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Towards An Infrastructure Policy Consensus and A National Capital Outlay Budget 2000-2010

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Introduction and abstract

This short discussion paper is part of an effort to spawn discussion concerning infrastructure decisions and decision-making in Israel. It seeks to start a penetrating, across the board examination of needs, means, institutions and management practices in Israel as a basis for forging an agreed upon budgeting procedure and a capital outlay budget for the years 2000-2010.

The following discussion paper addresses partly some of the issues that should be held at a backdrop of a considered infrastructure policy discussion. It provides a review of some recent literature. In particular it addresses the questions:

- What is infrastructure?
- Is it an important element of an economy?
- Does it affect economic development?
- How does it affect well being?
- Is there a better and a worse way to organize infrastructure?

This paper should be coupled with the enclosed policy paper R. Kroll concerning infrastructure investments in Israel.

The fundamental insight that emerges from reading the literature is that the economic importance of infrastructure, in the traditional sense of the term, remains uncertain. Furthermore, proper decision making concerning infrastructure is probably more significant economically than the volume of government infrastructure investment. More important, infrastructure composed of institutions that reduce transaction costs and increase economic interactions become increasingly important as the mobility of factors of production increases.

Some fundamental issues

Physical infrastructure is comprised of roads, ports, railways, electricity grids, water connections, telephones and many other physical facilities. In some countries, infrastructure policies and budgets are concerned also with education, public safety, environmental quality and resource stewardship. Some observers include in the definition of infrastructure a variety of other institutions, both public and private, that make possible transactions and other economic interactions.

Infrastructure is a means to an end. Provided that it is purposefully managed, it should support economic development. In the least, it lowers the costs of producing, consuming and transacting. As such, it contributes to the competitive advantage of places. The availability or absence of the 'appropriate' infrastructure

often influences the decisions of producers and consumers about where to live and work and what to produce. This in turn affects the ability of the economy as a whole to adjust to changes and external shocks. Most infrastructure facilities have a fixed location. To use it producers and consumers must be in the same place as the infrastructure facility. The availability of different types of infrastructure in a particular area often leads to agglomeration of economic activity in regions and cities.

Some infrastructure facilities produce noxious effects. Provided that adequate systems for environmental management are in place, the negative effects of infrastructure on the natural environment are confinable. Moreover, infrastructure projects can be managed so that they contribute to the preservation of natural resources.

Typically, decisions about infrastructure are made in the context of policies concerning growth, job creation, poverty alleviation and quality of life. The key issue is how infrastructure can be made to contribute to other economic policies. What incentives can be created so that institutions are fashioned in a manner that infrastructure-generated services are delivered to consumers in quantities and qualities demanded and at prices that people can afford to pay? Population growth and technology changes are among the key drivers of infrastructure policies and budgeting decisions. Too often such decisions are limited to concerns of benefits and costs of updating facilities.

A number of issues are common to all infrastructure policy-making:

- How, where and when does infrastructure contribute to economic growth and development?

- In this respect, do different parts of the infrastructure behave differently at different times and at different locations?

- What are the best mechanisms to meet the demand of various groups of consumers?

- What are the best means to plan, finance and implement infrastructure programs at the local, regional and national level?

- What mechanisms should be used to prioritise the removal of backlogs and inequities?

- What institutions and instruments need to be fashioned to drive the infrastructure machinery efficiently?

In Israel, in-depth discussions of infrastructure policies are not common. Squeaky-wheel policy making is the norm. Only some parts of the infrastructure, particularly telecommunications and electricity, have been examined in some depth. Other parts have not received even a rudimentary scrutiny. A number of broad issues need to be addressed:

- Is the quantity of infrastructure supplied in Israel adequate? Does it display allocative efficiency?

- Is the quality of infrastructure supplied in Israel adequate?

- Is the supply of infrastructure in Israel technically efficient?

- Are the infrastructure decision-making institutions in Israel suitable to the task?

- What are the infrastructure needs in Israel until the year 2010?

- What budgetary requirements will be generated by infrastructure supply that meets the needs in Israel?

- What financing mechanisms are appropriate in Israel?

What constitutes infrastructure?

Often, the provision of adequate infrastructure is seen as a necessary prerequisite for economic advancement. While economists are generally rather particular in the ways in which specific goods are categorized, the definition of

infrastructure tends to be vague and imprecise (Button [1998]).

The most common issues in infrastructure research are addressed in the context of three categories:

- Public infrastructure: roads, bridges, airports, transit, electricity, water supplies and sewer systems;
- Education and training: from pre-school programs to elementary and post-secondary education and on-the-job training;
- Research and development (R&D) in new science and technology.

