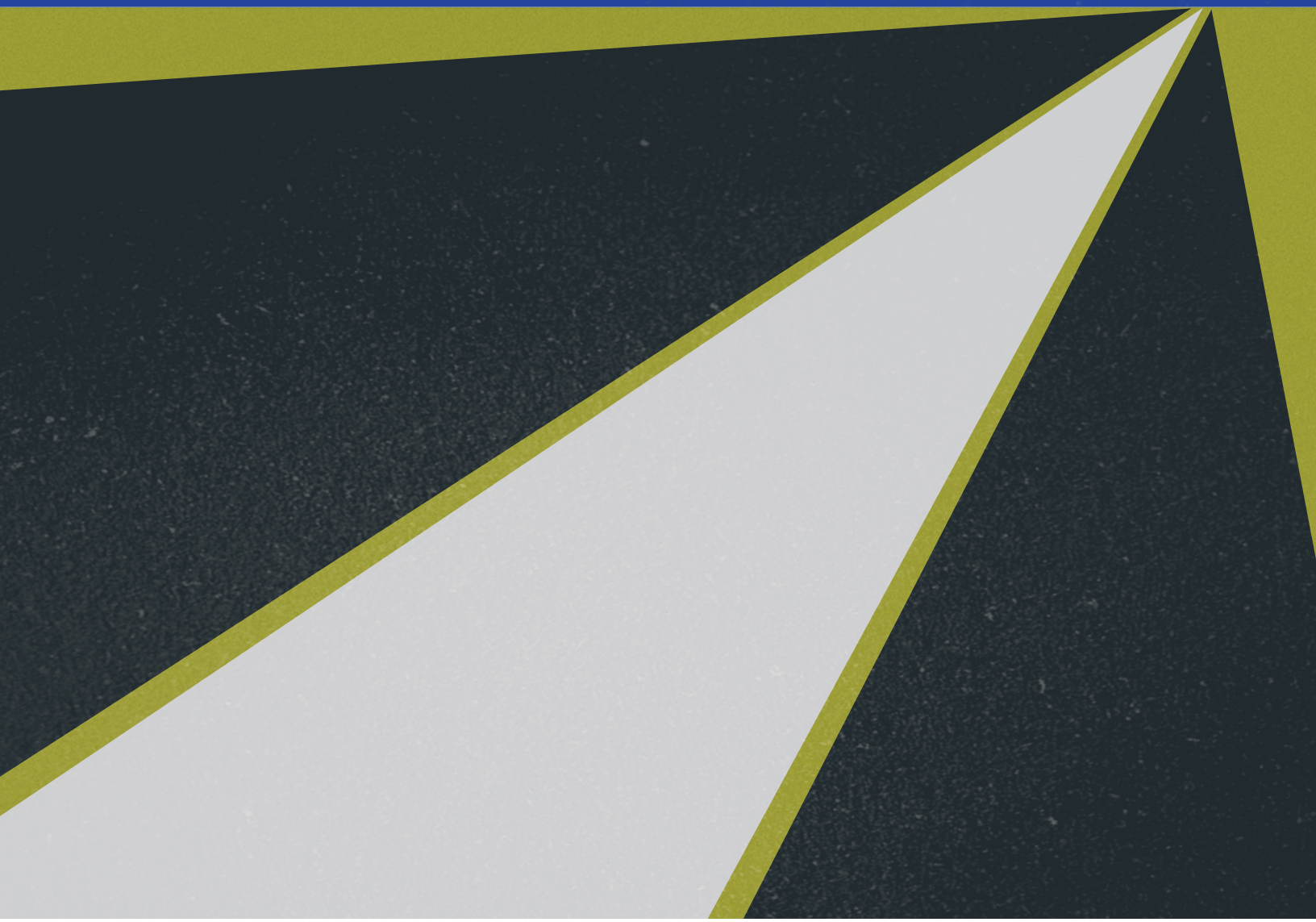
A Review of the Economic Impact of Energy East on Ontario

RICHARD CARLSON, ROB DORLING AND PETER SPIRO, WITH MIKE MOFFATT



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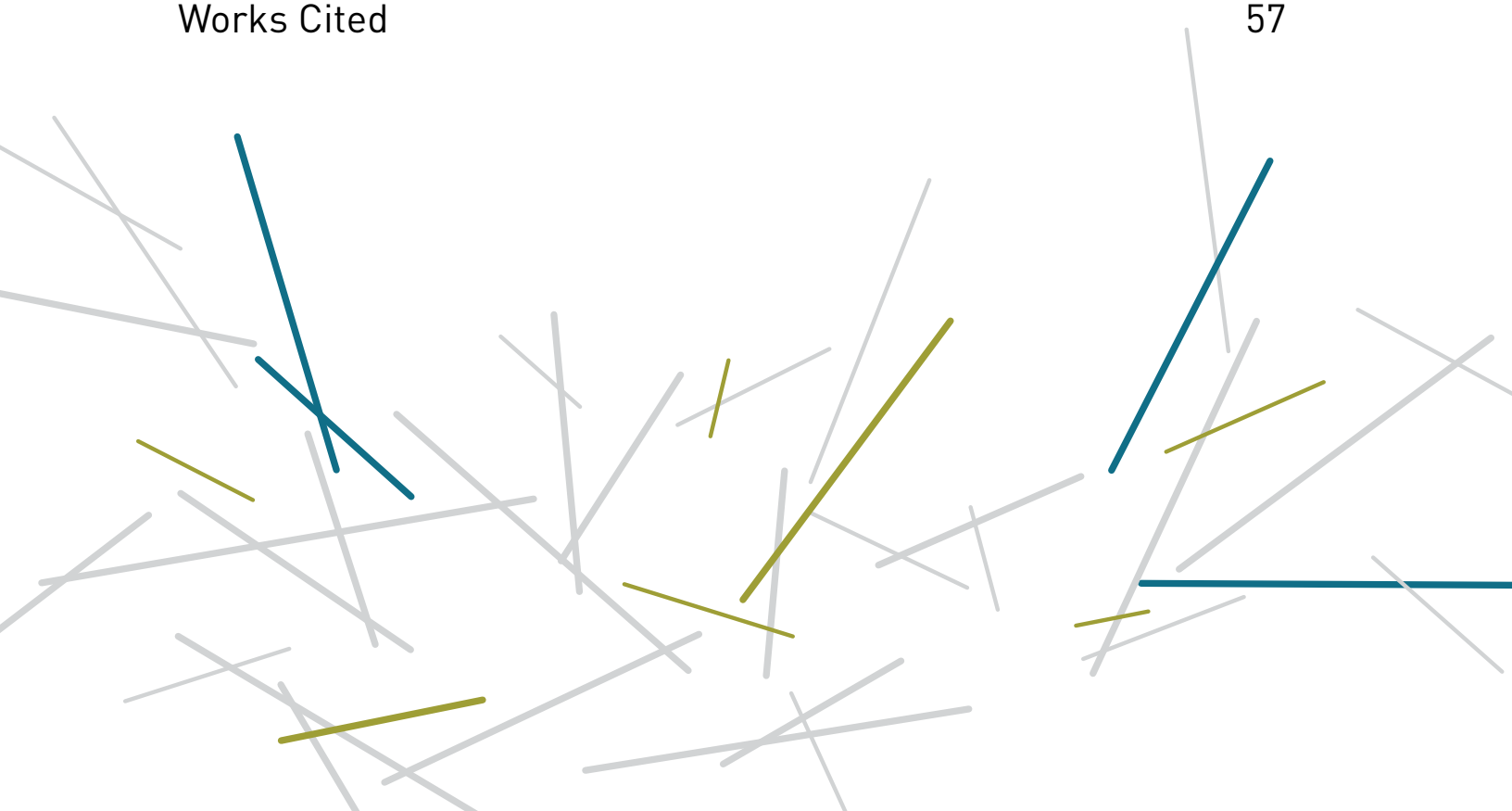


Executive Summary

In November 2013, the Minister of Energy engaged the Ontario Energy Board (OEB) to conduct a detailed review of the Energy East pipeline project, proposed by TransCanada PipeLines Ltd. (TCPL), and its effect on Ontario. The OEB's review is expected to inform the provincial government's position on the project. As one of the four main components of its review, the OEB was asked to consider the implications of "the short and long term economic impacts of the project in Ontario."[1]

The OEB has retained the Mowat Centre, at the University of Toronto's School of Public Policy and Governance, to provide analysis of the economic impacts of the Energy East project on Ontario.

Three economic impact reports have already been prepared on the Energy East pipeline project — by the Conference Board of Canada (which was included in TCPL's application within the National Energy Board), Deloitte (also commissioned by TCPL) and the Canadian Energy Research Institute (CERI).

This report will evaluate the existing economic impact assessments on Energy East. It will also provide an analysis of some of the larger, missing contextual variables that will influence the project's eventual short-term, medium-term and long-term economic impact on Ontario.

We believe that the claims about the project's positive economic impacts on Ontario should not be seen as predictions of what is likely to arise. The analyses on which they rest use a type of economic model where the results can only be understood as suggestive. Furthermore, the results from the analyses are limited and only represent one possible scenario among many.

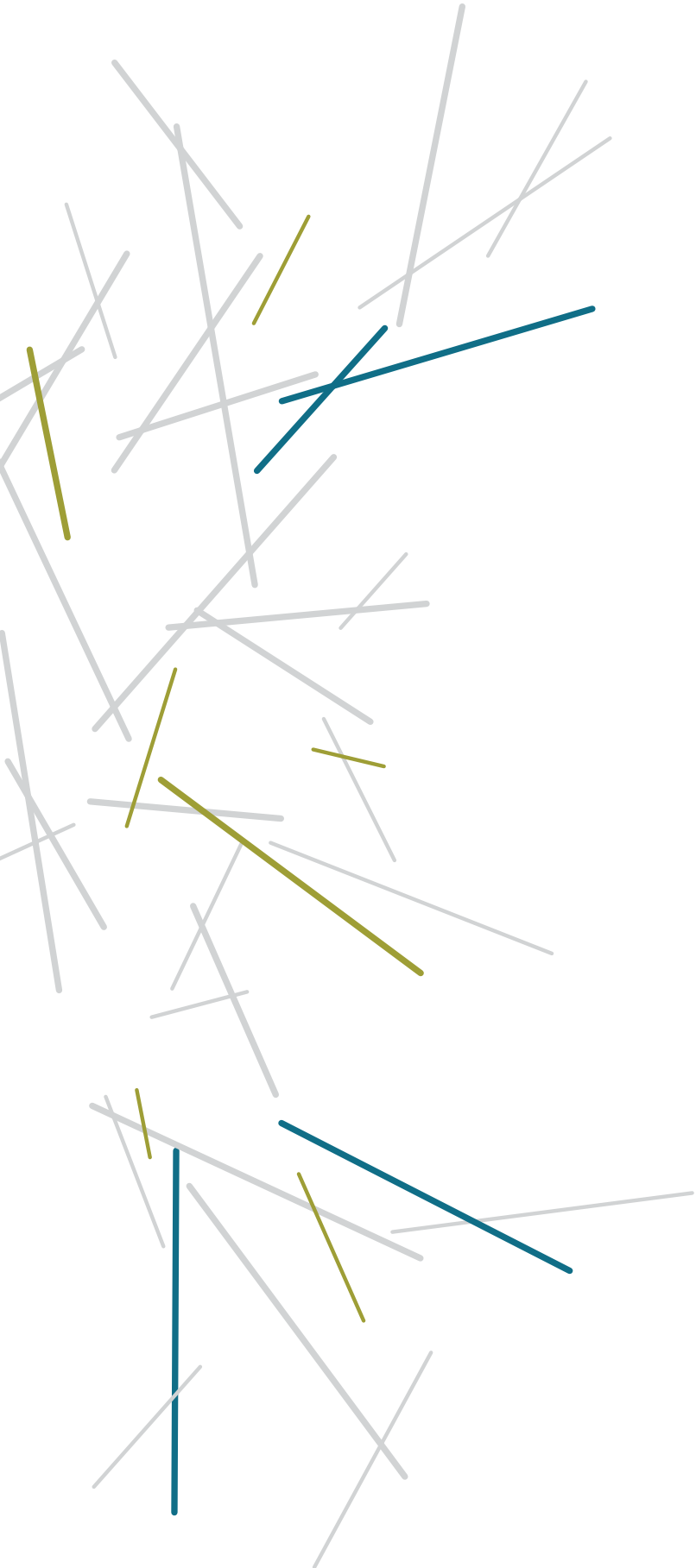
All three analyses use Input/Output (I/O) models to calculate their results, a common method of measuring the effect of new inputs into an economy and of modelling direct, indirect and induced benefits. I/O models are not very good at measuring large-scale impacts across a large economy such as Ontario's, for such reasons as:

» I/O models assume that past or present scenarios accurately predict the future, and do not account for any changes in the economy over the lifespan of the project.

» I/O models assume large indirect benefits for the economy. They do this by applying multipliers to the direct project spending. A multiplier is an estimate of how spending on the project affects the rest of the economy. Multipliers tend to inflate indirect benefits because they do not account for shortages in labour and assume that without the project, resources would be idle.

» When applied to large infrastructure projects, results from I/O models offer projections only about the potential positive impacts of the spending, without taking into consideration the costs.

1 Ontario Minister of Energy, *Letter from the Minister of Energy to Chair of the Ontario Energy Board, Ontario Energy Board Report on Implications for Ontario of TransCanada Pipeline Limited Energy East Project*, November 12, 2013. At http://www.ontarioenergy-board.ca/OEB/_Documents/Documents/ltr_Min_Chiarelli_to_OEB_Chair_EnergyEast_20131113.pdf.



Our analysis also indicates that the benefits projected for Ontario may be over-estimated due to both the way I/O models project future impacts and the assumptions made when the models were developed (see Table 1). Any claims about substantial GDP growth and job creation in Ontario from pipeline construction should be viewed critically.

This is not to deny that Energy East would bring benefits to the province. But a wider economic cost-benefit analysis that considers a broader range of variables could produce different estimates of potential economic impacts on Ontario.

For example, for illustrative purposes we modelled the potential effect of the increase in oil exports as a result of Energy East on the Canadian-U.S. exchange rate. Under one scenario, oil exports from the pipeline could lead to a sufficiently large increase in the exchange rate that it may result in a larger reduction on Ontario's GDP than the positive impacts that might be expected from the project. These kinds of medium-term and long-term, as well as more complex, impacts were not measured in earlier studies and any inclusion of these kinds of variables in the model would produce substantially different estimates of possible economic impacts on Ontario.

Our report has no view, implicit or explicit, on the overall merits of the Energy East project. It speaks exclusively to the possible economic impacts in Ontario.

TABLE 1:
Summary of economic concerns identified

Issue				Effect
General concerns with I/O models	The way indirect and induced benefits are calculated			I/O models use multipliers, an estimate of how spending on the project affects the rest of the economy, to calculate indirect and induced benefits. But the multipliers tend to inflate indirect benefits as they do not account for shortages in labour or for alternate use of resources.
	Supply constraints are not considered			I/O models assume that resources are idle and there will be no shortages. But resources are not all idle and so shortages can lead to price increases, which would reduce the projected benefits.
	Reliance on the present to estimate the future			I/O models assume that past trends will continue without change into the future. If there are changes in the broader policy environment, the predicted benefits could be inflated.
Concerns specific to the Energy East analyses	Use of 2009 data on Ontario's trade with the rest of the country			The analyses use 2009 trade figures (the most recent available), which inflates the role of Ontario's manufacturing as they do not account for the manufacturing slowdown in the province in recent years.
	For employment growth, labour availability or displacement are not considered			Estimated employment growth may be inflated because: - project could just involve the transfer of workers from Canadian Mainline to Energy East - labour is currently not idle, and there may be shortages of workers that are not considered when estimating job creation.
	Calculation of tax benefits from the pipeline			Impacts identified by TCPL are small. In addition, the benefits are likely inflated because in Ontario the project mostly involves the conversion of existing infrastructure, not new construction.
	The use of discount rates in the calculations			The analyses either do not use a discount rate or use a low discount rate.
	Operational lifespan			Operational lifespan is long in models (25-40 years). Reliability of future benefits is not clear.
Long-term policy risks	Possibly exacerbates problems with the federal Equalization program			As natural resource royalties are not available to fund Equalization, and yet are a main driver in the growth in differences in fiscal capacity between regions, other tax revenue may be needed to fund changes in Equalization.
	Potential appreciation of the Canadian-U.S. exchange rate			A higher Canadian-U.S. exchange rate affects the competitiveness of Ontario exporters, especially manufacturers.
	Increased GHG emissions	Stranded infrastructure	Reduced demand for oil sands products	The need to reduce GHG emissions could lead to a reduced operational life of the pipeline, thereby leading to lower economic benefits.
			Reduced demand for all fossil fuels	
		Export concerns		Carbon tariffs or other discriminatory trade policies could be applied against Canadian-made goods, reducing exports.
		Carbon pricing		Depending on the structure of the carbon pricing system, Ontario could face additional cost.
	Natural capital losses			Spills can be cleaned up, but there could be long-term losses to natural capital and to the services that the natural environment provides.
	Changes to energy flows			There are potential concerns with ensuring adequate pipeline capacity to supply natural gas to Ontario consumers.

1

Introduction

1.1 Overview of report

In November 2013, the Minister of Energy engaged the Ontario Energy Board (OEB) to conduct a detailed review of the potential effects on Ontario of TransCanada PipeLine Ltd's (TCPL) proposed Energy East pipeline.

The Energy East pipeline project falls under the jurisdiction of the National Energy Board (NEB), the federal energy regulator, as it crosses provincial borders. TCPL filed its application with the NEB on October 30, 2014.

The OEB's review is expected to inform the Ontario government's position on the project. The OEB was asked to consider the implications of "the short and long term economic impacts of the project in Ontario" as one of the four main components of its review.[2]

The OEB has retained the Mowat Centre, at the University of Toronto's School of Public Policy and Governance, to provide an analysis of the economic impacts of the Energy East project on Ontario. This report will:

» critically review and analyze the economic impact analyses prepared for TransCanada and other organizations

» analyze potential long-term economic costs and risks that may not be captured in the three prior economic analyses.

This report does not purport to fully examine the implications of the Energy East pipeline on Ontario. Nor does this report look into what could happen to the Canadian Mainline natural gas pipeline if the Energy East project is not approved. The aim of this report is much narrower: to assess existing studies of the short-term and long-term economic benefits of the Energy East project to Ontario and highlight the additional factors that might impact these economic analyses.

1.2 Overview of the Energy East pipeline

The Energy East pipeline project is proposed by TCPL, a publicly traded company based in Calgary. TCPL owns and operates a number of oil and gas pipelines in Canada and the U.S., including the Canadian Mainline (a natural

2 Ontario Minister of Energy, *Letter from the Minister of Energy to Chair of the Ontario Energy Board, Ontario Energy Board Report on Implications for Ontario of TransCanada Pipeline Limited Energy East Project,* November 12, 2013. At http://www.ontarioenergy-board.ca/OEB/_Documents/Documents/ltr_Min_Chiarelli_to_OEB_Chair_EnergyEast_20131113.pdf.

gas transmission corridor that consists of a number of parallel gas pipelines), as well as a number of electricity generating plants in North America.

TCPL's proposed Energy East project would involve the conversion of one of the existing Canadian Mainline natural gas pipelines from gas services to oil services. The Canadian Mainline stretches from Alberta to Quebec and parts of the U.S. built over the past 50 years. The pipelines have been used to supply gas from Western Canada to gas consumers in Eastern Canada and the U.S.

The Energy East pipeline would stretch 4,600 kilometres, from Hardisty, Alberta, to Saint John, New Brunswick. It would transport approximately 1.1 million barrels per day (mb/d) of crude oil from Alberta to refineries in Quebec and New Brunswick, as well as for export. Approximately 70 per cent of the Energy East pipeline would involve the partial conversion of the Canadian Mainline, with the remaining 30 per cent — mostly starting from near the Ontario-Quebec border — being newly built. Ontario, with over 2,000 kilometres of the proposed pipeline (1,918 kilometres of conversion plus 104 kilometres of new build), will host the longest stretch. Figure 1 shows the proposed route and where new pipeline would be constructed.

As part of the Energy East project, TCPL will also build the Eastern Mainline, a 250-kilometre gas pipeline from Markham, Ontario, to Iroquois in the Township of South Dundas, Ontario. The Eastern Mainline is needed to meet firm service commitments following the transfer of a portion of the Mainline capacity to oil service.[3]

The Energy East pipeline project is expected to cost $12.8 billion, including the Eastern Mainline project. If approved as scheduled, crude oil deliveries to Quebec are expected in 2018, with service to New Brunswick in late 2018.[4] TCPL has already signed firm 20-year oil transportation contracts for over 83 per cent of the Energy East's final capacity.[5] Although the destination of much of the crude shipped through the pipeline is not known, TCPL expects around half of the oil shipped through Energy East to be exported.[6]

A dramatic change in the gas market caused by a rapid increase in the supply of U.S. natural gas as a result in the growth of hydraulic fracturing (fracking) is one reason for the proposed project. This increase in gas supply, especially from the Marcellus shale, which is just south of the Ontario and Quebec border, has displaced Western Canadian gas transported by the Canadian Mainline to Ontario and Quebec. In 2013, for example, Western Canadian gas flows through the Canadian Mainline were down by 63 per cent from 2005 levels.[7]

The North America natural gas pipeline market is also changing as a result of the increase in supply. The availability of gas supplies close to markets has meant that gas pipeline contracts have changed from the long-haul, long-term firm contracted capacity that had previously typified contracts on the Canadian Mainline to shorter-distance, shorter-term contracts.[8]

All of these developments have reduced demand for the Canadian Mainline, forcing TCPL to raise tolls on the pipeline in order to recover operating costs. These tolls have pushed companies in Ontario and Quebec to turn more toward U.S. natural gas.[9]

3 For more information on the Eastern Mainline, see TransCanada, "Eastern Mainline: About the Project." At http://eastern-mainline.com/about/about-the-project/.

