

PUBLIC POLICY FOR THE

# Private sector

The World Bank Group

January 1997

Note No. 104

## Competition in Network Industries— Where and How to Introduce It

*Michael Klein  
and Philip Gray*

If privatizing network industries is to bring lasting public benefits, governments should also attempt to introduce competition. Otherwise, the regulation required in areas with monopoly segments may become so intrusive that it undermines the reform. The scope for such competition is growing with increasing deregulation and technological innovation. And as technology continues to improve, the use of “smart markets”—computer-assisted auction systems to clear competitive but complex markets—is likely to become feasible for an ever-expanding group of products and countries. This Note outlines the opportunities for introducing network competition—competition for the market, competition over existing networks, and competition among networks. It briefly considers in each case whether regulation will still be necessary and whether it will become easier or more complicated. It looks at how these opportunities could be applied in different networks. And it concludes with some basic guidelines for introducing competition.

### Competition for the market

One way of bringing competitive forces to bear on natural monopoly segments of an industry is to delineate a monopoly franchise and auction it off to the bidder offering the lowest price to consumers.<sup>1</sup> But monopoly franchises, especially long-term ones, still involve regulation—indeed, some commentators argue that this form of competition is simply a way of facilitating regulation. Prices and related terms of the franchise (often known as a concession) have to be adjusted in response to events. These adjustments can be complex, but there are basically two options for making them: rebidding the franchise periodically or using traditional

price regulation. Only rebidding promises an escape from the old-style regulated monopoly. But if there are significant sunk investments involved, assets will need to be transferred at the end of the franchise, leading to complex exercises in asset valuation. Still, by placing time limits on the franchise and requiring some form of competitive rebidding, governments can ensure regular challenges to the incumbent, and the incentive to maintain reputation will reduce the temptation to slacken efforts during the duration of the franchise.

### Competition over existing networks

There are three types of competition over existing networks, described here as open access, pooling, and time-tabling arrangements. Which type is suitable for a particular network industry depends on the technical characteristics of the goods and of the networks over which these goods are provided.

#### Open access

Open access regimes are found in many gas pipeline systems in Europe and the United States. Parts of telecommunications networks are also under open access regimes, including long-distance satellite communications, parts of the major carriers’ long-distance networks, and the local loop in systems where there is competition in long-distance services. In essence, open access occurs when allowing competition in one segment of an industry requires ensuring access to the remaining natural monopoly bottlenecks, provided that there is available capacity. If the owners of a gas pipeline have no interest in supply, for example, it will always pay them to allow access to additional





gas suppliers. When capacity constraints are binding, rationing of access (interconnection) to the bottleneck will be needed. This interconnection can be achieved efficiently without regulation, but the owners of the bottleneck facility may receive monopoly profits. If these profits are politically unacceptable, the access prices charged by the owners of the bottleneck facility and the prices for any other services they provide to final customers of the network industry will need to be regulated.

If the incumbent owns some of the competing supply facilities—for example, power plants, gas fields, or long-distance telephone transmission facilities—it may try to raise prices for network access to preclude competitors in the nonmonopoly segments of the network. To prevent such predatory behavior by owners of monopoly segments, regulators may impose access obligations and matching pricing principles, such as forcing the incumbent to pay a price for transport equal to the price it charges its competitors. If such limits cause the owner of the bottleneck facility to try to exploit market power in the competitive segments, there may be a case for imposing limits on vertical integration and separating ownership from other parts of the system.

### Pooling

The open access approach attempts to allow competition over the network by selling rights to network capacity to competing firms on a nondiscriminatory basis. But it may be difficult to define, adjust, and enforce such rights in a way that allows effective competition. For example, in a power system, the capacity used or unused at any moment in any part of the system is a function of all physical flows throughout the system, not of bargaining or individual transport decisions, so it may not be practical to define capacity or access rights. An alternative is to use a central dispatch system that optimizes system flows, instantaneously matching supply and demand. This ensures open access in the sense that winning bidders will always and by definition be dispatched. Such “smart” pooling systems are be-

ing used in electricity systems throughout the world and in gas systems in the United Kingdom and the United States.

