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Smart infrastructure decisions crucial to economic development, says C.D. Howe Institute study

Toronto, May 31, 2001 — Appropriate investment in general-purpose infrastructure assets is crucial to sustained economic development — a lesson graphically illustrated by the damage the 1998 ice storm caused to eastern Canada's electrical grid, says a study released today by the C.D. Howe Institute.

The study, *Building the Future: Issues in Public Infrastructure in Canada*, was edited by Simon Fraser University economists Aidan Vining and John Richards, who argue that decisionmakers need to take an interest in infrastructure policy even in the absence of an immediate crisis. But infrastructure is an unfortunately complex topic, say Vining and Richards, with different sectors requiring different things from government: some need public money, some need effective public management, and still others need less public management and more accommodation of cost-minimizing and profit-maximizing market behavior.

Vining and Richards argue that, just as it has become normal for politicians, journalists, and the general public to pose questions about a topic as arcane as appropriate noninflationary monetary policy, so a similar maturation of debate should take place on infrastructure policy. The public should expect governments to report results of evaluation studies prior to launching major projects. And these evaluations should explain clearly the techniques, assumptions, and variables that underlie them, so journalists, politicians, and the public can pose important questions about the results.

In his essay, Industry Canada economist David Swimmer assesses the adequacy of contemporary Canadian infrastructure. The nature of infrastructure has changed since the 1960s, he says. Four decades ago, the construction component (for example, railbeds and highways) dominated; now, machinery and equipment does. Swimmer suggests this change came about because of the digital revolution and because the energy price shocks of the 1970s provided an incentive for firms to invest in new energy-saving equipment.

Wilfrid Laurier University economist David Gillen conducts a rigorous survey of evidence on the links between public infrastructure investment and economic growth. He is cautious about any moves to increase aggregate public infrastructure investment, and wants decisionmakers to pay more attention to pricing as a mechanism to reveal the

demand for, and the appropriate supply of, public infrastructure. More infrastructure is not necessarily better.

Choosing among infrastructure proposals means comparing costs and benefits that arrive at different times, and that requires choosing an appropriate ‘discount rate.’ Economists Mark Moore, Anthony Boardman, and David Greenberg consider the range of options for discount rates for evaluating different infrastructure projects, and offer a way for policymakers to choose the best option. Getting it right is important, because an inappropriate discount rate will cause good projects to be rejected and bad projects to be pursued.

Aidan Vining and David Weimer, a professor at the University of Wisconsin-Madison, ask how government should decide whether any particular infrastructure project is socially desirable. Cost-benefit analysis is the route to economic efficiency, but political realities forces attention to distributional impacts. Inevitably, Vining and Weimer say, public officials face political incentives that conflict with efficiency and equity. They propose a “prudential approach” — already taken by the US federal government and some states — that would require Canadian federal government departments, provinces, and local governments to conduct and make public, on the Internet and elsewhere, full and comprehensible evaluations of proposed infrastructure projects.

Steven Globerman, professor of Canadian-US business and economic relations at Western Washington University, assesses government’s role in the digital revolution. He says the most important reason for government intervention in this area is probably network externalities: the idea that social returns from expanding access to the Internet exceed private returns to firms and individuals considering such investments. In principle, the level of private investment in Internet infrastructure may be too low, but Globerman is wary. He is concerned that enthusiasm for the Internet is leading to inefficiently large direct and indirect public sector investments.

An example of cost-benefit analysis at work is the focus of the book’s final essay, by Fernand Martin, an economist at the Université de Montréal, who summarizes a joint Quebec-Ontario-federal government evaluation of a high-speed rail connection along the Quebec City to Windsor corridor. The 1995 study rigorously analyzed six variants, differentiated by choice of technology and route length. Most variants offered net benefits, with the highest using French high-speed train technology and a route that connected Montreal and Toronto via Dorval airport, Ottawa-Hull, and Kingston.

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The C.D. Howe Institute is Canada’s leading independent, nonpartisan, nonprofit economic policy research institution. Its individual and corporate members are drawn from business, labor, agriculture, universities, and the professions.

