charge's incidence. The main problem is where private networks use their own facilities. Including them is administratively difficult; excluding them creates a distortion in favor of facilities ownership. On the whole it seems simpler to exclude them from the NetTrans account system. This does not mean that one needs to exclude them altogether from other forms of contribution to universal service. For example, today such networks are charged above cost for PBX trunk interconnection to the network. Such mechanisms could be maintained in the future, if desired, as long as they are neutral with respect to carriers.

²⁴Minneapolis Star and Tribune v Minnesota Commissioner of Revenue 460 US575 (1983)

Cable television operators, broadcasters, direct broadcast satellites, wire-

less cable? Traditionally, what can be broadly called the mass media have not been part of the support system for universal service in telephony, except in their capacity as large telephone customers, nor were they supported by telephony. Yet one cannot equitably burden the customers of one type of service without also providing a benefit to some of them, too. Hence the inclusion of cable operators in the system would mean that cable television provision itself would become subject to a universal service subsidy system, too, eg by a policy that all citizens of the population, regardless of location, be accessed by cable at affordable rates, that some cable companies in high-cost areas be subsidized, etc. This would be a policy that goes much further than the present approach. Also, the charge would have to be limited to the transmission function of such media, in order to be symmetric to the exclusion of ESPs and IPs discussed above, and in order to avoid establishing a constitutionally suspect burden on information and speech. But it is difficult to separate or impute transmission revenues in these media. This would argue for an exemption from NetTrans account.

It is a different matter if these media enter telecommunications-like services. Cable operators, for example, are beginning to offer voice, data and mobile services. It would be difficult to explain why such services should not be included. Nor should it be too difficult to measure their revenue, since presumably customers would be charged for these services.²⁵

Also exempt could be start-up carriers or new operations within these categories, below a certain revenue size, partly as a form of 'infant-industry' assistance, and partly to reduce the administrative burden by including only substantial carriers who seem to survive. Such exemption should be clearly limited in duration, for example to three years.

'Transmission revenues'

Once identified, how would these carriers be treated under NetTrans account system? Proportional allocation of the burden of universal service could be accomplished by using various criteria, such as number of access lines, number of customers or message units. On the whole, revenues are a good proxy for economic activity.²⁶ Transmission path revenues of a carrier are total revenues net of enhanced and miscellaneous services. Carriers would have an incentive to establish an accounting system that identifies non-transmission revenues and provides them with the desirable exclusions. Or one could simply charge all carrier revenues, without any exclusion for enhanced services, etc. The result would probably be a self-initiated structural separation of these activities by the carriers into arms-length subsidiaries which would have to be treated in a non-discriminatory fashion by the transmission company. Or one could debit *all* telecommunications revenues of a carrier company.

Total revenues would include payments received by other carriers, such as access charges, and receipts from various redistributive pools and funds. This would be symmetrical to the deductibility of such payments that will be discussed below.

'Net of payments to other carriers'

It is important in the value-added tax concept to give credit for the cost of inputs and outlays. In this case, those are transmission inputs

²⁵The companies would have to segregate the accounting of their telephone operations and run them on an arm's-length basis.

²⁶The revenue numbers are also available for the traditional carriers as a byproduct of the regulatory process. Furthermore, if new carriers were to be stymied in entering the market, their revenues and hence obligations would be small.

purchased by a carrier from other carriers. A long-distance or mobile carrier, for example, reaches its customers, or their called parties, through local exchange companies. It pays for such access through access charges. The carrier's own transmission path value-added revenues are its transmission path revenues minus payments for such services to others carriers. This feature of the plan means that there is no accumulation of tax upon tax, as would be the case with a sales tax imposed at each stage. In consequence there are no advantages to being vertically integrated across multiple stages. By the same logic, payments received by a carrier for transmission services are part of its regular transmission revenues.

