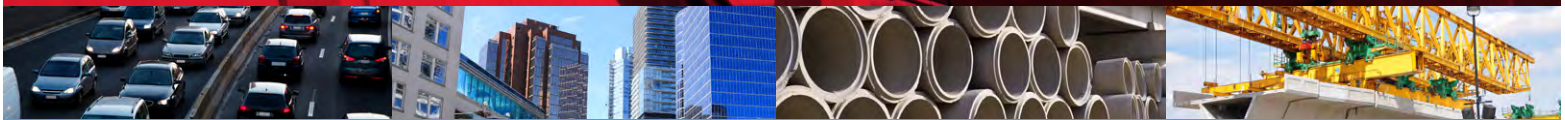


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AT THE INTERSECTION

The Case for Sustained and Strategic Public Infrastructure Investment



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CanadaWest
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The Canada West Foundation

Our Vision

A dynamic and prosperous West in a strong Canada.

Our Mission

A leading source of strategic insight, conducting and communicating non-partisan economic and public policy research of importance to the four western provinces and all Canadians.

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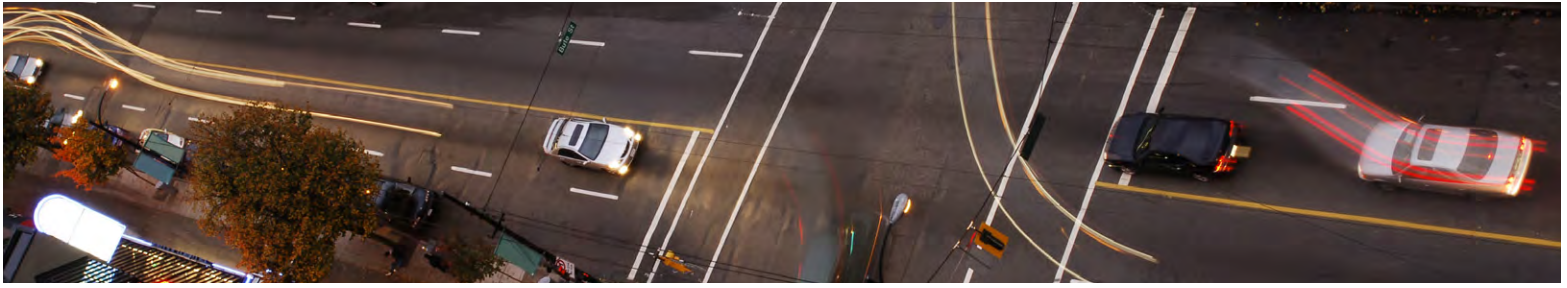
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At the Intersection was prepared by Canada West Foundation Senior Policy Analyst Casey G. Vander Ploeg and Senior Economist Michael Holden. The authors thank Canada West Foundation Vice President of Research, Robert Roach, Policy Analyst Robbie Rolfe and Research Intern Mike Decker for their contributions. Any errors or omissions remain the responsibility of the authors. The opinions expressed in this report are those of the authors only and are not necessarily those of the Canada West Foundation's Board of Directors, advisors or funders. Permission to use or reproduce this report is granted for personal or classroom use without fee and without formal request provided that it is properly cited. Copies may not be made or distributed for profit or commercial advantage. Copies are available for download at no charge from the Canada West Foundation website at www.cwf.ca.

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Canada's governments should not hesitate to maintain a high level of investment in infrastructure. Sustained and strategic investment in public infrastructure is essential to Canada's long-term economic growth and is critical to the quality of life enjoyed by Canadians.



INTRODUCTION

Spending on public infrastructure was seen as a good way to stimulate the economy during the last recession. Now that the worst is over—we hope—governments have to decide if it makes sense to continue spending on infrastructure or if we should put our scarce tax dollars toward other priorities. Complicating matters, this decision takes place against the backdrop of the ongoing fiscal meltdown in Europe and the potentially catastrophic level of debt accumulating in the US, both of which suggest that belt-tightening should be the order of the day rather than more public spending.

Despite the recent stimulus splurge, we have actually been shortchanging investment in our public infrastructure for years. If we continue on this track, productivity gains will not be adequate to maintain our quality of life.

With that in mind, the Canada West Foundation set out to answer a basic question: how much does investment in public infrastructure contribute to long-term economic growth?

Our review of the considerable body of economic research on the subject shows that there is a strong connection between investing in public infrastructure and long-term gains in economic productivity. Canada's productivity—how efficiently we produce goods and services—is critical to our current standard of living and quality of life, as well as to our future economic and social prospects.

Governments in Canada have been agonizing for at least two decades about why we are not seeing strong productivity gains in the economy. Many things have been tried to boost Canada's productivity from lowering taxes to investing in education. The research upon which this policy brief rests suggests that the missing link is investment in public infrastructure.

This finding comes with a caveat. The economic and productivity benefits of infrastructure investment are not automatic. If infrastructure is to contribute to productivity and generate long-term economic gains, the investments must be *strategic*. It's not just a matter of *more* infrastructure. To get infrastructure right, Canada needs to be investing in the *right* infrastructure in the *right* places and this means focusing on infrastructure that serves economic ends such as transportation systems and core services such as water and sanitation.

Canada needs to be investing in the **right** infrastructure in the **right** places

HAVE YOU CHECKED YOUR INFRASTRUCTURE TODAY?

You can imagine someone driving their kids to hockey and thinking fondly of the new interchange that cuts in half the time it takes to get to the rink.

It is harder to imagine that same parent thinking about how great it is that their kids will have more job opportunities than they otherwise would because that interchange enables trucks to get where they are going faster and, in turn, makes commerce more efficient and facilitates economic growth.

In other words, it is relatively easy to make the connection between good infrastructure—from the road leading to the rink to the recreation centre that houses it to the water system that provides the water to make the ice—and our quality of life. The connection between good infrastructure and Canada's long-term economic prosperity, on the other hand, is just not something most people think about.

Nonetheless, that pothole we hit on our way to work, the bridge we have to detour around because it is falling down and the boil water advisory we heard on the news are much more than inconveniences. They are warning signs telling us that we cannot take our infrastructure for granted.

Sustained infrastructure investment is essential to maintaining Canada's future prosperity and quality of life.



Although Canada has acceptable public infrastructure in place, this infrastructure is aging, our population and cities are growing and the global economy is becoming more competitive. To respond to these challenges, Canada must maintain, renew and replace its existing infrastructure while also building new infrastructure. If we don't, our economy, ability to compete and quality of life will erode.

What will this look like?

It will take us longer and become more dangerous to travel from point A to point B. Our recreational facilities, schools and hospitals will fall into disrepair. Our health, safety and security will be compromised as our water systems become less reliable. Traffic congestion will increase and pollution along with it. There will be a gradual and steady dulling of our competitive edge. Good-paying jobs will be harder to find and growth in our personal incomes will slow. Governments will find it more difficult to fund healthcare and education, resulting in spending cuts, tax increases or both.

When it comes to infrastructure, the strategy we have been largely following is to get by with what we have and defer the costs of renewal and replacement for as long as possible. The problems with this approach are:

- We are not capturing the economic benefits that come from strategic infrastructure investment.
- It creates a moral dilemma by offloading the problem and its cost onto our children and grandchildren.
- It compromises the health and safety of Canadians.

Infrastructure spending is often seen as a way to jump-start the economy during a recession. However, our review of the literature on public infrastructure investment and economic growth shows the most important economic benefits come from what infrastructure accomplishes in the economy over the long-term. This highlights the need for well-planned and sustained investment over short-term bursts during downturns.

The literature shows that inadequate public infrastructure is a threat to long-term economic growth. Inadequate public infrastructure lowers economic potential in a direct and obvious way according to this simple progression:

- Inadequate infrastructure results in increased costs for business.
- Increased costs result in a lower return on private investment.
- Lower returns—profits—mean less money for business to re-invest in new plants, machinery and technology.
- Less investment means fewer jobs and less productive labour.
- Lower productivity means less economic output and lower personal incomes.

The end result is a loss of competitiveness and lower rates of economic growth.

Failing infrastructure affects all Canadians. It translates into fewer job opportunities and lower incomes. And the effects of substandard infrastructure are not restricted to the economy. The social programs and benefits available to Canadians are funded in large part by taxing our incomes. If individual incomes don't grow sufficiently over time, government will find it increasingly difficult to fund important social priorities such as healthcare and education.

Canadians will be faced with a difficult choice: deciding which social programs and priorities we are willing to do without, paying higher taxes or both. That will also present our children and grandchildren with a double-whammy—inadequate infrastructure and higher taxes. That combination detracts even further from Canada's economic and social prospects.

STUCK IN TRAFFIC The Costs of Congestion

“A Toronto Board of Trade report earlier this year looked at commuting times in 19 major European and North American cities. Toronto's ranking? Dead last: worse than New York or London, worse than Los Angeles. But other Canadian cities were scarcely better. Montreal was 18th, Vancouver 14th, Calgary 13th, Halifax 10th. ...

Traffic is slowly strangling our cities. It's the time wasted in traffic that could have been put to more productive use. It's the late deliveries, the missed appointments, and the margin of error needed to cover the risks of either. It's the extra repair costs from all those additional fender-benders. It's the higher fuel consumption and consequent higher emissions to which stop-and-go traffic gives rise, to say nothing of the added wear and tear on roads, and tires, and engines—and heart muscles: being in heavy traffic triples your risk of a heart attack within an hour, according to German researchers. It's the measurable drop in property values in areas overtaken by the traffic blight. It's the noise, and smell, and general unsightliness. And much more besides.

Add it up and the costs are massive, and growing. A 2006 Transport Canada study put the cost of congestion

nationwide, taking everyday and “non-recurring” congestion (accidents, road work and so on) together, at as much as \$6.7 billion. (Interestingly, measured in congestion costs per vehicle-kilometre, Vancouver can lay claim to having the worst traffic in the country.) Yet even this is almost certainly an underestimate. The figures are in 2000 dollars, for starters, and traffic has appreciably worsened since the early years of the decade, when the study was conducted. Costs were estimated only in the nine largest urban areas, only at rush hour, only for cars (not trucks or buses), and only included the drivers' wasted time and excess fuel consumption (and related greenhouse gas emissions).