Until rather recently, infrastructure was defined narrowly as encompassing those real estate products that increase the efficiency of the use of production factors and meet several other requirements. It is directly productive. It is characterized by stock features, such as capital good. And it has the character of a semi-public goods (Nijkamp and Ubbels [2000]).

Typically, infrastructure policy was considered in the context of endogenous growth theory. Consequently, the range of traditional production factors (such as capital, land, labor) is extended to include contemporaneous "modern" productive factors, such as knowledge, R&D, education, etc. One of the fundamentally important challenges for public policy-making is to address the economy-wide balance between directly productive inputs and social overhead capital. It is hypothesized that unbalanced

economic growth may be the result of a lack of fine-tuning between the two elements.

Upon testing the many essential features of infrastructure, Nijkamp and Ubbels [2000] claim that three categories of infrastructure can be distinguished:

- physical network infrastructure, such as transport infrastructure and public utilities, water management and industrial sites;
- immaterial knowledge infrastructure, such as research at universities, R&D and information communication technology (ICT); and
- nature and environmental infrastructure, which is of increasing importance as a factor in choice of location for businesses and households.

Infrastructure, growth and innovative environment

It seems apparent that existence of appropriate and plentiful infrastructure is a necessary condition for economical development. The possible relationship between infrastructure and development has been studied in depth ever since the 1950s, first at the national level and in recent decades at the regional and local levels. Development theory has emphasized the importance of physical (or material) components of public capital on growth. Often, the focus has been on the removal of bottlenecks in the development of an economy and on

improvements of all types of accessibility. Recently, attention was devoted to the instrumental role of infrastructure in removing structural, interregional inequality conditions. Still more recently, it has been argued that a broad analysis of interregional competitiveness conditions, in particular with a view of the acquisition of foreign direct investments, needs to address issues of infrastructure policy.

Both empirical evidence and contemporary theoretical literature indicate that economic growth tends to be faster in areas that have a relatively large stock of capital, a highly educated population and an economic environment favorable to the accumulation of knowledge (Button [1998]). It is very surprising that the question of the effects of infrastructure investment on growth has not been given an unambiguous verdict in the professional literature.

The first issue that arises in all analyses of the relationship of infrastructure and development is concerned with measurement. Several authors argue that GDP per capita is a proper output indicator, while others (Aschauer [1989] and Munnell [1990]) suggest that productivity growth is a better indicator. The choice of indicator depends partly on the availability of data and on the goal of the policy study concerned (Nijkamp and Ubbles [2000]). The use of the term "infrastructure" is flexible with no agreed on definition. Simple acceptance of official accounting data supplied by governments may disguise important measurement, qualitative and definition differences and problems (Gramlich [1994]).

The time horizon for studying the impacts of infrastructure expenditures is another important source of concern. Surprisingly, most impact studies are static in nature and involve attempts to measure the economic effects of infrastructure improvement during the same period that the investments were made. Obviously such studies can not embrace the time span of real impacts of investments in infrastructure. Such investments have a very long lifetime and the impacts of infrastructure improvements materialize during a rather extended period. It may take a long time before the relevant actors have adjusted to the possibilities and challenges implied by the new infrastructure. It is possible that other processes are being triggered as a result of changes induced by infrastructure improvements, processes accompanied by unexpected and often undesirable side effects. In addition, it is impossible to assess what would have been the nature of development without a particular infrastructure project (Rietveld [1995]).

Relationships between output, productivity and various types of infrastructures have been the focus of much recent research. Yet, the insights gained have been divergent and ambiguous. Thus, economists have utilized production function estimates to test how various types of infrastructure affect, or ameliorate, the productivity of conventional factors such as labor and capital. Such efforts face the difficulty that it is not known to what extent infrastructure is physically embodied in the productivity of specific inputs, or whether its disembodied effects accrue more generally to the overall productivity of firms (Batten [1996]). At a macroeconomic level,

infrastructure and productivity are positively correlated in many western economies (including the United States). However, it remains unclear whether the correlation reflects causation and if so, whether causation runs from infrastructure to productivity, or in the reverse direction (Fernald [1997]).

The provocative empirical study by Aschauer [1989] led to a major reassessment of the inter-relationship between infrastructure investment and economic efficiency. Aschauer estimated an aggregate Cobb-Douglas production function in levels, and found that public capital appears abnormally productive. Holtz-Eakin [1994a and 1994b] pointed out that Aschauer's results are not robust and suggested that, perhaps, they reflected a misspecification of trend. The appearance of a seminar paper by Aschauer linking productivity growth to infrastructure provision provided arguments for rethinking of the role of public policy in stimulating regional development.