The rationale for subtracting input payments is to avoid multiple payments. But if that input is exempt from payment, there is no reason for a subtraction. For example, if the interconnected carrier is a foreign government carrier from which no NetTrans payment may be obtainable, then payments to such a carrier should not be subtractable. Similarly, a carrier's equipment input purchases are not deductible since these firms do not contribute to NetTrans.

'Credited . . . for net transfer outlays'

One major advantage of the NetTrans account system is that it does not force an already existing subsidy mechanism to change. Nor is it dependent on such a change. Instead, one would credit all these programs within a general calculation of share of burden. If contributions to transfer programs such as toll pools, high-cost pools, universal service funds or clearly defined programs such as hearing-impaired relay services have already been made by a carrier, they are credited in the account, to the point that disproportionately high burdens through other contribution programs could lead to a refund. Conversely, revenues already received by a carrier from such transfer programs would be debited. If the present hodge-podge of contribution programs should, by some miracle, be perfectly equitable in its net financial burdens on the various carriers, no additional transfers at all would take place. The magnitude of all these outlays is well defined, since they are paid out explicitly. There is also no need to calculate 'above cost' contributions, because all payments to other carriers or joint pools are credited, as described above.

'Flat percentage'

We can define and estimate a revenue base for the NetTrans mechanism. If we know how much of a universal service contribution we must generate in total, we can calculate a debit percentage, analogous to a tax rate. That percentage rate, applied to any carrier's net transmission path and transfer receipt revenues, would then result in a debit in its NetTrans account.

The question of how much revenue is needed for universal service support is directly connected to the question of LEC efficiency. It would be surprising if after a century of monopoly some high costs would not have accumulated even after various efficiency measures. The reform of universal service finance should accelerate this process, in contrast with the present high-cost pool system. The new system should start with today's actual rather than desirable cost, or else it would bog down from the beginning. By rapidly making competition possible for most types of customers, it will inevitably lead to cost efficiencies. As this process

takes place, and as prices drop, the magnitude of the debit rate is regularly reduced, either by periodic reviews or by an annual productivity-factor mechanism.

'Independently administered'

For the account system to operate equitably and above suspicion, it could not be administered by any particular industry group, or else it may shift its costs to its rivals. The alternatives are:

- *A government agency.* This would probably stretch a regulatory body too thin. It could delegate operations to a private contractor and supervise the system.
- *A private entity* governed by a representative board comprising all carries, users and the public. Such a group could subcontract with other entities such as an accounting firm for the actual operations.

The administering body verifies a carrier's calculation of its account debits and credits. At the end of an accounting period, a true-up takes place. It collects the amount due, or reimburses a carrier which has a net positive balance.

'Customers receive "virtual vouchers", usable at any carrier as a credit to its account'

It is not the task of this article to analyze what types of services might be supported, for how long, what kinds of users might benefit, and whether support ought to be broad-based and expansionary or narrow and means-tested. The NetTrans mechanism could accommodate any benefit structure. For example, it could be used for upgrading of the communications infrastructure, if such is decided upon. Similarly, the linking up of schools, hospitals and libraries could be accelerated by crediting carriers. Or a tier of enhanced universal service could be defined.

Benefits could go to users, and/or to carriers. After defining the benefited users, these users would be provided with 'virtual vouchers'. They would choose carriers freely and shop around to minimize their payments net of the voucher. The chosen carrier would then be credited in its NetTrans account for the value of the voucher. The customers' telephone bill would show the credit. Such a system would be much simpler to administer than millions of actual vouchers that would have to be sent out and collected, and would protect against trading in vouchers.

These customers were previously an uninviting business target for alternative service providers. Their subsidized 'affordable rates' were a golden chain tying them to the established carrier, because the subsidy was not portable.²⁷ With the voucher system, subsidization and provider-neutral choice can be combined. Without a monopolistic hold on these customers, the efficiency of providing service is also likely to improve, leading to a reduction in the gap between cost and price.