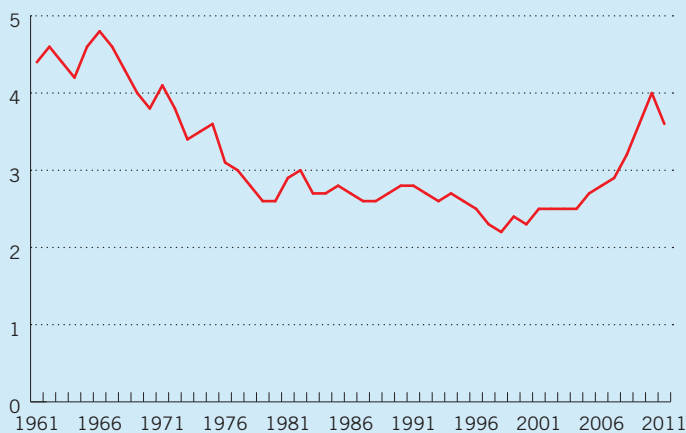
A more comprehensive estimate, conducted in 2008 for Metrolinx, the agency responsible for transportation in the Greater Toronto and Hamilton Area, put the annual cost of the congested state of the region's roads at \$6 billion, when knock-on costs to the surrounding economy are included. That suggests annual congestion costs for the country as a whole would today approach \$15 billion, nearly one per cent of GDP” (Coyne 2011).



DECLINING INFRASTRUCTURE INVESTMENT

Most of Canada's infrastructure was built in the 1950s and 1960s. Once that infrastructure was in place, it made sense to slow the pace of investment. Governments began shifting tax dollars toward building the modern social safety net—things like public healthcare. Since then, health, education and social services have dominated government budgets to the point where we began postponing essential maintenance of our infrastructure and deferring new investments. This has led to an infrastructure deficit—a gap between the infrastructure Canadians need and the funding that is available. In the 1960s, governments in Canada combined were investing about 5% of GDP into infrastructure. By 2000, investment had fallen to 2%. While investment has recently grown, there is still a lot of backfilling to do.

Total Government Infrastructure Investment as a Percentage of GDP, 1961-2011



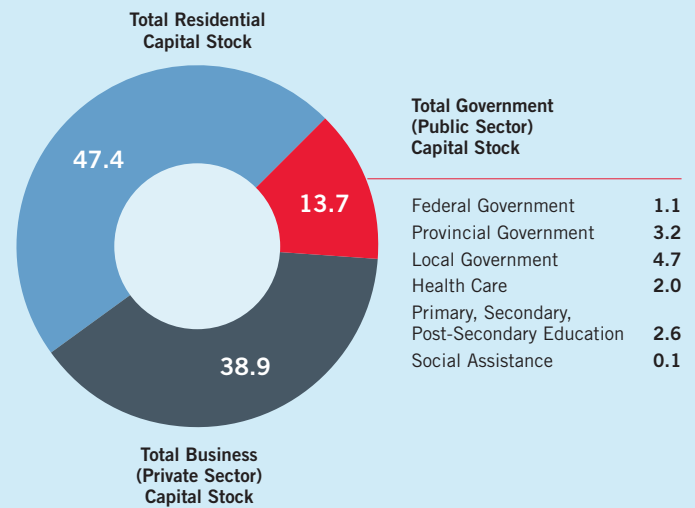
Source: Derived by Canada West Foundation from Statistics Canada data. Includes federal, provincial and local government flows of gross fixed capital formation.

THE VALUE OF PUBLIC AND PRIVATE INFRASTRUCTURE IN CANADA

\$4 Trillion

Individual Canadians, Canadian businesses and governments own a set of physical capital investments valued at \$4 trillion. This stock of “fixed capital investment” includes the value of our homes, all the factories, machinery and equipment of business and the public infrastructure of government. These assets—used by Canadians on a daily basis—are what enable the economy to function, public services to be provided and social interaction to occur in our communities.

Stock of Total Public and Private Physical Capital in Canada, 2011



Source: Derived by Canada West Foundation from Statistics Canada data.

BAD BRIDGES Say Your Prayers

While Canadians depend on public infrastructure each and every day, it is usually not top of mind until it fails. Then it becomes headline news. On September 30, 2006, a 60-foot long section of the De la Concorde overpass in Laval collapsed onto Highway 19 directly underneath. On July 31, 2011, commuters in Montreal were stunned after a 45 cubic foot block of concrete fell inside the Ville-Marie Tunnel. On August 24, 2010, one of Saskatoon's most important crossings over the South Saskatchewan River—the Traffic Bridge—was permanently closed after inspectors uncovered severe corrosion. On August 30, 2011 the southbound lanes of Diefenbaker Bridge in Prince Albert

were closed after a metal fatigue crack was found in one of the main steel girders. The bridge carries some 140,000 people every week. In March 2011, two engineering reports on Montreal's Champlain Bridge said the structure was in a state of severe deterioration and that a partial or complete failure could not be ruled out. The Champlain Bridge is one of Canada's longest and busiest bridges. It is 6 km in length and handles 160,000 daily crossings. After the reports were released, the Archdiocese of Montreal erected a billboard at the entrance to the bridge advising motorists—tongue-in-cheek—to “*Faites votre prière*” or “*Say your prayers.*”

Investments in infrastructure increase productivity.



In the 1950s and 1960s, developed economies around the world enjoyed robust economic growth, fuelled by tremendous gains in productivity. Canada was no exception; strong productivity growth led to a growing economy, rising incomes and greater national wealth.

In the 1970s and 1980s, however, productivity growth slowed and so did economic growth.

In 1989, a study by David Aschauer, an economist working for the Federal Reserve Bank of Chicago, argued that lower public infrastructure investment was behind much of the drop in productivity growth. This finding—highly controversial at the time—sparked a new line of economic inquiry focused on the relationship between public infrastructure and productivity. Work in this area revolves around three questions:

- Is there a relationship between public infrastructure investment and productivity?
- If there is a relationship, does infrastructure result in productivity growth, or is it the reverse?
- If infrastructure does result in productivity growth, how strong is the impact?

What does the academic literature tell us about these three important questions?

First, there is no doubt that investments in public infrastructure are related to productivity growth, and hence, long-term economic growth. There is virtual unanimity on this point.

Second, there has been considerable debate about whether infrastructure generates gains in productivity or whether the impact runs in the opposite direction. This question of causality has largely been settled. There is a strong consensus in the literature that investments in public infrastructure generate productivity gains. Few papers suggest otherwise and those that do tend to be based on less rigorous research.

Third, there is a lack of consensus on the strength of the impact that infrastructure investment has on productivity. In other words, we know that the effect of infrastructure on productivity is positive, we just don't know how great that effect is. There are many reasons for this, including differences in the types of infrastructure examined, the scope of the studies and the economic models that were used.

THE IMPORTANCE OF PRODUCTIVITY

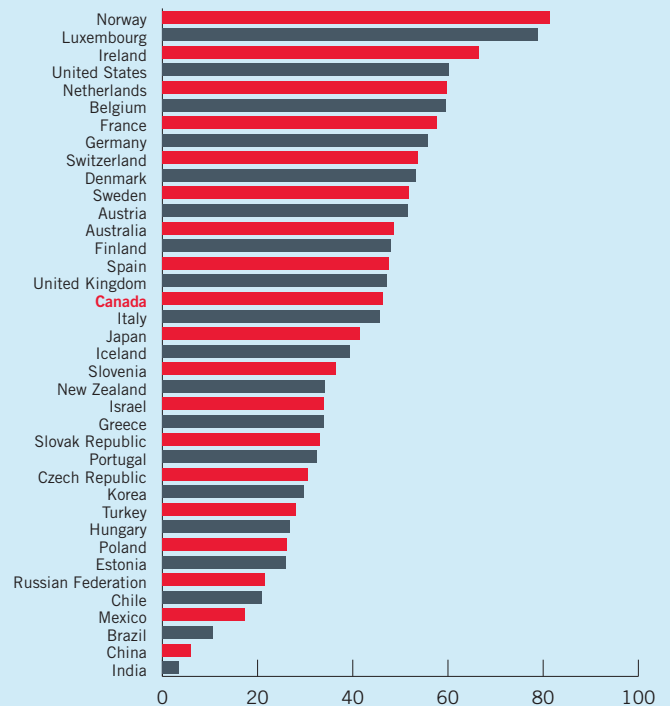
According to the Conference Board of Canada, “Productivity is the single most important determinant of a country’s per capita income over the long-term. Countries that are innovative and able to adapt to the ebb and flow of the new global economy boast high productivity and thus a superior standard of living. Productivity is a measure of how efficiently goods and services are produced.” Despite its importance to our economic future, “Canada’s labour productivity has been lower than that of the top countries for many decades, hurting our international competitiveness.” Some of the papers that we reviewed suggest that the gap in Canada-US productivity growth since the 1990s was largely the result of Canada investing less in public infrastructure compared to the US. Because the academic literature supports the conclusion that infrastructure boosts productivity, it is likely that more infrastructure investment—if it is done strategically—will help close the Canada-US productivity gap (Conference Board of Canada 2012a and 2012b).

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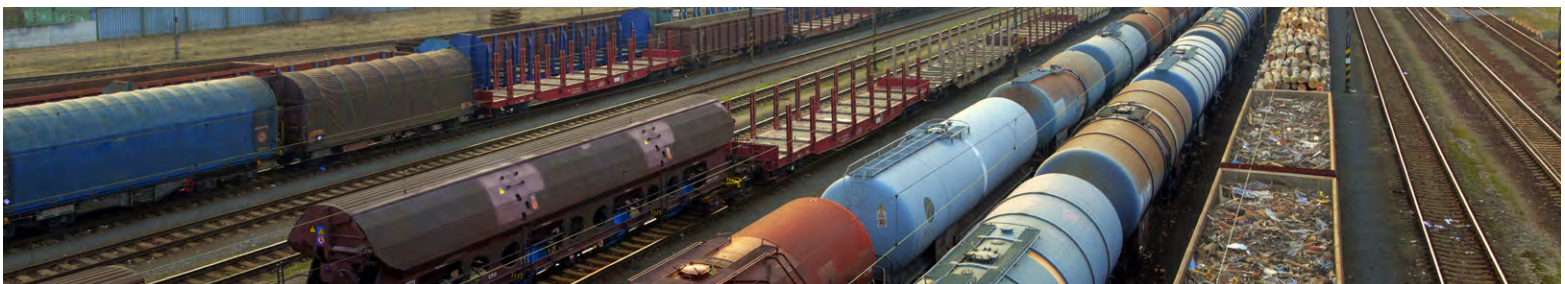
CANADA’S PRODUCTIVITY RECORD

Our future prosperity, both as individual Canadians and as a nation, revolves around our ability to become more productive. Labour productivity in Canada—the amount of GDP produced per hour worked—has grown from \$25 in 1961 to \$57 in 2011. This has helped propel Canadians’ average incomes (adjusted for inflation) from \$18,000 per year in 1961 to almost \$50,000 in 2011. The problem is that Canada fares poorly with our most important competitors. Half of the countries in the OECD have higher labour productivity than Canada and our labour productivity growth has been very poor. Among the G-7, Canada also shows very slow growth in multi-factor productivity.