4 For more information on the pipeline route see TransCanada's project website at http://www.energyeastpipeline.com/, and Ziff Energy, *Ontario Natural Gas Background Report – 4NC111M*, Report for the Ontario Energy Board, March 2014. At http://www.ontarioenergyboard.ca/html/oebenergyeast/documents/Background_Report_Ontario_Natural_Gas_Ziff_201403.pdf.

5 Conference Board of Canada, *Energy East Pipeline Project: Understanding the Economic Benefits for Canada and its Region, Appendix Vol 1-1*, October 2014. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2541562/Vol_1-Energy_East_Project_and_Asset_Transfer_Applications-Appendix_1-1_CBoC_Report_-_A4D8R3.pdf?nodeid=2541125&vernum=-2.

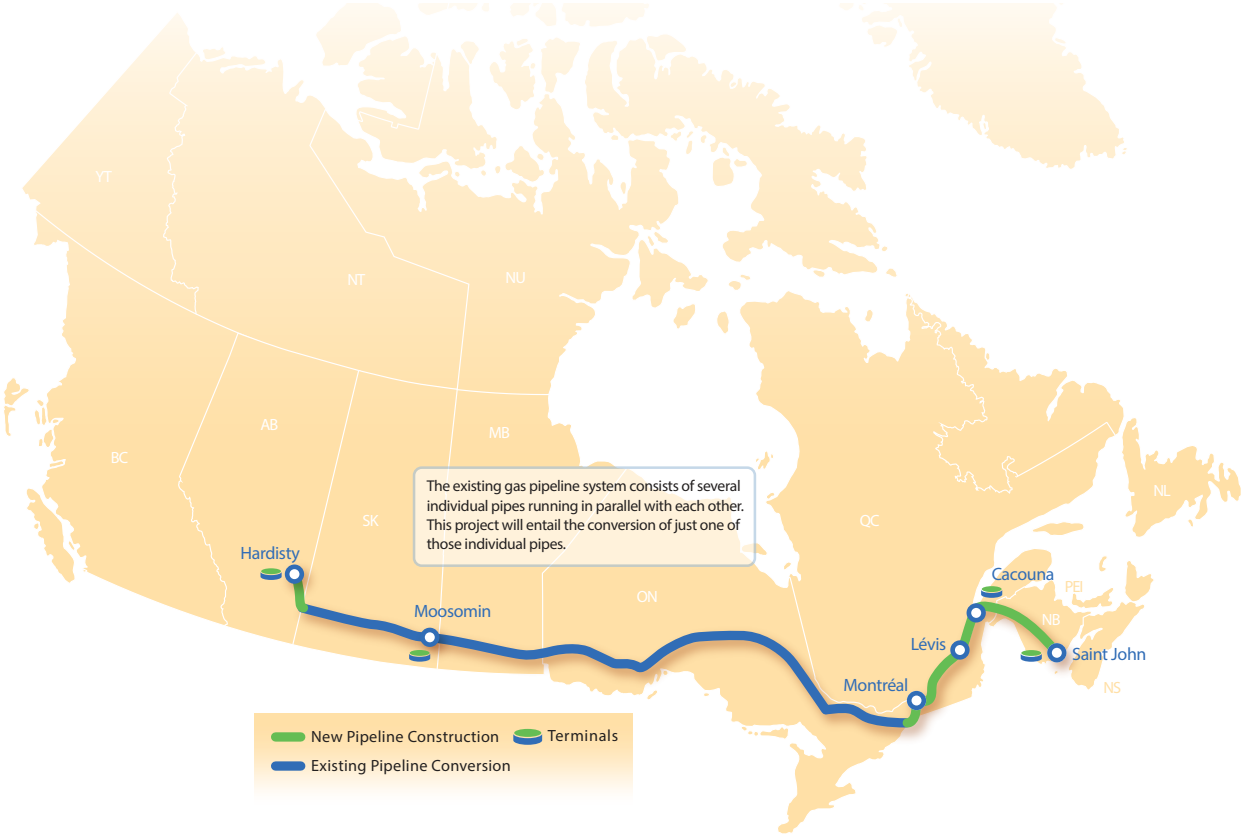
6 TransCanada, "Press Conference, Energy East Pipeline," Thursday, October 30, 2014. At http://www.gowebcasting.com/events/transcanada-corporation/2014/10/30/webcast/play/stream/12238.

7 Ziff Energy, *Ontario Natural Gas Background Report – 4NC111M, Report for the Ontario Energy Board,* March 2014. At http://www.ontarioenergyboard.ca/html/oebenergyeast/documents/Background_Report_Ontario_Natural_Gas_Ziff_201403.pdf.

8 TransCanada, "Management's discussion and analysis," February 19, 2014, p. 27. At http://www.transcanada.com/docs/Investor_Centre/2013-TransCanada-Pipelines-Limited-TCPL-MDA.pdf.

9 Shawn McCarthy, "TransCanada's Mainline sees tolls frozen for five years," *Globe and Mail*, March 27, 2013. At http://www.

FIGURE 1
The proposed route of the Energy East pipeline



Source: TransCanada, "Route Map." At http://www.energyeastpipeline.com/home/route-map/.

The Ontario government has announced that it is generally supportive of the Energy East pipeline, stating it to be in the national interest.[10] In addition, at the August 2014 Council of the Federation meeting in Charlottetown, the Ontario government signed on to the development of a pan-Canadian energy strategy that would include new pipeline projects as well as investments in renewable energy, economic development from investments in energy technology, and the reduction of GHG emissions and the protection of the environment.[11]

Most recently, the governments of Ontario and Quebec jointly announced seven principles that the two provinces will use to assess proposed pipeline project:

» "Compliance with the highest available technical standards for public safety and environmental protection;

» Have world-leading contingency planning and emergency response programs;

» Proponents and governments consult local communities and fulfill their duty to consult with Aboriginal communities;

» Take into account the contribution to greenhouse gas emissions;

» Provide demonstrable economic benefits and opportunities to the people of Ontario and Quebec,

theglobeandmail.com/report-on-business/industry-news/energy-and-resources/transcanadas-mainline-sees-tolls-frozen-for-five-years/article10453810/.

10 Robert Benzie, "Ontario, Alberta premiers agree to 'work together' on Energy East oil pipeline," *Toronto Star*, December 3, 2014. At http://www.thestar.com/news/queenspark/2014/12/03/ontario_alberta_premiers_agree_to_work_together_on_energy_east_oil_pipeline.html.

11 Council of the Federation, *Canadian Energy Strategy: Media Backgrounder*, August 29, 2014. At http://www.canadaspremiers.ca/phocadownload/newsroom_2014/energy-final.pdf.

in particular in the areas of job creation over both the short and long term;

» Ensure that economic and environmental risks and responsibilities, including remediation, should be borne exclusively by the pipeline companies in the event of a leak or spill on ground or water, and provide financial assurance demonstrating their capability to respond to leaks and spills;

» Interests of natural gas consumers must be taken into account."[12]

Both the proposed framework for the Canadian energy strategy and Ontario and Quebec's seven principles go beyond pipelines to include wider policy issues related to energy, such as economic development, emissions reductions, innovation and protecting the environment. Both make it clear that short-term economic impacts, while important, should not be the only consideration when evaluating a project's long-term economic impact on the province and the country.

This report undertakes to:

» review and analyze the economic impact analyses prepared for TransCanada and other organizations

» analyze potential long-term economic costs and risks that may not be captured in the three economic analyses.

12 Office of the Premier, "Backgrounder: Agreements Reached at Québec-Ontario Joint Meeting of Cabinet Ministers," November 21, 2014. At http://news.ontario.ca/opo/en/2014/11/agreements-reached-at-quebec-ontario-joint-meeting-of-cabinet-ministers.html.

History of the Canadian Mainline: The Gas Pipeline Affair

TransCanada PipeLines Ltd (TCPL) was created in 1951 to build a cross-Canada natural gas transmission corridor, the Canadian Mainline, which it now proposes to partially convert into Energy East. The Canadian Mainline was created to ensure that Ontario and Quebec had a secure supply of energy for their industrial development, as well as to provide a market for Western Canadian natural gas.

TCPL started construction in 1957, and natural gas started flowing in 1958. Since then the Canadian Mainline has been expanded and refurbished several times, and it now extends down into the U.S.

But even in the 1950s, pipeline construction was controversial. The Canadian Mainline was promoted by C.D. Howe when he was Minister of Trade and Commerce. It was under his guidance that TCPL, a consortium of Canadian and American investors, was formed. Yet when Howe tabled a bill authorizing the construction of the Canadian Mainline and providing a loan for construction, he found strong opposition in Parliament. The CCF (the precursor to today's NDP) wanted a nationalized pipeline, while the Conservatives did not want American capital involved. The debate was rancorous, and the government had to introduce closure to end the debate and pass the bill.

Closure was not the end of the government's troubles. Opposition parties continued attacking the government over the bill and claiming that the government's use of closure denied them the right to speak. There were even reports of scuffles in the House between government and opposition members. Many of the attacks were directed at Prime Minister Louis St. Laurent personally. The attacks eventually died down, but the Gas Pipeline Affair, as it became known, is now seen as a contributing factor to St. Laurent's defeat to John Diefenbaker in the 1957 election.

See, Robert Bothwell, "Pipeline Debate," *Canadian Encyclopedia*, July 2, 2006. At http://www.thecanadianencyclopedia.ca/en/article/pipeline-debate/; Parks Canada, "The Gas Pipeline Affair." At http://www.pc.gc.ca/eng/lhn-nhs/qc/stlaurent/natcul/natcul2/natcul2g.aspx.

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Review of existing Energy East economic impact analyses

2.1 Overview of economic impact analyses

Three major reports on the economic impacts of the proposed Energy East project have been prepared. The most recent, conducted by the Conference Board of Canada, was prepared for TCPL as part of its NEB application. TCPL also commissioned an earlier analysis by Deloitte. In addition, the Canadian Energy Research Institute (CERI) — a Calgary-based think tank — conducted its own independent analysis. All three reports use Input/Output (I/O) models to calculate the economic impacts of the Energy East pipeline project.[13]

Tables 2 and 3 summarize the headline economic results from these economic impact reports. These results only reflect the construction and operation of the Energy East pipeline and not the upstream benefits from the production of the oil that it would transport. Generally, Ontario is seen as receiving around one-third of the projected benefits from the pipeline project, which would be expected given that the province will host close to half of the entire pipeline but will see little new build on its portion of the pipeline.

It should be noted that Tables 2 and 3 were created for descriptive purposes only. Unless specified, all figures are in 2013 inflation-adjusted numbers. The three studies differ in their underlying assumptions. As a result, the results from each study cannot be directly compared. There are three primary differences in the methods used:

1. The Conference Board's results include the impact of the construction of the Eastern Mainline gas pipeline, a proposed new gas pipeline from Markham, Ontario, to Iroquois, Ontario. This new pipeline is designed to ensure that there is pipeline capacity to meet firm service commitments following the

13 The reports are available at Conference Board of Canada, *Energy East Pipeline Project: Understanding the Economic Benefits for Canada and its Region*, Appendix Vol 1-1, October 2014. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2541562/Vol_1-Energy_East_Project_and_Asset_Transfer_Applications-Appendix_1-1_CBoC_Report_-_A4D8R3.pdf?nodeid=2541125&vernum=-2; Deloitte, *Energy East: The Economic Benefits of TransCanada's Canadian Mainline Conversion Project*, September 2013. At http://www.energyeastpipeline.com/wp-content/uploads/2013/09/Energy-East-Deloitte-Economic-Benefits-Report.pdf; Canadian Energy Research Institute, *An Economic Analysis of TransCanada's Energy East Pipeline Project,* Study No. 140, May 2014. At http://www.ceri.ca/images/stories/2014-05-06_CERI_Study_140_-_Energy_East_Pipeline_Project.pdf.

TABLE 2

Estimated economic impact of Energy East on GDP and jobs in Canada from the Conference Board, Deloitte and CERI studies

Canada		Conference Board			Deloitte			CERI
		Development and construction	Operation	Total	Development and construction	Operation	Total	Total
GDP ($ billions)	Direct	$4.55	$22.95	$27.50	$3.67	$6.78	$10.45	$13.90
	Indirect	$3.65	$6.96	$10.61	$4.07	$13.37	$17.44	$8.70
	Induced	$3.30	$3.28	$6.58	$2.31	$5.15	$7.46	$11.30
	Total	$11.51	$33.19	$44.70	$10.05	$25.30	$35.34	$33.90
Tax revenue (in $ billions)				$9.26			$10.20	$7.60
FTEs	Direct	58,654	23,615	82,269	30,213	43,480	73,693	
	Indirect	37,176	63,716	100,892	40,677	77,120	117,797	
	Induced	32,507	30,319	62,826	20,964	49,480	70,444	
	Total	128,337	117,650	245,987	91,854	170,080	261,934	321,000

Source: Data for all tables and figures from Conference Board of Canada, *Energy East Pipeline Project: Understanding the Economic Benefits for Canada and its Region, Appendix Vol 1-1*, October 2014. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2541562/Vol_1-Energy_East_Project_and_Asset_Transfer_Applications-Appendix_1-1_CBoC_Report_-_A4D8R3.pdf?nodeid=2541125&vernum=-2; Deloitte, *Energy East: The Economic Benefits of TransCanada's Canadian Mainline Conversion Project*, September 2013. At http://www.energyeastpipeline.com/wp-content/uploads/2013/09/Energy-East-Deloitte-Economic-Benefits-Report.pdf; Canadian Energy Research Institute, *An Economic Analysis of TransCanada's Energy East Pipeline Project*, Study No. 140, May 2014. At http://www.ceri.ca/images/stories/2014-05-06_CERI_Study_140_-_Energy_East_Pipeline_Project.pdf. For all tables and figures here, and unless otherwise specified, the numbers presented in the respective reports are used without change.
Inflation-adjusted 2013 numbers are used in CERI and the Conference Board, while Deloitte's numbers are NPV using a discount rate of 2.46 per cent.

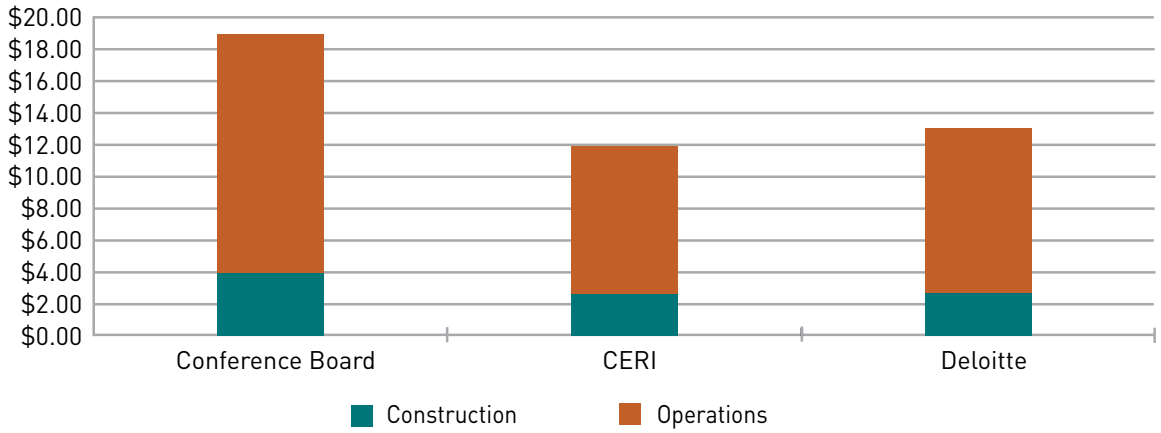
TABLE 3

Estimated economic impact of Energy East on GDP and jobs in Ontario from the Conference Board, Deloitte and CERI studies

Ontario		Conference Board			Deloitte			CERI
		Development and construction	Operation	Total	Development and construction	Operation	Total	Total
GDP ($ billions)	Direct	$1.38	$10.46	$11.84	$0.92	$1.41	$2.33	
	Indirect	$1.32	$3.02	$4.35	$1.06	$6.74	$7.80	
	Induced	$1.21	$1.54	$2.74	$0.71	$2.19	$2.90	
	Total	$3.91	$15.02	$18.93	$2.69	$10.34	$13.03	$11.90
Tax revenue (in $ billions)				$3.20			$3.66	$2.21
FTEs	Direct	16,189	4,372	20,560	6,813	7,240	14,053	
	Indirect	13,550	32,618	46,168	11,019	43,440	54,459	
	Induced	11,531	14,408	25,940	6,456	21,560	28,016	
	Total	41,270	51,398	92,668	24,288	72,240	96,528	114,000

FIGURE 2

Estimated impact of Energy East to Ontario's GDP by stage of project ($ billion)

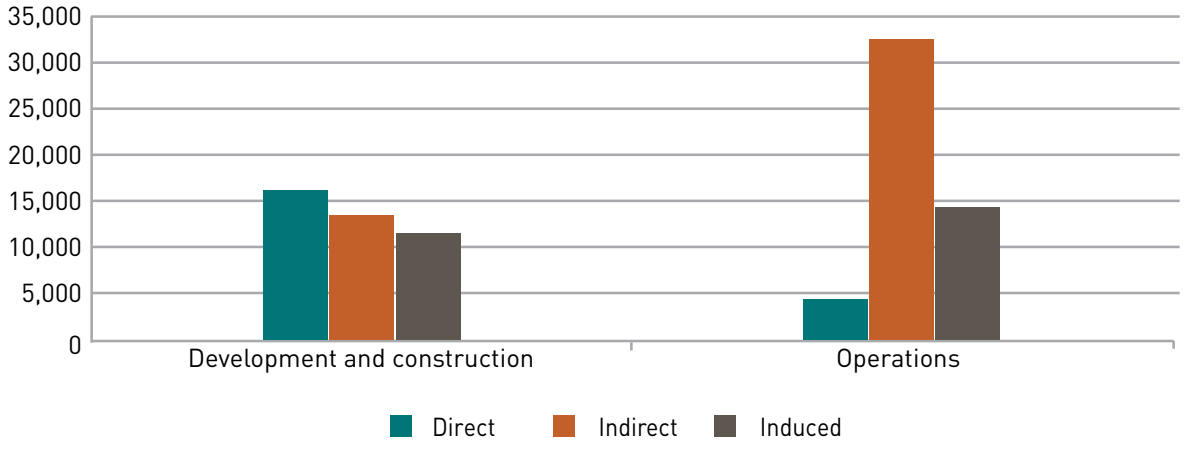


Note: The operating lifespan in the Conference Board's report is 20 years, versus 40 years for Deloitte and 25 years for CERI. For all tables and figures here, and unless otherwise specified, the numbers presented in the respective reports are used without change. Inflation-adjusted 2013 numbers are used in CERI and the Conference Board, while Deloitte's numbers are NPV using a discount rate of 2.46 per cent.

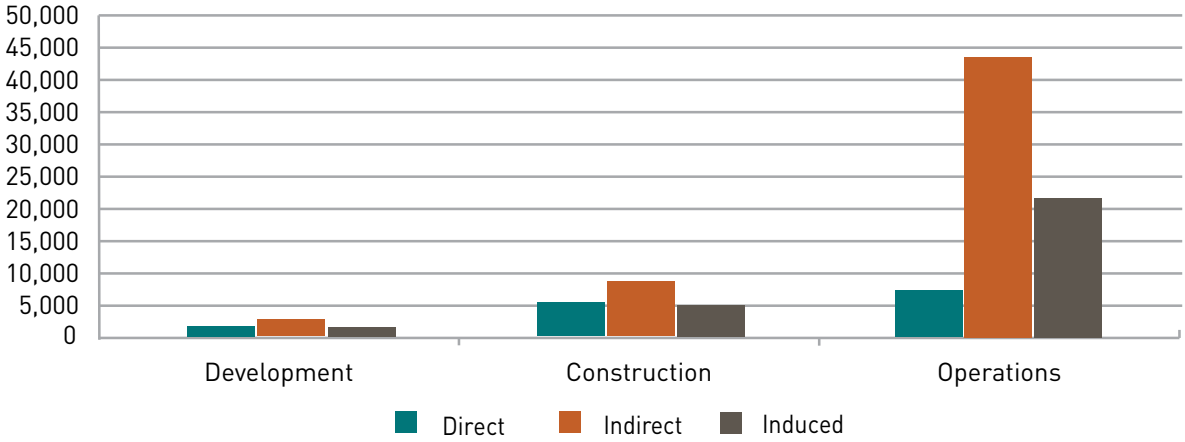
FIGURE 3:

A breakdown of total jobs created in Ontario as a result of Energy East by stage of project (total FTEs)

Conference Board



Deloitte



Note: Only Deloitte's and Conference Board's numbers are included here as CERI did not provide a breakdown for comparison.

transfer of a portion of Canadian Mainline's capacity to oil service.