'Credited . . . for offering service to all users in low-density regions'

Universal service also has an inescapable geographic dimension. Certain areas of the country are more costly to service due to their low density. Unless one determines that this is not a problem, those carriers providing services in such areas would receive a credit. But this would not be on an exclusive basis. If an alternative carrier wishes to enter

²⁷See also Schwartz, Gail Garfield 'Universal service assurance via equal access to the subsidies' Thinking Points by the Teleport Communications Group (21 September 1993).

such an area and provide service to any and all who want to sign up – no cherry-picking here by targeting low-cost customers in order to receive a subsidy based on average cost – they should not be excluded from a pro-rated credit. The notion of a carrier of last resort should be a floor to assure service by at least one carrier, but it should not set a ceiling of one to prevent entry. The regulatory task is to define ‘low-density service areas’ rather than ‘high-cost carriers’. The incumbent carrier, meanwhile, should not be a captive of its territory, but should be able to exit after selling rights and obligations to another firm, ie by being able to hold a private auction.

It is sometimes proposed to hold periodic public auctions for an exclusive franchise territory and extend the subsidy to the lowest bidder. This idea appears attractive, but it has serious problems because, unlike the auctioning of ‘virgin’ services, in the case of local exchange services a losing incumbent would have to turn over its existing plant, according to some at historic book value, and fire or redeploy its workforce. The uncertainty of future ownership would create disincentives to invest in rural networks and in human skills. This effect would increase the frequency of the auctions. On the other hand, a long term for the monopoly franchise would encourage inefficiency.²⁸ Therefore, if an auction is instituted, it would have to be for the subsidy to serve all customers rather than for the assets to do so. An incumbent who lost the auction could then either sell its assets or continue to offer service without the subsidy, as soon as a replacement ‘public network’ is in place. To discourage unrealistic bids, bidders would have to provide a construction schedule, and if they do not meet it, the incumbent would step in and bill the entrant. Furthermore, the quality and technological definition of the service would have to be clearly defined to avoid corner-cutting.

On the whole, it seems preferable to engage neither in setting up a monopoly nor in expropriation. Therefore a winning bid should not be exclusive. Other carriers could also have access to the support mechanism, though on a reduced basis from the winning bid in order to reward the low bidder. And to be eligible a carrier would have to concretely offer service to all customers in the bidding territory, meet a construction plan and minimum quality standards, and be compensated on an actual per mile or per customer basis. While it is true that a non-exclusive credit to all universal service providers will increase its cost in the short term, it will also lead to efficiencies and cost reductions in the long run. The question is a pragmatic one of empirical economics. In some cases the likelihood of alternative infrastructure entry is small.

One could then combine an auction with subsequent competition by conducting the auction for a subsidy to a *wholesale infrastructure* which would then be available for various retail service providers. These entities, some of which would be systems integrators, would compete with each other for customers. This approach would be preferable to a winner-take-all situation in low-density regions.

One question is how to handle the problem of ‘stranded investment’, ie of LEC investments that may become economically or technically obsolete due to the competitive entity. Here one needs to differentiate between ‘new’ stranded investments and ‘old’ ones. If new investments in a competitive environment become worthless, investors bear the burden, as in any industry. Earlier investments, however, were undertaken within a context of assured but lower returns for a specified period

²⁸ Furthermore, a regulated bidding system is likely to include a variety of political ownership mandates, conditions and preferences whose cost would increase the required subsidy.

in an exclusive franchise, and were approved by regulators. Furthermore, it would be impossible for regulators to require or expect new investments in an economic area unless they can credibly protect a reasonable return on them. Fortunately, the magnitude of 'old investments' shrinks as each passing year leads to further amortization. A remaining balance might have to be recovered by spreading the amortization in some equitable way. LECs then have a choice in dealing with their own part: they can either write down the value of the investment and thereby lower their cost, in which case their competitive position improves, but shareholders bear the loss of investment value, or they can keep cost at the original level but thereby provide an added incentive for competitors to enter.

A sales tax?