Labour Productivity in OECD and BRIC Nations, 2011
\$US Earned Per Hour of Labour



Source: Derived by Canada West Foundation from OECD Statistical Database.



Economic and productivity gains related to infrastructure are not automatic. The highest economic and social returns on infrastructure investment only occur with strategic investment.



Studies exploring the relationship between infrastructure, productivity and economic growth take many forms and help uncover the conditions under which infrastructure investment pays the biggest dividends.

Type of infrastructure: The research is clear that not all infrastructure is created equal. Some forms of infrastructure are more valuable as an economic input than others. At the top of the list is infrastructure that facilitates economic activity such as wastewater, energy, communications and transportation systems.

The existing infrastructure stock: The amount, quality, usage, efficiency and reliability of the existing infrastructure stock must be factored into decisions regarding new investments. Maintaining and renewing existing infrastructure—especially our basic assets and transportation systems—often provides higher returns than investing in new projects. A clear strategic direction is needed to ensure that these systems are being well maintained and that new investments are not made when there are opportunities to better or more efficiently use existing assets.

Location of the build: Making the right investments in the right places is also critical. Many studies suggest, for example, that investments in urban areas tend to pay higher economic returns and we know that resource development requires a certain amount of rural infrastructure to be in place. In addition, infrastructure investments in one area can also generate considerable benefits that “spill over” into other areas. Properly locating the right investments ensure that the spillover effects are maximized.

There are two factors that many people ignore when it comes to making the case for infrastructure investment. First, investing in infrastructure involves an *opportunity cost*. Once money is spent on infrastructure, that money is no longer available for other things such as reducing taxes, closing budget deficits or more spending on social programs. Second, it is possible to overinvest in infrastructure. These factors speak to the importance of ensuring investments are strategic in nature.

Being strategic means not everything on the “wish list” can or should be built. Being strategic means not all existing infrastructure should be refurbished. Being strategic means making sure our infrastructure builds amount to *investment* rather than *spending*.

DIMINISHING RETURNS

Infrastructure investment in countries such as China, India, Brazil and Indonesia has been very rapid. Some of these countries are investing over 10% of their GDP into infrastructure, a rate three to four times that of Canada. The initial reaction is that Canada should be doing the same. However, that is not the case. These countries lack many of the basic infrastructure systems that Canada already has in place. A high level of investment is good policy for those countries because it is virtually guaranteed to pay huge economic dividends. Once essential infrastructure is in place, adding more to the existing stock provides lower and lower returns. Those returns may still be positive, but they will be lower. If too much infrastructure is built, the returns might become negative. Diminishing returns are the reason investments in Canada must be strategic.

PAST STRATEGIC INVESTMENTS STILL PROVIDING BENEFITS

The standard of living and level of prosperity enjoyed by Canadians today is intimately linked with the major public infrastructure investments of the past. Arguably, much of the prosperity our children and grandchildren will enjoy tomorrow will be affected by the infrastructure investments that we make today.

Infrastructure has played a major role in Canada's historical development. In fact, some of the world's largest and most impressive infrastructure projects can be found in Canada. The list includes projects such as the Canadian Pacific Railway (CPR), the St. Lawrence Seaway, the Trans-Canada Highway, Confederation Bridge, the James Bay and Lower Churchill River hydroelectric projects, and western Canada's network of dams, canals and reservoirs that irrigate some of the most productive agricultural land in the world.

Viewed from this angle, the recent discussion about infrastructure in Canada is not a new phenomenon. For example, debate about construction of the CPR was one of Canada's first significant public policy issues. The Canada we enjoy today owes much to Canadians of the past with broad imagination and a strong vision for what Canada could and would become.

STRATEGIC INFRASTRUCTURE

Detroit International River Crossing

The Ambassador Bridge—a privately-owned crossing that connects Detroit to Windsor—is one of the most important Canadian-US trade connections. Over \$120 billion in trade crossed the bridge in 2011. However, there are growing concerns about the bridge's ability to handle all that traffic, especially its capacity to accommodate any increase.

In the absence of modifications or upgrades to improve capacity at that crossing, one study estimates that the US is foregoing more than \$2.6 billion (US) in economic production every year. In Canada, that figure is even higher – more than \$4.0 billion (CDN). In the absence of any investment to improve flow, the cumulative employment losses by 2020 could total more than 28,000 jobs.

As a result, Canada and the US have been exploring the possibility of building a new bridge to alleviate the growing congestion. The proposed Detroit River International Crossing would be only a few miles from the Ambassador Bridge with direct connections to highways on both sides of the border. The project is conceived as a public private partnership project, with a private consortium building the bridge itself at a cost of \$950 million.

The economic benefits of the Detroit River International Crossing have been estimated in at least one study. For Michigan, the infrastructure is expected to create 6,800 permanent jobs and increase state GDP by \$630 million per year. Similar effects are anticipated on the Canadian side.



Ambassador Bridge connecting Detroit and Windsor

Now is the right time to make critical economy-enhancing investments in Canada's public infrastructure.



The economic benefits of infrastructure go well beyond short-term stimulus. The more important rationale for sustained and strategic infrastructure investments is how they capture the opportunity for enhanced economic productivity and better growth over the long-term.

This fact aligns with a number of conditions that favour infrastructure investment at this time.

First, interest rates are low. This makes borrowing money to pay for infrastructure relatively cheap. In fact, the current situation is similar to that of the 1950s and 1960s, when much of our current stock of infrastructure was laid down.

Second, while our economy is recovering, it's not firing on all cylinders. The productive potential of the Canadian economy is still above our actual level of production—think of a factory operating two shifts per day instead of three. This “output gap” in Canada is smaller than in other countries, but it still exists. An output gap means that infrastructure investments today can still provide a short-term stimulus effect and secure long-term productivity gains with less risk of “crowding out” private sector investments.

Third, the Canadian dollar is trading high against its US counterpart. This makes it more cost-effective to purchase infrastructure inputs from US suppliers. The combination of low interest rates and a high Canadian dollar is rare; now is the time to take advantage of it.

Fourth, our current stock of infrastructure is aging and nearing the end of its lifespan. Now is the time for a sustained and strategic plan to make the required investments.

Finally, we need investments to take advantage of emerging economic opportunities, particularly the rapid growth occurring in Asia. Canada's standard of living is intimately connected with our ability to trade. Securing new markets for our goods and services can only occur if we have the infrastructure to get our products to those markets.

To be sure, the environment for infrastructure investment is not perfect. Governments are still posting budget deficits, the international global economy is still shaky and the US economy is still wobbly. There are ongoing labour shortages in various places across Canada, which has pushed up construction costs. None of this, however, is an argument against proceeding. Rather, it underscores once again the need to identify and invest in strategic projects.

THE GROWING IMPORTANCE OF ASIA

The importance of developing new markets and expanding the list of Canadian trading partners is increasingly being seen as an economic growth strategy going forward. On a recent trade mission to India, Prime Minister Stephen Harper said that “For Canada to realize its full economic potential, it will have to diversify to countries like India that are growing and expected to grow much more rapidly.” There is no doubt that destinations other than the US are becoming more important to Canada, and this trend will likely only accelerate. If Canada is to take advantage of these emerging opportunities, investment in infrastructure will have to happen.

.....
For Canada to realize its full economic potential, it will have to diversify its markets
.....

THE MATH OF INFRASTRUCTURE INVESTMENTS

“Infrastructure spending that adds to the economy’s productive capacity will raise tax revenues that will offset the added financing costs.” (Shenfield 2012)



INFRASTRUCTURE INVESTMENT AROUND THE WORLD

Canada is not alone in facing a considerable public infrastructure challenge. Substantial investments are taking place around the globe to improve living conditions and facilitate economic growth.

- Brazil is currently working under a four year plan to spend \$300 billion (US) on a range of infrastructure including roads, ports and power plants.
- In 1999, infrastructure spending in Russia was about \$7 billion (US) or 3.5% of GDP. In 2010, infrastructure investments were \$110 billion (US) and 7.5% of GDP.
- India is currently working through a five-year plan of public infrastructure investments totaling \$500 billion (US). Plans are underway to develop another five-year plan for 2012-2017 with a doubling of infrastructure investment to \$1 trillion (US).
- China is expected to dedicate trillions of dollars to infrastructure over the next ten years. Currently, China is spending about 10% of its GDP annually on infrastructure. Priorities for investment revolve around ten areas including railways, roadways and technological innovation. By 2020, China is expected to have 53,000 miles of roads, exceeding the 47,000 miles that exist in the US.
- Concerns over the economic implications of under-investing in public infrastructure first emerged in the United States in the late 1980s and early 1990s. Estimates of the infrastructure required in the US are as high as \$2 trillion. Currently, investment in the US is proceeding under the American Recovery and Reinvestment Act (ARRA), the American version of stimulus provided under Canada’s Economic Action Plan. The ARRA includes funding of over \$800 billion (US), of which one-third has been largely dedicated to public infrastructure. Up to an additional \$150 billion (US) will be invested in developing renewable energy sources and related infrastructure.
- Infrastructure spending by member nations of the European Union (EU) was in decline for most of the past decade, averaging about 1% of GDP. In 2007, the EU announced a new \$20 billion (US) program focused on transportation through the Trans-European Transportation Network or “Ten-T.” The global economic and financial crisis prompted the European Commission to table a plan for \$60 billion (US) in transportation, energy and digital technology networks under a new “Connecting Europe Facility” plan. Analysts suggest that infrastructure will come back strongly across Europe, which is expected to invest up to \$200 billion annually within the next 10 years.

The world's emerging market economies are placing high priority on infrastructure, with investments that eclipse those of North America and Europe. In 2008 alone, emerging economies spent \$1.2 trillion—equal to 6% of their combined GDP—on infrastructure. This is twice the amount spent by developed economies. Some analysts are suggesting that emerging economies may invest upward of \$20 trillion over next decade, led by Asia-Pacific economies such as China, India, Malaysia, Indonesia, Hong Kong and Singapore, all of which are leaning on infrastructure and making it a high priority for long-term public spending.

The countries investing the most infrastructure today and anticipated to do so in the future are the same countries recording the fastest economic growth rates. While that has led some to argue for a clear correlation between infrastructure and growth, such enthusiasm is tempered by at least two considerations. First, emerging economies are more likely to suffer from an insufficient infrastructure stock. As such, they also stand to enjoy higher rates of

return from infrastructure investments than developed nations with a stronger and more functional inventory of public capital. Infrastructure investment—despite its benefits—is subject to the law of diminishing returns.

Second, higher rates of economic growth in emerging economies are producing growth in government revenues over and above historical levels, which provides growing fiscal capacity to make the investments. In many ways, this mirrors the infrastructure investments made by developed nations 50 years ago.