2. The projected economic lifespan of the project varies from 20 years for the Conference Board, to 25 years for CERI and to 40 years for Deloitte. Using a longer operating lifespan to calculate benefits would increase the estimated economic benefit for Ontario. This is especially true for employment because the studies use "full-time equivalencies" (FTEs) to measure jobs over the lifespan of the project. One job held for 40 years counts as 40 FTEs.

3. The Deloitte report includes a discount rate, while the Conference Board and CERI reports do not. A discount rate is used to value future costs and benefits in today's dollars. If higher discount rates were used the projected benefits would be significantly lower.

As just 100 kilometres of the 2,000 kilometres of proposed pipeline in Ontario will be newly built, with the remainder a repurposing of an existing pipeline, it is really in the operations phase that all three reports view the province as benefiting the most (see Figures 2 and 3).

In addition to these economic benefits, TCPL says that natural gas transmission costs are expected to be reduced by $750 million over 15 years as a result of lower tolls and the proposed Eastern Mainline natural gas pipeline project.[14]

The three economic impact analyses follow standard practice in using I/O models. But as we explain in sections 2.2 and 2.3, there are some concerns with the results from the I/O models in the context of the Energy East project. First, I/O models, while useful in some circumstances, may not be the best method to measure the economic impact of a pipeline project. In addition, some of the assumptions made in the models may not reflect current market and economic conditions in Ontario, leading to potentially inflated results.

14 Karl Johannson (Executive VP and President Natural Gas Pipelines, TCPL), "Energy East: An Oil Pipeline That Is Also Good for Natural Gas." At http://www.energyeastpipeline.com/energy-east-an-oil-pipeline-that-is-also-good-for-natural-gas/.

2.2 General concerns with Input/ Output models

2.2.1 Overview of Input/Output models

To model the economic impact of the Energy East project, all three reports have used I/O modelling, a commonly used technique to evaluate the economic impact of an infrastructure project.

There are a number of I/O models available, but the primary and most commonly used model in Canada is created, and regularly updated, by Statistics Canada. The federal government also uses this model. The Conference Board and Deloitte both used the Statistics Canada I/O model. CERI used its own Multi-Regional Input-Output Model. All the models relied upon 2009 figures, the latest complete data set available.

I/O models were developed in the early days of the Soviet Union for use in command-and-control central planning.[15] The late Harvard economist Wassily Leontief (allowed out of the Soviet Union in 1925) brought I/O models to the west, eventually winning the Nobel Prize for his work.[16]

In brief, I/O models measure the effect of "shocks" to the economy. In this case, the shock is the spending on the construction, conversion and operation of the pipeline. The model then uses historical data about the ratios between different types of spending to calculate the effect of that spending down through the entire economy.[17]

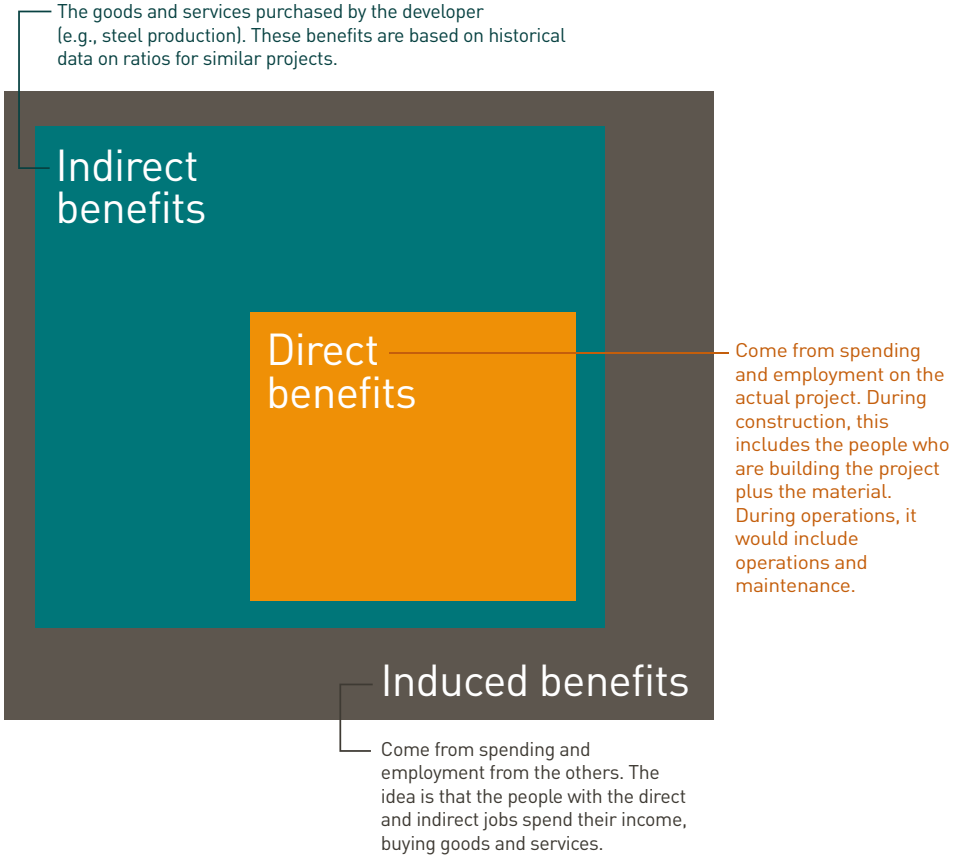
A criticism of I/O models is that they cannot reliably predict the economic impacts of investment projects. An Australian think tank recently critiqued the increasing use of I/O modelling:

15 A.A. Belykh, "A note on the origins of input-output analysis and the contribution of the early soviet economists: Chayanov, Bogdanov and Kritsman," *Soviet Studies*, Vol. 41, Issue 3, 1989, pp. 426-429.

16 Erik Dietzenbacher and Michael L. Lahr, eds., *Wassily Leontief and Input-Output Economics*, Cambridge University Press, 2004, p. 137.

17 For example, it is known that historically every million dollars of pipeline construction required X dollars of steel, Y dollars of cement, etc. In turn, every million dollars of steel requires X dollars of coal, Y dollars of electricity, etc. All these ratios are used to calculate the total amount of resulting spending in different industries and regions in response to a project.

FIGURE 4:
Direct, indirect and induced benefits



> The problem has become, however, that in an era in which segments of the media no longer have the time or inclination to examine claims before they are reported, bad economic modelling [using I/O models] is preferred by many advocacy and industry groups to good economic modelling for three main reasons:
>
> 1. it is cheaper
> 2. it is quicker
> 3. it is far more likely to yield the result preferred by the client.[18]

All three organizations that conducted impact analyses understand and acknowledge the limitations of I/O modelling. They are clear that the results should be seen as examples indicating potential costs and benefits. According to Deloitte, "the output economic impacts of this study's I/O Model runs should be considered directionally correct rather than scientifically precise."[19]

The original purpose of I/O modelling was to alert central planners to supply constraints. For example, if a country or region is going to have a new mega-project, it is good to know what inputs will be required, to gauge the extent to which this would create shortages for other industries. Ironically, the current use of I/O models has turned this purpose on its head. The models as applied to Energy East are used to predict the effects of a positive demand shock while assuming that supply constraints do not exist. If you spend more money, according to the I/O model approach, you can expand your

18 Richard Denniss, *The use and abuse of economic modelling in Australia: Users' guide to tricks of the trade*, Technical Brief No. 12, the Australia Institute, January 2012, p. 1. At http://www.tai.org.au/node/1813.

19 Deloitte, *Energy East: The Economic Benefits of TransCanada's Canadian Mainline Conversion Project*, September 2013, p. 22. At http://www.energyeastpipeline.com/wp-content/uploads/2013/09/Energy-East-Deloitte-Economic-Benefits-Report.pdf.

TABLE 4:
GDP multipliers used in the three economic impact analyses for the development and construction phase

Region	Study	Project capital expenditure ($ billions)	Predicted GDP impact ($ billions)	Implied multiplier
Ontario	Conference Board	$3.72	$3.91	1.05
	Deloitte	$2.17	$2.69	1.24
	CERI	$1.47	$2.60	1.77
Canada	Conference Board	$12.74	$11.51	0.90
	Deloitte	$11.30	$10.05	0.88
	CERI	$11.28	$13.60	1.21

Note: Data for both tables from Conference Board of Canada, *Energy East Pipeline Project: Understanding the Economic Benefits for Canada and its Region, Appendix Vol 1-1*, October 2014, Table 2, p. 10. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2541562/Vol_1-Energy_East_Project_and_Asset_Transfer_Applications-Appendix_1-1_CBoC_Report_-_A4D8R3.pdf?nodeid=2541125&vernum=-2; Deloitte, *Energy East: The Economic Benefits of TransCanada's Canadian Mainline Conversion Project*, September 2013, Table 2 and Table 6. At http://www.energyeastpipeline.com/wp-content/uploads/2013/09/Energy-East-Deloitte-Economic-Benefits-Report.pdf; Canadian Energy Research Institute, *An Economic Analysis of TransCanada's Energy East Pipeline Project, Study No. 140*, May 2014, Figure 2.2 and 3.6. At http://www.ceri.ca/images/stories/2014-05-06_CERI_Study_140_-_Energy_East_Pipeline_Project.pdf.

GDP without limit. That is obviously wrong. This is one of the methodological problems with the I/O models used in the three existing Energy East studies.

In terms of calculating the economic impacts of changes in demand, I/O models are mainly useful for examining negative shocks. This means that I/O models have value in estimating the short-term impact of a major industry shutting down in a region, such as by a strike or a natural disaster, as inputs that were previously in use become suddenly idle.[20]

In addition, I/O models have limited reliability when assessing large infrastructure projects such as pipeline projects. The concerns are:

» the way indirect and induced benefits are calculated

» supply constraints in the labour market are not considered

» reliance on the present to estimate the future.

These concerns could inflate the benefits that are calculated for Ontario and are discussed in detail below.

20 Cletus C. Coughlin and Thomas B. Mandelbaum, "A Consumer's Guide to Regional Economic Multipliers," *Federal Reserve Bank of St. Louis Economic Review,* Jan.-Feb. 1991, pp. 24-25.

2.2.2 Calculation of indirect and induced benefits

As project spending trickles down to the rest of the economy, indirect and induced benefits are calculated by the use of multipliers. A multiplier is an estimate of how spending on the project affects the rest of the economy.

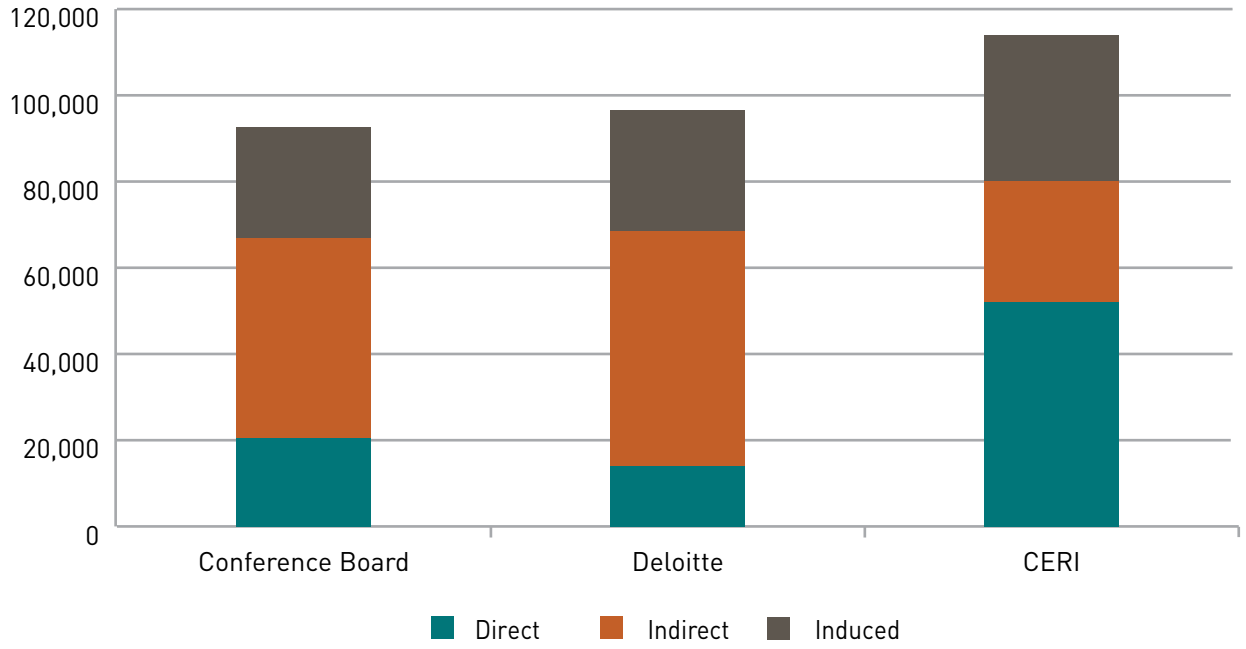
But the relationship between the direct investment in an infrastructure project and the resulting GDP and employment growth may not be directly causal. There are three ways that benefits are accounted for in I/O models: direct, indirect and induced (see Figure 4).

Direct spending and the benefits from that can be clear — based on previous experience, for example, it should be known how many people are required to put in a pipeline or to build a pump station. Indirect spending can be more difficult to estimate given that it is not always known where supplies will be produced before a project starts (see section 2.3.2 below). If materials are produced in another jurisdiction, the benefits will flow there.

Induced benefits can be even more difficult to estimate. The idea is that investment in a large project may lead to the building of a new restaurant, for example, to service the workers, and may also lead to the government building a school for the workers' children. Yet the new restaurant

FIGURE 5:

Comparison of the impact of Energy East on jobs in Ontario (in total FTEs)



Note: The annual figures found in the report are multiplied by the operational lifespan to arrive at a total figure.

and school might have been needed regardless. It is therefore inappropriate to consider such benefits in isolation as there may be a number of causes.[21]

I/O models apply multipliers to direct spending to calculate indirect and induced benefits.

Table 4 summarizes the implied GDP multipliers used in the three existing Energy East impact analyses for the development and construction phase. For more details on calculating multipliers used, see Appendix D.

Despite the difference in capital expenditure, the GDP multiplier in the Conference Board and Deloitte reports are both around 0.9. A multiplier that is less than 1.0 reflects the fact that the modern Canadian economy is very open, and a large proportion of industrial inputs are imported.

By comparison, a study by the OECD estimated infrastructure multipliers from 1.1 to 1.3 for a large country such as the United States and 0.9 to 1.1 for a smaller country such as Belgium.[22] Leakages lost to imports are always greater for a smaller, more open economy. For example, a Conference Board study looking at Canadian electricity infrastructure investment calculated a multiplier of only 0.86.[23]

Comparing the number of direct to indirect and induced jobs is another good way of examining the multipliers used in the models to calculate indirect and induced benefits. Figure 5 looks at the Conference Board's, Deloitte's and CERI's results for job growth in Ontario.

The difference can be striking. While the Conference Board and Deloitte have similar total FTE results, direct employment is higher in Ontario in the Conference Board analysis. This difference is not related to the model as both used the same I/O model, which can be seen as the ratio of induced to total FTEs is 0.25 for both, a plausible figure. We conclude that the higher direct employment in the Conference Board's results must be related to the higher project cost and that this is due to the Conference Board's inclusion of the Eastern Mainline gas pipeline project, which Deloitte did not include.

21 Patrick Grady and R. Andrew Muller, "On the use and misuse of input-output based impact analysis in evaluation," *The Canadian Journal of Program Evaluation*, Vol. 3, No. 2, 1988, pp. 49-61.

22 Organization for Economic Cooperation and Development, OECD Economic Outlook, *Interim Report March 2009*, OECD, March 31, 2009, pp. 114-116 (Box 3.1).

23 Conference Board of Canada, *Shedding Light on the Economic Impact of Investing in Electricity Infrastructure*, February 2012, Table 7. At http://www.conferenceboard.ca/e-library/abstract.aspx?-did=4673.

In CERI's analysis, the number of direct jobs, relative to indirect and induced jobs, is much higher than in the other two. The reason for the difference in results is not clear.

As can be seen, there are differences in the multipliers used, and the appropriateness of the multiplier can be questioned.

The use of multipliers in I/O models to estimate indirect and induced impacts has in itself at times been questioned. In the State of Victoria in Australia, for example, the Auditor General cautioned that the "magic of multipliers in providing leverage from an initial investment can turn out to be a myth when account is taken of the alternative uses of resources... By effectively not accounting for crowding out effects and price changes, I/O analysis can exaggerate the benefits of projects to an economy."[24]

I/O models are also simple accumulators of activity. Therefore, the more activity the greater the benefit. An I/O model would, for example, show higher benefits if the pipeline were put in, removed, and then put in again. This could not possibly be true.

Predicting induced impacts is imprecise for a variety of reasons. For example, one reason is that the extent of the indirect and induced impacts will depend on the state of the economy at the time of the project. If economic conditions are poor, the induced impacts will be higher than if the economy is already experiencing low unemployment. In the latter case, the Bank of Canada may just react to the extra demand by increasing interest rates, with the result that there is no net impact.[25]

The tendency to overestimate the benefits has been identified by Jack Mintz, director of the School of Public Policy at the University of Calgary, when he wrote that "By adding up all the multipliers that industry associations predict, Canada would be the same size as the United States."[26]

2.2.3 Supply constraints

Resources are limited, but I/O models do not include shortages. The models assume that there are sufficient inputs, be those labour or goods, available at market rates to complete the project. Shortages of workers or goods, and the possible cost-inflationary concerns from shortages, are not considered.

In reality, any increase in output predicted by an I/O model would be a net benefit only if all the inputs used for the project — labour and goods — would otherwise be idle or go to waste. That is never the case. Even in recessionary conditions, only a small percentage of the inputs would be idle. Therefore, it would be that idle portion that would benefit from the new project. In essence that would be only the net new benefit.

2.2.4 Reliance on the present

I/O models are based on the future being like the present.

I/O models assume that all policy and market conditions at the time the models were made, or even earlier depending upon data availability (the three analyses all use data from 2009), will be the same for the entire operating life of the project. Yet, as any survey of the past 20 to 30 years will show, such an assumption cannot be relied upon.

One of the most important factors to be considered is the macroeconomic feedback from the project itself. The investment from a large project could affect interest rates, inflation or currency exchange rates, thereby changing the entire economic conditions assumed in the I/O model. There is evidence that I/O models overestimate the impacts from projects over time as macroeconomic feedback tends to reduce the value of the multiplier.[27]

2.3 Analysis of existing economic impact models of Energy East

The results of any economic model are only as good as the assumptions that went into them. In

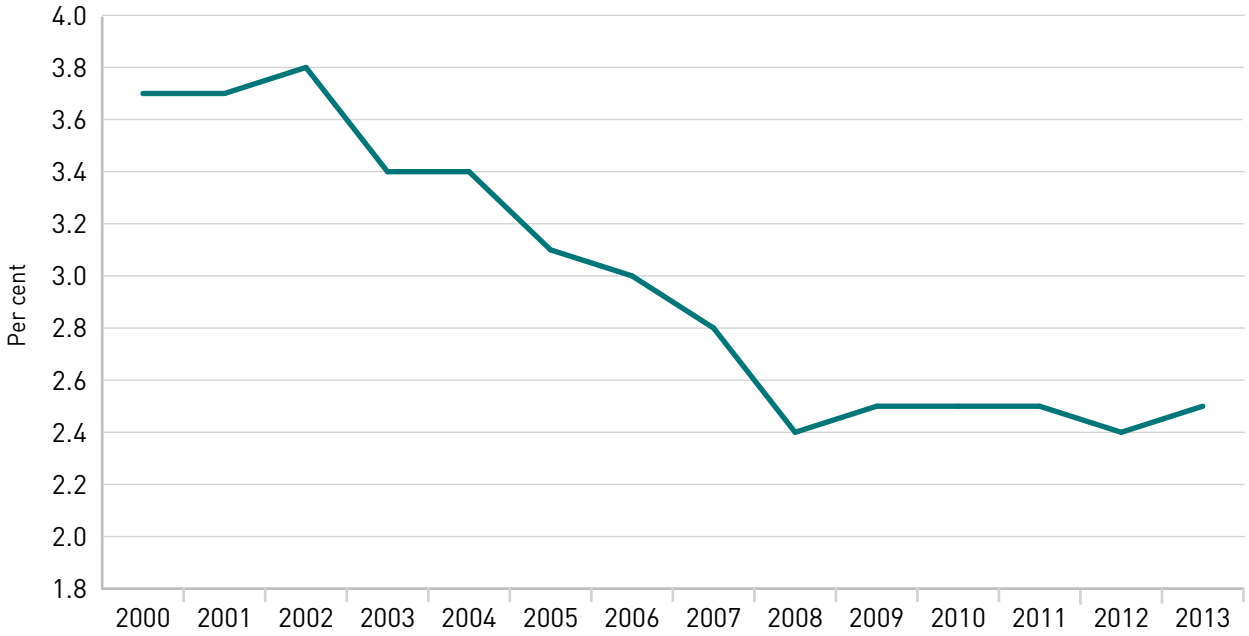
24 Auditor General Victoria, "Investment Attraction and Facilitation in Victoria," No. 152 - Session 1999-2002, 2002, p. 31. At http://www.parliament.vic.gov.au/papers/govpub/VPARL1999-2002No152.pdf.