Edward Bergman and Daoshan Sun [1996] focused on the problem of infrastructure and manufacturing productivity. They use a Cobb-Douglas function to estimate the contributions of conventional factors (manufacturing capital and labor) and each of thirteen different infrastructure components. The productive effects of each of these components are complex. Their relationships can be competitive, complementary or both. Some of the conclusions reached by the authors serve to emphasize the complexity of the relationships involved. Even with the same type of region, seemingly similar forms of infrastructure can have opposite effects. Not all forms of infrastructure

accomplish the goals or benefits assumed, and some actually detract from their intended objective.

According to Gramlich [1994], economic studies may show positive correlation between economic performance and the state of infrastructure, but the direction of causation is not immediately clear. Wealthier areas may simply have more resources for infrastructure provision. Fernald [1997] argues that the measurement of the "true" productivity growth must be done differently for different periods. Until mid 1970s the productivity growth in the USA was associated with investments in roads. In the last decade or two, computer-driven technological innovations increased and they would reflect the increase in productivity today. History may often display revolutionary influences: road networks, computers, mass production techniques, steam engines - innovations that effect productivity for decades. Under this interpretation, roads may have raised productivity before 1973, just as computers raise "true" (though perhaps unobserved) productivity today. According to this approach the measurement of the "true" effects of investment in infrastructure is further complicated by the fact that different kinds of infrastructure may be causing higher productivity and more intensive growth at different times.

Casual observation suggests that the initial economic conditions of a place are an important determinant of the effects of infrastructure investments. An area with a feeble and backward economic structure will face greater difficulties in reaping the fruits of infrastructure expenditures than an area with an already flourishing

economy. On the other hand, infrastructure is often subject to decreasing returns to scale. When a region is already well provided with infrastructure, adding infrastructure is of little value. For example, highway investment, while making a significant contribution to manufacturing productivity, does not yield large general economic payoffs. Eberts [1997] claims that highway infrastructure accommodates growth more than it stimulates it. The provision of extensive network of highways makes more and more industries footloose. As a result, the importance of road infrastructure as a location factor decreases.

The phenomenon of decreasing marginal returns manifests itself also in cases where bottlenecks are preventing progress. An area with severe structural bottlenecks will find it much easier to accelerate its growth pace after proper investment than an area where the system is functioning well already. By expanding capacity where bottlenecks develop, infrastructure investment reduces impediments to growth. However, building or expanding a certain infrastructure system in a region that does not have other growth factors in place is unlikely to stimulate growth (Eberts [1997]). Improvements in infrastructure are not a sufficient condition for development. Many other intermediary factors play a role (Rietveld [1989]).

In Europe, it is a widely held belief that infrastructure investments have a large impact on employment. The possible reason is that in many cases new infrastructure leads to high growth rates of economic activity in its immediate surroundings. However, closer inspection usually reveals that such growth is mainly a matter of differential growth

within regions. Locations near access points to roads, for example, grow at a higher rate than the regional average whereas locations further away grow at lower rates. It should be noted that the majority of firms that relocate move a very short distance. According to empirical studies, the rapid growth in the number of firms that is sometimes observed at particular places near newly improved highways, is to a considerable extent the consequence of relocation within regions. These relocation processes are quite relevant at a local level, but from a broader regional or national perspective they are less important (Button [1998]).

Potentially, there are two major ways in which infrastructure may affect employment. The first concerns the substitution/complement effects that may occur between production factors due to infrastructure availability (Button [1998]). The second relates to the differential impacts infrastructure investments may have on the competitive position of regions and countries. An improvement in an external input, such as infrastructure, can be seen as a shift in the production function with the effect that less private inputs are needed to produce a given volume of production. This can lead to a decrease in both private capital and employment or to reallocation between the two. In the transport sector there often seems to be a tendency for infrastructure investments to result in more capital intensive methods of production.

Another perspective concerns inter-regional or international competition. Transport infrastructure improvement can lead to decreases in transport costs hence

stimulate inter-regional trade. The intensity of competition increases because sectors in regions, which were formerly sheltered, are now confronted with cheap imports. The result is that while consumers in these regions may be able to buy at lower prices, employment in these sectors in such regions declines. The theory of trade predicts that in each region employment in some sectors will expand while in others it will contract as a result of improved infrastructure. The overall impact on a region will depend on, amongst other things, its sector structure (Button [1998]).