In some ways, the international scene may be viewed as threatening—the pace of infrastructure investment around the globe is strengthening the position of Canada's competitors. But viewed from another angle, those investments are also required to strengthen those economies and create new markets for Canadian exports. Another economic opportunity also presents itself in the form of Canadians exporting infrastructure knowledge, expertise, and innovation to those markets.



Vitoria, Brazil



Moscow, Russia



Hong Kong, China



Delhi, India (Paul Prescott/Shutterstock)

1

Sustained and strategic investments in Canada's public infrastructure should be continued.

Even if stimulus spending is winding down, Canada is far from “mission accomplished.” Infrastructure investment is much more than a short-term policy response to economic recession or reluctantly rehabilitating aging and deteriorating systems. Infrastructure investment is a critical part of government's responsibility to facilitate the nation's continued economic progress and social development. Economic research has concluded that sustained and strategic investments will generate the productivity growth needed to drive economic growth and the quality of life benefits that flow from it.

2

Priority should be given to public infrastructure that enhances economic performance.

The economic benefits that flow from infrastructure accrue across the long-term by increasing productivity. Not all investments, however, carry such promise. Infrastructure investments that hold the greatest potential for economic rewards should be pursued as a top priority. This includes investments that support trade by easing and increasing access to existing markets and securing access to new markets. This implies a focus on infrastructure that supports resource development and transportation. In addition, due consideration needs to be given to the infrastructure of Canada's burgeoning urban areas that serve as hubs for much of Canada's infrastructure networks and must also attract and retain the skilled human talent critical to future economic competitiveness. Infrastructure with a clear economic focus helps grow tax revenues that can then be used to fund the investments.

Governments should encourage innovative approaches to the design of public infrastructure.

Canada's growing infrastructure needs are not likely to be addressed under a "business-as-usual" approach. Infrastructure projects that incorporate new technologies and better designs will be more efficient and reduce operational and maintenance costs.

Governments should not focus exclusively on new infrastructure and should give due consideration to renewing existing public infrastructure.

Renewal of existing infrastructure assets can have as much, if not more, economic benefit than new projects. As such, governments should support the strategic renewal of existing infrastructure as well as new builds.

Ongoing analysis and evaluation of recent public infrastructure investments should be conducted and the lessons applied to future investments.

Those who don't know their history are doomed to repeat it. This lesson applies perfectly to infrastructure spending in Canada. Policymakers and the public need to be confident the right investments have been made, and if not, to learn from these mistakes as they start a new round of investment. To date, there has been little to no economic or cost-benefit analysis of previous investments. Yet, specific and focused work in this area is immensely important. Such work helps governments be more selective and strategic and results in projects with the greatest potential for the highest return.

Canadians expect their governments to do what is right for the economy and what is best for preserving a high quality of life. To achieve these goals, governments have many options, but limited resources. In addition, our governments must find a better balance between the insatiable demand for current spending—and the related tendency to live beyond our means—and investing in Canada’s future.

Unlike other forms of government *spending* that create jobs and provide a short-term boost in GDP, renewing and building strategic infrastructure is an *investment* in the long-term productivity of the Canadian economy. If we don’t make these investments now—if we wait and let short-term pressures dominate—we risk undermining our economic prosperity. It is not just a matter of lost opportunities, it is also a matter of sliding backward due to failing or missing infrastructure.

CONCLUSION

There are several very good reasons why governments should commit to making sustained and strategic investments in Canada's public infrastructure. Many of the macro-economic conditions are right, including low interest rates and a high Canadian dollar. Our existing infrastructure systems are aging and in need of comprehensive renewal. New global export opportunities are emerging, requiring additional infrastructure to access those markets. The conclusions from decades of economic research are very clear: strategic public infrastructure investment increases productivity, which is critical to future economic growth.

When our individual incomes are growing, we can purchase goods and services that improve our standard of living and secure the many comforts and conveniences that this affords. But there's more to it than just being able to buy more stuff. When our individual incomes are growing, government revenues grow as well. This allows us to continue to afford our highly-valued social programs such as health care and education and to devote revenue to environmental conservation.

The question of how much to invest in infrastructure relative to spending on other priorities is ultimately a question for voters and the people they elect to represent them. The need for, and benefits of, strategic infrastructure investments are not in doubt, however, and they should be front and centre in this debate.

Sustained and strategic investments in public infrastructure are an investment in our economic and social future and that of our children and grandchildren. If we get infrastructure wrong, we will not be able to capitalize on our economic opportunities and we will saddle coming generations with insufficient infrastructure and the dimmer future this will bring.

One of the first economists to examine the link between public infrastructure investment and economic output was Dr. David Aschauer, an American economist with experience in the US Federal Reserve system and a faculty member at Bates College in Lewiston, Maine. Aschauer's ground-breaking work suggested that there is a positive correlation between public capital and productivity. The correlation was so strong, argued Aschauer, that the benefits or "returns" to public capital exceeded that of private capital (Aschauer 1989). Aschauer got everyone's attention. His work spawned significant interest in his findings and effectively kick-started the debate.

Aschauer argued that public infrastructure should be included as a separate input into overall economic activity. Using a production-function model, Aschauer found that declining levels of public infrastructure in the US in the 1970s and 1980s corresponded with a slowdown in productivity growth over the same period. He also found that public capital played a greater role in this slowdown than the change in private capital. According to his estimates, a 10% increase in the stock of public capital is capable of generating productivity growth and output gains of 3.8% to 5.6%.

INFRASTRUCTURE DEFICITS AND DEBT

The terms infrastructure "deficit" and "debt" refer to gaps between actual infrastructure spending and that which is required. Infrastructure deficits (an annual gap between the infrastructure needed and what was actually built) lead to infrastructure debt (an accumulated backlog).

In the 1990s, serious concern emerged over the sustainability of government budget deficits and mounting public debt. Because the great bulk of this borrowing was used to finance operating expenditures rather than capital assets, the debt imposed an unfair cost to future generations. It was the current generation who drew benefit from the borrowing for government programs and services, but the bill was being left to the next generation who would not directly benefit.

Failing to adequately invest in infrastructure—both new assets and the maintenance, repair, renewal, rehabilitation and replacement of our existing assets—presents the same intergenerational dilemma. If today's generation consumes all of the "life" out of the nation's infrastructure, then future generations will be left with the bill to replace it. This is the equivalent of passing on a financial debt. The only difference is the nature of the liability.

Over the past decade, numerous estimates have been made of the size of Canada's infrastructure "deficit" and the accumulated backlog. These estimates have relied on surveys, in-depth sector specific studies, benchmarking, detailed asset management approaches and economic analysis and complex economic and econometric modeling (e.g., input-out models, production-function equations, cost-benefit analysis, general equilibrium models and growth theory models).

The latest survey on the infrastructure requirements of Canada's municipal governments was conducted in 2007 by the Federation of Canadian Municipalities. It estimated that we have an accumulated infrastructure debt of some \$123 billion for existing infrastructure and a need for \$115 billion in new infrastructure. This total does not include provincial and federal infrastructure debt.

To be sure, there is disagreement on the size of the infrastructure funding gap in Canada. This is not surprising given the difficulty in measuring such things and the fact that people have different opinions on what an infrastructure "need" is. But there is a general consensus that investments in our nation's public infrastructure have been insufficient in the past and the amounts required today to fill that gap are sizeable.

While many other studies began to use Aschauer's methodology to examine the relationship between public infrastructure and economic growth, his work attracted criticism as well. Some pointed out that just because a slowdown in public infrastructure spending coincided with a period of slower productivity growth did not mean that the one necessarily caused the other (Tatom 1993). Others went a step further and suggested that the causality may, in fact, run in the opposite direction—strong economic growth and productivity gains may be responsible for generating demand for additional public infrastructure (Kruger 2012). Other studies were even more critical, arguing that Aschauer's results were implausibly large and exaggerated the importance of public capital to output (Aaron 1990).

An addition to the debate came as a result of the resurgence in US productivity growth beginning in the mid-1990s. This growth did not coincide with major public infrastructure spending, but with large-scale private investment in information and telecommunications technology. For some, this was clear evidence that private sector investment is preferable to public investment. For others, the success of private investment in fuelling productivity growth had nothing at all to do with the ability of public investment to achieve comparable, if not better, results.

Aschauer's work was instrumental in calling attention to the potential link between public infrastructure and long-term economic prosperity. His general approach was replicated and built upon by other researchers, most of whom came to some of the same broad conclusions, although the degree to which they found a positive link between public infrastructure and economic growth varied considerably from one study to the next. Growing disagreement and divergent results led economists to largely abandon the production-function approach and pursue other alternatives, including highly complex general equilibrium models.

The purpose of the new models was to get a better handle on issues like spurious correlation (i.e., public capital, productivity or output moving in the same direction over time but having nothing to do with each other), multicollinearity (i.e., public capital, productivity or output moving in the same direction, having nothing to do with each other but both being affected by some other variable outside the model), causality (i.e., determining if public capital is causing changes in productivity or output, or whether the impact runs in the opposite direction), and feedbacks (i.e., public capital affects productivity or output but is also affected by the change in productivity and output that it creates). Each of the models has differing capacity to deal with these issues.

Over the years, the body of work examining public infrastructure investment and long-term economic growth expanded in depth, breadth and complexity. Researchers built on existing models, developed entirely new approaches, and continued the search for answers to a wide range of questions.

Our scan of the literature indicates that there is wide agreement that a generally positive relationship exists between public infrastructure investment, productivity, output and the performance of an economy across the long-term. This consensus has grown, developed and strengthened as a result of ongoing research into the matter. Embedded within the consensus is the realization that much depends on the particular circumstances and conditions that surround infrastructure investment.

The literature supports the following conclusions:

- There is a positive correlation between infrastructure, productivity and economic growth, evident across the entire spectrum of economic models and other approaches used to test for that relationship. There are outliers but they are increasingly found to be in the minority.
- There is disagreement when it comes to the magnitude of the economic impact. Early studies using production function and variable cost function models are almost universally agreed to have produced results that over-estimate the economic impact of public infrastructure. The results of later and more sophisticated modeling show that the strength of the correlation remains positive, but not as large as the earlier studies.
- Not all forms of investment in public infrastructure have the same effect on productivity. Investments in infrastructure that provide core services, improve the transportation network and linked to an integrated network are the most likely to boost productivity.
- There has been debate about whether infrastructure is a cause of economic growth or whether it is a result of economic growth. While there are arguments to be made on both sides, the literature shows that arguments for a "reverse causality" are weakening. Our sense of the debate, however, is that the relationship may not run exclusively in one direction or the other. In all likelihood, there is some back and forth—a sort of "push and pull" where public infrastructure investment and economic growth are mutually stimulating.