25 Patrick Grady and R. Andrew Muller, "On the use and misuse of input-output based impact analysis in evaluation," *The Canadian Journal of Program Evaluation*, Vol. 2, No, 3, 1988, pp. 49-61.

26 Jack M. Mintz, "How Keystone, other oil projects suffer from fossilized economics," *Financial Times*, August 14, 2014. At http://business.financialpost.com/2014/08/14/jack-m-mintz-how-keystone-other-oil-projects-suffer-from-fossilized-economics/.

27 Patrick Grady and R. Andrew Muller, "On the use and misuse of input-output based impact analysis in evaluation," *The Canadian Journal of Program Evaluation*, Vol. 2, No, 3, 1988, pp. 49-61.

FIGURE 6:
Ontario's net exports to other provinces (by per cent of the rest of Canada's GDP)



Source: Statistics Canada, *Table 384-00384*. Available at http://www5.statcan.gc.ca/cansim/home-accueil?lang=eng&p2=49&MM.

this section, we examine the assumptions made in the three economic impact reports analyzed and conclude that some of these assumptions might need to be reconsidered given Ontario's current economic and political context.

The most important of these assumptions apply to:

1. the data used for Ontario's trade
2. employment growth
3. calculation of tax benefits from the pipeline
4. the use of discount rates in the calculations.

These assumptions are discussed below.

2.3.1 Ontario's trading data

The three impact analyses assume that Ontario businesses will benefit from their manufactured goods or services being used in the construction of the pipeline in other provinces as well as in Ontario. The extent of the activity in Ontario is an estimate based on a variety of historical assumptions and may be exaggerated.

In the construction and development phase, the Conference Board, for example, estimates that 44 per cent of manufacturing jobs and 42 per cent of jobs in financing and administration associated with the project will go to Ontario. During operations, over half of the administrative jobs are expected to go to Ontario.[28] As with Deloitte and CERI, the Conference Board uses 2009 trading data, the latest for which full data is available, to arrive at these estimates.

While it is true that Ontario benefits from pipeline development with the purchasing of its manufactured goods, as well as from being the centre of Canadian finance, the use of 2009 trading data could lead to inflated results. In recent years Ontario has seen reduced exports not just to the United States, but also to other provinces (see Figure 6). Data from 2009 will be even more out-of-date when the project starts because these trade partners are substituting goods they import from other countries for goods that they might formerly

28 Conference Board of Canada, *Energy East Pipeline Project: Understanding the Economic Benefits for Canada and its Region, Appendix Vol 1-1*, October 2014, pp. 20-21, 40-41. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2541562/Vol_1-Energy_East_Project_and_Asset_Transfer_Applications-Appendix_1-1_CBoC_Report_-_A4D8R3.pdf?nodeid=2541125&vernum=-2.

TABLE 5:
Direct employment on the Energy East pipeline in Ontario

Region	Development and construction	Operations	
	Peak year employment	Annual employment	Total person years of employment (FTEs for 20 years)
Northern Ontario (conversion)	2,206	190	3,800
Eastern Ontario (new build)	735	10	200
Total in Ontario	2,941	200	4,000

Source: TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C1: Northern Ontario, Section 6: Employment and Economy*, October 30, 2014, pp. 24-28. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543126/ESA_V3_PC1_ON_S6_EmplEcon_-_A4E0Q1.pdf?nodeid=2543447&vernum=-2; TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C2: Ontario East, Section 6: Employment and Economy*, October 30, 2014, pp. 15-18. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543668/ESA_V3_PC2_ON_S6_EmplEcon_-_A4E0Z9.pdf?nodeid=2543264&vernum=-2.

have purchased from Ontario. If this trend continues, the multipliers used in the models might not accurately reflect future economic possibilities.

The decline in Ontario's exports has been due to two factors. One is the general trend of globalization along with much stronger competition from newly industrializing companies. The other has been the sharp appreciation of the Canadian dollar compared to the level it was at in the early 2000s (for more on currency appreciation, see section 3.3 below).

It is not clear how much of the material used in the construction of the pipeline would be purchased from Ontario suppliers. For the proposed Keystone XL project, for example, much of the steel pipe has been purchased, and it was produced by Evraz steel mills in Camrose, Alberta, and Regina, as well as imported from Welspun, an Indian manufacturer.[29]

As a result of these factors, there is uncertainty around the level of indirect benefits that Ontario could receive from the pipeline project from manufacturing in particular given the changes in the province's economy since 2009.

2.3.2 Employment growth

According to the economic impact analyses, Ontario is projected to benefit from employment opportunities, both during construction as well as in operation. While there would clearly be direct employment in Ontario related to the construction and operation of the pipeline, the amount of indirect and induced employment may be inflated due to assumptions concerning labour availability and labour displacement.

The number of direct jobs working on the pipeline can be taken from TCPL's application to the NEB (see Table 5). It is also important to understand that the full-time equivalent (FTE) jobs identified in impact studies can be confusing. The FTE essentially counts one year of full-time work as one job. In this way one job during the operation stage of the project that lasts for 10 years will be counted as 10 FTEs. As such, the number of FTEs created by a project has to be considered along with the project's duration.

For direct jobs in the development and construction phase, the peak year will be in late 2016 and early 2017, which is when most of the actual construction will occur. By 2018 the number of jobs would be expected to be significantly reduced as most of the construction will have been completed.

The figures from TCPL of 200 annual jobs in operations equals 4,000 FTEs over a 20-year period, a figure that matches the Conference Board direct jobs figure of 4,372 person years as that figure includes jobs from the Eastern Mainline.

29 Lara Skinner and Sean Sweeney, *Pipe Dreams? Jobs Gained and Jobs Lost by the Construction of Keystone XL*, A report by Cornell University Global Labor Institute, January 2012, pp. 11-13. At http://www.ilr.cornell.edu/globallaborinstitute/research/upload/GLI_keystoneXL_Reportpdf.pdf.

It is not clear how many of these jobs will actually benefit the local communities or the province. During the construction phase, temporary mobile workers from outside the region will be brought in as it is expected that there will be skills shortages.[30] This would reduce the benefit of short-term local employment, and if the workers came from outside the province would reduce the benefits to the province.

In the operations phase, it is not clear how many of the 200 positions will be new positions as most of the Energy East pipeline in Ontario is already in the ground as the Canadian Mainline and there are people currently operating that pipeline. People working on the Canadian Mainline now could be moved to Energy East.

The indirect and induced jobs are modelled based on multipliers applied to spending in the supply chain. Yet if the bulk of the projected direct construction jobs go to out-of-province workers and if the direct operations jobs are not new net positions, then the benefit of indirect and induced would also be smaller than assumed.

In addition, constructing and operating the Energy East pipeline requires skilled technical workers, and those tend to be in short supply in any market. An infinite supply of labour is not, as assumed in the I/O models, available at all times.

The result could actually be a displacement of Ontario labour. The pipeline will require skilled workers, for example welders, a skill that is already in short supply.[31] If there happens to be trained, unemployed welders at the point in time when they are needed, that would represent job creation. However, if there is a shortage of welders and the pipeline could only get them by bidding them away from other projects (by being willing to pay more), then this would be a diversion of labour, with no net job creation. This potential risk is well explained in a recent Alberta Treasury Board report:

> When using the employment multipliers, users are cautioned that these multipliers show the total number of jobs that are required to support the change in activity being considered, but does not indicate the number of new jobs created. When the economy is running at full employment, it is important to remember that the number of jobs required for a particular project must come from other projects/ industries or from outside the province. As indicated above, the I/O model assumes unlimited capacity, whereas in reality, there is a limited number of people in the workforce.[32]

Such a situation was part of a 2014 Australian court case. In that case, the Supreme Court of New South Wales rejected the argument of a mining company that an expanded coal mine would provide large employment benefits, an argument for which the company relied on I/O modelling. Employment benefits were necessary if the mine were to receive permission to open. Opponents to the mine pointed out that there was actually a shortage of mine workers in Australia, meaning that developers imported workers, and that the employment predicted by the I/O model would probably not reflect actual benefits to the region. The mine opponents' argument was accepted by the court.[33]

There could thus be an opportunity cost to Ontario from having its scarce skilled labour working on the pipeline. If these skilled workers are in short supply, other projects, with potentially higher benefits to the province, may be delayed, or more expensive due to the scarcity of labour.

While shortages may cause wages to increase for some workers in Ontario, and while this would

30 TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C2: Ontario East, Section 6: Employment and Economy*, October 30, 2014, pp. 15-18. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543668/ESA_V3_PC2_ON_S6_EmplEcon_-_A4E0Z9.pdf?nodeid=2543264&vernum=-2.

31 Rob Houle, "Firm Looks to Fill 200 Jobs," *St Catherines Standard*, May 6, 2014. At http://www.stcatharinesstandard.ca/2014/05/06/firm-looks-to-fill-200-jobs.

32 Alberta Treasury Board and Finance, *Alberta Economic Multipliers 2009*, October 2013, p. 7. At http://www.finance.alberta.ca/aboutalberta/economic-multipliers/2009/Alberta-Economic-Multipliers-2009.pdf.

33 *Warkworth Mining Limited v Bulga Milbrodale Progress Association Inc [2014] NSWCA 105 (7 April 2014)*, paras. 287-88. At http://www.austlii.edu.au/au/cases/nsw/NSWCA/2014/105.html.

benefit the individual workers, wage increases do not lead to a net increase in economic activity. Higher wages (due to labour shortages) could make other economic activity in the province unfeasible as costs for new projects increase. In addition, as many of these workers may be brought into the region to work on the pipeline, any benefits from higher wages may not remain in Ontario.

2.3.3 Taxes and government benefits

In the three economic impact analyses, there are benefits flowing to all three levels of government through taxes and other payments for the construction and operation of the pipeline. The benefits to Ontario, however, may be overestimated due to uncertainty about federal spending and the fact that the project in Ontario is primarily a conversion rather than new construction.

The Conference Board estimates Ontario would receive an additional $1.7 billion in fiscal revenue from the 20-year operation of the pipeline through the following:

» $826 million in additional provincial tax

» $827 million from the federal government, as the province's per capita share of federal fiscal revenue.[34]

First, as discussed above, the manufacturing and other economic benefits to Ontario from the pipeline may be inflated due to the changing economy of the province. This could reduce the estimated increase in provincial corporate tax revenue.

Second, the Conference Board assumes that federal tax revenue will be spent and distributed on a per capita basis across the country. If this turns out not to be the case — if the federal government distributes less money in Ontario than its per capita share, which is the usual pattern of the federal government — the economic benefits to Ontario will be lower than suggested.

In terms of local municipal tax benefits, there could be some important benefits in some regions, but on the whole the effects would be marginal.

First, there is the potential for reduced residential property values, which could then affect the property tax paid for the land. While there has been little research on residential property values and proximity to oil pipelines, a study conducted for the Trans Mountain pipeline in British Columbia says that there is generally no long-term impact on property values. This could change, however, if a major pipeline spill occurs.[35] If the market value of property declines, then the municipality's property tax revenue could likewise decline, or the rates could be increased to make up the difference.

Second, in terms of property tax paid by TCPL for the pipeline and its operations, most municipalities on the route would not see significant changes in their tax base. This is because the tax paid for a pipeline is set through provincial legislation, and is based on the physical properties of the pipeline, such as materials used and diameter, and not what flows through the pipeline.[36] Since most of the Energy East pipeline in Ontario would be a conversion, as long as the physical properties of the pipeline do not change, which is expected to be the case, the property tax currently paid by TCPL would stay the same.

There will be some additional construction as a result of the conversion, such as for the pump stations. The addition of machinery and equipment, and possibly new buildings, would likely affect the total assessed value of the land. TCPL expects that its current annual municipal tax bill in the 1,900-kilometre-long converted section to increase by 13 per cent, to $30.5 million, a $3.5 million a year increase. Given that the only additional major taxable infrastructure will be the pump stations, an estimated 13 per cent increase in municipal taxes for TCPL would appear to be a reasonable estimate.[37]

34 Conference Board of Canada, *Energy East Pipeline Project: Understanding the Economic Benefits for Canada and its Region*, Appendix Vol 1-1, October 2014, pp. 45-46. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2541562/Vol_1-Energy_East_Project_and_Asset_Transfer_Applications-Appendix_1-1_CBoC_Report_-_A4D8R3.pdf?nodeid=2541125&vernum=-2.

35 Tsur Somerville and Jake Wetzel, *Pipelines and Property Values: A Review of the Academic Literature, Prepared for the Trans Mountain Expansion Project,* May 22, 2014. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/548311/956726/2392873/2451003/2480554/B47-2_-_Trans_Mountain_Response_to_Amy_C_IR_No._1.3g-Attachment1_-_A3X5Y7.pdf?nodeid=2480459&vernum=-2.

36 Information provided by MPAC, September 19, 2014.

37 TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontar-*

TABLE 6:

Discount rate sensitivities in the total economic impact of the Energy East project on Ontario ($ billion)

Discount rate (%)	0	2.46	5	8
Conference Board (20 years of operation)	$18.93	$13.75	$10.29	$7.66
Deloitte report (40 years of operation)	$21.86	$13.03	$8.54	$5.81
CERI report (25 years of operation)	$11.90	$8.81	$6.84	$5.35

Notes: The shaded numbers are the originals from the three economic impact analyses.
All numbers are based on inflation-adjusted 2013 dollars.
Source: Conference Board of Canada, *Energy East Pipeline Project: Understanding the Economic Benefits for Canada and its Region*, Appendix Vol 1-1, October 2014, Table 6, p. 47 (high case scenario). At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2541562/Vol_1-Energy_East_Project_and_Asset_Transfer_Applications-Appendix_1-1_CBoC_Report_-_A4D8R3.pdf?nodeid=2541125&vernum=-2; Deloitte, *Energy East: The Economic Benefits of TransCanada's Canadian Mainline Conversion Project*, September 2013, p. 12. At http://www.energyeastpipeline.com/wp-content/uploads/2013/09/Energy-East-Deloitte-Economic-Benefits-Report.pdf; Canadian Energy Research Institute, *An Economic Analysis of TransCanada's Energy East Pipeline Proje*ct, Study No. 140, May 2014, Figure 3.5. At http://www.ceri.ca/images/stories/2014-05-06_CERI_Study_140_-_Energy_East_Pipeline_Project.pdf.

There would be additional municipal tax revenue for the 100 kilometres of new pipeline construction in eastern Ontario and the two pump stations planned on that section. TCPL estimates that once completed and operational, TCPL will pay $10.5 million a year in property tax to the communities affected by the new construction.[38] Although this section is shorter, as this is new infrastructure — and not converted infrastructure as in northern Ontario — the increase in property tax revenue will be higher here.

The 250-kilometre Eastern Mainline gas pipeline project in Ontario will also be new construction, and, while some of it will be on land currently owned by TCPL, it will have an effect on the municipal taxes of the communities it goes through.

For more information on local benefits, and the potential impact on individual communities, see Appendix B.

2.3.4 Discount rates

To assess long-term projects, and to understand their impact in current dollar terms, it is common to sum all the future benefits into one value, which is referred to as the net present value. A discount rate is used to value future costs and benefits in today's dollars.

The use of a discount rate is common in economic analyses because of the many uncertainties the future holds, and a discount rate is chosen to reflect the level of risk and lost opportunity cost of the investment.

The choice of discount rates can significantly change the long-term results leading to higher-than-expected benefits. A high discount rate would lead to lower net present value, and in these calculations it would mean lower economic benefits to Ontario from the project.

The Conference Board and the CERI reports do not use any discounting in their calculations, while the Deloitte study discounts future impacts using the long-term Canadian bond rate of 2.46 per cent.

We consider the discount rate choice by Deloitte to be low as the long-term Canadian bond rate assumes that the future is relatively risk free.

For illustrative purposes, Table 6 shows how the long-term economic impacts of the pipeline in Ontario could change depending upon the discount rate used. All numbers are in inflation-adjusted 2013 dollars.

As an example, the Auditor General of Ontario criticized the Ontario Power Authority for using a 4 per cent discount rate when it evaluated the

io, C1: Northern Ontario, Section 6: Employment and Economy, October 30, 2014, pp. 32. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543126/ESA_V3_PC1_ON_S6_EmplEcon_-_A4E0Q1.pdf?nodeid=2543447&vernum=-2.

38 TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C2: Ontario East, Section 6: Employment and Economy*, October 30, 2014, p. 22. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543668/ESA_V3_PC2_ON_S6_EmplEcon_-_A4E0Z9.pdf?nodeid=2543264&vernum=-2.

costs of relocating the two gas plants, saying that 6 per cent was more reasonable.[39] We likewise believe that the use of a higher discount rate when evaluating the Energy East project would be more reasonable.

2.4 Summary

Despite the limitations of I/O models, they are commonly used to assess the economic impact of large projects. But their results should be seen as illustrations — if everything stays the same — that show the maximum potential economic benefits, and not a complete economic cost-benefit analysis.

An analysis of the three economic impact reports shows that the benefits estimated for Ontario are likely inflated. There are a number of reasons for this:

» The reports assume that past or present scenarios accurately predict the future, and do not account for any changes in the economy over the lifespan of the project, or from when the data was compiled.

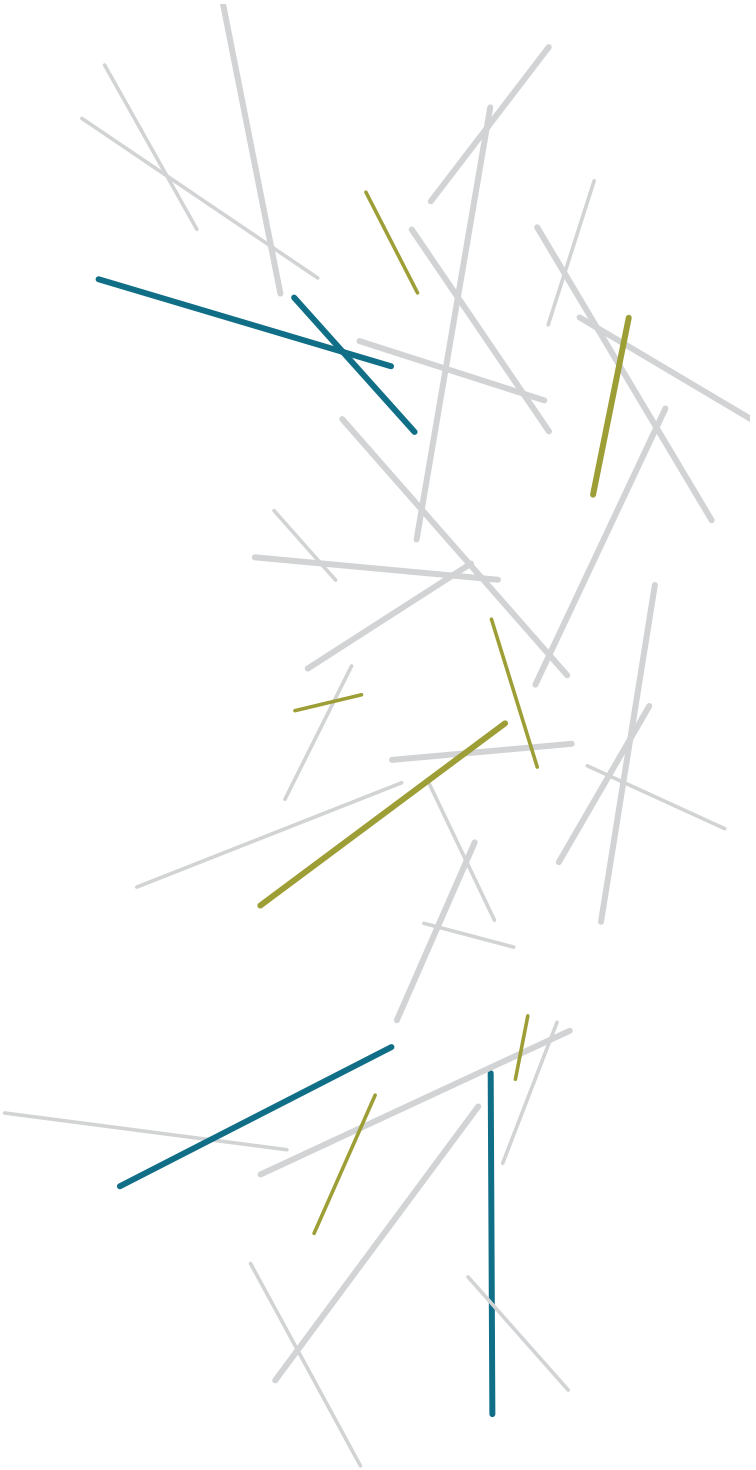
» The reports assume large indirect benefits for the economy. The reports do this by applying multipliers to the direct project spending. A multiplier is an estimate of how spending on the project affects the rest of the economy. Multipliers tend to inflate indirect benefits because they do not account for resource availability or alternate use.

» The results rely on all necessary inputs, such as labour, being available, and do not account for any shortages. It also does not account for displacement as labour may already be working, and the project would only displace workers from existing projects to the proposed one.

» The reports do not sufficiently take into account that most of the project in Ontario will be a conversion of an existing pipeline, and so projected increases in tax benefits and employment may be lower.