### Time-tabling

In power or natural gas supply systems, the source of the electrons or molecules a customer receives does not matter because the product is sufficiently homogeneous. But for airlines, railways, or telecommunications, where freight, passengers, or callers need to reach a particular customer or point in the network, the requirements for network optimization are more complex than simply that total inflows match total outflows.

If rights to use railway tracks, for example, were defined and allocated to multiple parties, secondary trading should yield the optimal set of paths through the network—the set that maximizes welfare given producers’ and consumers’ valuations of the service. The optimal set of paths forms the optimal delivery schedule or timetable (delivery of person or good  $x$  to point  $y$  at time  $z$ ). The issue is whether an optimal timetable can be generated through decentralized bargaining. Because the value of each right to use a segment of track at a particular time depends on what happens with all adjacent segments (all segments are indirectly adjacent to all others), a single, optimizing smart market may be needed. Sweden and the United Kingdom are investigating whether such smart markets can be established for railways. Another potential application is airport slots. For now, experiments with such smart markets have been limited to computer simulations.

### Competition among networks

The discussion has suggested that the hard core of natural monopoly is the smart market, whether for dispatch or for optimizing time-tabling. But in some cases, competition among multiple networks may be desirable. For long-distance telecommunications networks, petroleum product distribution systems competing with natural gas systems, or railways competing with trucks, for example, the theoretical

---

benefits of complete and integrated scheduling are probably less important than the practical benefits of allowing competition among networks. Competition is most useful where the central planning problem is hardest because of great uncertainty or complexity. There are thus dynamic or informational benefits from incomplete scheduling, which allows competition on the basis of some duplication. This duplication is necessary to try out new things and to check monopolistic behavior. Centralized scheduling is likely to be inevitable only when temporary congestion is very costly—such as systemwide electricity blackouts.

### Industry guidelines

How competition is introduced and how effectively and easily it is implemented will vary from one network industry to another, depending on the physical characteristics. Introducing competition is generally easiest in industry segments where sunk costs are unimportant, such as for many transport vehicles—ships, planes, trucks, and taxis. The policy solution here is free entry without economic regulation. Where economies of scale due to scheduling are important, such as in urban bus transport or solid waste collection services, awarding monopoly franchises competitively may be efficient. As long as sunk costs are not important, repeated franchise bidding can provide a good level of competition without a need for extensive regulation. There has been positive experience with competition in all these transport industry segments.

Where sunk costs are important, introducing competition becomes more complex. For electricity and natural gas systems, which produce and transport fairly homogeneous products, the best solution appears to be smart competitive pools wherever a sufficiently large market can be created to sustain workable competition. This argues, of course, for fostering international trade in energy services wherever possible. Although still at an experimental stage, competitive pools have shown clear promise.

Smart markets have yet to provide practical solutions for introducing competition in networks

where goods and services are not homogeneous and where starting and end points of network flows matter, though possible solutions are being debated in the context of the Swedish and U.K. railway reforms. The currently preferred option for such networks is some form of open access or common carriage system with regulation of interconnection. This approach is particularly appropriate for telecommunications, but it is also used in such networks as railroads, airports, and natural gas pipelines.

One way to introduce unregulated competition is to rely on competition between networks, or intermodal or substitute competition. Railways, for example, often face competition from trucks. And competition from the petroleum products market can discipline pricing behavior in the natural gas market, as in Finland, Germany (for large users), and Hong Kong. An international comparison of regulatory regimes shows that countries are most likely to leave the rail and natural gas sectors unregulated, relying on substitute competition to provide pricing discipline.

In telecommunications, line-based networks are increasingly exposed to competition from wireless services and in many cases even from new line-based networks being established as the cost of such infrastructure falls. Further technical progress may obviate the need for regulation. Countries with limited regulatory capability can already rely on competition from wireless services to provide basic consumer protection.