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COMMUNIQUÉ

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Selon une étude de l'Institut C.D. Howe, des décisions judicieuses en matière d'infrastructure sont essentielles au développement économique

Toronto, le 31 mai 2001 — Des investissements pertinents dans l'infrastructure générale sont essentiels à un développement économique durable; ce fait est prouvé par les dommages qu'a causés la tempête de verglas de 1998 au réseau électrique de l'Est canadien. C'est du moins ce qu'affirme une étude de l'Institut C.D. Howe publiée aujourd'hui.

Intitulée *Building the Future: Issues in Public Infrastructure in Canada (Bâtir l'avenir : enjeux de l'infrastructure publique au Canada)*, l'étude est dirigée par deux économistes de l'Université Simon Fraser, Aidan Vining et John Richards, qui soutiennent que les décisionnaires doivent s'intéresser aux politiques en matière d'infrastructure, même s'il n'y a pas de crise dans l'immédiat. Les auteurs expliquent que l'infrastructure est un sujet malheureusement complexe et que différents secteurs exigent différentes choses du gouvernement : certains secteurs ont besoin de financement public, d'autres, d'une gestion publique efficace, et d'autres encore, d'une gestion publique moindre, mais de davantage de souplesse face au comportement du marché en matière de réduction des coûts et de maximisation des profits.

MM. Vining et Richards soutiennent que, de même qu'il est devenu normal pour les politiciens, les journalistes et le grand public de poser des questions sur un sujet aussi obscur que le choix d'une politique monétaire non inflationniste, il convient de favoriser une certaine évolution des débats sur les politiques en matière d'infrastructure. Le public devrait s'attendre à ce que les gouvernements fassent part des résultats des études d'évaluation avant d'entreprendre de grands projets. De plus, ces évaluations devraient décrire clairement les techniques, hypothèses et variables utilisés, pour que les journalistes, les politiciens et le public soient en mesure de poser des questions importantes sur les résultats.

Dans son exposé, David Swimmer, économiste auprès d'Industrie Canada, passe en revue le caractère adéquat de l'infrastructure canadienne contemporaine. Il souligne que la

nature de l'infrastructure a beaucoup changé depuis les années 60. Il y a 40 ans, les éléments de construction (comme les voies ferrées et les autoroutes) étaient dominants; maintenant, c'est le tour du matériel et de l'outillage. M. Swimmer suggère que ce changement est le produit de la révolution numérique et du choc pétrolier des années 70, qui a incité les entreprises à investir dans du matériel économe en énergie.

David Gillen, qui est économiste à l'Université Wilfrid Laurier, mène un examen rigoureux du rapport entre l'investissement dans l'infrastructure publique et la croissance économique. Il met en garde contre toute mesure visant à accroître l'investissement global dans l'infrastructure publique et il souhaite que les décideurs s'arrêtent davantage aux prix pour établir la demande et l'offre appropriées en matière d'infrastructure publique. Il souligne qu'il n'est pas forcément mieux d'avoir plus d'infrastructure.

Faire un choix entre plusieurs projets d'infrastructure signifie qu'il faut comparer des coûts et des avantages qui surviennent à différents moments; pour y parvenir, il faut donc choisir un « taux d'escompte » pertinent. Les économistes Mark Moore, Anthony Boardman et David Greenberg passent en revue la gamme de choix de taux d'escompte pour divers projets d'infrastructure, et offrent aux décideurs un moyen de faire le meilleur choix. Il est important de ne pas commettre d'erreur, car un taux d'escompte inapproprié entraînera le rejet de projets valables et l'adoption de projets non valables.

Aidan Vining, ainsi que David Weimer, un professeur à l'Université du Wisconsin-Madison, se demandent comment un gouvernement devrait décider si un projet d'infrastructure particulier est socialement souhaitable. Une analyse coûts-avantages est la meilleure façon d'obtenir une efficacité économique, mais les réalités politiques sont telles qu'elles forcent à prêter attention à l'impact de la répartition. Selon MM. Vining et Weimer, il se produit inévitablement une situation où les fonctionnaires font face à des incitatifs politiques qui sont en conflit avec l'efficacité et l'équité. Ils proposent une « approche prudente » — laquelle a déjà été adoptée par le gouvernement fédéral et plusieurs États américains — qui exigerait des ministères du gouvernement fédéral canadien, des provinces et des administrations locales, qu'ils mènent des évaluations globales et approfondies des projets d'infrastructure et qu'ils rendent ces évaluations publiques, par le biais d'Internet et d'autres moyens.