The reports use no discount rates or an unrealistically low discount rate in their calculations to account for future uncertainty and costs. A discount rate is used to value future costs and benefits in today's dollars. If a more realistic discount rate were used in the economic modelling, the projected benefits would be significantly lower.

The results of I/O models in general, and the three under study in particular, do not consider potential costs or other risks.



39 Auditor General of Ontario, O*akville Power Plant Cancellation Costs: Special Report,* October 2013, p. 20. At http://www.auditor.on.ca/en/reports_en/oakville_en.pdf.

3

Long-term economic and policy costs and risks

3.1 Overview

As mentioned above, one of the limitations of economic impact estimates using I/O models is that they assume that the economic, political and environmental context will not change in the future. Yet given the operating life of energy infrastructure — 25 years plus in the case of Energy East — it is unreasonable to think that the future will be the same as the present.

The Energy East project is an example of how the political and economic context can change quickly. The decision to convert one of the Canadian Mainline gas pipelines to carry crude oil comes from the radical changes in the North American energy sector — changes that are less than a decade old. The most important change was the growth in fracking for natural gas in the U.S., which increased the availability of low-priced gas in Ontario and Quebec,[40] reducing demand for Western Canadian gas transported on the Canadian Mainline. At the same time, oil sands production in Alberta started to increase, and demand for transporting that crude to market rose.

Although the future cannot be predicted, it is important to consider broader long-term policy risks when evaluating the economic impact of a major infrastructure project. Each investment project has its own risk profile in which different factors — market, environmental, technical, regulatory or political — have different degrees of prominence. The severity of these risks depends on the investment project.

From Ontario's perspective, there are a number of long-term economic and political risks associated with the Energy East pipeline project. While these risks may perhaps have a low probability of occurring, their impact would be large and could determine the long-term economic impact of the Energy East pipeline on Ontario. Many of these risks are outside the ability of TCPL and the Ontario government to mitigate. In addition, these risks are difficult to quantify, and as such this section will only look into potential broader economic and political risks that could impact the costs or benefits of the pipeline project to Ontario, namely:

» problems with the federal Equalization program

» potential appreciation of the Canadian-U.S. exchange rate

40 Energy Information Administration "Market Trends: Natural Gas," *Annual Energy Outlook*, May 7, 2014. At http://www.eia.gov/forecasts/aeo/MT_naturalgas.cfm.

» increased GHG emissions and carbon pricing

» losses in natural capital

» changes to energy flows.

Examining these broader costs and risks when assessing the long-term economic impact of the project on Ontario will require looking at the upstream and downstream implications of the pipeline. This includes examining the increased development of the oil sands and associated GHG emissions, as well as exports and the operation of the pipeline itself. See Appendix A for more details on the upstream assumptions used in this report.

3.2 Problems with the Equalization program

The federal Equalization program sends nearly $17 billion of federal tax dollars to provincial governments that have lower fiscal capacity to ensure that all provinces have the ability to deliver reasonably comparable public services at reasonably similar tax rates.[41] We believe that the current design of the program serves Ontario poorly, creating a situation whereby, despite the Ontario government receiving modest payments through the program, Ontarians are net contributors to the program (and to the federation overall). This is due in large part to the way resource royalties are considered, and it would be exacerbated by any growth facilitated by Energy East.

Resource royalties are the exclusive domain of the provinces. The federal government does not receive any of the direct revenue from resource development in the provinces — only indirectly to the extent it is reflected in higher corporate or personal income taxes. And in calculating Equalization for the provinces, only 50 per cent of provincial resource royalties are taken into consideration.

Access to resource royalties is the major driver of the inequality in revenue available to provincial governments. For example, the four provinces with above-average fiscal capacity — in other words, the provinces that do not receive Equalization payments — are the ones that receive the highest share of natural resource revenues in the country. As a result the cost of the Equalization program could be borne by residents all across Canada, with about 40 per cent of the revenue coming from Ontario, which significantly exceeds the share that comes back to the provincial government.[42]

The Energy East pipeline could exacerbate this problem as it could allow for both increased oil sands production and higher prices for the oil produced. This would lead to higher resource royalties for the provinces (primarily Alberta and Saskatchewan), widening the resource-driven imbalances between provinces and placing further strain on an Equalization program that already falls well short of its objectives.

3.3 Potential appreciation in Canadian-U.S. exchange rates

There is a broad consensus that increased oil exports lead to an increase in the value of the Canadian dollar and that increases in the Canadian dollar have a negative impact on the overall GDP of the Ontario economy.[43] Research by TD Economics has shown that the Canadian dollar moves with the price of oil, with a 10 per cent decline in the price of West Texas Intermediate, the standard oil price for North America, leading to a decline of about 1 per cent in the value of the Canadian dollar.[44]

41 Noah Zon, *Filling the Gap: Measuring Ontario's Balance with the Federation*, Mowat Centre, March 2013. At http://mowatcentre.ca/filling-the-gap/.

42 Thomas Granofsky and Noah Zon, *Cheques and Balances: The Finances of the Canadian Federation*, Mowat Centre, April 2014. At http://mowatcentre.ca/cheques-and-balances/.

43 International Monetary Fund, *Canada 2012 Article IV Consultation*, IMF Country Report No. 13/40, February 2013, p. 42. At http://www.imf.org/external/pubs/ft/scr/2013/cr1340.pdf; Also see: International Monetary Fund, *Canada 2012 Article IV Consultation: Selected Issues*, February 2013, pp. 46-47. At https://www.imf.org/external/pubs/ft/scr/2013/cr1341.pdf. See also Ramzi Issa, Robert Lafrance, and John Murray, *The Turning Black Tide: Energy Prices and the Canadian Dollar,* Bank of Canada Working Paper, 2006-29, August 2006. At http://www.banqueducanada.ca/wp-content/uploads/2010/02/wp06-29.pdf; Jean-Philippe Cayen, Donald Coletti, René Lalonde, and Philipp Maier, *What Drives Exchange Rates? New Evidence from a Panel of U.S. Dollar Bilateral Exchange Rates,* Bank of Canada Working Paper, 2010-5, February 2010. At http://www.bankofcanada.ca/wp-content/uploads/2010/05/wp10-5.pdf.

44 Randall Bartlett, *Of Oil and Output: An overview of the impacts of falling oil prices on the Canadian economy*, TD Economics. October 17, 2014. At http://www.td.com/document/PDF/economics/special/OilAndOutput.pdf.

Why are we singling out oil exports?

Our model shows that an increase in the value of net exports of oil and refined petroleum products leads to an appreciation of the Canadian dollar, thereby hurting other exporters, notably in Ontario. However, it could be asked if an increase in the exports of any good or service from Canada could also affect the exchange rate. If so, then Ontario's auto exports, for example, could also negatively affect exporters in other provinces.

The answer is yes, an increase in the exports of any good would affect the exchange rate. But crude oil exports, and other natural resource exports, are different from other exports, for three reasons:

1. Oil exports have a large effect on Canada's net exports (total exports minus total imports). This is because there are not many imported components in oil production. In auto production, for example, many of the inputs would be imported. Therefore, $1 billion in auto exports may actually only be an increase of $500 million (in net exports) as half the components needed to make the vehicles may be imported.

2. The sheer scale of the increase in net exports as a result of the pipeline is greater than it would be for other new industries. The Energy East pipeline is expected to lead to an increase in net oil exports of $10 billion. A large number of new auto plants would be needed to increase net exports by that much. The impact of the pipeline will also be felt quickly, with the net exports growing as soon as it is completed and before the economy can adjust to the change (see Appendix A and C).

3. Natural resource revenues are treated differently in the Equalization program than other economic revenue. Resource royalties are generally not available to the federal government and only 50 per cent are included in the formula that calculates Equalization (see section 3.2). This means that revenue from oil resource royalties cannot be used to support regions that are disadvantaged by the increase in exports.

So while increased net exports of any good or service would affect the exchange rate, increased oil exports — and the exports of other natural resources — cause greater negative effects on other exporters than an increase in other exported goods or services.

Any increase in the Canadian-U.S. exchange rate poses a large risk for Ontario as its economy is more sensitive to any exchange rate changes than the rest of Canada.[45] The effect of any changes in the exchange rate on Ontario's economy was highlighted by Ontario's Ministry of Finance in the 2014 budget. It was stated there that an increase in the exchange rate would reduce Ontario's GDP growth.[46]

The Energy East pipeline is projected to increase the net exports of Canadian oil and refined petroleum products.[47] This could lead to an appreciation in the Canada-U.S. exchange rate, potentially hurting the Ontario economy.

To understand the potential effect, we need to examine how oil exports affect the exchange rate. Oil is priced in U.S. dollars. This means that as more Canadian oil and refined petroleum products are exported, more U.S. dollars are transferred to Canadian oil producers from international buyers. These Canadian oil producers must then exchange their U.S. dollars into Canadian dollars to pay workers, purchase goods, make capital investments and pay dividends.

It is this increase in the demand for the Canadian dollar due to exports of oil and refined petroleum products that is important. As with most goods and services, a higher demand for something of limited supply increases its value. In this case, the increased demand for Canadian dollars relative to the U.S. dollar leads to a rise in the value of the Canadian dollar.

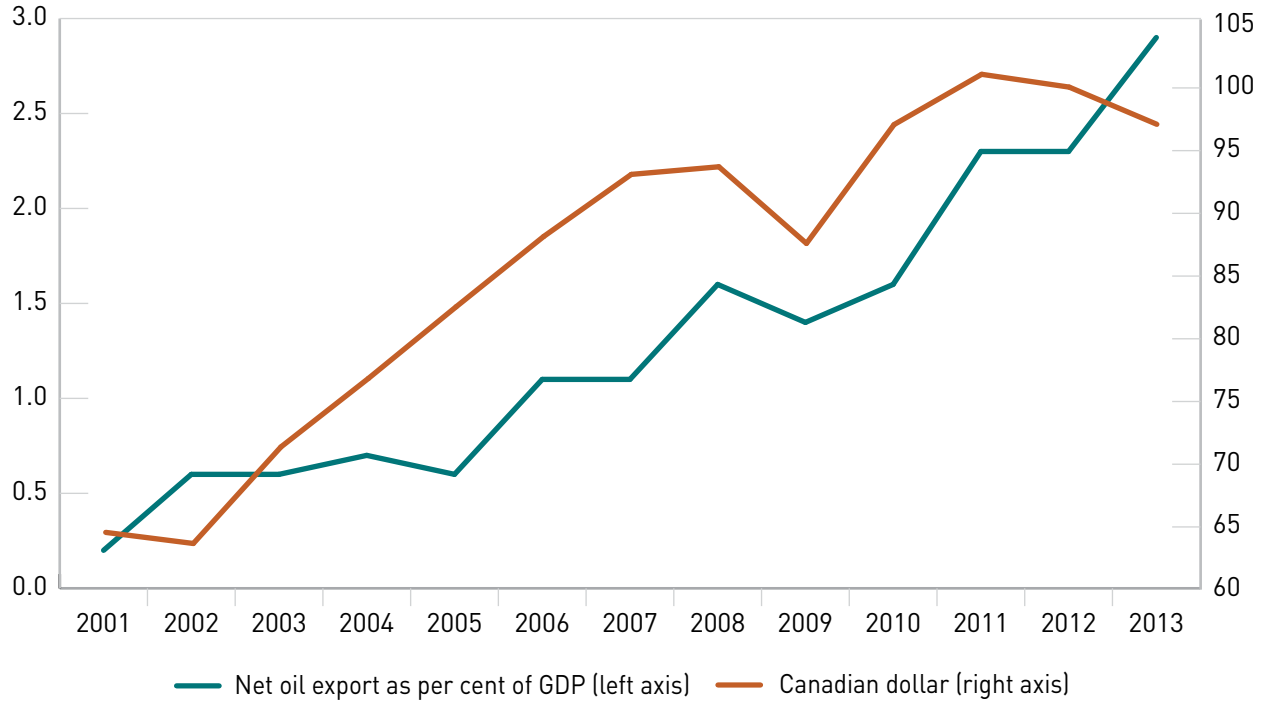
The relationship between net crude oil exports (exports minus imports) and the Canadian dollar can be seen in Figure 7.

45 This is noted by Peter Spiro, "A Sectoral Analysis of Ontario's Weak Productivity Growth," *International Productivity Monitor*, Number 26, Fall 2013, Table 10. There, it was found that impact of the exchange rate on manufacturing production in the rest of Canada was much smaller than in Ontario, and it was just barely statistically significant.

46 Ontario Ministry of Finance, "Chapter II: Ontario's Economic Outlook and Fiscal Plan," *Budget 2014*, p. 205. At http://www.fin.gov.on.ca/en/budget/ontariobudgets/2014/papers_all.pdf.

47 See Navius Research's model on the Energy East pipeline in Appendix A.

FIGURE 7:
Change in the share of net oil exports to GDP and the value of the Canadian dollar



Source: Data from Statistics Canada. At www.statcan.gc.ca.

While the increased value of oil exports will hurt Ontario's economy through the appreciation in the exchange rate, there will also be some positive effects from increased oil exports. This is because some of the additional income received by workers from other provinces will find its way to Ontario through the purchase of goods and services from Ontario. This effect, while partially captured in the benefits identified by the three impact analysis reports by the Conference Board, Deloitte and CERI, must also be considered when balancing out the exchange rate impact.

3.3.1 Potential cost of currency appreciation to Ontario

Historical data can be used to estimate the potential costs to Ontario from an increase in the value of oil exports. The statistical technique known as regression analysis is used here for estimating the effect of these changes on Ontario's GDP based on past fluctuations. Appendix C has more details on the regression analysis and how the figures were calculated.

The share of net oil and refined petroleum products in Canada's GDP is used in our model to calculate the changes in the Canadian-U.S. exchange rate (this figure is adjusted for changes in the exports of transportation services and machinery imports, see Appendix C.2).

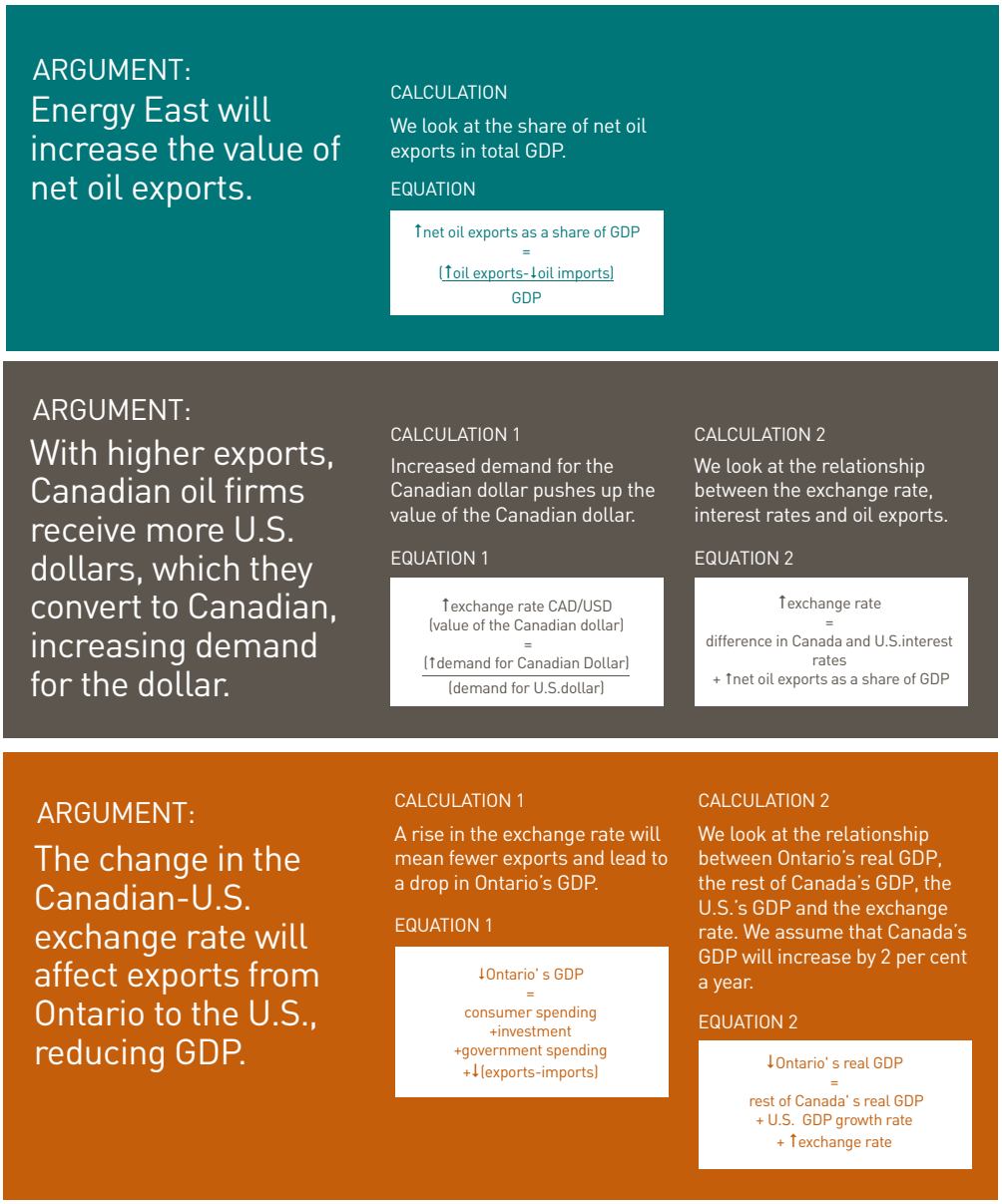
We assume that since Energy East will increase the value of net exports of oil and refined petroleum products — the amount earned from exports minus the amount spent on imports — the share of the value of net oil and refined petroleum products exports to Canada's GDP will also increase. To assess the value of future increases in the value of net exports, we assume that Canada's GDP will have a 2 per cent annual growth rate for the entire study period.

In addition, the difference between the Canadian and U.S. short-term treasury bill interest rates is included in the calculation as a policy factor to explain other variations in the model. This was chosen as a higher interest rate in Canada tends to attract investment, pushing up the exchange rate.[48]

48 There is a lot of uncertainty in determining the exchange rate, as it is affected not just by observable variables, but also the vagaries of psychology and market sentiment. This can be seen in how dramatically the exchange rate can move over relatively short periods of time. This model attempts to capture this uncertainty using this policy factor.

FIGURE 8:

How we calculate the effect of increased net oil exports on Ontario's GDP



According to our model, as the ratio of net oil and refined petroleum products exports to Canada's GDP increases, the value of the Canadian dollar rises as well. Since the value of net exports that could be attributed to Energy East varies during the modelling period, the increase in the value of the Canadian dollar that could be attributed to the pipeline likewise varies during this period, ranging from a 1.2 cents U.S. increase to a 2.5 cents U.S. increase ($0.012 to $0.025), holding all else constant.

This change in the exchange rate due to Energy East that we modelled is then used to calculate the impact on Ontario's GDP. To calculate the effect of the exchange rate on Ontario's GDP, we look at the historical relationship between Ontario's GDP and three variables:

1. The first variable is the percentage change in GDP in the rest of Canada, outside of Ontario. This variable estimates how a change in GDP growth rate outside of Ontario would effect Ontario's GDP growth rate.

2. The second variable is the difference between the current year's U.S. GDP growth rate and the previous year's, a variable which reflects Ontario's strong trade ties to the U.S.

TABLE 7:

Estimate of potential impact on GDP in comparison to benefits projected in the economy impact analyses ($ billions)

Report	Conference Board		Deloitte		CERI	
Project lifespan	26 years		46 years		28 years	
Discount rate (%)	2.50	5.0	2.46	5.0	2.50	5.0
Benefits from analyses	$13.75	$10.29	$13.03	$8.54	$8.81	$6.84
GDP reduction	-$38.61	-$26.33	-$86.05	-$48.09	-$56.14	-$35.49
Total	-$24.86	-$16.04	-$73.02	-$39.55	-$47.33	-$28.65

Note: GDP figures were adjusted for inflation in 2013 dollars. Statistics Canada, Cansim table 379-0030. At http://www.statcan.gc.ca/.

3. The third variable is the value of the Canadian dollar in U.S. cents.

Figure 8 shows in more detail how we calculated the effect of increased net oil exports on Ontario's GDP.

Our model shows that the full GDP effect of any exchange rate change takes place over eight years, with the annual impact increasing every year due to changes in net oil and refined petroleum products exports as highlighted in Appendix A. Based on the regression results, after eight years the initial change in the exchange rate would no longer impact the yearly GDP's growth rate; however, the GDP would remain at a permanently lower level than what it would have been otherwise.

Starting in the autumn of 2014 the Canadian dollar fell dramatically when compared to the U.S. dollar. This change in Canada's exchange rate, while generally beneficial for Ontario's economy, would not affect the overall results of our model. The model is designed to show how changes in oil exports will affect Ontario's GDP, all other changes in the economy being equal (see Table C.5 in Appendix C for the method of calculation). Therefore, the impact on Ontario's GDP caused by the increase in the value of oil exports due to Energy East would occur regardless of any other change in the exchange rate. Any additional effects would be cumulative. For example, if the international price of oil exports increases then there would be an additional increase in the value of Canadian net oil exports, and this would also increase the value of the Canadian dollar. This increase would be in addition to the increase due to Energy East.