Infrastructure organization

The way in which infrastructure is organized, managed and priced may be as important in determining its effects as the level of infrastructure expenditure per se (Winston [1991]). For historical reasons or as a result of specific local contingencies, infrastructure systems have been totally state-owned in certain countries, entirely privatized in others, and sometimes provided through a mixture of public, private and self-help arrangements.

Many governments are reevaluating the manner in which services have been provided in the past. Governments are searching for ways of increasing the efficiency of service delivery and for sources of non budget financing. A number of issues arise. Does the management of infrastructure systems need to be made by governmental intervention and regulation or are the pricing and allocation (as well as

basic provision) better achieved as a result of the interacting market forces?

At the most basic level there can be two rationalizations for the state's participation in an economy. The first is a social equalizer, redistributing the fruits of a nation's production under the presumption that a particular social need takes precedence over private desires. The second is the assertion that markets fail to produce an efficient outcome. Where equity issues are concerned, the role of the state is unambiguous. The question in regard to infrastructure provision is not whether the investment should be public or private, but rather - who in the governmental hierarchy should be responsible for every specific kind of service.

Clearly, some responsibilities can best be handled at local levels, while others are better handled by the central government. In thinking about how the allocation of responsibility should be made, it is useful to distinguish between infrastructure development and redistribution. Peterson [1996] suggests that it is generally desirable to give the local authorities responsibility for development programs, while reserving to the government responsibility for redistribution.

In most developed countries local authorities are better suited for managing the physical and social infrastructure necessary for the country's economic growth - roads, education, mass transit systems, public parks, police and fire services and sanitation systems. When providing a developmental infrastructure, local governments must be

sensitive to local residents and businesses, as wrong decisions would cause people or businesses to move and the effects of location choices can be quickly felt. For the same reason that local governments are well suited to providing economic development (to attract labor and capital) - they are not very effective at achieving redistribution goals. For example, any locality making a serious attempt to tax high-income groups for programs targeting the poor should expect to attract more poor citizens and drive away the most productive contributors.

The desirable balance between the local and the federal, or national, public investment in infrastructure has become a controversial issue. The economic effects of federal spending are summarized in a document prepared in response to a request from the senate Committee on the Budget in the USA. The document contains a review of the available data on the economic value of federal investment in infrastructure, including education, training and R&D (Alslam et al [1998]). The paper concludes that additional federal investment spending is unlikely to have a perceptible effect on economic growth. The conclusions stem from the following observations:

- Many federal investment projects yield net economic benefits that are small, or even negative. Increases in federal investment spending that are not targeted toward cost-beneficial projects can reduce growth.
- Federal investment spending can displace investments by local governments and the private sector. Federal

spending that displaces other investment is unlikely to have a positive effect on growth.

Many contemporary studies suggest that the state's role as a promoter of economic growth is the issue that raises the most complex questions. Once the state has involved itself in the economy, its influence will have wide-ranging and unanticipated consequences. State institutions that are not bound to obey market forces exert an influence long after their usefulness has passed. Is governmental regulation and investment in infrastructure really productive? Does it promote market efficiency? There are a number of studies that suggest that government intervention in the provision of infrastructure either creates economic failures or worsen imperfections that already exist. If the markets were allowed full play, these imperfections would not be serious.

In general, public policies toward infrastructure changed drastically in recent years. Policies promoting direct control have been largely replaced by indirect control policies. They serve to facilitate the operation of the markets by means of flanking measures or market-based incentives. Decentralization, deregulation and privatization have become trend-setting mechanisms to enhance efficiency in a regional system while leaving the responsibility for regional development as much as possible with the stakeholders involved (Nijkamp and Ubbels [2000]). Europe has witnessed massive privatization efforts of public utilities (such as electricity, water, buses, railways) and of cultural facilities (such as museums). In other cases, such as in the case of new infrastructure,

entirely private finance has been designed and built (for example the Channel Tunnel).

The "public good" nature of infrastructure continues to serve as the main reason for the public sector involvement in directly planning and supplying it. Button [1996] argues that certain types of infrastructure (specifically, transportation) should not be viewed and treated as a public good. Public goods are goods with a particular kind of externality that include non-rivalry and non-excludability. Transport infrastructure, however, is frequently congested and, while, in parts of a network one user's consumption may have a negligible impact on others, this is certainly not universally the case. Even if one cannot accept the intuitive idea that transport and communications infrastructure are much nearer to being private goods rather than public goods, there is little evidence that absence of government involvement leads to adverse effects. And there is empirical evidence to draw upon. In the U.K. and USA, where a large part of the investment in transport has in the past come from private rather than public sources, there appears little empirical evidence of relative under-investment when markets were allowed to operate. The history of the U.K. railways and London's underground system suggests that private investment, based upon commercial criteria, actually provided more capacity than has subsequent public ownership (Button [1996]).