- The general view is that public capital investment is, by and large, complementary to private investment.
- The impact is sensitive to whether investment is made in stand-alone systems or incremental additions to networks. A lot of public infrastructure does not stand alone, but is part of a larger integrated network, such as a short bridge embedded within a much longer roadway. When it comes to networks, the economic effects of new investment are highly dependent on whether it makes a substantial addition or improvement to the network, such as alleviating troublesome bottlenecks in transportation corridors.
- Economists are quick to warn of the dangers associated with investments in new stock at the continual expense of investment in existing stocks. A lot of the studies take as their starting point additions of new assets to the public capital stock. However, some have suggested that minor and major maintenance, and renewal and rehabilitation, can be even more efficiency-enhancing and productivity-boosting than major replacements and construction of new assets. Securing this type of data is not always easy, and it can be difficult to test. Despite this difficulty, it is widely acknowledged that oversupplying infrastructure can actually cause economic harm by drawing resources away from the maintenance and operation of existing stocks.
- Infrastructure is not exempt from the effect of diminishing returns. When very little infrastructure is in place, initial investments can result in clear and tangible impact. When a lot of infrastructure is in place, incremental additions will have a less clear and much smaller benefit. Diminishing returns couples with opportunity cost to imply—at least theoretically—that there is an optimal level of infrastructure. If infrastructure is below the optimal level, there will be positive, even if diminishing, economic gains. If infrastructure is provided over the optimal level, then adding more will actually hurt the economy.
- The economic impact of infrastructure is affected by both the quantity and quality of the existing public capital stock, including consideration of whether it is being utilized effectively and efficiently. If the current public capital stock is underutilized for whatever reason, then new additions will not be productivity-enhancing and can actually do more harm than good.
- The short-term or “static” impacts of infrastructure and the long-term or “dynamic” impacts can differ. The static effects of infrastructure investment are the economic impacts in the short term. There is a near universal consensus that infrastructure investment has a positive impact on levels of GDP and growth rates of GDP across the short term, especially if there is any slack in the economy. This generalized agreement is one of the reasons why most governments around the world have engaged in “stimulus” spending during the recent recession, a lot of which has involved public infrastructure investment. The bigger question concerns the dynamic or long-run effects, which is where most of the debate has centered. When it comes to the short term, economists are inclined to see the impact showing up in increased output. In the long term, some are more inclined to see the impact showing up through attracting private capital and helping boost productivity. The notion that “timing is everything” can also be said to apply. Investing during periods of slack demand are more likely to produce a net positive return.

Conducting their own literature review for the European Investment Bank (EIB), economists Ward Romp and Jakob de Haan draw three firm conclusions on the impact of public infrastructure investment. First, while not all studies have found a growth-enhancing effect to public capital investment, each addition to the research is strengthening the consensus that it does have a net positive economic impact. Second, all of the later studies show a growth-enhancing effect that is smaller than the earlier studies that also concluded with a positive correlation between infrastructure and economic growth. Third, the effect is very heterogeneous—it can differ widely depending on a multitude of conditions and circumstances (Romp and de Haan 2005).

BIBLIOGRAPHY

- Aaron, Henry. 1990. Discussion on David Aschauer's Why is Infrastructure Important? Is There a Shortfall in Public Capital Investment? Alicia Munnell (ed.). Conference Series No. 34. Proceedings of a conference held at Harwich Port, MA. Federal Reserve Bank of Boston.
- Abdih, Yasser and Joutz, Frederick L. 2008. The Impact of Public Capital, Human Capital, and Knowledge on Aggregate Output. IMF Working Paper No. 08-218. International Monetary Fund.
- Agenor, Pierre-Richard and Neanidis, Kyriakos. 2011. The Allocation of Public Expenditure and Economic Growth. Manchester School Vol. 79, No. 4.
- Ai, Chunrong and Cassou, Steven. 1995. A Normative Analysis of Public Capital. Applied Economics Vol. 27, No. 12.
- American Society of Civil Engineers. 2009. Guiding Principles for the Nation's Critical Infrastructure.
- Andrews, Kimberly and Swanson, James. 2006. Does Public Infrastructure Affect Regional Performance? Growth and Change Vol. 26, No. 2.
- Antunes, Pedro; Beckman, Kip; and Johnson, Jacqueline. 2010. The Economic Impact of Public Infrastructure in Ontario. Conference Board of Canada.
- Apparicio, Philippe; Dussalt, Gaetan; Polese, Mario; and Shearmur, Richard. 2007. Transport Infrastructure and Local Economic Development: A Study of the Relationship Between Continental Accessibility and Employment Growth in Canadian Communities. Institut national de la recherche scientifique, urbanisation, culture et societe.
- Arslanaldp, Serkan; Bornhorst, Fabian; Gupta, Sanjeev; and Sze, Elsa. 2010. Public Capital and Growth. IMF Working Paper No. 10-175.
- Aschauer, David. 1987. Is the Public Capital Stock Too Low? Essays on Issues No. 2. Federal Reserve Bank of Chicago.
- Aschauer, David. 1988. Rx for Productivity: Build Infrastructure. Essays on Issues No. 13. Federal Reserve Bank of Chicago.
- Aschauer, David. 1989. Is Public Expenditure Productive? Journal of Monetary Economics Vol. 23, No. 2.
- Aschauer, David. 1989. Does Public Capital Crowd Out Private Capital? Journal of Monetary Economics Vol. 24, No. 2.
- Aschauer, David. 1989. Public Investment and Productivity Growth in the Group of Seven. Federal Reserve Bank of Chicago.
- Aschauer, David. 1990. Why is Infrastructure Important? Is There a Shortfall in Public Capital Investment? Is There a Shortfall in Public Capital Investment? Alicia Munnell (ed.). Conference Series No. 34. Proceedings of a conference held at Harwich Port, MA. Federal Reserve Bank of Boston.
- Aschauer, David. 1990. Highway Capacity and Economic Growth. Economic Perspectives September-October 1990. Federal Reserve Bank of Chicago.
- Aschauer, David. 1993. Public Capital and Economic Growth. Public Infrastructure Investment: A Bridge to Productivity Growth? Public Policy Brief No. 4. Jerome Levy Economics Institute of Bard College.
- Aschauer, David. 1995. Fiscal Policy and Aggregate Demand. The American Economic Review Vol. 75, No. 1.
- Aschauer, David. 1997. Output and Employment Effects of Public Capital. Working Paper No. 190. Jerome Levy Economics Institute of Bard College.
- Aschauer, David. 1997. Dynamic Output and Employment Effects of Public Capital. Working Paper No. 191. Jerome Levy Economics Institute of Bard College.
- Aschauer, David. 1998. How Big Should the Public Capital Stock Be? in The Relationship Between Public Capital and Economic Growth. Public Policy Brief No. 43. Jerome Levy Economics Institute of Bard College.
- Aschauer, David. 2000. Do States Optimize? Public Capital and Economic Growth Annals of Regional Science Vol. 34, No. 3.
- Aschauer, David. 2000. Public Capital and Economic Growth: Issues of Quantity, Finance, and Efficiency. Economic Development and Cultural Change Vol. 48, No. 2.
- Aschauer, David. 2001. Output and Employment Effects of Public Capital. Public Finance and Management Vol. 1, No. 2.
- Attaray, E. 1988. Transportation and Economic Prosperity. Economic and Financial Analysis Branch of the California Department of Transportation.
- Auerback, Alan. 2009. Implementing the New Fiscal Policy Activism. American Economic Review Vol. 99, No. 2.
- Azzimonti, Marina. 2009. Barriers to Investment in Polarized Societies. American Economic Review Vol. 101, No. 5.

- Bagala, Biswal; Satya, Paul; and Singh, Balbir. 2004. Public Infrastructure and the Productive Performance of Canadian Manufacturing Industries. Southern Economic Association. Chapel Hill, N.C.
- Bain and Company Inc. 2009. The Great Eight: Trillion Dollar Growth Trends to 2020.
- Baker McNeill, Jena. 2008. Building Infrastructure Resiliency: Private Sector Investment in Homeland Security. Heritage Foundation.
- Baldwin, John and Dixon, Jay. 2008. Infrastructure Capital: What is it? Where is it? How Much of it is There? Statistics Canada. Catalogue No. 15-206-X, No. 016.
- Baltagi, Badi and Pinnoi, Nat. 1995. Public Capital Stock and State Productivity Growth: Further Evidence. *Empirical Economics* Vol. 20, No. 2.
- Banister, David and Berechman, Yossi. 2000. The Economic Development Effects of Transport Investments. A paper prepared for presentation at the TRANS-TALK Workshop held November 6-8, 2000 in Brussels, Belgium.
- Barro, Robert. 1991. Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy* Vol. 98, No. 5.
- Batina, Raymond. 1998. On the Long Run Effects of Public Capital and Disaggregated Public Capital on Aggregate Output. *International Tax and Public Finance* Vol. 5, No. 3.
- Batina, Raymond. 1999. On the Long Run Effect of Public Capital on Aggregate Output: Estimation and Sensitivity Analysis. *Empirical Economics* Vol. 24, Issue 4.
- Batina, Raymond. 2001. The Effects of Public Capital. *Public Finance and Management* Vol. 1, No. 2.
- Bivens, Josh. 2010. An Assessment of the American Recovery and Reinvestment Act. A presentation to the House Budget Committee on July 14, 2010, Washington, DC. Economic Policy Institute.
- Bivens, Josh. 2012. Public Investment: The Next New Thing for Powering Economic Growth. EPI Briefing Paper No. 338. Economic Policy Institute.
- Bivens, Josh; Irons, John; and Pollack, Ethan. 2009. Transportation Investments and the Labour Market: How Many Jobs Could Be Generated and What Type? Economic Policy Institute Briefing Paper No. 252. Economic Policy Institute.
- Bottasso, Anna; Castagnetti, Carolina; and Conti, Maurizio. 2011. And Yet They Co-Move! Public Capital and Productivity in the OECD: A Panel Cointegration Analysis With Cross-section Dependence. Paper No. 154. Dipartimento di economia politica e metodi quantitativi. Università degli studi di Pavia, Italy.
- Bougheas, Spiros; Demetriades, Panicos; and Mamuneas, Theofanis. 2000. Infrastructure, Specialization, and Economic Growth. *Canadian Journal of Economics* Vol. 33, No. 2. Canadian Economics Association.
- Brox, James. 2008. Infrastructure Investment: The Foundation of Canadian Competitiveness. *Policy Matters* Vol. 9, No. 2. Institute for Research on Public Policy (IRPP).
- Brox, James A. and Fader, Christina. 2005. Infrastructure Investment and Canadian Manufacturing Productivity. *Applied Economics* Vol. 37, Issue 11.
- Brox, James and Leonard, Jeremy. 2009. Shoring up the Competitive Posture of Canadian Manufacturers: What are the Policy Levers? *Choices* Vol. 15, No. 4. Institute for Research on Public Policy (IRPP).
- Calderon, Cesar and Serven, Luis. 2004. The Effects of Infrastructure Development on Growth and Income Distribution. Working Paper No. 3400. The World Bank.
- Calderon, Cesar; Moral-Benito, Enrique; and Serven, Luis. 2011. Is Infrastructure Capital Productive? A Dynamic Heterogeneous Approach. World Bank.
- Canning, David. 1999. A Database of World Infrastructure Stocks, 1950-1995. World Bank.
- Canning, David and Bennathan, Esra. 2000. The Social Rate of Return on Infrastructure Investments. World Bank Policy Research Working Paper No. 2390. World Bank.
- Canning, David and Pedroni, Peter. 2004. The Effects of Infrastructure on Long-Run Economic Growth. Department of Economics Working Paper 2004-04. Williams College.
- Canning, David and Pedroni, Peter. 2008. Infrastructure, Long-Run Economic Growth, and Causality Tests for Cointegrated Panels. *Manchester School* Vol. 76, No. 5.
- Chu, Wen-wen. 2011. Market Socialism, Chinese Style: Bringing Development Back into Economic Theory. *China Economic Journal* Vol. 3, No. 3.
- City of Ottawa. 2009. An Analysis of Social Infrastructure and City Competitiveness: Synthesis and Key Findings.
- Clarida, Richard. 1993. International Capital Mobility, Public Investment and Economic Growth. NBER Working Paper 4506. National Bureau of Economic Research.
- Coad, Len; Crawford, Todd; and MacDonald, Alicia. 2010. Shedding Light on the Economic Impact of Investing in Electricity Infrastructure. Conference Board of Canada.
- Cohen, Jeffrey and Morrison-Paul, Catherine. 2004. Public Infrastructure Investment, Interstate Spatial Spillovers, and Manufacturing Costs. *The Review of Economics and Statistics* Vol. 86, No. 2.
- Conference Board of Canada. 2012a. Investment and Productivity.
- Conference Board of Canada. 2012b. Labour Productivity Growth.
- Congressional Budget Office. 1991. How Federal Spending for Infrastructure and other Public Investments Affects the Economy. Congressional Budget Office.
- Cooper, David. 2012. Assessing the Economic Benefits of Increased Investment in Los Angeles's Public Transit Infrastructure. EPI Issue Brief No. 334. Economic Policy Institute.
- Costa, Jose da Silva; Ellson, Richard; and Martin, Randolph. 1987. Public Capital, Regional Output, and Development: Some Empirical Evidence. *Journal of Regional Science* Vol. 27, No. 3.
- Cox, Wendell. 2009. A Canadian Autobahn: Creating a World-class Highway System for the Nation. Policy Series. No. 76. Frontier Centre for Public Policy.