Steven Globerman, professeur de relations commerciales et économiques entre le Canada et les États-Unis à l'Université Western de Washington, se penche sur le rôle du gouvernement dans le cadre de la révolution numérique. Il indique que la raison la plus importante pour l'intervention gouvernementale dans ce domaine repose probablement sur les externalités du réseau, soit l'idée que le rendement obtenu de l'élargissement de l'accès à Internet dépasse le rendement qu'en tirent les entreprises et les particuliers qui envisagent des tels investissements. En principe, le degré d'investissement privé dans l'infrastructure d'Internet est peut-être trop faible, mais M. Globerman se méfie de tels investissements. Il s'inquiète de ce que l'enthousiasme pour Internet amène le secteur public à faire des investissements directs et indirects de trop grande envergure et non efficaces.

Un exemple d'une analyse coûts-avantages à l'œuvre est le sujet du dernier exposé du recueil et est rédigé par Fernand Martin, économiste à l'Université de Montréal. Il y présente un sommaire d'une évaluation conjointe menée par le Québec, l'Ontario et le gouvernement fédéral, et qui porte sur une connexion ferroviaire à grande vitesse reliant la ville de Québec au corridor de Windsor. Menée en 1995, l'étude analysait avec grande rigueur six variantes, qui se différençaient en fonction de la technologie et de la longueur de l'itinéraire. La plupart des variantes offraient des avantages nets et la meilleure employait la technologie française du TGV, et un itinéraire qui liait Montréal à Toronto, en passant par l'aéroport de Dorval, la région d'Ottawa-Hull et Kingston.

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Building the Future

*Issues in Public
Infrastructure in Canada*

*Aidan R. Vining
and
John Richards,
editors*

Policy Study 34

C.D. Howe Institute

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The Study in Brief

Assessing the adequacy of infrastructure available to an economy is like assessing one's personal health: it becomes a subject of concern only when something goes wrong. The rest of the time, the temptation is strong to ignore the issue. Most Californians, for example, were oblivious to the impact of regulation and regulatory change on the availability and price of electrical power until a combination of political, market, and environmental events culminated in rotating blackouts, events usually associated with Third World countries. Similarly, residents of central Canada did not much concern themselves with the reliability of the power grid until the 1998 ice storm.

This collection of essays attempts the almost impossible: to interest policymakers in infrastructure policy, writ large, without the spur of an immediate crisis. The rationale is the belief that investments in certain *general purpose* assets are a necessary — if far from sufficient — condition for sustained economic development.

That said, we must acknowledge that there is no accepted definition of what comprises infrastructure. Few will dispute that it includes physical facilities such as roads, railroads, seaports, and airports. Most would extend the set to include basic utilities (electricity distribution and urban water systems) and the transmission facilities for electronic digitized communication (information technology hardware).

But we would argue that the list should be extended beyond physical investments to include intangible human capital. Emerging evidence suggests that investments in, for example, general purpose education and training are as important as investments in airports and highways. Indeed, the quality of a country's aggregate human capital, rather than its physical facilities and machinery, is probably the primary determinant of economic growth.

In the first essay in this volume, we provide a simple framework for thinking about government's role as either a provider or facilitator of infrastructure, differentiating among types of infra-

structure and the severity of market failures arising for each type. (Private markets in a sector are said to fail when key characteristics of the sector prevent approximately rational individual agents from generating an efficient outcome.) The more serious the market failures, the more extensive should be government intervention. To quote from our concluding paragraph:

The main message is that infrastructure policy is important, but, unfortunately, it is complex and hard to get right. Different infrastructure investments in different sectors of the economy require different things from government. Some need public money, some need effective public management, and others need less public management and more accommodation of cost-minimizing and profit-maximizing market behavior.

In other words, the devil's in the detail. We take from David Gillen's essay the negative, but nonetheless important, policy conclusion that the supply in particular sectors may well be below or above optimum but the *aggregate* supply of Canadian infrastructure is probably adequate. Another of Gillen's conclusions is the importance of pricing, where feasible, as a means to reveal demand for infrastructure. Finally, in deciding whether to undertake particular public infrastructure projects, what should matter to decisionmakers are the results of evaluative techniques such as cost-benefit analysis.