A useful way of separating conventional market failures from government intervention failures is to consider the pricing of roads. In practice, with the exception of toll

roads, road users in Europe are seldom charged directly for their use of infrastructure. In many cases much of the revenue is gathered from fixed charges on vehicles. This leads to transport infrastructure being over used and to congestion. The extent to which road users underpay for the facilities they use can be glimpsed from an examination of the congestion cost associated with road traffic. The arguments for resolving such problems through devices such as road pricing and a shifting of user charges to tolls and away from annual taxation and fuel duties are well documented in the literature (Winston [1991]). Appropriate charges for infrastructure can provide signals as to investment needs and priorities. Second, appropriate prices can generate revenue that provides the basis for the funding of new infrastructure and the maintenance of existing facilities.

It is argued that a more limited role for government in infrastructure provision might reduce some of the problems and lead to a more substantive provision of infrastructure. An interesting question is to what extent the problems of current incorrect pricing of infrastructure might be avoided by privatization.

The electricity industry provides an interesting stage for exploring some fundamental public decision-making processes concerning the industrial organization of modern economies. The constellation of extant technologies, historical decisions and embedded economic as well as political interests make for a variety of mosaics on which to explore the common and the unique.

In electric systems dominated by public sector ownership, privatization is deemed as a worthy means to improve efficiency. Regulation alone has been judged incapable of improving the extant conditions (Czamanski [1999]). While research findings, such as Pollitt [1996], support the claim that privately owned utilities exhibit higher productive efficiency than state-owned enterprises (SOEs), public debate is clouded by uncertainty concerning the resulting overall economic efficiency, as well as the extent to which other policy objectives are served well by privatization.

In many countries, the introduction of private capital and control, even in the case of minority stock ownership, was viewed with apprehension. In many ways the regulation of a privately controlled monopoly was deemed easier than of a SOEs. State owned utilities are governed by politically appointed boards of directors, subject to ruling party interests and often to strong labor union influences. In countries governed by left-of-center governments, labor unions are often the holders of the managerial decision-making powers, and boards of directors are relegated to a role of committees characterized by rubber-stamp, decision-making powers, in light of decisions made in labor union committee meetings.

Typically, privatization of utilities, and of electric utilities in particular, is accompanied by restructuring and changes in the regulatory regime. The absence of privatization does not always involve stringent regulatory activities by the governments. Extensive privatization does not eliminate regulation. Recent privatization and

restructuring activities created a variety of mixed models for the interaction of private interests, competition and regulation.

An alternative option is introduction of multiplicity of rival actors in the production of the infrastructure services and thus the introduction of competition. The number of actors interacting in service provision affects the nature and integrity of information and decision flows. Multiplicity of producers leads to contests on improving the efficiency of services. The multiplicity of interactions resulting from administrative processes governing relationships between the different actors (user, producers and regulators) affects efficiency (Humplick, [1996]).

Empirical investigations suggest that (Humplick [1996]):

- Decreasing the role of the public sector in service provision generally results in improvements in performance.
- The magnitude of the number of independent actors, all other things equal, improves performance. Vertical integration tends to deteriorate performance.
- The character of decision-making environment plays a definite role in qualifying the performance outcomes seen in a given setting. Democratic and freer countries - which are expected to have more transparent decision-making processes and higher accountability of public decision-makers - exhibit higher performance than others do.

