

Public Infrastructure Investment and Labour Productivity in the Canadian Manufacturing Sector

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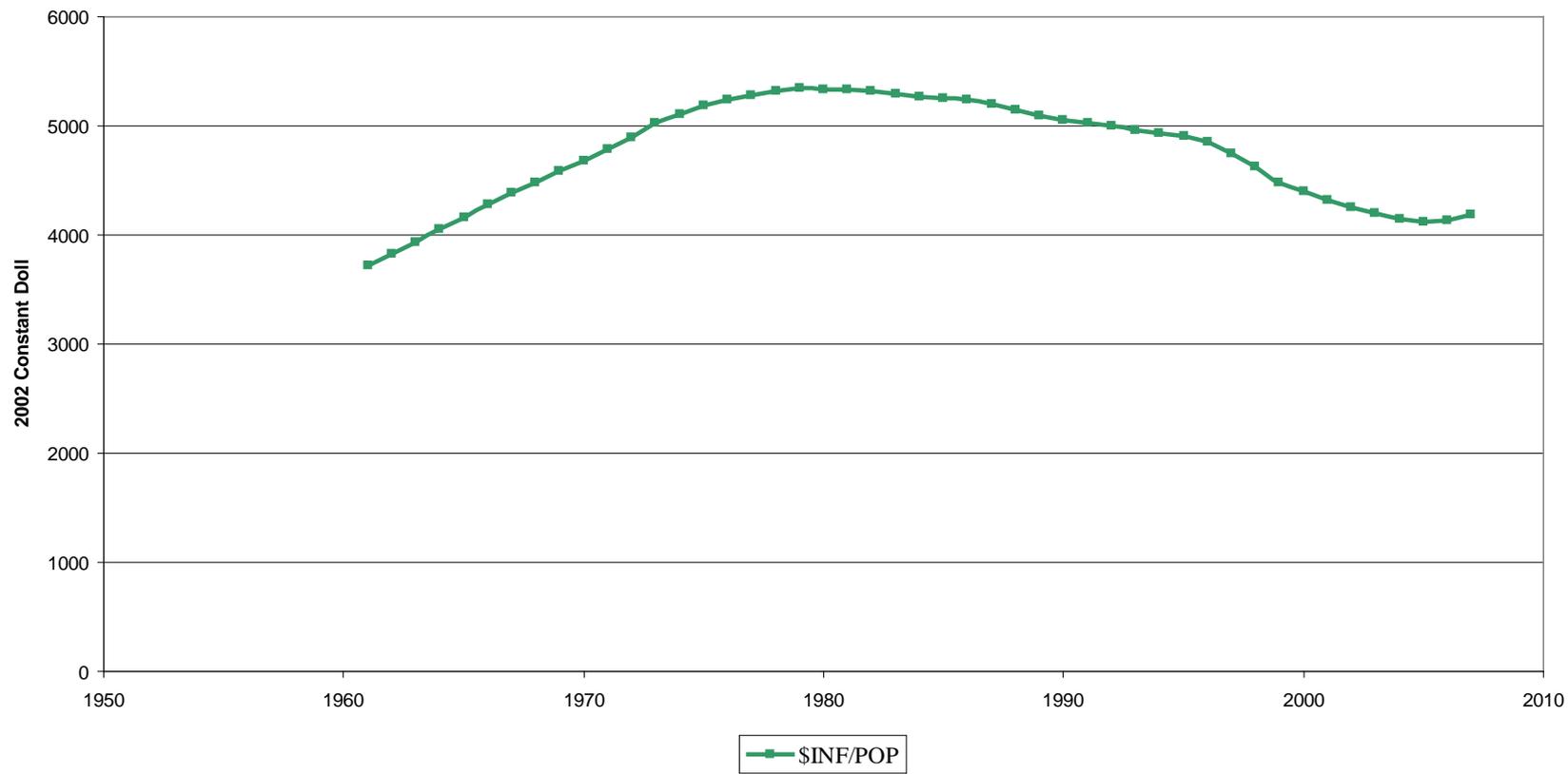
- It is generally accepted that labour productivity in the Canadian manufacturing sector lags behind that in many other developed economies and particularly behind that in the United States.
- This essay examines the role of the so-called infrastructure gap in the Canadian labour productivity puzzle. There are a number of important policy questions to be addressed.
- First, how much public infrastructure investment is currently needed?
- Second, does infrastructure investment change how manufacturers choose to produce?
- Third, if public infrastructure does change private production decisions, is public infrastructure capital a complement or a substitute for private capital?
- Fourth, what is the impact of public infrastructure investment on labour productivity in the manufacturing sector?