Over the past generation, it has become normal for politicians, journalists, and the general public to pose questions about appropriate noninflationary monetary policy. We hope an analogous maturation takes place with respect to discussion of infrastructure policy. The general public should expect governments to report cost-benefit analysis results prior to launching major projects. Journalists and politicians should understand the logic of these techniques sufficiently to pose meaningful questions about net present values, discount rates and other such concepts.

The Current State of Canadian Infrastructure

David Swimmer undertakes a heroic exercise to compare the adequacy of contemporary Canadian infrastructure, relative to that of

other industrial countries and relative to Canada's infrastructure in previous decades.

He reviews the findings of a Swiss group, IMD, which concludes that, as of 1999, Canada failed to make the top ten ranked countries in seven of twelve measure of *basic infrastructure* and two of ten measures of *technological infrastructure*. Overall, IMD concludes, Canada's ranking slipped in the 1990s. World Economic Forum, another organization comparing infrastructure, is more optimistic, ranking Canada second in overall infrastructure in 1999. Such rankings are fraught with uncertainty, however, and Swimmer considers in some detail the stocks, and additions to stocks (that is, investment), in major infrastructure sectors. Gillen's cautions should be next in mind when evaluating the value of such league tables.

The nature of aggregate private and public infrastructure has changed since the 1960s. Four decades ago, the construction component (railbeds, highways, and so on) dominated; now, machinery and equipment does. Swimmer identifies two broad explanations for this change. One is the energy price shock post-1973, which provided an incentive for firms to invest in new energy-saving equipment. The second is the digital revolution.

Assessing the Evidence

David Gillen conducts a broad and rigorous survey of evidence on the links between public infrastructure investment and economic growth. He takes the reader through the range of theoretical approaches:

- *Aggregate production function studies*: Researchers using this approach posit an aggregate production function in which public infrastructure is one among several inputs required to generate an economy's output.
 - *Cost function studies*: Here, researchers attempt to capture more about firms' optimizing strategies than is feasible via the production function approach. Cost function studies examine the extent to which public infrastructure (highways, for example) affect production costs and firms' input choices.
-

- *Endogenous growth theory*: Over the past two decades, researchers have measured the effects of particular variables as determinants of productivity growth. Some of these studies entail variation in infrastructure levels (such as the level of research and development).
- *General equilibrium models*: The most ambitious theoretical approach fits infrastructure into multi-equation models of a national or regional economy. This allows estimation, for example, of the opportunity costs elsewhere in an economy when revenues from taxes are diverted to public infrastructure investment.

The empirical results of these various approaches are far from consistent. After a thorough assessment of the evidence, Gillen is cautious about any moves to increase aggregate public infrastructure investment:

[S]hould government change its policy to undertake once again more public capital investment in infrastructure? I say no. The most compelling argument is that such investment redistributes costs and benefits, rather than augments overall economic productivity.

Rather than concern themselves with aggregate infrastructure investment, decisionmakers should pay more attention to the amount and quality of infrastructure in particular sectors. They should also accord an increased role to pricing as a mechanism to reveal the demand for — and indicate the appropriate supply of — public infrastructure:

[W]hat is required is an institutional change in the way public capital is funded and managed. The disconnect between user payments and investment has led to too much public capital in most cases and not enough in others.

The Social Discount Rate in Canada

Typically, infrastructure investments last a long time. They entail present costs and the prospect of future benefits. That benefits and

costs of infrastructure projects may accrue far in the future requires decisionmakers to think carefully about the problem of discounting the future in order to arrive at an equivalent to current costs and benefits. The social discount rate (SDR), an analogue to market interest rates, is the parameter defining the varying weights to place on project benefits and costs accruing in different time periods in order to arrive at present values. For a typical infrastructure project, in which costs precede benefits, an increase in the SDR will lower the present value of benefits more than the present value of costs. *Mutatis mutandis*, a decrease in the SDR will raise a project's net present value. Small changes in the SDR frequently change the sign of a project's net present value. Hence, the choice of the level of the SDR is a crucial parameter in the conduct of cost-benefit analysis.

Mark Moore, Anthony Boardman, and David Greenberg analyze the appropriate SDR for evaluating infrastructure projects in Canada. They focus on what they see as the three crucial issues: whether or not to use a market interest rate as a measure of the SDR; whether and how to account for a project's effects on future generations; and how to account for the impact on investment versus consumption.