The toughest regulatory challenges remain in electricity, water, airports, and roads. As previously indicated, in electricity, the solution may lie in competitive power pools. In water, competitive forces may be conceptually similar to power pools, but their effective introduction is a fair way off. In the roads sector, operations may be revolutionized as electronic traffic management in conjunction with congestion pricing may soon become more widespread as a result of tests in such countries as Italy, Norway, Singapore, and the United States. In California, for example, a private toll lane has been financed by charging congestion tolls that are inversely proportional to the traffic on the free



alternative. Auctions of airport landing rights still await the arrival of appropriate smart markets, which would also be instrumental in efficiently managing road networks and decentralizing investment decisions in these networks.

The key to finding new solutions for introducing competition is technical progress. In telecommunications, technical change offers hope for workable competition among networks. In other industries, such as transport and energy, new solutions will depend on advances in telemetry and telecommunications combined with computer-based smart markets.

### Free entry or not?

Policymakers are sometimes reluctant to allow free entry for what sound like good reasons. An unsustainable or suboptimal outcome may result from the competition for a natural monopoly under a policy of free entry. Or regulation may provide incentives for excessive bypass—where vertically integrated incumbents may try charging excessive access or interconnection fees that lead suppliers to bypass the system. Or network externalities may create either excess inertia (too little investment while firms wait for others to invest in expanding the network) or excess momentum (too much investment as firms try to establish an advantage by moving first). These arguments for barriers to free entry in natural monopolies reflect concerns about undersupply or excessive costs of service delivery.

Some arguments for entry barriers have little foundation, however. Some parties will argue that entry barriers are required to maintain subsidies. Certainly, cross-subsidies can be sustained only if competition is somehow limited and cherry picking restricted. But the same subsidy can be provided explicitly, funded from competition-neutral sources. Some say barriers are necessary for financing—hence the call for exclusivity periods, long concession terms, and the like. Investors, investment bankers, and short-term revenue-maximizers in government will naturally all argue for entry barriers to lower the cost of capital when privatizing infrastruc-

ture firms or issuing concessions to build new facilities. Monopoly rights do lower the cost of capital and make financing easier. But they do so by shifting risk to customers, not by reducing overall risk. In the last century, investments not protected by entry barriers were nevertheless funded. And today, new investments in competitive segments of network industries also are being financed, such as power plants in competitive markets in Argentina, Chile, and the United Kingdom.

The technological changes and new thinking discussed in this Note suggest the following guidelines for policymakers introducing competition:

- The more complex the network and the lower the sunk cost, the more value there is likely to be in introducing competition from other networks.
- Where technical change is rapid, defining the bounds of natural monopoly will be more difficult and the dynamic benefits of competition will be large.
- Where government capacity to benevolently and efficiently recognize natural monopoly and establish barriers to entry is weak, entry probably should not be limited by policy.

But because there are so many questions about whether monopoly should ever prevail and whether government is capable of identifying the situations in which it should, there is a need for an underlying policy rule: In case of doubt, do not restrict entry—and if entry barriers are imposed, subject them to an automatic test after a set period and prolong them only if warranted by a cost-benefit review.

This Note is based on a paper by Michael Klein, “Competition in Network Industries” (Policy Research Working Paper 1591, World Bank, Washington, DC, April 1996).

<sup>1</sup> See Antony Dnes, “Franchising and Privatization” (Note 40, March 1995), and Pierre Guislain and Michel Kerf, “Concessions—The Way to Privatize Infrastructure Sector Monopolies” (Note 59, October 1995).

*Michael Klein, Manager (mklein@worldbank.org), and Philip Gray (pgray@worldbank.org), Private Sector Development Department*

The Note series is an open forum intended to encourage dissemination of and debate on ideas, innovations, and best practices for expanding the private sector. The views published are those of the authors and should not be attributed to the World Bank or any of its affiliated organizations. Nor do any of the conclusions represent official policy of the World Bank or of its Executive Directors or the countries they represent.

To order additional copies please call 202-458-1111 or contact Suzanne Smith, editor, Room G8105, The World Bank, 1818 H Street, NW, Washington, D.C. 20433, or Internet address [ssmith7@worldbank.org](mailto:ssmith7@worldbank.org). The series is also available on-line ([www.worldbank.org/html/fpd/notes/notelist.html](http://www.worldbank.org/html/fpd/notes/notelist.html)).

©Printed on recycled paper.