- Public infrastructure capital stock includes:
- highways; other transportation facilities including docks and ports;
- water treatment and distribution systems;
- public safety systems such as police and fire protection;
- collection, and disposal of garbage;
- sewage treatment, public utilities, etc., all of which provide the necessary environment for private production to occur.

- Services provided by public infrastructure enter both directly and indirectly into the private production process and so must affect the productivity of the private economy.
- Directly, they make up a portion of the intermediate inputs or services used in the production process.
- For example, firms need water, power, transportation facilities, etc., to produce.
- There is also an indirect relationship because private and public capital may well be considered complements in some cases, substitutes in others.

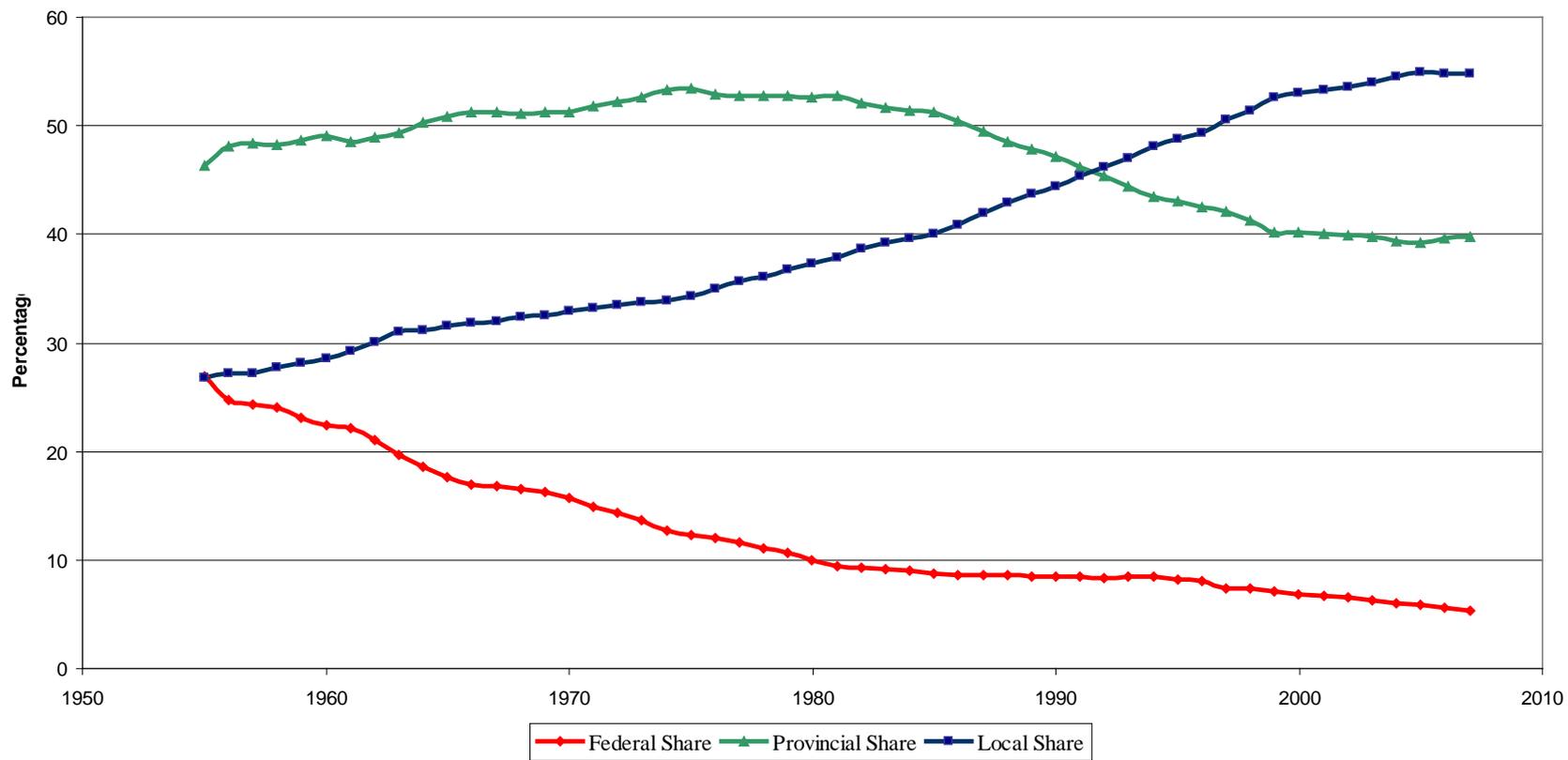
- How much infrastructure investment is needed?
- There are several measures.
- One measure looks at the level of infrastructure per capita over time.
- Others consider the need for maintenance of the existing stock of infrastructure