Full details of the regression analysis and equations used in these calculations are available in Appendix C.

Table 7 summarizes how the potential exchange rate impact could affect the calculation of the benefits that were estimated in the three economic impact analyses. As with any economic modelling, actual future results are uncertain as factors not foreseen at the time could dramatically change the results. Yet under the scenario we modelled, the impact of Energy East on Ontario could be negative due to the projected impacts on the exchange rate.

3.4 Increased GHG emissions

Despite a trend toward more active climate reduction policies throughout the world, the Canadian government has introduced few reduction policies.[49] Unlike in other jurisdictions, carbon emissions are often overlooked as a major risk factor in Canada,[50] a point raised by Ontario's Environmental Commissioner.[51] As other jurisdictions look to mitigate climate risks, and in the absence of a national emissions-reduction policy, Canada, although a small source of emissions globally, could become an outlier if emissions-reduction policies are not introduced. In addition, if other countries reduce their emissions,

49 World Bank, *State and Trends of Carbon Pricing*, 2014. At http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/05/27/000456286_20140527095323/Rendered/PDF/882840AR0Carbo040Box385232B00OUO090.pdf.

50 See, for example, UNEP Financial Initiative, *Portfolio Carbon,* July 2013. At http://www.unepfi.org/fileadmin/climatechange/UNEP_FI_Investor_Briefing_Portfolio_Carbon.pdf.

51 Environmental Commissioner of Ontario, *Looking for Leadership: The Costs of Climate Inaction*, July 2014. At http://www.eco.on.ca/uploads/Reports-GHG/2014/GHG2014%20Looking%20for%20Leadership.pdf.

then the relative share in global emissions from oil sands development would increase.[52]

With the increase in emissions associated with oil sands production that would be facilitated by the Energy East pipeline, there could be negative effects on Ontario through:

» stranded infrastructure

» export concerns

» carbon pricing.

3.4.1 Stranded infrastructure

Ontario will receive most of its benefits from the Energy East pipeline during the operations phase and so the longer the pipeline operates, the greater the benefits for the province.

The potential for stranded infrastructure due to market changes applies to any large project. The threat of a portion of the current Canadian Mainline system becoming a stranded asset due to reduced demand for Western Canadian natural gas is one of the reasons for the Energy East project.

But concerns and future policies over GHG emissions, especially emissions from oil sands production, could lead an increased risk of Energy East becoming a stranded asset.

Two emissions-related risks that could strand the pipeline are:

» reduced demand for oil sands products

» reduced demand for fossil fuels.

Environment NGOs (ENGOs) have already called for a boycott of the oil sands. In the U.S., several companies, including Whole Foods, Trader Joe's, Seventh Generation and Walgreens, have changed fuel suppliers to reduce their oil sands consumption.[53]

In addition to unofficial boycotts, some jurisdictions, such as the EU and California, have prepared fuel quality directives or low carbon fuel standards (LCFS) that could limit the demand for crude from the oil sands.[54]

The EU's LCFS was recently changed to potentially allow for greater use of oil sands crude,[55] a change that was seen as a victory for Canadian oil sands producers.[56] However, if the change is not successfully passed by the European Parliament or if the LCFS are strengthened in the future, the overall effect would be to reduce demand for products derived from the oil sands. This in turn could lower the need for infrastructure transporting products from the oil sands.

There is also the possibility that demand for all forms of crude oil could fall if the international community became serious about currently-proposed future emission targets. The Intergovernmental Panel on Climate Change (IPCC) estimates that the world's "carbon budget," the amount of GHG that can be emitted in the future if we are likely to keep warming to 2°C, at 306 GtC (gigatonnes of carbon). In comparison, human activity had already led to 515 GtC in emissions by 2011.[57]

Meeting the 2°C target cap could leave a large percentage of Canadian oil reserves undeveloped. By some accounts, up to 85 per cent of total reserves will have to be left in the ground

52 Michael Levi, *The Canadian Oil Sands: Energy Security versus Climate Change*, Council of Foreign Relations Special Report No. 47, May 2009. At http://www.cfr.org/content/publications/attachments/Oil_Sands_CSR47.pdf.

53 Christina Nunez, "Boycotting Tar Sands Oil: Will It Work?," *National Geographic Daily,* May 5, 2014. At http://news.nationalgeographic.com/news/energy/2014/05/140505-tar-sands-oil-energy-refineries-sierra-club-environment/.

54 For more details, see European Commission, "Fuel Quality." At http://ec.europa.eu/clima/policies/transport/fuel/index_en.htm; California Energy Commission, "Low Carbon Fuel Standard." At http://www.energy.ca.gov/low_carbon_fuel_standard/.

55 European Commission, "Climate action: Reducing the carbon content of transport fuels," IP/14/1095, October 7, 2014. At http://europa.eu/rapid/press-release_IP-14-1095_en.htm?locale=en.

56 Barbara Lewis and Scott Haggett, "EU abandons 'dirty' label for Canada oil sands crude," *Globe and Mail*, October 8. 2014. At http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/eu-abandons-dirty-label-for-canada-oil-sands-crude/article20983313.

57 Intergovernmental Panel on Climate Change, "Summary for Policymakers," *Climate Change 2013: The Physical Science Basis: Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, October 2013. At http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf.

to meet this target.[58] For Canada, under the International Energy Agency's 450 Scenario, which is designed to keep warming to under 2°C, oil sands production is around 3 mb/d in 2035.[59] By comparison, in 2013, 1.9 mb/d of crude came from the oil sands, with the Canadian Association of Petroleum Producers projecting 4.8 mb/d by 2030.[60]

ENGOs are calling for reduced consumption of oil sands production and fossil fuels in general. In addition to boycotts, ENGOs have called for investors to divest assets connected to fossil fuel production. Although the effect of the divestment calls has so far been small, Stanford University, the British Medical Association, and a number of private retirement funds and American cities (including Oakland, Portland, Seattle and San Francisco) have divested fossil fuel assets they had owned.[61] The Rockefeller Brothers Fund and the World Council of Churches have also divested their fossil fuel assets,[62] and the University of Toronto has formed a committee that will examine fossil fuel divestment.[63]

Research has shown that oil sands development in a carbon-constrained world would be highly dependent upon carbon policy.[64] The risk of carbon policy stranding assets has been raised by Mark Carney, current governor of the Bank of England and formerly governor of the Bank of Canada. He says that the Bank of England will be looking into the risks to investment and credit from the possibility of stranded assets.[65] In December 2014, the UK energy secretary, Ed Davey, called for a debate into whether companies should be forced to disclose their exposure to fossil fuel assets so investors can understand the risks.[66]

Since Ontario will host the longest stretch of the pipeline, and there will be little new construction in the province, the bulk of the economic benefits Ontario is projected to receive would be from the operation of the pipeline. If the operational life of the pipeline were shorter, that would lower the total benefits received. For example, even the municipal taxes paid on a non-operational pipeline are lower than an operational one.

3.4.2 Export concerns

If Canada does not introduce emissions-reduction policy measures, and the share of the oil sands in global emissions increases, it is possible that Canada could become a target of GHG-emissions-related trade actions.

There is the potential of other countries and trading blocs implementing a carbon tariff on Canadian imports, charging a penalty on Canadian-made goods to account for not reducing emissions. Although difficult to implement, and possibly to get past the World Trade Organization, the use of such a tariff, or at least "border adjustments", was discussed in the U.S. during negotiations over the (failed) Clean Energy and Security Act.[67] If Ontario's trading partners implement such a tariff, Ontario's exports could be further hurt.

58 Christophe McGlade and Paul Ekins, "The geographical distribution of fossil fuels unused when limiting global warming to 2 °C," *Nature*, No. 517, January 8, 2015, pp. 187–190. At http://www.nature.com/nature/journal/v517/n7533/full/nature14016.html.

59 International Energy Agency, *World Energy Outlook 2010,* OECD, 2010, p. 450.

60 Canadian Associate of Petroleum Producers, *Crude Oil: Forecast, Markets and Transportation*, June 2014. At http://www.capp.ca/forecast/Pages/default.aspx.

61 For more information, see the Go Fossil Free! Website at http://gofossilfree.org/.

62 Suzanne Goldenberg, "Heirs to Rockefeller oil fortune divest from fossil fuels over climate change," *Guardian*, September 22, 2014. At http://www.theguardian.com/environment/2014/sep/22/rockefeller-heirs-divest-fossil-fuels-climate-change.

63 University of Toronto, Office of the Vice-President and Provost, "Presidential Advisory Committee on Divestment from Fossil Fuels," November 3, 2014. At http://www.provost.utoronto.ca/public/pdadc/2014_to_2015/Presidential_Advisory_Committee_on_Divestment_from_Fossil_Fuels.htm.

64 Gabriel Chan, John M. Reilly, Sergey Paltsev, and Y.-H. Henry Chen, *Canada's Bitumen Industry Under CO2 Constraints*, MIT Joint Program on the Science and Policy of Global Change, January 2010. At http://globalchange.mit.edu/files/document/MITJPSPGC_Rpt183.pdf.

65 Mark Carney, *Letter from Mark Carney to Joan Walley, MP, Chair Environmental Audit Committee*, October 30, 2014. At http://www.parliament.uk/documents/commons-committees/environmental-audit/Letter-from-Mark-Carney-on-Stranded-Assets.pdf.

66 Alex Morales, "Fossil-Fuel Exposure May Need to Be Disclosed in U.K.," *Bloomberg News*, December 11, 2014. At http://www.bloomberg.com/news/2014-12-11/companies-should-disclose-fossil-fuel-exposure-u-k-s-davey.html.

67 Catherine Izard, Christopher Weber and Scott Matthews, "Scrap the Carbon Tariff," *Nature*, December 17, 2009. At http://www.nature.com/climate/2010/1001/full/climate.2010.132.html.

The U.S. government is reportedly pursuing a new climate change policy that would include "naming-and-shaming" countries with high carbon emissions.[68] It is possible that Canada could be included in this, further hurting Canada's image.

And any trade barrier would not have to be official government policy. Popular boycotts, and the reputational risks associated with them, can have a larger influence than would be assumed. For example, boycotts against Canadian-made forestry products during the Clayoquot Sound protests in the early 1990s changed the way the industry dealt with old growth lumber.[69]

It is possible that a popular boycott against crude from the oil sands could be extended to all Canadian-made products. Any general boycott on Canadian-made goods would more negatively affect Ontario given that exports of finished goods are more economically important for Ontario than other provinces.

3.4.3 Carbon pricing

It should be noted that the risk mentioned above are primarily due to a lack of an effective national GHG reduction policies. If stringent emissions-reductions policies were introduced, which could include a price on carbon, these risks could be mitigated. Canada's failure to price carbon has exacerbated the risks associated with the Energy East project.[70]

With an increase in oil production as a result of the Energy East pipeline, there will be higher carbon emissions. If a carbon pricing regime were introduced in Canada, there could be additional costs coming from these higher emissions. In effect, these additional emissions costs could be transferred to other sectors of the economy.

To understand the potential costs of carbon would be, both nationally and provincially, as well as the impact that a carbon pricing regime could have, two scenarios are considered here, both of which include upstream carbon emissions from the oil sands and consider national frameworks. For convenience, this analysis only looks at carbon taxes, and does not consider a cap-and-trade system or other forms of carbon pricing, although other carbon pricing systems could be used to mitigate the associated risks from increasing carbon emissions.

The two carbon tax scenarios presented here differ on whether the tax is revenue positive (used by the government) or revenue neutral, as in British Columbia.

The first scenario considers the effect of the Energy East pipeline if there were a national carbon tax where total emissions and costs were shared by the entire country. This scenario also assumes that the tax would not be revenue neutral. In this scenario, Ontario would have to pay for emissions in other provinces, such as Alberta, based on its share of GDP, and would receive no benefits.

The second scenario looks at how Ontario could be affected through a revenue-neutral carbon tax, such as what was introduced in British Columbia. This scenario assumes that the revenue raised nationally by the carbon tax would be redistributed nationally.

For both of these scenarios, three possible carbon prices are considered:

» the BC carbon tax of $30 per metric tonne[71]

» the Quebec reserve price for the 2014 Quebec carbon auction under the Western Climate Initiative of $12.82 per metric tonne[72]

» the Social Cost of Carbon (SCC) as evaluated by the U.S. Environmental Protection Agency, a cost

68 Coral Davenport, "Obama Pursuing Climate Accord in Lieu of Treaty," *New York Times*, August 26, 2014. At http://www.nytimes.com/2014/08/27/us/politics/obama-pursuing-climate-accord-in-lieu-of-treaty.html.

69 Doug Saunders, "Greenpeace: Tactics Not So Clear Cut Anymore," *Globe and Mail*, March 24, 2011. At http://www.theglobeandmail.com/report-on-business/rob-magazine/greenpeace-tactics-not-so-clear-cut-anymore/article589576.

70 Matthew Mendelsohn and Richard Carlson, *The Politics of Pipelines: Ontario's Stake in Canada's Pipeline Debate*, Mowat Centre, November 2013. At http://mowatcentre.ca/wp-content/uploads/publications/76_the_politics_of_pipelines.pdf.

71 BC Ministry of Finance, "How the Carbon Tax Works." At http://www.fin.gov.bc.ca/tbs/tp/climate/A4.htm.

72 Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques, *California Cap-and-Trade Program and Québec Cap-and-Trade System: 2014 Annual Auction Reserve Price Notice*, September 19, 2014. At http://www.mddelcc.gouv.qc.ca/changements/carbone/ventes-encheres/reserve-notice09162014.pdf.

TABLE 8:

Potential costs from net new GHG emissions from Energy East operating for 20 years under a carbon tax that shares costs nationally ($ billions)

Share of costs	5 per cent discount rate			2.5 per cent discount rate		
	Social Cost of Carbon	BC's carbon tax ($30)	Quebec ($12.82)	Social Cost of Carbon	BC's carbon tax ($30)	Quebec ($12.82)
Total costs	$1.61	$0.83	$0.36	$6.98	$1.38	$0.59
Ontario's share*	$0.59	$0.31	$0.13	$2.56	$0.51	$0.22

Notes: * Calculated as 36.7 per cent of total cost of emissions, based on Ontario's share of Canada's GDP.
Net new GHG emission from Navius Research. See Appendix A.

that all American federal projects must use in their accounting.[73]

However, it should be noted that this analysis considers national pricing frameworks. If, instead, there were an Ontario-only carbon pricing policy, then the impact of the pipeline on Ontarian would be negligible.

3.4.3.1 Carbon tax that shares costs nationally

In this scenario, the costs for all emissions in Canada are shared by the entire country. In other words, people in all provinces would be responsible for emissions in other provinces. In this example, Ontario, as well as the other provinces, would be responsible for emissions from Alberta.

Although such a carbon pricing policy may be politically unlikely, it is important to note that emissions in other provinces can have a cost on Ontario. Canada has made national commitments to reduce emissions, and there could be national costs to that.

To model Ontario's share of Canada's total emissions costs, we assume that the total national costs will be divided among each province based on that province's share of total GDP. In 2013, Ontario comprised 36.7 per cent of Canada's GDP,[74] and hence we assume that Ontario would be responsible for paying for the equivalent percentage of carbon emissions.[75]

Table 8 shows the cumulative costs of the additional emissions, including upstream, that could be associated with 20 years of Energy East pipeline operation, and two discount rates, using the different pricing schemes.

3.4.3.2 Revenue-neutral carbon tax

Perhaps a more likely carbon pricing scheme would be a revenue-neutral carbon tax. As is done in British Columbia, any additional costs from the carbon tax would be returned through lower taxes, keeping government revenue at current levels.

To model this assumption with regard to Energy East and Ontario, we assume that all of the revenue collected through the carbon tax nationally will be returned to the provinces based on their share of Canadian GDP. For example, we assume that as Ontario's share of Canada's GDP is 36.7 per cent, Ontario would receive 36.7 per cent of the benefits, despite Ontario not being responsible for that amount of Canada's total emissions.

73 U.S. Environmental Protection Agency, "The Social Cost of Carbon." At http://www.epa.gov/climatechange/EPAactivities/economics/scc.html. The SCC is an estimate of the economic damages associated with GHG emissions. This value is calculated for various discount rates, and increases over time due to the ever increasing concentration of GHGs in the atmosphere. The SCC at a 5 per cent discount rate starts at U.S. $12 in 2015 and increases to U.S. $28 by 2050. Unlike the SCC, in our calculations, we fix B.C.'s and Quebec's carbon prices at present values. Given the role of discount rates, this leads to a very low price for future emissions under both the B.C. and Quebec pricing schemes, and much higher future cost of for the SCC pricing model.

74 2013 figure from Statistics Canada, "Gross domestic product, expenditure-based, by province and territory," November 5, 2014. At http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/econ15-eng.htm.

75 Basing Ontario's share of emissions on its share of total GDP may be a crude measure compared to other alternates, such as taking into account consumption patterns and elasticities of demand. However, we feel it is a fair method of taking into account national carbon emissions.

TABLE 9:

Potential costs from net new GHG emissions from Energy East operating for 20 years under a revenue-neutral carbon tax ($ billions)

Share of costs	5 per cent discount rate			2.5 per cent discount rate		
	Social Cost of Carbon	BC's carbon tax ($30)	Quebec ($12.82)	Social Cost of Carbon	BC's carbon tax ($30)	Quebec ($12.82)
Ontario's share	-$0.44	-$0.22	-$0.09	-$1.96	-$0.37	-$0.16

Note: Net new GHG emission from Navius Research. See Appendix A.

The revenue could be returned as spending, or more likely as income or corporate tax reductions. The form of benefit — such as whether the tax leads to lower income or corporate tax — is not considered.

For Ontario's costs under the carbon tax, we use the figures for Ontario's emissions as a result of the construction and operation of the pipeline from the modelling by Navius Research.

We calculate the impact of such a revenue-neutral carbon tax by the following:

1. First we calculate Ontario's share of total benefits by multiplying the net increase in GHG emissions due to the Energy East by the three prices for carbon (figures available in section 3.4.3), and then by Ontario's share of Canadian GDP.

2. Then we calculate the carbon tax paid by Ontario for the development and operation of the Energy East pipeline in Ontario under the three pricing schemes.

3. Finally we calculate the total by subtracting the costs for carbon emissions due to the operation of Energy East in Ontario from the benefits.

The results can be seen in Table 9. In a scenario with a revenue-neutral carbon tax system, Ontario, as a less intense GHG emitter, could benefit, while heavy GHG-emitting provinces such as Alberta could face additional costs. This is due to the fact that benefits from the revenue-neutral measures, such as cuts in income tax rates, would outweigh the emissions in Ontario.

3.5 Natural capital losses

Any large pipelines spills could reduce Ontario's natural capital assets.

Although it may be possible to clean up any spill — given enough time and money — and the pollutants may be removed, the effects of the spill on the ecosystem and how that ecosystem is used could persist in the long-term. In order to evaluate losses from such damage, it is necessary to consider the concept of natural capital accounting.

The idea behind natural capital accounting is to get beyond simple GDP calculations of costs and benefits to also account for the depletion of non-renewable resources (such as oil and natural gas), timber, groundwater, as well as degradation from pollution.[76] According to a TD Economics report published in November 2014, "Incorporating natural capital in the planning process results in smarter, better decisions for firms and the communities they serve."[77]

Natural capital refers to the natural assets or resources that provide benefits to communities and the economy.[78] The functions and services that natural capital assets can provide in Ontario include: pollution regulation, climate regulation, water regulation, water supply, soil retention, soil formation, nutrient cycling, waste treatment, pollination, biological control, habitats, food

76 Wealth Accounting and the Valuation of Ecosystem Services (WAVES), *Moving Beyond GDP: How to Factor Natural Capital into Economic Decision Making, 2012*. At http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/06/07/000386194_20120607014800/Rendered/PDF/696120WP0Movin-00606020120Box369282B.pdf.

77 Craig Alexander and Brian DePratto, *Valuing the World Around Us: An Introduction to Natural Capital*, TD Economics Special Report, November 20, 2014, p. 9. At http://www.td.com/document/PDF/economics/special/NaturalCapital.pdf.

78 Craig Alexander and Brian DePratto, *Valuing the World Around Us: An Introduction to Natural Capital*, TD Economics Special Report, November 20, 2014, p. 2. At http://www.td.com/document/PDF/economics/special/NaturalCapital.pdf.

production, raw materials, genetic resources, medicinal resources, recreation, education, culture and spirituality.[79] For example, a number of the waterways in Ontario that Energy East will traverse supply drinking water, a service that may not be accounted for in traditional accounting. That many of these waterways are on First Nations lands could also affect the valuation of any spill.[80]

Valuing these goods and services is difficult, but the body of knowledge in this field is growing. TD Economics has valued Toronto's tree canopy at $7 billion, and said that every dollar in maintenance returns anywhere from $1.35-$3.20 worth of benefits and cost savings each year.[81] Research by environmental organizations has estimated that Ontario's Lake Simcoe water basin provides ecosystem services worth $975 million per year[82] and the Greenbelt in the Great Toronto Area provides approximately $2.6 billion dollars in ecosystem services per year.[83] In addition, a System of Environmental-Economic Accounting (SEEA), based on the existing System of National Accounts (SNA), is being developed by the UN Statistical Commission to introduce international standards into natural capital accounting.[84]

79 R. S. De Groot, "A Typology for the Classification, Description, and Valuation of Ecosystem Functions, Goods and Services," *Ecological Economics*, Vol. 41, 2002, pp. 393– 408. At http://portal.nceas.ucsb.edu/working_group/ebm-matrix/pdf-reprints/de%20Groot_2002.pdf.