Could this system be accomplished similarly through a special sales tax on telecommunications? As has been argued above, the kind of sales tax at each stage of telecommunications would accumulate across carriers, and thus be distortive, without being much simpler. Another alternative would be to institute a single-stage sales tax, collected only at the end-user level. Such an approach²⁹ appears simpler. It is also favored by those who believe that if a tax is levied on customers, (a) there is less of a burden on carriers and more on users, and (b) by making a tax explicit one creates a backlash against redistribution. Both are flawed reasons for a sales tax. It is fundamental that the actual incidence of a tax on a transaction is borne in proportion to supply and demand elasticities, regardless of who pays formally. Second, any desired form of transparency of the tax burden can be given to the customer for any variety of systems, including NetTrans. It is simply a matter of bill design.

The problems with a sales (or ad-valorem) tax are more fundamental:

- Who is an end user? Many entities use telecommunication services as an *input* to more complex services offered to other users further down the line. For example, a bank uses telecommunication services and enhances them to offer an ATM system accessible to its customers, who pay for it indirectly. What is the final and taxable output, and how is it measured? A system of exclusions would have to be devised. Given the large number of user entities, this would be complex.
- What kinds of billings are taxable to the end user? The use of databases? Vidcotex? Hardware rentals? Software downloading? Here, too, a system of exemptions would be likely. Otherwise the same services offered by non-carriers would also have to be reached if neutrality among competitors is to be preserved.
- A sales tax would be a new and additional tax, and would not offer credit for existing contributions to universal service by a carrier and its customers. For example, the customers of long-distance carriers already make a contribution through the access charge and universal service fund mechanism. The sales tax would be a tax upon a tax. If the sales tax mechanism does not give credit for universal service contributions made by some carriers, would these contribution systems have to be first scrapped in 52 jurisdictions?
- As an explicit new tax rather than an intercarrier accounting mechanism, a sales tax may not be politically feasible.

Many of these questions can be resolved by various exemptions and credits. But when they are, the result is not a sales tax, but probably

²⁹Egan and Wildman *op cit* Ref 14. The authors propose a value-added services surcharge, with 'value-added services' defined eclectically as 'all service providers interconnecting with public switched networks, with the exception of local-loop services provided to residents by state-certificated common carriers'. This approach is non-neutral with respect to common users and applications.

something very much like the proposed NetTrans account system, only more complex, less neutral, and without clear underlying principles.

Jurisdictional issues

In the USA one question to consider is the role of the state public utility commissions (PUCs) in this system. At the one extreme, if the system is entirely state-based it would be unworkable because each state would have to calculate its own transmission path revenues and universal service costs. Carriers would shift operations, or at least accounting costs and revenues, according to which state offers a lower rate. The result would be a 'race to the bottom' by states to attract telecommunications carriers, and inefficient operations by carriers chasing the lowest rate. The other extreme, total national uniformity, would abandon a history of federalism and regional diversity. This suggests a mixed system. Federal guidelines would establish a national system. The states, given their considerable expertise in calculating the cost of universal service in their region, would have a role in the implementation, variation and supplementation, especially on the benefits side. Some might wish to offer more generous support mechanisms for rural users; others would want to be more supportive of the cities and the poor.³⁰

An important question is whether the new system would be a tax subject to congressional tax legislation, and whether the subsequent support of universal service would be an appropriation subject to the congressional budget process. The alternative would be for the measures to be part of the regulatory scheme delegated to the FCC or state PUCs. The present system is almost entirely in the regulatory category. The new system, while different, pursues the same policy goals as before, as part of reconciling the introduction of competition with the protection of universal service. Both are in pursuance of express congressional policy and of the 1934 Communications Act.

For the FCC, the measure would be in the nature of integrating its already existing subsidy schemes. Participants would only be those carriers who have applied for an FCC identification number – signifying their being part of a larger network environment. Carriers that would not interconnect into the larger network system would not be included in the financing arrangements.