Per Capita Infrastructure Stock



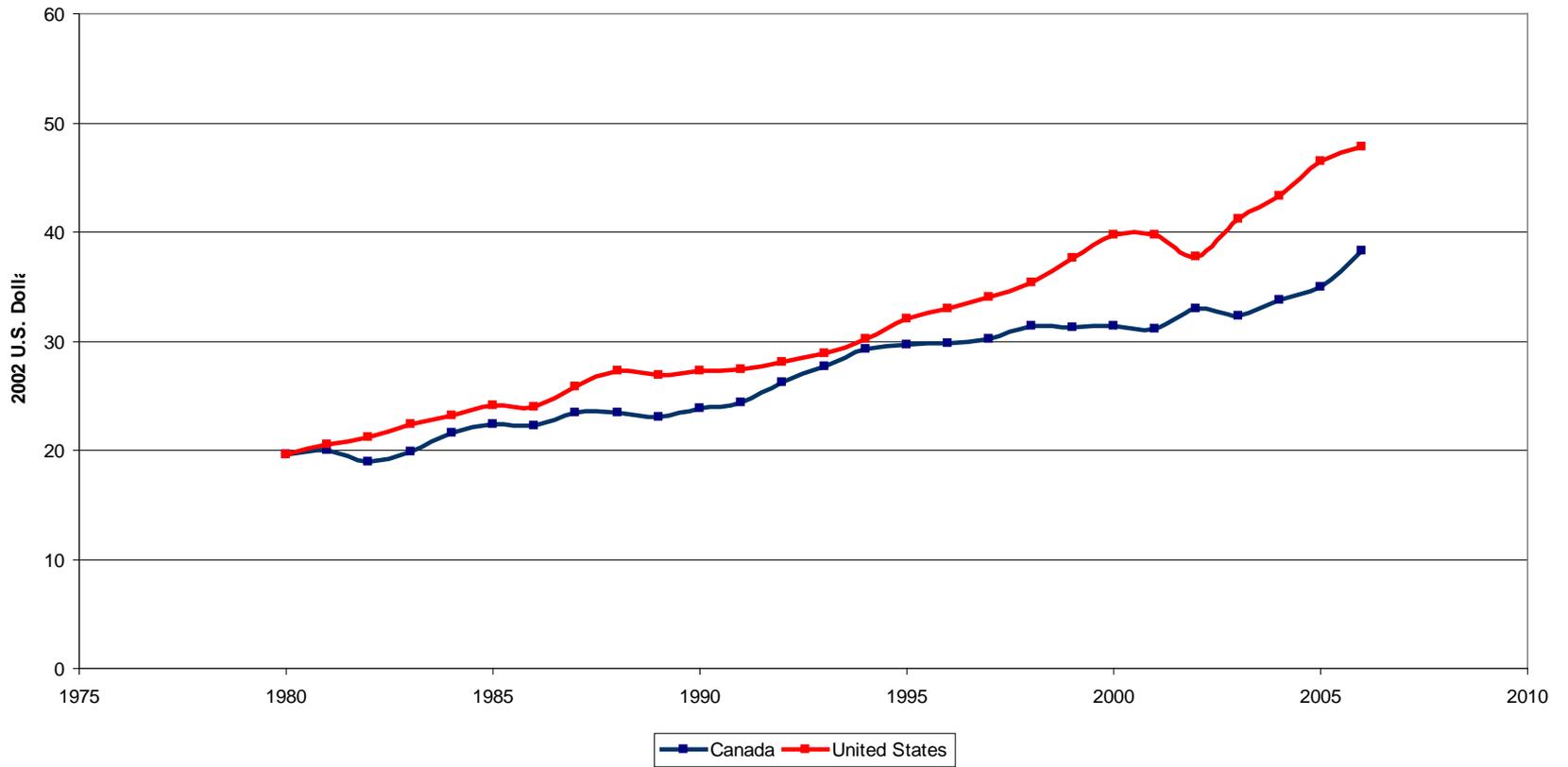
- Increasingly, in Canada, the jurisdictional responsibility for funding much of public infrastructure has been shifted to the local or municipal level.
- A strong argument can be made that it is efficient to have public infrastructure facilities under the jurisdiction of local authorities, so that the local people can decide what sort of public infrastructure is really desired.
- However, since local revenue sources have not kept pace with the expenditure requirements, the result has been a tendency to allow existing public infrastructure to deteriorate.