80 For more information on the waterways affected, see Council of Canadians, *Energy East: Where Oil Meets Water*, August 19, 2014. At http://www.canadians.org/sites/default/files/publications/energyeast-waterways-0814.pdf.

81 TD Economics, *Urban Forests: The Value of Trees in the City Of Toronto*, July 9, 2014. At http://www.td.com/document/PDF/economics/special/UrbanForests.pdf.

82 Sara J. Wilson (Natural Capital Research & Consulting), *Lake Simcoe Basin's Natural Capital: The Value of the Watershed's Ecosystem Services, Friends of the Greenbelt Foundation Occasional Paper Series*, June 2008. At http://www.davidsuzuki.org/publications/downloads/2011/Lake-Simcoe-GreenbeltNatural-CapitalJune%2020_2_.pdf.

83 David Suzuki Foundation, *Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services,* 2008. At http://www.davidsuzuki.org/publications/downloads/2008/DSF-Greenbelt-web.pdf.

84 United Nations Statistical Commission, "System of Environmental-Economic Accounting (SEEA)." At http://unstats.un.org/unsd/envaccounting/seea.asp.

3.6 Changes to energy flows

Part of what makes converting the Canadian Mainline to carry crude oil an economically attractive project are recent changes in the North American gas sector, and changes to gas import flows to Ontario and Quebec in particular.

As part of the OEB's consultation, a detailed study on the effects of the Energy East pipeline on Ontario natural gas consumers will be prepared and so we will not engage with that debate.

4

Conclusion

Policy-makers always have to consider the trade-offs between benefits and costs in any large infrastructure decision.

In this report we have assessed existing studies that attempted to estimate the economic impact of the Energy East project on Ontario. These studies used standard Input/Output models, models that have significant methodological weaknesses that need to be understood when evaluating their results.

I/O models cannot fully capture the complexity of the issues because:

» They assume that past or present scenarios accurately predict the future, and do not account for changes.

» They assume that resources are idle.

» They use multipliers (an estimate of how spending on the project affects the rest of the economy), in the process of calculating indirect and induced benefits.

I/O models just measure spending, and assume that additional spending leads to more benefits. To an I/O model, it would make more sense to build an entirely new pipeline, rather than convert portions of an existing line, as that would increase spending even more. In fact, putting in a pipeline, taking it out, and then putting it back in again would, according to the models, offer larger benefits than the current plan. This is clearly absurd, and underscores again the problematic nature of the I/O models used in existing studies to quantify the benefits to Ontario.

In addition, there were a number of assumptions made in the preparation of the analyses that could be questioned. First, 2009 trade figures (the most recent available) were used, which could inflate the role of Ontario's manufacturing and subsequently the estimated indirect and induced benefits could be lower. And the benefits estimated in the reports either do not use a discount rate, such as the Conference Board, or use a low discount rate, such as Deloitte. If discount rates were used in the economic modelling, the projected benefits would be lower.

As a result, there is a great deal of uncertainty about the economic impact of Energy East on Ontario and the results from the previous studies should be understood as suggestive or plausible, rather than predictive. It is possible that some of the positive impacts in these reports are inflated

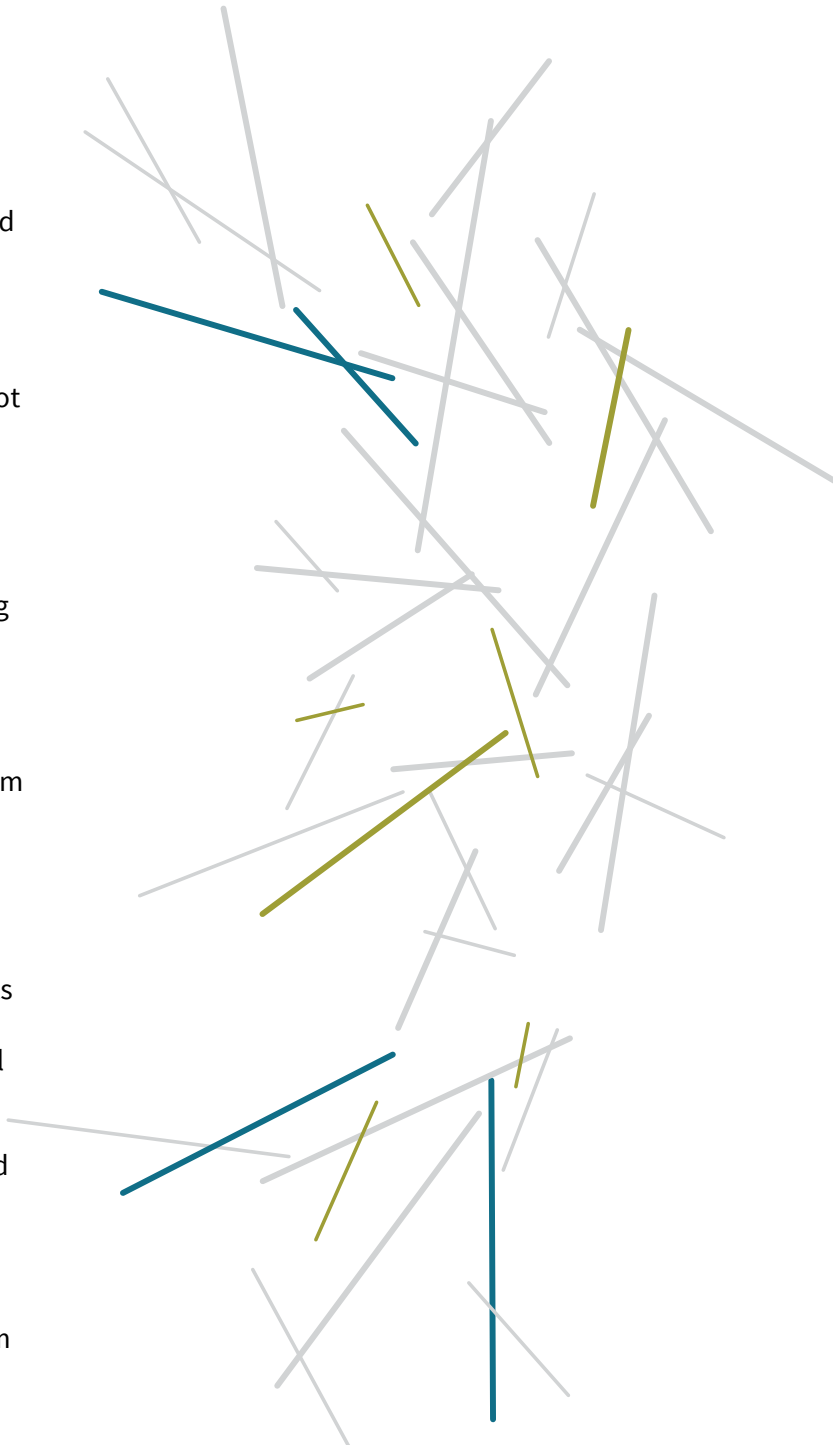
or that some of its benefits could be eroded due to factors not taken into account by the existing studies such as increased GHG emissions, a change in energy flows or an appreciation in the Canadian-U.S. exchange rate. The economic impact on individual municipalities or sub-regions of the province is even more uncertain.

We have also highlighted the many longer term policy and political risks and variables that have not been accounted for in the existing economic impact analyses. These include impacts on the exchange rate, carbon emissions and costs that could emerge due to carbon pricing and threats to natural capital, among others. Their inclusion in any analysis would dramatically change the estimated economic impact on Ontario. For example, we modelled one scenario that included a possible impact on the exchange rate. This model produced assessments of the economic impact on Ontario that were different than the three previous studies. This was intended to highlight that many factors are in play that cannot be captured through traditional I/O models.

A full evaluation of the short- and long-term economic impacts of the Energy East pipeline project in Ontario requires not only looking at potential economic benefits, and understanding the limitations in the models, but also looking at potential economic costs and risks. If the potential economic costs are measured against the potential benefits we see that the project could be neutral or have a net negative long-term economic impact on Ontario.

This is not to say that Ontario would not receive any benefits from the Energy East project. There may be additional benefits from oil sands development in Ontario. For example, investments in the clean technology sector in Ontario to remediate the environmental damage from the oil sands might produce economic benefits. But such an impact would require a policy choice by the federal government to invest more in research and development.

Politics and policy choices made by governments in Canada and around the world will have an enormous influence on the eventual medium-term and long-term economic impact of Energy East on the Ontario economy. Our paper has provided a survey of what those issues are. By way of illustration, if some of these forces have an impact on the Canadian-U.S. exchange rate, it would be possible any economic benefits would disappear. In short, there is so much uncertainty regarding the impact of Energy East on the Ontario economy that it would be unwise to make a judgement about the value of Energy East on the basis of the current estimated economic impact on Ontario.



Appendix A: Assumptions related to Energy East: Oil production, GHG emissions and trade flows

TABLE A.1:
The impact of the Energy East pipeline on oil sands production, GHG emissions and trade flows

Five–year period	Net new oil production due to Energy East, (thousands of barrels per day)	GHG emissions from net new oil production per year ($MtCO_2e$)	Changes in trade flows (annual net exports, in billions of 2010 dollars)		
			Crude oil and refined petroleum products	Machinery and equipment	Transportation services
2018-2022	14.30	-1.30	$4.36	-$0.05	-$0.27
2023-2027	46.76	0.13	$10.17	-$0.19	-$2.79
2028-2032	70.76	4.75	$9.90	-$0.81	-$5.49
2033-2060	91.24	9.60	$13.81	-$1.05	-$5.75

Note: Figures provided by Navius Research, and are in 2010 dollars. The numbers used are from the Reference case scenario. This scenario assumes: no other pipelines other than Energy East are approved; the elasticity of demand for refined products is in the middle of the published range. For more details see the Navius Research report.

Our economic analysis relies in part on assumptions related to changes in oil production, GHG emissions and trade flows as a result of the Energy East pipeline. The assumptions we are using are based on an analysis prepared for the Ontario Energy Board by Navius Research.

Table A.1 shows the net increase in exports of crude oil and refined petroleum products (by dollar value), production and GHG emissions, along with changes in associated trade flows, that could be attributed to the Energy East pipeline during four five-year periods. These numbers are used for calculating the effect of net exports of oil and refined petroleum products on the exchange rate (see Appendix C.2).

It should be noted, however, that long-term forecasts are always subject to substantial uncertainty.

Appendix B: Overview of local benefits from the Energy East project

B.1 Introduction

The Energy East project will provide local economic benefits to many of the communities through which it passes. The extent of these benefits is difficult to quantify at this stage, given the availability of data and the nature of the information thus far submitted to the NEB by TCPL.

Energy East's local benefits will arise in two ways:

» municipal taxes paid by TCPL (in addition to the provincial and federal taxes)

» employment opportunities in construction and operations.

The benefits in northern Ontario, where the project will only involve the conversion of the Canadian Mainline and the building of new pump stations, will be much lower than in eastern Ontario, where the pipeline will be newly built. This section does not look at the impact, if any, of the proposed Eastern Mainline gas pipeline project. This new pipeline — designed to ensure that there is sufficient pipeline capacity to supply gas to consumers Ontario and Quebec without the converted sections of the Canadian Mainline — would only be required if Energy East is completed.

There is not enough information available to estimate the impact of the project on any one community or sub-region and many details — such as the precise locations of all pump stations, the future assessed value of any new pump stations, and the availability of local labour — have yet to be determined. Decisions on these issues will determine the nature and location of local economic impacts.

Because many decisions have either not been made or not submitted as part of the public record, a full analysis of the impact on specific municipalities is not possible. This appendix provides our best analysis of the plausible local economic benefits and the various factors that are likely to influence the extent and duration of economic benefits to communities in Ontario.

We will confine ourselves to a broad analysis of potential region-wide benefits in northern Ontario and eastern Ontario in terms of municipal taxes and employment, as well as a summary of the factors that will determine the extent and duration of local economic impacts. We cannot make estimates of the impact on particular municipalities.

We do conclude, however, that local benefits are likely to be small, especially in northern Ontario where the pipeline will be converted and not newly built.

B.2 Municipal taxes

Municipal tax revenue, paid through property taxes by TCPL, will increase as a result of construction and land-use changes due to the Energy East project. The extent of the increase, however, will vary depending on the level of new construction in the regions:

TABLE B.1:

Projected change in annual municipal property taxes paid by TransCanada in the converted pipeline section

Region	Taxes paid in 2013	Additional taxes in first year of operation	Total taxes paid during the first year of operation
	$ millions		
Northwest (Kenora to Thunder Bay)	6.6	1.4	8.0
Northeast (Hearst to Mattawa)	12.1	1.6	13.7
Southeast (Petawawa to Ottawa)	8.0	0.5	8.5
Total	26.7	3.5	30.2

Source: TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C1: Northern Ontario, Section 6: Employment and Economy*, October 30, 2014, pp. 32. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543126/ESA_V3_PC1_ON_S6_EmplEcon_-_A4E0Q1.pdf?nodeid=2543447&vernum=-2.

» In municipalities in northern Ontario, where the project will only involve the conversion of the Canada Mainline, municipal property taxes are unlikely to increase appreciably.

» Municipalities in eastern Ontario, on the other hands, could see larger increases in property tax revenue as a result of new pipeline construction.

B.2.1 Impact on property tax revenue in northern Ontario (pipeline conversion)

The municipalities in northern Ontario, where the project will primarily involve the conversion of the current Canadian Mainline into the Energy East pipeline, are unlikely to see significant changes in their tax base as a result of the project.

TCPL already pays property tax in the region as a result of the Canadian Mainline. Due to the conversion and newly required facilities, TCPL expects that its current annual municipal tax bill in the 1,900-kilometre long converted section to increase by 13 per cent, to $30.5 million, a $3.5 million a year increase (See Table B.1). Given that the only additional major taxable infrastructure will be the pump stations, an estimated 13 per cent increase in municipal taxes for TCPL would appear to be a reasonable estimate.

The pipeline conversion itself is unlikely to add tax revenue to local municipalities due to the way in which pipelines are assessed for property tax. While there are local differences in rates, the tax rate formula for a pipeline is set through provincial legislation, and is based on the physical properties of the pipeline, such as materials used and diameter, and not what flows through the pipeline.[85] In the converted sections, and as long as the physical properties of the pipeline do not change, which is expected to be the case, the property tax paid by TCPL for the pipeline would not be expected to change either.

There will be some newly built facilities in northern Ontario, primarily the pump stations, and it is this new construction that would lead to an increase in property tax. While TCPL plans for most of its pump stations in Ontario to be built on the same plot of land as the Canadian Mainline gas compressor stations, when possible,[86] the addition of machinery and equipment would likely increase the total assessed value of the land and hence the property tax paid, especially if new buildings were erected on the site.

If we therefore assume that the majority of the $3.5 million in additional property taxes TCPL is expected to pay in northern Ontario is due to the 28 new pump stations, each new pump station would result, on average, in an additional $125,000 in annual property tax for the local municipality. The actual revenue for each municipality would differ somewhat from this average, depending on local tax rates as well as on station design, which is not yet part of the public record.

85 Information provided by MPAC, September 19, 2014.

86 TransCanada, "Pump Stations." At http://energyeast.wpengine.com/wp-content/uploads/2013/07/Energy-East-Pipeline-Pump-Stations.pdf.

TABLE B.2:
Direct employment on the Energy East pipeline in Ontario

Region	Development and construction	Operations
	Peak year employment	Annual employment
Northern Ontario (conversion)	2,206	190
Eastern Ontario (new build)	735	10
Total in Ontario	2,941	200

Source: TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C1: Northern Ontario, Section 6: Employment and Economy*, October 30, 2014, pp. 24-28. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543126/ESA_V3_PC1_ON_S6_EmplEcon_-_A4E0Q1.pdf?nodeid=2543447&vernum=-2; TransCanada, Energy East Project ESA, Volume 3, Part C: Ontario, C2: Ontario East, Section 6: Employment and Economy, October 30, 2014, pp. 15-18. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543668/ESA_V3_PC2_ON_S6_EmplEcon_-_A4E0Z9.pdf?nodeid=2543264&vernum=-2.

To put that into context, the City of Dryden currently collects $13.8 million annually in property tax.[87] The additional $125,000 from the one pump station proposed to be built in the township would equal a 1 per cent increase in local property tax revenue.

B.2.2 Impact on property tax revenue in eastern Ontario (new pipeline construction)

The proposed new build section in eastern Ontario (from roughly Ottawa to the Quebec border) will provide new municipal tax revenue. TCPL estimates that it will pay $10.5 million in municipal taxes in 2019, the first full year of operation.[88]

It should be noted that since the pipeline is not built yet in this region, this amount is uncertain as it depends upon the assessment of the project and the tax rates in the future. TCPL provides no estimate of how the property tax will be divided among the communities affected. As there are five municipalities directly affected, however, each municipality could expect to receive $2.1 million in annual tax revenue from the pipeline, on average.

B.3 Local employment

In TCPL's application to the NEB, they estimate the number of direct jobs created by the pipeline project. These estimates are summarized in Table B.2, taken from their application.

During the development and construction phase, TCPL states that the peak years will be 2016 and 2017, which is when most of the actual construction will occur. At its peak, employment in the construction of the Energy East pipeline in northern Ontario would amount to between 0.7 per cent and 1.0 per cent of the labour force within the regions affected.[89] In the new build sections, construction employment is expected to equal 0.1 per cent of the labour force in the region (including Ottawa, the largest urban centre near the route in Ontario).[90] By 2018 the number of jobs is expected to be significantly reduced as most of the construction will be completed.

TCPL has indicated that it will try to create employment opportunities for local residents and aboriginal people, but temporary mobile workers

87 City of Dryden, *Financial Statement 2013*. At http://www.dryden.ca/cms/One.aspx?portalId=7851&pageId=7973.

88 TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C2: Ontario East, Section 6: Employment and Economy*, October 30, 2014, p. 22. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543668/ESA_V3_PC2_ON_S6_EmplEcon_-_A4E0Z9.pdf?nodeid=2543264&vernum=-2.

89 TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C1: Northern Ontario, Section 6: Employment and Economy*, October 30, 2014, pp. 24-28. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543126/ESA_V3_PC1_ON_S6_EmplEcon_-_A4E0Q1.pdf?nodeid=2543447&vernum=-2.

90 TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C2: Ontario East, Section 6: Employment and Economy*, October 30, 2014, p. 16. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543668/ESA_V3_PC2_ON_S6_EmplEcon_-_A4E0Z9.pdf?nodeid=2543264&vernum=-2.

from outside the region are planned to be brought in due to expected skill shortages.[91]

TCPL estimates that 200 permanent jobs will be created in operations, which would include employees of Energy East as well as contractors. This would account for 0.01 per cent to 0.02 per cent of the total labour force in the regions affected.

The use of mobile workers during construction would reduce the benefit of short-term local employment, and if the workers came from outside the province would reduce any tax revenue to the province. In the operations phase, it is not clear how many of the 200 positions will be new positions. Most of the Energy East pipeline in Ontario is already in the ground and there are people currently operating that pipeline. People working on the Canadian Mainline now could be moved to Energy East.

B.4 Summary

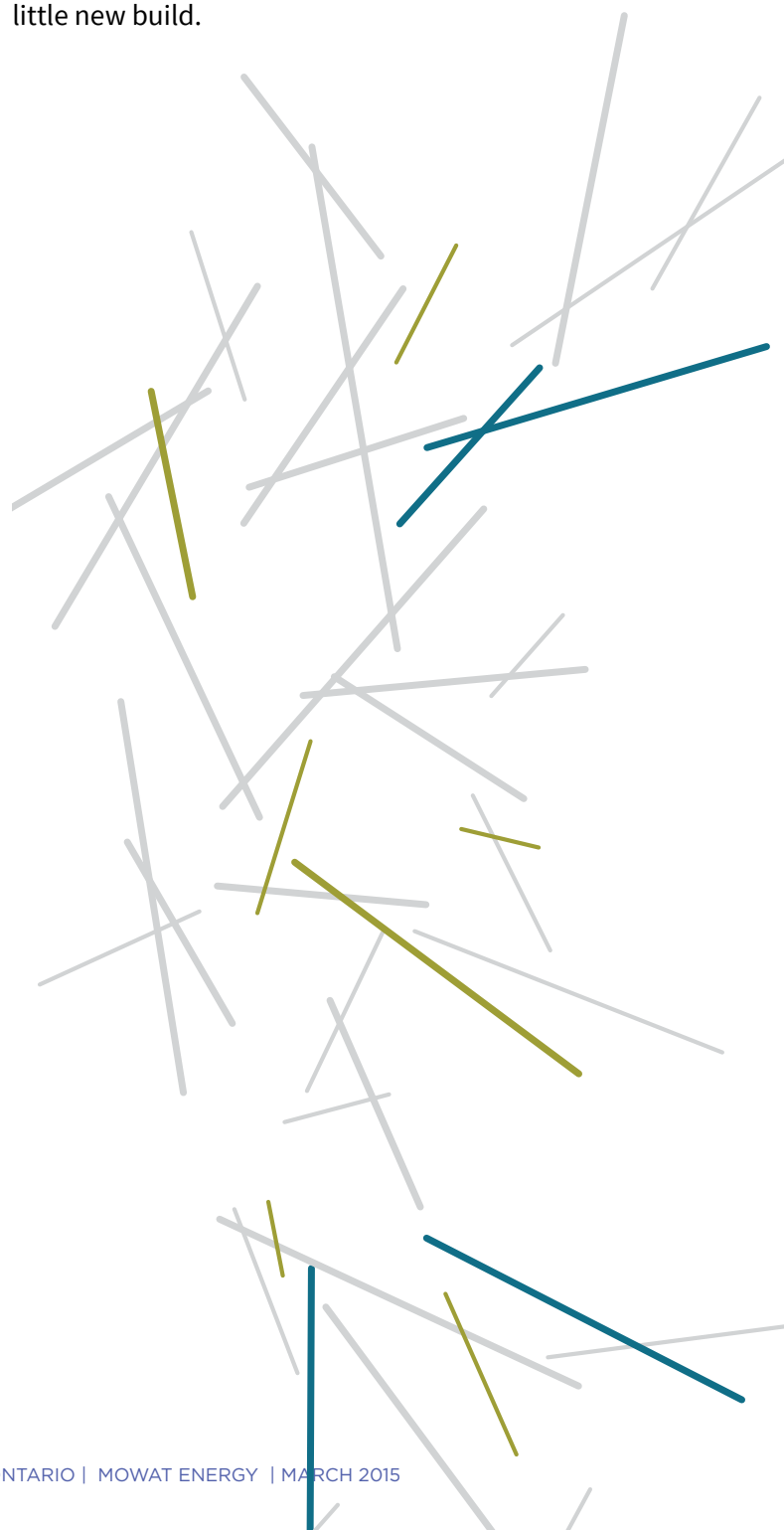
While there is the potential for some local short-term benefits, the long-term benefits in terms of employment, tax revenue and local business opportunities will likely be small.