It therefore seems that the FCC would be within its delegated powers to introduce such a system. However, it would also make sense for the broad outlines of the system to receive express congressional approval. But it would be a mistake to make these in a form that is as detailed as tax legislation, and with special provisions for various favored causes.

Conclusion

Why fix the old system? The answer is that the old system is a patchwork that barely holds together, and that it is a stumbling block to a transition to a truly competitive telecommunications environment. We have neither real competition, since we are reluctant to dismantle the welfare arrangement everybody has grown used to, while at the same time we are undermining the universal service support system by present inaction. It is the worst of both worlds. One can pretend that present policy is not at cross-purposes. And one can pretend that competition and technology will solve all problems, ignoring that the policy question is

³⁰The credit mechanism would have to have state caps so as not to permit any state to be generous at the expense of the other states.

not one of efficiency but one of allocation. But sooner or later we will have to face the problem. The underlying forces will not go away; they bring us many benefits, but they also force us to pursue policy goals such as universal service in new ways.

Appendix

A numerical example for Net-Trans accounts

Let us look at a simple numerical example of NetTrans, using arbitrary numbers (see Table 1). Assume:

- 1 an LEC with two customer services, which cost 30 each to provide, and whose price is regulated at $A = 10$; $B = 40$; cost of providing access to an interconnecting carrier is 5;
- 2 a competitive IXC interconnecting into an LEC, with an operating cost of 5 per customer, a regulated access charge to the LEC of 15;
- 3 a rival local ALT, also with a cost of 30, and a freely set price of 30 for its customer D.³¹

Under the present system

Customer A is being subsidized at a price that is 20 below cost. The revenue comes from two sources: (a) customer B, who pays 10 above cost, and (b) long-distance customer C, whose call generates an access contribution of price minus actual cost of $15 - 5 = 10$. In such a system:

- (a) The ALT will have an over-incentive to serve customer B. It will be prevented from offering that service to B, or else the contribution by B to A would be lost. B thus has no choice among local carriers.

- (b) ALT will try not to serve customer A, who thus has no choice among local carriers.
- (c) IXC has an incentive to link up with ALT rather than LEC. It will be prevented from doing so to maintain the subsidy from C to A. (If it is permitted to bypass LEC, to maintain the subsidy to A, the rates on B would have to be increased from 40 to 50, thereby increasing the pressures on B to try to switch to ALT.)
- (d) Customers C and B call less than otherwise, because their rates are above cost, while customer A calls more than otherwise.
- (e) LEC has no incentive to reduce the cost of operations.

Under NetTrans

Local competition and pricing flexibility are instituted. Assume that the price for subsidized customer A remains at 10.³² Total net transmission revenues are:

IXC:	customer C = 20 - 15	=	5
	(access charge to LEC)		
LEC:	customer A	=	10
	customer B	=	40
	access charge from IXC:	=	15
ALT:	customer D	=	30
	Total net revenues	=	100

To support A's universal service out of the aggregate net revenues of the en-

tire telecommunication system of 100 requires these revenues to be charged at a NetTrans debit rate of about 28.6%. We assume that customer A's rates remain at 10, requiring a subsidy of $30 - 10 = 20$, plus NetTrans on that amount, ie A does not pay the NetTrans debit charge on the subsidized part of the cost. The formula for the debit percentage can be calculated as $\% = (C - P) / (R - P)$, where C is the cost, P is the subsidized price and R is the total of net revenues. In our example $C = 30$, $P = 10$ and $R = 100$, for a debit percentage of about 28.6%.³³

This would mean debits on the various carriers' net revenues of about:

IXC:	$-0.286 \times 5 = -1.4$
LEC:	$-0.286 \times 65 = -18.6$
ALT:	$-0.286 \times 30 = -8.6$

for a total of 28.6, the required subsidy amount (20 + NetTrans on 30) of a voucher.

Scrapping the old system

Let us also assume for the moment that the previous subsidy schedules are abolished, and competition is free. What happens?