Responsibility for Infrastructure



- Some forms of infrastructure are consumption commodities adding to local utility, i.e., cultural and sports facilities, parks, water and sewage facilities for households.
- Local jurisdictions are increasing using the amount of infrastructure provided as a policy to attract industries to the area. This attraction is both for production and for the living environment for potential employees.
- However, infrastructure capital may directly affect productivity in many sectors of the economy.
- Does the apparent lack of infrastructure capital result in low labour productivity in key sectors such as manufacturing.

Labour Productivity in Manufacturing



- Most of my own published research on the infrastructure-productivity relationship takes a flexible functional-form empirical approach[\[1\]](#).
- I employ a variable-cost version of the constant elasticity of substitution translog (CES-TL) model which is commonly employed by economists to study production processes.
- This model explains the optimal input mix which will result in the lowest cost of production for a given level of output.

[\[1\]](#) The analysis presented here is based on research published in *Canadian Journal of Regional Science* (1996), *Applied Economics* (2005), and the *Journal of Economic Asymmetries* (2006), *IRPP Policy Matters* (2008).

- To implement the model empirically, I specify four private factor inputs: (1) labour, (2) capital, (3) energy, and (4) intermediate inputs (materials).
- If production decisions are, in fact, affected by infrastructure, then the traditional production function must be extended to allow for these effects.
- Therefore, I include the level of the infrastructure capital stock as an exogenous (fixed) factor that affects the cost relationship.
- It is beyond the control of the private firms, but they will react to changes by altering the mix of private inputs used in production.

- The cost elasticity with respect to infrastructure shows the per cent change in production costs associated with a 1 per cent increase in the stock of infrastructure, and thus directly measures the "productivity effect" of infrastructure investment.
- For the auto sector, the value of -0.677 implies that a 10 per cent increase in infrastructure capital would decrease the cost of producing a given amount of output by 6.8 per cent.
- The infrastructure effect found for all manufacturing is smaller (-0.476), but nonetheless at the high end of estimates by other researchers.

Summary and Policy Conclusions

- New facilities are required to allow for growth for existing industries, to attract new industries and private investment, and to enhance Canada's international economic competitiveness.
- In addition, existing infrastructure is aging, and investments in repair and maintenance are required to shore up the quality of the current stock.
- The estimated dollar value of this required investment is of the order of \$200 billion -- up to \$72 billion in new infrastructure facilities, depending on how the gap is measured, and up to \$123 billion in repairs and upgrades to existing facilities.

- The importance of well-maintained infrastructure is first and foremost public safety (as the collapse of the viaduc de la Concorde and the contamination of water supplies in Walkerton tragically illustrate), but it serves an equally important economic development aspect.
- Infrastructure is important to industries when making location decisions.
- Infrastructure plays a critical role as a basic foundation for industrial development (which is, in fact, almost the definition of “infrastructure”), but a large body of research shows that changes in the stock of infrastructure have important ongoing effects on the cost structure, choice of inputs and productive capacity of individual firms.

- My analysis of the Canadian manufacturing sector over the past three decades suggests that a sustained 10 per cent annual increase in the stock of infrastructure spending (which is approximately the amount promised in recent federal and provincial infrastructure initiatives) could reduce manufacturing costs by nearly 5 per cent per year.
- A welcome development in the context of the strong Canadian dollar
- This would help narrow the Canada-U.S. manufacturing productivity gap and enhance the sector's competitive profile.
- The analysis shows that infrastructure investment has important interactions with investment and employment decisions of Canadian manufacturers.