- Coyne, Andrew. 2011. "Stuck in Traffic." *Maclean's* January 17.
- Crampton, Graham. 2003. Economic Development Impacts of Urban Rail Transport. Economics Department at Reading University, Reading United Kingdom.
- Crowder, William and Himarios, Daniel. 1997. Balanced Growth and Public Capital: An Empirical Analysis. *Applied Economics* Vol. 29, No. 8.
- Cullison, William. 1993. Public Investment and Economic Growth. *Economic Quarterly* Vol. 79, No. 4. Federal Reserve Bank of Richmond.
- D'Aquino, Thomas. 2008. Seizing the Opportunities of Globalization. Policy Options. (June 2008 Issue.) Institute for Research on Public Policy (IRPP).
- Demetriades, Panicos and Mamuneas, Theofanis. 2000. Intertemporal Output and Employment Effects of Public Infrastructure Capital: Evidence from 12 OECD Economies. *The Economic Journal* Vol. 110, Issue 465.
- Deno, Kevin. 1988. The Effect of Public Capital on US Manufacturing Activity: 1970-1978. *Southern Economic Journal* Vol. 55, No. 2.
- Deno, Kevin and Eberts, Randall. 1991. Public Infrastructure and Regional Economic Development: A Simultaneous Equations Approach. *Journal of Urban Economics* Vol. 30, No. 3.
- Deshpande, Manansi and Elmendorf, Douglas. 2008. An Economic Strategy for Investing in America's Infrastructure. Brookings Institution.
- Development Research Group. 2010. Infrastructure and Growth. World Bank.
- Dissou, Yazid and Didic, Selma. 2011. Public Infrastructure and Economic Growth: A Dynamic General Equilibrium Analysis with Heterogeneous Agents. (Preliminary Paper.) Department of Economics. University of Ottawa.
- Duggal, G.; Saltzman, C.; and Klein, L.R. 1999. Infrastructure and Productivity: A Nonlinear Approach. *Journal of Econometrics* Vol. 92, No. 1.
- Eberts, Randall. 1986. Estimating the Contribution of Urban Public Infrastructure to Regional Growth. Working Paper 8610. Federal Reserve Bank of Cleveland.
- Eberts, Randall. 1990. Cross-Sectional Analysis of Public Infrastructure and Regional Productivity Growth. Working Paper 9004. Federal Reserve Bank of Cleveland.
- Eberts, Randall and Fogerty, Michael. 1987. Estimating the Relationship Between Local, Public, and Private Investment. Working paper 8703. Federal Reserve Bank of Cleveland.
- Egert, Balazs; Kozluk, Tomasz; and Sutherland, Douglas. 2009. Infrastructure and Growth: Empirical Evidence. OECD Economics Department Working Paper No. 957. Organisation for Economic Cooperation and Development (OECD).
- Eisner, Robert. 1991. Infrastructure and Regional Economic Performance. *New England Economic Review*. Federal Reserve Bank of Boston. September-October 1991 Issue.
- Eisner, Robert. 1994. Real Government Saving and the Future. *Journal of Economic Behavior and Organization* Vol. 23 No. 2.
- Erenburg, Sharon. 1992. The Relationship Between Public and Private Investment. Economics Working Paper Archive (WP-85). Jerome Levy Economics Institute of Bard College.
- Esfahani, Hadi Salehi and Ramirez, Teresa Maria. 1999. Infrastructure and Economic Growth. *Borradores de Economia*. No. 123. Banco de la Republica de Colombia.
- Esfahani, Hadi Salehi and Ramirez, Maria Teresa. 2003. Institutions, Infrastructure, and Economic Growth. *Journal of Development Economics* Vol. 70, No. 2.
- Esteban, Joan and Ray, Debraj. 2006. Inequality, Lobbying, and Resource Allocation. *American Economic Review* Vol. 96, No. 1.
- Evans, Paul and Karras, Georgios. 1993. Is Government Capital Productive? Evidence From a Panel of Seven Countries. *Journal of Macroeconomics* Vol. 16, No. 2.
- Evans, Paul and Karras, Georgios. 1994. Are Government Activities Productive? Evidence From a Panel of U.S. States. *The Review of Economics and Statistics* Vol. 76, No. 1.
- Felice, Giulia. 2010. A Two-Sector Model of Public Investment and Growth. Kiel Institute for the World Economy.
- Fernald, John. 1999. Roads to Prosperity? Assessing the Link Between Public Capital and Productivity. *American Economic Review* Vol. 89, No. 3.
- Finlayson, Jock. 2011. Transportation Infrastructure for a Globally Connected BC Economy. Business Council of British Columbia.
- Finn, Mary. 1993. Is all Government Capital Productive? *Economic Quarterly* Vol. 79, No. 4. Federal Reserve Bank of Richmond.
- Ford, Robert and Poret, Pierre. 1991. Infrastructure and Private Sector Productivity. *Economic Studies* No. 17. Organisation for Economic Cooperation and Development (OECD).
- Fox, William and Smith, Tim. 1990. Public Infrastructure Policy and Economic Development. *Economic Review* March-April 1990. Federal Reserve Bank of Kansas City.
- Garcia-Milà, Teresa and McGuire, Therese. 1992. The Contribution of Publicly Provided Inputs to States' Economies. *Regional Science and Urban Economics* Vol. 22, No. 2.
- Garcia-Milà, Teresa; McGuire, Therese; and Porter, Robert. 1996. The Effect of Public Capital in State-Level Production Functions Reconsidered. *The Review of Economics and Statistics* Vol. 78, No. 1.
- Gillen, David. 2000. Public Capital, Productivity and the Linkages to the Economy: Transportation Infrastructure. Department of Economics, School of Business and Economics, Sir Wilfrid Laurier University.
- Gordon, Emily; Hays, Jeremy; Pollack, Ethan; Sanchez, Daniel; and Walsh, Jason. 2011. Water Works: Rebuilding Infrastructure, Creating Jobs, Greening the Environment. Economic Policy Institute.
- Greenstein, Robert and Kogan, Richard. 2011. Balanced Budget Amendment Highly Ill-Advised for Addressing Long-Term Fiscal Problems. Center on Budget and Policy Priorities.