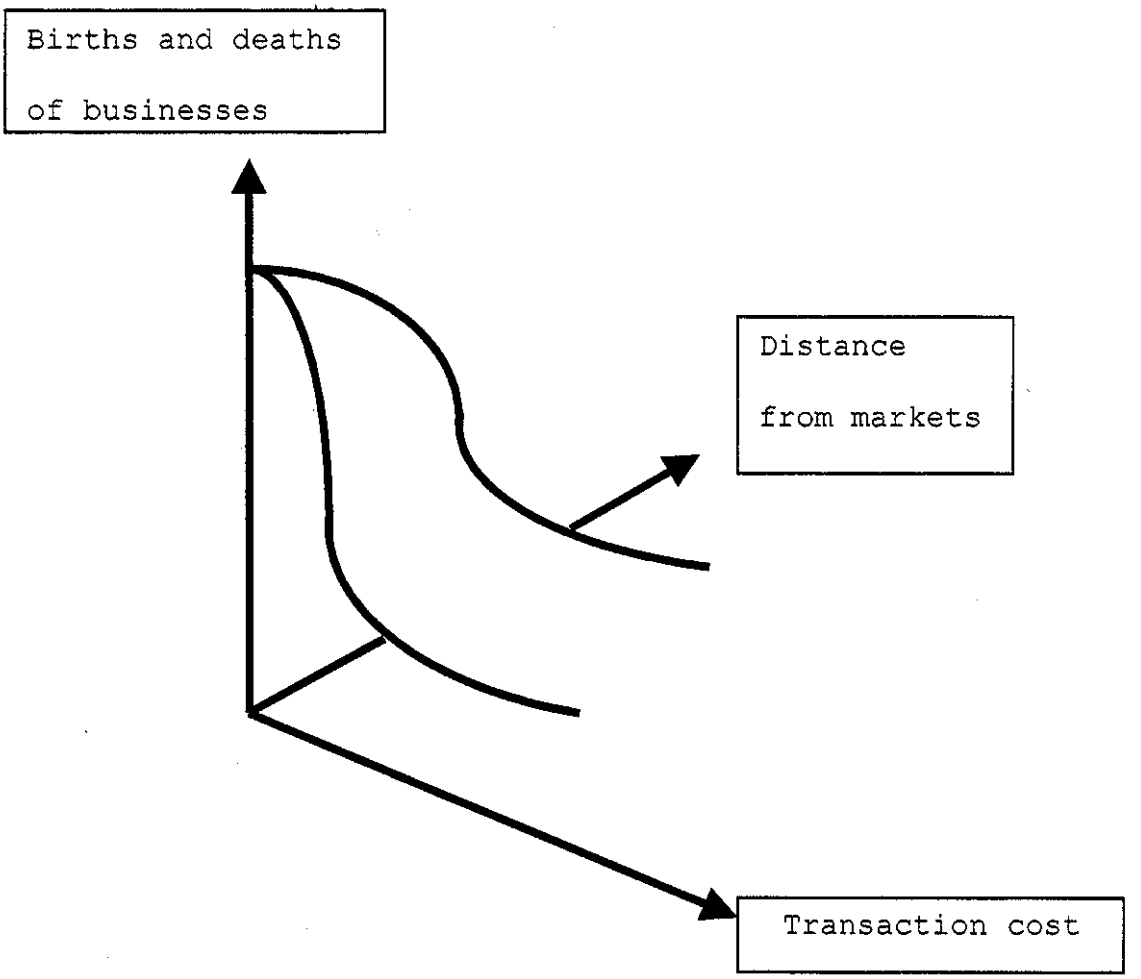
- The level of development in a country is correlated to the performance of the service delivery enterprises.

Multiplicity of actors is important, and perhaps more important, than private ownership in increasing efficiency. Reducing the degree of vertical integration is likely to improve performance as much as transfers of ownership are. Also important is the nature of endogenous institutions that determine the structure of decision-making environments in a country. Public ownership in a highly developed, democratic and free country may be more efficient than in an underdeveloped, non-democratic and interventionist country. For the latter type of countries, privatization may be the best mechanism for achieving long-term efficiency gains.

Modern infrastructure and transaction costs

From the perspective of economic development the most crucial aspect of infrastructure and the least well examined, is concerned with its effects on the cost of conducting personal and business interactions. This cost is termed transaction cost. It has a negative effect on the number of interactions that people engage in. The lower the cost, the greater is the rate at which businesses are formed and disbanded. A similar effect is exercised by the physical, and more importantly, social distance from input and output markets (see figure below).

The volume of interactions is an indicator of the ease or difficulty of doing business. It is a telling sign of the mobility of people, institutions and of ideas. The higher birth and death rates of businesses are an indicator of mobility. Economies blessed by high rates of mobility are innovative. They are successful in creating an environment in which people wish to live and work. The high per capita GNP and income that is experienced in such economies is just a byproduct of the interactions-conducive environment.



Thus, infrastructure that contributes to the reduction in the cost of transacting is of utmost importance to economic growth. It very well may be that this type of infrastructure is of greater importance than high quality of the physical environment made possible by traditional infrastructure. Certainly, modern infrastructure policy should address both types of infrastructure.

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