The authors disagree with the Treasury Board's recommendation of a 10 percent real SDR, viewing it as too high. Next, they outline the hypothetical situation under which the choice of an SDR would be obvious, and show why, alas, the real world is far from meeting these requirements. They then outline and critique eight separate approaches to choosing an SDR: using some kind of market interest rate (methods 1–4); an approach based on an explicit societal valuation of the well-being of future generations (method 5); approaches that weight a project's impact on investment as a multiple of its impact on consumption (methods 6 and 7); and an approach with a variable SDR (method 8), one whose value declines as a project's time horizon lengthens, in order to allow serious present-day evaluation of very long-term environmental or health effects. Moore, Boardman, and Greenberg conclude with their best judgments about the discount weights to use in any given situation, and suggest upper and lower bounds.

Criteria for Infrastructure Investment

How should government decide whether any particular role in infrastructure investment is socially desirable? Cost-benefit analysis provides the starting point. A fuller normative framework, however, requires that attention be given to distributional impacts as well as to the economic efficiency impacts valued with cost-benefit analysis. Theoreticians have to recognize the harsh reality that any normative framework will be implemented by public officials who face political incentives that often conflict with normative prescriptions. A prudential approach attempts to create institutions that push, however gently, political choices in the direction of the appropriate normative values.

Aidan Vining and David Weimer here propose a prudential approach that requires federal departments, provinces, and local governments to conduct and make public cost-benefit and multi-goal analyses of proposed infrastructure projects. This is along the lines of requirements of the US federal government and quite a few of the more sophisticated states. Over time, this innovation should improve infrastructure policies. Specifically, Vining and Weimer would require project sponsors to file studies with the Treasury Board and with the Public Accounts Committee of the House of Commons. The Treasury Board would post these studies on the Internet along with comments from interested parties. While no panacea, the process would tend to discourage excessive benefit claims, provide a way to generate information about costs and benefits from those affected, and contribute to a gradual improvement in the analytical capability of the units of government that play important roles in the design and choice of infrastructure projects.

The Information Superhighway

If one splits infrastructure into a number of broad categories, then the fastest-growing of these is transmission facilities for digitized information. Steven Globerman carefully assesses the potential role of government in this sector by examining the extent to which market failure takes place in it. Likely the most important market fail-

ure is network externalities — the idea that the social return from expanding access to the Internet exceeds the private return to firms and individuals considering such investments. This gap suggests that the level of investment in Internet infrastructure is too low. While, in principle, market failure warrants government policies to accelerate access, Globerman is cautious: “The available evidence does not permit persuasive argument about whether government is doing too much or too little subsidization.” He is concerned that enthusiasm for the Internet is leading to “inefficiently large direct and indirect public sector investments.”

Evaluating a Large-Scale Infrastructure Project

As Vining and Weimer demonstrate in this volume, cost-benefit analysis is an important tool for the evaluation of infrastructure investments. The principle underlying cost-benefit analysis is to evaluate project benefits in terms of what consumers would be willing to pay if the benefits were sold in a market, and to evaluate project costs in terms of benefits forgone due to the diversion of resources to the proposed project. The rationale for cost-benefit analysis is to subject decisionmaking on infrastructure projects to the discipline of a competitive market, if it were feasible to organize one. Unfortunately, cost-benefit analysis is only as good as its practitioners, who may bias results by an inappropriate choice of parameter values, and as the politicians in charge, who may simply ignore unwanted results.

Fernand Martin summarizes a particularly rigorous application of cost-benefit analysis: a joint undertaking of the Quebec, Ontario, and federal governments to evaluate a high-speed rail connection along the Quebec City to Windsor corridor. The study, completed in 1995, analyzed in detail six variants, differentiated by choice of technology (the Lynx technology used by the French high-speed rail system, TGV, or the less expensive but slower Sprinter technology) and route length (various routes along the entire corridor, or along the shorter Montreal-Toronto section of the corridor). Most variants generated a positive net present value using the base

values for the parameters. The most attractive, in terms of generating the largest net present value, was a variant using Lynx technology, between Montreal and Toronto, passing through Dorval airport, Ottawa-Hull, and Kingston.

Aidan R. Vining
and John Richards
April 2001