- Greenstone, Michael and Looney, Adam. 2011. Investing in the Future: An Economic Strategy for State and Local Governments in a Period of Tight Budgets. Brookings Institution.
- Gu, Wulong and MacDonald, Ryan. 2009. The Impact of Public Infrastructure on Canadian Multifactor Productivity Estimates. Statistics Canada Catalogue No. 15-206-X, No. 021.
- Harchaoui, Tarek and Tarkhani, Faouzi. 2003. Public Capital and its Contribution to the Productivity Performance of the Canadian Business Sector. Statistics Canada Catalogue No. 11F0027MIE, No. 017.
- Harchaoui, Tarek; Tarkhani, Faouzi; and Warren, Paul. 2003. Public Infrastructure in Canada. Where do we Stand? Statistics Canada Catalogue No. 11-624-MIE, No. 005.
- Harchaoui, Tarek; Tarkhani, Faouzi; and Warren, Paul. 2004. Public Infrastructure in Canada, 1961-2002. Canadian Public Policy Vol. 30, No. 3.
- Haughwout, Andrew. 2000. Public Infrastructure Investments, Productivity, and Welfare in Fixed Geographic Areas. Staff Report No. 104. Federal Reserve Bank of New York.
- Haughwout, Andrew. 2000. The Paradox of Infrastructure Investment: Can a Productive Good Reduce Productivity? Brookings Institution.
- Henckel, Timo and McKibbin, Warwick. 2010. The Economics of Infrastructure in a Globalized World. Brookings Institution.
- Hillestad, Richard; Van Roo, Ben; and Yoho, Keenan. 2009. Fast-Forward: Key Issues in Modernizing the US Freight-Transportation System for Future Economic Growth. RAND Corporation.
- Hockett, Robert and Frank, Robert. 2012. Public Infrastructure Investment, Renewed Economic Growth and the US Fiscal Position. Cornell Legal Studies Research Paper No. 2-04. Cornell Law School.
- Holtz-Eakin, Douglas. 1988. Private Output, Government Capital, and the Infrastructure Crisis. Discussion Paper No. 394. Department of Economics, Columbia University.
- Holtz-Eakin, Douglas. 1993. New Federal Spending for Infrastructure: Should We Let This Genie Out of the Bottle? In Public Infrastructure Investment: A Bridge to Productivity Growth? Public Policy Brief No. 4. Jerome Levy Economics Institute of Bard College.
- Holtz-Eakin, Douglas. 1994. Public Sector Capital and the Productivity Puzzle. The Review of Economics and Statistics Vol. 76, No. 1. Massachusetts Institute of Technology Press.
- Holtz-Eakin, Douglas and Lovely, Mary. 1995. Scale Economies, Returns to Variety, and the Productivity of Public Infrastructure. Working Paper No. 5295. The National Bureau of Economic Research.
- Holtz-Eakin, Douglas and Schwartz, Amy Ellen. 1995. Spatial Productivity Spillovers From Public Infrastructure: Evidence From State Highways. Working Paper No. 5004. National Bureau of Economic Research.
- Holtz-Eakin, Douglas and Wachs, Martin. 2011. Strengthening Connections Between Transportation Investment and Economic Growth. RAND Corporation.
- Hulten, Charles. 1996. Infrastructure Capital and Economic Growth: How Well You Use It May Be More Important Than How Much You Have. National Bureau of Economic Research (NBER) Working Paper No. 5847.
- Hulten, Charles and Schwab, Robert. 1991. Is There Too Little Capital? Infrastructure and Economic Growth. American Enterprise Institute.
- Hulten, Charles and Schwab, Robert. 1992. Infrastructure Spending: Where do we go From Here? National Tax Journal Vol. 46, No. 3.
- Isaksson, Anders. 2009. Public Capital, Infrastructure, and Industrial Development. Research and Statistics Branch. United Nations Industrial Development Organization (UNIDO).
- Jones, Christopher. 2006. The Trading Dragon: Boosting Canada's Transportation Infrastructure to Accommodate the New China Syndrome. Policy Options December 2005-January 2006.
- Kamps, Christophe. 2004. New Estimates of Government Net Capital Stocks for 22 OECD Countries, 1960-2001. IMF Working Paper No. 04/67. Fiscal Affairs Department, International Monetary Fund.
- Kamps, Christophe. 2005. Is There a Lack of Public Capital in the European Union? European Investment Bank Papers Vol. 10, No. 1.
- Kamps, Christophe. 2005. The Dynamic Effects of Public Capital: VAR Evidence for 22 OECD Countries. International Tax and Public Finance Vol. 12, No. 4.
- Kelejian, Harry and Robinson, Dennis. 1997. Infrastructure Productivity Estimation and its Underlying Econometric Specifications: A Sensitivity Analysis. Papers in Regional Science Vol. 76, Issue 1.
- Khanam, Bilkis. 1996. Highway Infrastructure Capital and Productivity Growth: Evidence from the Canadian Goods Producing Sector. Logistics and Transportation Review Vol. 32, No. 3.
- Kruger, Niklas. 2012. Does Infrastructure Really Cause Growth? The Time Scale Dependent Causality Nexus Between Infrastructure Investments and GDP. Working Paper 2012-15. Centre for Transport Studies.
- Lammam, Charles. 2010. The Benefits of Congestion Pricing. Fraser Forum. February 2010. The Fraser Institute.
- Lapointe, Alain. 2004. Competitiveness and Attractiveness of Canadian Cities: A New Deal Background Paper. École des Hautes Études commerciales de Montréal (HEC Montreal), Université de Montréal.
- Lau, Sau-Him Paul and Sin, Chor-Yiu. 1997. Public Infrastructure and Economic Growth: Time-Series Properties and Evidence. Economic Record Vol. 73, Issue 221.
- Lawson, Sandra and Dragusanu, Raluca. 2008. Building the World: Mapping Infrastructure Demand. Global Economics Paper No.166. Goldman Sachs.
- Leduc, Sylvain and Wilson, Daniel. 2012. Roads to Prosperity or Bridges to Nowhere: Theory and Evidence on the Impact of Public Infrastructure Investment. NBER Working Paper 18042. National Bureau of Economic Research.
- Lefebvre, Mario and Brender, Natalie. 2006. Canada's Hub Cities: A Driving Force of the National Economy. Conference Board of Canada.
- Levy, Jay and Cadette, Walter. 1998. Overcoming America's Infrastructure Deficit. Public Policy Brief Highlights Series. Bard College Publications Office.

- Liu, Yang and Qin, Fengming. 2009. The Scale of Infrastructure and Economic Growth: A Perspective from Demand Side. *China Economist* September-October 2009.
- Lucas, Robert. 1976. *Econometric Policy Evaluation: A Critique*. Carnegie-Rochester Conference Series on Public Policy Vol. 1, No. 1.
- Lynde, Catherine. 1992. Private Profit and Public Capital. *Journal of Macroeconomics* Vol. 14, Issue 1.
- Lynde, Catherine and Richmond, James. 1991. The Role of Public Capital in Production. *The Review of Economics and Statistics* Vol. 74, No. 1.
- Lynde, Catherine and Richmond, James. 1993. Public Capital and Total Factor Productivity. *International Economic Review* Vol. 34, No. 2.
- MacDonald, Ryan. 2008. An Examination of Public Capital's Role in Production. *Statistics Canada Catalogue No. 11F0027M*, No. 050.
- Mattoon, Richard. 2004. *Infrastructure and State Economic Development: A Survey of the Issues*. A paper prepared for a conference held June 7-8, 2004 in Ottawa, ON entitled Prepared for Emerging Challenges: New Insights on the Economy and Society. Conference sponsored by Statistics Canada. Statistics Canada.
- McMillan, Charles. 2011. *Innovation in Canada's Trade Gateways and Corridors*. Policy Options September 2011. Institute for Research on Public Policy (IRPP).
- McMillin, Douglas and Smyth, David. 1994. A Multivariate Time Series Analysis of the United States Aggregate Production Function. *Empirical Economics* Vol. 19, No. 4.
- Merriman, David. 1990. Public Capital and Regional Output: Another Look at Some Japanese and American Data. *Regional Science and Urban Economics* Vol. 20, No. 4.
- Milbourne, Ross; Otto, Glenn; and Voss, Graham. 2003. Public Investment and Economic Growth. *Applied Economics* Vol. 35, Issue 5.
- Milke, Mark. 2009. A High-Speed Train Collision with Fiscal Sense. Notes From the Frontier Centre for Public Policy. (July 2009.)
- Mitra, Pritha. 2006. Has Government Investment Crowded Out Private Investment in India? *American Economic Review* Vol. 96, No. 2.
- Mittnik, Stefan and Neumann, Thorsten. 2001. Dynamic Effects of Public Investment. *Vector Autoregressive Evidence from Six Industrialized Countries*. *Empirical Economics* Vol. 26, No. 2.
- Moomaw, Ronald and Williams, Martin. 1991. Total Factor Productivity Growth in Manufacturing: Further Evidence From the States. *Journal of Regional Science* Vol. 31, No. 1.
- Moomaw, Ronald and Williams, Martin. 1995. The Interregional Impact of Infrastructure Capital. *Southern Economic Journal* Vol. 61, No. 3.
- Montgomery, David. 1989. *Public Infrastructure Investment: Lessons from the Past, Opportunities for the Future*. Congressional Budget Office (CBO).
- Moreno, Rosina; Artis, Manuel; Lopez-Bazo, Enrique; and Surinach, Jordi. 1997. Evidence of the Complex Link Between Infrastructure and Regional Growth. Department of Econometrics. University of Barcelona. Barcelona, Spain.
- Morrison, Catherine and Schwartz, Amy. 1996. State Infrastructure and Productive Performance. *American Economic Review* Vol. 86, No. 5.
- Morrison, Catherine and Schwartz, Amy. 1996. Public Infrastructure, Private Input Demand, and Economic Performance in New England Manufacturing. *Journal of Business and Economic Statistics* Vol. 14, No. 1.
- Munnell, Alicia. 1990. Is There a Shortfall in Public Capital Investment? An Overview. In *Is There a Shortfall in Public Capital Investment?*
- Munnell, Alicia (ed.). Conference Series No. 34. Proceedings of a conference held at Harwich Port, MA. Federal Reserve Bank of Boston.
- Munnell, Alicia. 1990. Why has Productivity Growth Declined? Productivity and Public Investment. *New England Economic Review*. (January-February 1990). Federal Reserve Bank of Boston.
- Munnell, Alicia. 1992. Policy Watch: Infrastructure Investment and Economic Growth. *Journal of Economic Perspectives* Vol. 6, No. 4.
- Munnell, Alicia and Cook, Leah. 1990. How Does Public Infrastructure Affect Regional Economic Performance? *New England Economic Review*. (September-October 1990). Federal Reserve Bank of Boston.
- Nadiri, Ishaq and Mamuneas, Theofanis. 1994. The Effects of Public Infrastructure and R&D on the Cost Structure and Performance of US Manufacturing Industries. *The Review of Economics and Statistics* Vol. 76, No. 1.
- Nannan, Yu and Jianing, Mi. 2012. *Public Infrastructure Investment, Economic Growth and Policy Choice: Evidence from China*. School of Management, Harbin Institute of Technology. Harbin, China.
- Neusser, Klaus. 1993. Public Capital Stock and Private Sector Productivity in the Long Run. In *Economic Growth in the World Economy*. Siebert H. (Ed.). JCB Mohr.
- Nourzad, Farrokh and Vrieze, Martin. 1995. Public Capital Formation and Productivity Growth: Some International Evidence. *Journal of Productivity Analysis* Vol. 6, No. 4.
- O'Fallen, Carolyn. 2003. *Linkages Between Infrastructure and Economic Growth*. Ministry of Economic Development, Government of New Zealand.
- Organisation for Economic Cooperation and Development (OECD). 2002. *Impact of Transport Infrastructure Investment on Regional Development*. OECD.
- Organisation for Economic Cooperation and Development. 2006. *Infrastructure to 2030: Telecom, Land, Transport, Water, and Electricity*. OECD.
- Organisation for Economic Cooperation and Development. 2008. *Infrastructure to 2030: A Policy Brief*. OECD.
- Otto, Glenn and Voss, Graham. 1994. Public Capital and Private Sector Productivity. *Economic Record* Vol. 70, No. 209.
- Otto, Glenn and Voss, Graham. 1996. Public Capital and Private Production in Australia. *Southern Economic Journal* Vol. 62, No. 3.
- Otto, Glenn and Voss, Graham. 2002. Public and Private Investment in the United States and Canada. *Economic Modelling* Vol. 19, No. 4.