- (a) Customer A gets a voucher enabling him to get service at the previous rate.³⁴ However, since he

Table 1. Numerical example of NetTrans.

Carrier	Customer	Current price	Cost	Paid to other carriers	Net revenue	Universal Service* and competitive prices without NetTrans	Carrier's NetTrans debit	Price incl NetTrans and voucher
LEC	A	10	30	0	10	30/10*	8.6	10
	B	40	30	0	40	30	8.6	38.6
	IXC access	15	5	0	15	5	1.4	0
IXC	C	20	20	15	5	5	1.4	12.8
ALT	D	30	30	0	30	30	8.6	38.6
Total		115	115	15	100	100/80	28.6	100

receives a subsidy of 28.6 directly, such as by voucher, he has a choice among carriers.

(b) With the contribution in the access charge to LEC abolished, access charges would be at cost (5), plus NetTrans charge. Also, because of competition in the long-distance market, and since all other IXC's would have the same reduced access charge costs, the IXC cost to serve customer C would drop (to 12.8, comprised of IXC's operating cost of 5, plus its access charge payment, now at a cost-based 5, plus NetTrans on the access of 1.4, instead of the subsidizing of 15, plus the universal service contribution of 1.4 on its net revenue). IXC can use both LEC and ALT for access to customers. It pays either of them only cost-based access charges. IXC customer C contributes to universal service only its pro-rata share, whereas before it paid above average.

(c) LEC lowers its contributory price to customer B, since it now faces competition for that customer from ALT. (The price would drop to 30, plus NetTrans of 8.6, ie to 38.6.)

(d) LEC can charge A the market price, ie 38.6, against which A can use his voucher of 28.6.

(e) ALT can now contest customers A and B. (Its price would be 30 plus NetTrans of 8.6 for 38.6.) If ALT's

cost were 29 instead of LEC's 30, it would gain both customers. ALT and LEC would, in effect, compete for A's subsidy voucher by lowering their price.

(f) LEC customer B contributes to universal service only its pro-rata share, whereas before it paid above average. ALT customer D contributes to universal service its pro-rata share, whereas before it was below average.

(g) LEC would have major incentives to reduce its cost. First, because it could keep the cost savings. Second, because if it does not reduce costs it will lose its customers to ALT. Third, because a built-in productivity improvement factor, the virtual voucher to A, would be lowered for Period 2 as prices drop, and LEC would be credited less for each universal service customer served.

Keeping the old system

It is likely that not all previous contribution elements would be abolished. The NetTrans accounting would accommodate elements of the old system. If access charges, for example, were not reduced, NetTrans could simply account for that. (If IXC would still have to pay LEC an access charge of 15, including a contribution of 10, to a universal service fund that

goes to LEC, the contribution would be credited to IXC's account against its debit of 1.4. IXC would then be owed a net of 11.5. LEC, on the other hand, would have to add 10 to its debit of 18.6, for a total of 28.6.)

³¹We assume in this example, for numerical simplicity, that no ALT access charges exist. There is no problem in dropping that assumption. Similarly, the assumption that cost to serve customers A, B and D is in each case 30 is made for computational simplicity and transparency. There is no problem in assuming that costs are different from each other. Also, the example has no high-cost rural LEC that would receive low-density support.

³²We assume here that the NetTrans assessment on A's payment would not be passed on to A. However, there is no problem in A's absorbing this charge. It would make the calculation simpler, but would mean a net increase in A's actual payment. The 'benefited service' of A would still be subject to a NetTrans debit, but it would not be paid by A, even on the portion he is paying. LEC would both be debited for the NetTrans and credited for it, so it would be a wash. One could therefore leave it out entirely from the NetTrans system. But in so doing, one creates unnecessary accounting and administrative problems, since the LEC (and ALT) would have to segment their revenues between different customer classes.

³³If to A's price at 10 would be added a NetTrans charge, the equation becomes $\% = (C-P)/(R-C+P)$. In this case it would be 25%.

³⁴See previous note.