- Pereira, Alfredo. 2000. Is All Public Capital Created Equal? The Review of Economics and Statistics Vol. 82, No. 3. Massachusetts Institute of Technology Press.
- Pereira, Alfredo. 2001. International Evidence on Public Investment and Private Sector Performance. Public Finance and Management Vol. 1, No. 2.
- Pereira, Alfredo. 2001. On the Effects of Public Investment on Private Investment: What Crowds in What? Public Finance Review Vol. 29, No. 1.
- Pereira, Alfredo and Andraz Jorge. 2001. On the Impact of Public Investment on the Performance of U.S. Industries. Public Finance Review Vol. 31, No. 1.
- Pereira, Alfredo and Andraz, Jorge. 2010. On the Economic and Fiscal Effects of Investments in Road Infrastructures in Portugal. Department of Economics Working Paper No. 33. College of William and Mary.
- Pereira, Alfredo and Andraz, Jorge. 2010. On the Economic Effects of Public Infrastructure Investment: A Survey of the International Evidence. Department of Economics Working Paper No. 108. College of William and Mary.
- Pereira, Alfredo and Andraz, Jorge. 2012. On the Economic Effects of Public Infrastructure Investment: A Survey of the International Evidence. Working Paper 108. Department of Economics. College of William and Mary.
- Pereira, Alfredo and de Frutos, Rafael. 1999. Public Capital Accumulation and Private Sector Performance. Journal of Urban Economics Vol. 46, No. 2.
- Peterson, George. 1990. Is Public Infrastructure Undersupplied? In Is There a Shortfall in Public Capital Investment? Munnell, Alicia (ed.). Conference Series No. 34. Proceedings of a conference held at Harwich Port, MA. Federal Reserve Bank of Boston.
- Pina, Álvaro and St. Aubyn, Miguel. 2005. How Should We Measure the Return on Public Investment in a VAR? Economics Bulletin Vol. 8, No. 5.
- Pinnoi, Nat. 1994. Public Infrastructure and Private Production Measuring Relative Contributions. Journal of Economic Behavior and Organization Vol. 23, Issue 2.
- Pollack, Ethan. 2009. Street Smart: Reforming the Transportation Budget Process. Economic Policy Institute Briefing Paper No. 254. Economic Policy Institute.
- Pollack, Ethan and Theiss, Rebecca. 2010. Impact of Alternate Public Transit and Rail Investment Scenarios on the Labour Market. Issue Brief No. 285. Economic Policy Institute.
- Prud'Homme, Remy. 2004. Infrastructure and Development. (A paper prepared for the Annual Bank Conference on Development Economics, held May 3-5, 2004 in Washington, DC.) World Bank.
- Puig-Junoy, Jaume. 2001. Technical Inefficiency and Public Capital in US States. A Stochastic Frontier Approach. Journal of Regional Science.
- Rakhra, Amrik. 1991. Reinvesting in Infrastructure: Review with Annotated Bibliography. US Department of Transportation (Capital and Construction Projects Directorate, Surface Transportation and Machinery Branch).
- Ram, Rati and Ramsey, David. 1989. Government Capital and Private Output in the United States: Additional Evidence. Economics Letters Vol. 30, No. 3.
- Ratner, Jonathan. 1983. Government Capital and the Production Function for US Private Output. Economics Letters Vol. 13, No. 2.
- Research and Library Service. 2010. The Role of Infrastructure Investment in Stimulating Economic Growth During a Recession, with Examples from Australia and USA. Northern Ireland Assembly.
- Riedl, Brian. 2008. Why Government Spending Does Not Stimulate Economic Growth. Heritage Foundation.
- Rioja, Felix. 2003. The Penalties of Inefficient Infrastructure. Review of Development Economics Vol. 7, No. 1.
- Rives, Janet and Heaney, Michael. 1995. Economic Development Infrastructure and the Links Between Them. Journal of Regional Analysis and Policy Vol. 25, No. 1.
- Rodriguez, Francisco. 2007. Have Collapses in Infrastructure Spending Led to Cross-Country Divergence in Per Capita GDP? DESA Working Paper No. 52. Department of Economic and Social Affairs, United Nations.
- Romer, Paul. Endogenous Technological Change. Journal of Political Economy Vol. 98, No. 5.
- Romp, Ward and De Haan, Jakob. 2005. Public Capital and Economic Growth: A Critical Survey. EIB Papers Vol. 10, No. 1. European Investment Bank.
- Roy, Francine. 2008. From Roads to Rinks: Government Spending on Infrastructure in Canada. Statistics Canada. (Catalogue No. 11-624, No. 019).
- Rudd, Jeremy. 2000. Assessing the Productivity of Public Capital with a Locational Equilibrium Model. Federal Reserve Board.
- Sanchez-Robles, Blanca. 1998. Infrastructure Investment and Growth: Some Empirical Evidence. Contemporary Economic Policy Vol. 16, Issue 1.
- Satya, Paul; Balbi, Sahni; and Bagala, Biswal. 2004. Public Infrastructure and the Productive Performance of Canadian Manufacturing Industries. Southern Economic Journal Vol. 70, No. 4.
- Schulman, Joseph and Chaundy, David. 2005. Building an Efficient Transportation System: Atlantic Priorities for Transportation Policy Reform in Canada. Atlantic Provinces Economic Council.
- Schultze, Charles. 1990. The Federal Budget and the Nation's Economic Health. In Setting National Priorities: Policy for the Nineties. Aaron, Henry (ed.). Brookings Institution.
- Schwab, Klaus. 2011. The Global Competitiveness Report, 2011-2012. World Economic Forum.
- Shatz, Howard; Kitchens, Karin; Rosenbloom, Sandra; and Wachs, Martin. 2011. Highway Infrastructure and the Economy: Implications for Federal Policy. RAND Corporation.
- Shenfield, Avery and Tal, Benjamin. 2011. Energizing Infrastructure. CIBC in Focus. (September 2011 Issue). Canadian Imperial Bank of Commerce (CIBC).
- Shenfield, Avery 2012. "Canada's Plan B." Economic Insights. CIBC World Markets. News Release.

- Shioji, Etsuro. 2001. Public Capital and Economic Growth: A Convergence Approach. *Journal of Economic Growth* Vol. 6, No. 3.
- Spoehr, John; Burgan, Barry; and Molloy, Simon. 2012. Public Investment, Productivity and Economic Growth: The Role and Contribution of Debt Funding. Australian Institute for Social Research. University of Adelaide.
- Stephan, Andreas. 1997. The Impact of Road Infrastructure on Productivity and Growth: Some Preliminary Results for the German Manufacturing Sector. Discussion Paper No. FS-IV-97-47. (Wissenschaftszentrum Berlin für Sozialforschung.)
- Stiff, David and Smetanin, Paul. 2012. Public Infrastructure Underinvestment: The Risk to Canada's Economic Growth. *Risk Analytica*.
- Straub, Stephane. 2008. Infrastructure and Development: A Critical Appraisal of the Macro Level Literature. World Bank.
- Sturm, Jan and de Haan, Jakob. 1995. Is Public Expenditure Really Productive? New Evidence for the USA and the Netherlands. *Economic Modelling* Vol. 12, No. 1.
- Tatom, John. 1991. Public Capital and Private Sector Performance. Article published by Federal Reserve Bank of St. Louis.
- Tatom, John. 1993. Is an Infrastructure Crisis Lowering the Nation's Productivity? Article published by Federal Reserve Bank of St. Louis.
- Tatom, John. 1993. Paved With Good Intentions: The Mythical National Infrastructure Crisis. *Policy Analysis*. No. 196. Cato Institute.
- Toigo, Pietro and Woods, Robert. 2006. Public Investment in the United Kingdom. *OECD Journal on Budgeting* Vol. 6, No. 4.
- Tomer, Adie; Kneebone, Elizabeth; Puentes, Robert; and Berube, Alan. 2011. Missed Opportunity: Transit and Jobs in Metropolitan America. Brookings Institution.
- United Nations. 2001. UNCTAD Infrastructure Report. United Nations Conference on Trade and Development (UNCTAD).
- US Department of Treasury. 2010. An Economic Analysis of Infrastructure Investment. US Department of Treasury.
- US Department of Treasury. 2012. A New Economic Analysis of Infrastructure Investment. US Department of Treasury.
- Utt, Ronald. 2008. More Transportation Spending: False Promises of Prosperity and Job Creation. Heritage Foundation.
- Veldhuis, Niels and Lammam, Charles. 2010. The Stimulus Didn't Work. *Fraser Forum*. May 2010. The Fraser Institute.
- Veldhuis, Niels and Palacios, Milagros. 2009. Stop the Stimulus Spending. *Fraser Forum*. October 2009. The Fraser Institute.
- Veldhuis, Niels; Lammam, Charles; and Palacios, Milagros. 2009. An Irresponsible Budget. *Fraser Forum*. March 2009. The Fraser Institute.
- Veldhuis, Niels; Lammam, Charles; and Palacios, Milagros. 2010. An Age of Austerity? *Fraser Forum*. April 2010. The Fraser Institute.
- Vijverberg, Wim; Vijverberg, Chu-Ping; and Gamble, Janet. 1997. Public Capital and Private Productivity. *The Review of Economics and Statistics* Vol. 79, No. 2.
- Wachs, Martin. 2011. Transportation, Jobs, and Economic Growth. RAND Corporation.
- Wang, Baotai. 2005. Effects of Government Expenditure on Private Investment: Canadian Empirical Evidence. *Empirical Economics* Vol. 30, No. 2.
- Weisbrod, Glen and Reno, Arlee. 2009. Economic Impact of Public Transportation Investment. The American Public Transportation Association (APTA).
- Winston, Clifford. 1990. How Efficient is Current Infrastructure Spending and Pricing? Is There a Shortfall in Public Capital Investment?
- Munnell, Alicia (ed.). Conference Series No. 34. Proceedings of a conference held at Harwich Port, MA. Federal Reserve Bank of Boston.
- World Bank Group. 2008. Sustainable Infrastructure Action Plan.
- World Economic Forum. 2010. Positive Infrastructure: A Framework for Revitalizing the Global Economy.
- Wylie, Peter. 1996. Infrastructure and Canadian Economic Growth, 1946-1991. *Canadian Journal of Economics* Vol. 29, No. 1.
- Yoshino, Naoyuki and Nakahigashi, Masaki. 2000. The Role of Infrastructure in Economic Development. Keio University, Tokyo, Japan.
- Zegeye, Aklilu. 2000. U.S. Public Infrastructure and Its Contribution to Private Sector Productivity. Working Paper 329. U.S. Bureau of Labor Statistics.



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