The precise local economic benefits, however, cannot be quantified due to a lack of data and many uncertainties. Likely local economic benefits will only become clear when the project is completed. As TCPL states, "The degree to which certain and reasonably foreseeable physical activities will utilize labour and business in the [region] will depend on the extent to which workers and businesses with the requisite skills and qualifications are available."[92]

The estimates for local jobs and benefits, therefore, should be considered projections of maximum possible benefits, and not precise calculations.

TCPL has indicated that it will try to hire local residents and aboriginal people to maximize local community benefits, but details of such plans have not been made public.

A lack of detail on the construction plans in each community makes it impossible at this stage to estimate the impact the project will have on increasing tax revenue in any one community. The numbers provided by TCPL, however, suggest relatively insubstantial local economic impacts, especially in northern Ontario where there will be little new build.



91 TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C2: Ontario East, Section 6: Employment and Economy*, October 30, 2014, pp. 15-18. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543668/ESA_V3_PC2_ON_S6_EmplEcon_-_A4E0Z9.pdf?nodeid=2543264&vernum=-2.

92 TransCanada, *Energy East Project ESA, Volume 3, Part C: Ontario, C1: Northern Ontario, Section 6: Employment and Economy*, October 30, 2014, p. 38. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2543126/ESA_V3_PC1_ON_S6_EmplEcon_-_A4E0Q1.pdf?nodeid=2543447&vernum=-2.

Appendix C: Details of the model used to estimate the Canadian-U.S. exchange rate impact

A statistical technique known as regression analysis was used in this paper to estimate the Canadian-U.S. exchange rate impact of increased exports of oil and refined petroleum products. Regression analyses are used by economists to model the relationships among economic variables. In undertaking such an analysis, one is trying to infer a causal relationship between X and Y. For example, if X is the Canadian dollar exchange rate and Y is Ontario's real GDP, the aim is to be able to predict what effect each 1 cent increase or decrease in the dollar has on GDP.

Regression analysis is used to determine the relationship among economic variables that is best able to explain the past behaviour of the target variable. "Best" is defined in terms of statistical criteria that try to exclude findings that might be due to chance correlations (e.g., where two variables happen to move together over the sample period, but neither causes the other, and both are the result of some unknown third factor). There is never a perfect fit, as there are random events that cannot be explained. This means that there is always a margin of error in making predictions. The statistical report provides various insights into the result. For example, in the regression equations used in this report there is an item called "R-squared," which tells us what proportion of the historical variation of the target variable is explained by our model. A value approaching 1 would mean that 100 per cent is explained in the equation, but that is rarely achieved.

The larger the historical sample, the greater the confidence we can have in our inferences, generally speaking. However, this also assumes that the underlying causal linkages are stable, and that the future will behave much like the past. Major changes in political or technological conditions could lead to weaker or stronger causal relationships among any two variables in the future than in the past. Judgement has to be used in drawing inferences from the past.

Here, one of the key linkages we are considering is the effect of oil exports on the Canadian-U.S. exchange rate. As we explained, that linkage is relatively clear and it is reasonable to assume so in the future.

C.1 Regression equations used for modelling the exchange rate impact

The model we use follows a two stage approach. First we estimate the effect of net exports of oil and refined petroleum products on the exchange rate, with the results from this regression presented in Table C.1. We then estimate the effects of these changes in the exchange rate on Ontario's GDP, with the regression results from this regression presented in Table C.2. We show how the second model performs when compared to historical data in Figure C.1. In addition to the regression results from Table C.2, we show results from a variation to the second part of our model in Table C.3.

Table C.1 shows a least squares regression model where independent variables OILEXPGDP and INTDIF are used to explain the dependent variable REALEX. Looking at the coefficient of OILEXPGDP, our model estimates that a 1 per cent increase in net exports of oil and refined petroleum products as a percentage share of nominal GDP could lead to a U.S. 7.6 cent rise in the real Canadian-U.S. exchange rate. Notice that the independent variable INTDIF is deemed not statistically significant at the 95 per cent or 90 per cent level.

TABLE C.1:
Regression analysis on the value of the Canadian dollar

Dependent Variable: REALEX
Method: Least Squares
Sample: 1989 2013
Included observations: 25
Convergence achieved after 9 iterations
MA Backcast: 1988

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	77.66319	2.994766	25.93298	0.0000
INTDIF	1.944577	1.136919	1.710392	0.1019
OILEXPGDP	7.609410	2.334816	3.259105	0.0038
MA (1)	0.800219	0.108228	7.393804	0.0000

R-squared	0.794181	Mean dependent var	85.54401
Adjusted R-squared	0.764779	S.D. dependent var	11.62496
S.E. of regression	5.638065	Akaike info criterion	6.442605
Sum squared resid.	667.5433	Schwarz criterion	6.637626
Log likelihood	-76.53257	Hannan-Quinn crite	6.496696
F-statistic	27.01050	Durbin-Watson stat	1.446866
Prob (F-statistic)	0.000000		

Inverted MA Roots	-.80

Note
» REALEX is the real exchange rate: the actual value of the Canadian dollar in U.S. cents, divided by the ratio of the U.S. and Canadian price indexes for GDP.
» INTDIF is the difference between the Canadian and U.S. short-term treasury bill interest rates.
» OILEXPGDP is crude oil exports minus imports as a percentage of Canadian nominal GDP.
» MA(1) is the mean autoregressive correction for time series data.

The R-squared value indicates that 79 per cent of the sample variation in the historical data of REALEX is explained by the model. The sample size in this regression is 25 yearly observations from 1988 to 2013.

Table C.2 shows the results from the second part of the model, a least squares regression model where independent variables RYR, the difference between RYU and RYU lagged one year, and DD are used to explain the dependent variable REALEX. All independent variables are deemed to be statistically significant at the 95 per cent level for our sample.

Using PDL, the model indicates that there are statistically significant marginal changes in GDP growth rate in each of the first eight years after the exchange rate shock. The yearly marginal GDP growth rate (a negative value in this case) is declining over time; that is, the first year's marginal growth rate is less than the eighth year's marginal growth rate. The marginal growth rate of year one is estimated to be -0.086 while the marginal growth rate of year eight is estimated to be -0.049. However, the total annual reduction in GDP (from the base level) of the eighth year is greater than that of the first year because it is based on a cumulative sum of the previous seven years of marginal GDP reductions.

The model estimates that a U.S. 1 cent rise in the value of the Canadian dollar could lead to an annual reduction of 0.486 per cent in Ontario's GDP eight years after the initial shock. This means that Ontario's real GDP could remain permanently lower by 0.486 per cent eight years after the changes in the initial exchange rate.

The R-squared value indicates that 90 per cent of the sample variation in the historical data of RYO is explained by the model. The sample size in this regression is 31 yearly observations from 1982 to 2012.

TABLE C.2:

Regression analysis on Ontario's real GDP growth

Dependent Variable: RYO
Method: Least Squares
Sample: 1982 2012
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	0.106608	0.291477	0.365750	0.7176
RYR	1.063995	0.096830	10.98832	0.0000
RYU-RYU(-1)	0.329881	0.082125	4.016832	0.0005
PDL01	-0.058418	0.017876	-3.267926	0.0031
PDL02	0.006185	0.006103	1.013422	0.3206
PDL03	-0.001003	0.003088	-0.324731	0.7481

Lag Distribution of DD	i	Coefficient	Std. Error	t-Statistic
* .|	0	-0.08600	0.03111	-2.76447
* .|	1	-0.07480	0.01758	-4.25434
* .|	2	-0.06561	0.01561	-4.20301
* .|	3	-0.05842	0.01788	-3.26793
* .|	4	-0.05324	0.01772	-3.00417
* .|	5	-0.05006	0.01527	-3.27849
* .|	6	-0.04889	0.01766	-2.76800
* .|	7	-0.04973	0.03185	-1.56124
Sum of Lags		-0.48673	0.08508	-5.72096

R-squared	0.909545	Mean dependent var	2.633469
Adjusted R-squared	0.891454	S.D. dependent var	2.913110
S.E. of regression	0.959763	Akaike info criterion	2.927724
Sum squared resid	23.02861	Schwarz criterion	3.205270
Log likelihood	-39.37972	Hannan-Quinn criter.	3.018197
F-statistic	50.27611	Durbin-Watson stat	1.433190
Prob(F-statistic)	0.000000		

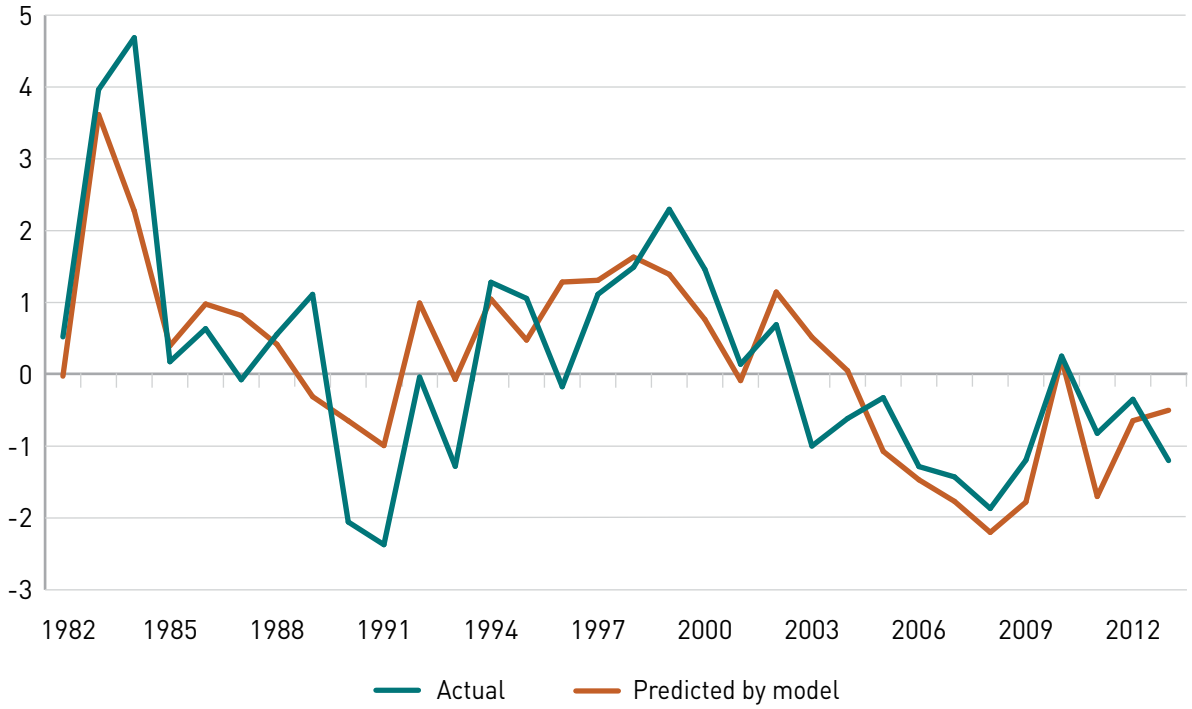
Notes
Trace test indicates two co-intergrating equations at the 0.05 level
» RYO is the annual percentage change in real GDP in Ontario.
» RYR is the annual percentage change in real GDP in the "rest of Canada," defined as Canadian GDP minus Ontario provincial GDP.
» RYU is the annual percentage change in real GDP in the United States.
» DD is the value of the Canadian dollar in US cents, minus its value in the previous year.
» PDL is an abbreviation for "polynomial distributed lag," and it is the functional form through which DD is included in the equation.

Figure C.1 compares the predicted values from the model with historical data. As can be seen, the model performs well at predicting past performance.

In this equation, the actual exchange rate was used, rather than the real exchange rate. Calculating the latter requires the GDP price index, and this results in less historical data being available. That is a problem because of the long distributed lag on the real exchange rate. Over the shorter sample period from 1989 to 2012, a regression using the real exchange rate has slightly higher coefficients and t-statistics than one using the actual exchange rate.

There is a criticism that might arise with respect to the equation above, namely that it does not account for a possible separate impact of the price of crude

FIGURE C.1:
Ontario's real GDP growth difference (Ontario minus the rest of Canada)



Note: Mathematically, there is no difference between subtracting the rest of Canada's growth from the dependent variable versus including it on the other side of the equation as an explanatory variable. For this reason we have chosen to present the actual values of Ontario's real GDP minus the rest of Canada, plotted with the predicted estimates from our model. The variable of Ontario's GDP minus the rest of Canada is simply more interesting to visualize over time.

oil on Ontario's economy. Ontario imports all of its oil, and therefore a higher price of oil reduces the incomes of Ontario consumers and businesses, which has a negative impact on the economy.

It also happens that, in the past several years, the Canadian dollar has tended to display a positive correlation with the price of oil. The dollar rises when the price of oil rises. This creates the possibility that part of the negative impact of the rising dollar on Ontario's GDP that is picked up in the above equation may be due to the rising price of oil. The reason why this is a concern is that we are positing that the dollar may rise in the future because of increased oil exports from Canada, without any increase in the global price of oil. It could be argued that, in such a scenario, the impact of a rising dollar on Ontario's GDP would be less negative.

To double check the equation, a separate analysis was done directly on the root impact of the exchange rate on Ontario's trade.

There are two separate components to this analysis. The first component is Ontario's net exports (defined as exports minus imports) to foreign countries (see Table C.3).[93]

The sum of coefficients on the exchange rate from this equation is -0.39, as compared to -0.49 from the results from Table C.2. However, that is reasonably consistent, as the -0.39 would only represent the direct loss in trade to the Ontario economy. In Appendix D, it is observed that the Conference Board and Deloitte were assuming multipliers of 1.05 and 1.24, respectively. Using the multiplier of 1.05 assumed by the Conference Board would produce a coefficient of -0.41, implying a possible reduction of 4.1 percentage points in Ontario's real GDP due to a 10 U.S. cent increase in the exchange rate. The Deloitte multiplier applied to the coefficient of -0.39 in Table C.2 would bring it up to -0.48, implying a possible reduction of 4.8 percentage points in Ontario's real GDP.

93 In practice, for Ontario, about 90 per cent of foreign exports are to the United States.

TABLE C.3:

Variation of the regression analysis on Ontario's real GDP growth

Dependent Variable: RYO
Method: Least Squares
Sample: 1982 2012
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	1.153648	0.411758	2.801758	0.0095
RYU-RYU(-1)	0.384458	0.184327	2.085739	0.0470
PDL01	0.073989	0.040513	-1.826290	0.0793
PDL02	0.002156	0.014041	0.153537	0.8792
PDL03	0.004482	0.007106	0.630729	0.5337

Lag Distribution of DD	i	Coefficient	Std. Error	t-Statistic
* .|	0	-0.04012	0.07213	-0.55617
* .|	1	-0.06037	0.04099	-1.47274
* .|	2	-0.07166	0.03584	-1.99934
* .|	3	-0.07399	0.04051	-1.82629
* .|	4	-0.06735	0.03984	-1.69040
* .|	5	-0.05175	0.03424	-1.51133
* .|	6	-0.02718	0.04071	-0.66771
.*|	7	0.00635	0.07427	0.08547
Sum of Lags		-0.38608	0.19503	-1.97952

R-squared	0.289502	Mean dependent var	1.090944
Adjusted R-squared	0.180195	S.D. dependent var	2.471642
S.E. of regression	2.237901	Akaike info criterion	4.595644
Sum squared resid	130.2133	Akaike info criterion	4.826932
Log likelihood	-66.23248	Hannan-Quinn criter.	4.671038
F-statistic	2.648512	Durbin-Watson stat	1.684046
Prob(F-statistic)	0.056007		

Notes:
» NETEXFOR is Ontario constant dollar exports minus imports (foreign countries, excluding imports and exports to other provinces).
» RYU is the annual percentage change in real GDP in the United States.
» DD is the value of the Canadian dollar in US cents, minus its value in the previous year.
» PDL is an abbreviation for "polynomial distributed lag," and it is the functional form through which DD is included in the equation.

It should also be noted that the possible impact estimated through the net exports to foreign countries is not the entire impact. There is another component of lost trade that could be added, which would make the negative impact of the exchange rate on trade larger.

This second component of the impact would be on Ontario's net exports to other provinces. The latter would be less sensitive to the exchange rate, as trade with other provinces uses the Canadian dollar. However, the Canadian dollar would still have some impact, as foreign goods and services are alternatives to buying within Canada. For example, when the Canadian dollar rises, not only does Ontario sell less to the United States, but people in other provinces are less likely to buy manufactured goods from Ontario, as they can now buy these goods from the U.S. or elsewhere relatively less expensively than they could before (compared to prices in Ontario).[94] Unfortunately, it is not possible

94 Ontarians would also buy fewer manufactured goods from other provinces. However, since most other provinces' exports are much more resource based than Ontario's, the net impact on Ontario's trade balance with other provinces due to an exchange rate appreciation is almost certain to be negative.

to untangle trade in energy and other commodities between Ontario and the other provinces. Data for imports and exports to other provinces excluding such commodities are not available.

Taking these considerations into account, the estimate from Table C.2 provides a reasonably cautious and conservative estimate of the potential negative impact of an exchange rate appreciation on Ontario's economy.

C.2 Calculating the potential cost of Canadian-U.S. exchange rate changes

We use the estimates from Navius Research to calculate the future share of net oil and refined petroleum products exports on Canada's GDP and the estimated effects on the Canadian dollar and Ontario's economy. In order to produce the most comprehensive estimates, we also need to account for other changes in exports and imports that might be induced by Energy East.

Energy East is expected to lead to an increase in the net export of oil and refined petroleum products exports for three reasons. First, there will be an increase in the quantity of oil that is exported. Second, the price discount between the price Canadian producers receives (such as through the Western Canadian Select (WCS) price) and international prices (such as WTI or Brent) is expected to shrink, meaning that Canadian producers would receive a higher price for their product. And third is due to the changes in the export and import components that directly go into the production of oil, such as transportation services and machinery imports.

While the increase in the quantity of oil and refined petroleum products exported and the price increase are accounted for in our exchange rate model, we also need to consider the third component. To better understand the relationship between these variables we must look closely at our exchange rate model. Oil exports as a share of GDP acts as a proxy to estimate many variable changes, such as price and quantity of oil, in addition to other variables that have been excluded from the regression analyses but are highly correlated with net oil exports as a share of GDP, such as oil transport services and capital import goods.

The results from Navius Research suggest that there would be a shift in the value of the exports of oil transportation services with Energy East. This is because if Energy East is approved, oil and refined petroleum products would be shipped to the East Coast of Canada, with transportation services adding value to the oil along the way. Oil from Alberta would have a higher value on the East Coast of Canada because of increased market access, with most of the margin being Canadian value added. However, at the same time it would be less costly to move oil to its final destination than at present, which would mean that the pipeline would lead to a decrease in the export of oil services. Moreover, additional refining capacity would have to be added in Eastern Canada to process the heavy oil if Energy East is approved. This would increase the imports of large machinery and equipment used for refining.

TABLE C.4:
Estimated effect on the Canadian-U.S. exchange rate of the increase in exports of oil and refined petroleum products as a result of Energy East

Years	Incremental net exports due to Energy East (in 2013 $ billions)	Increase in exports as a percentage share of Canada's projected 2020 GDP	Increase in Canadian dollar exchange rate over base case (in U.S. cents)
2020	$4.286	0.198	1.438
2025	$7.865	0.329	2.390
2030	$4.380	0.166	1.205
2035	$7.993	0.274	1.992

Note: The increase in incremental net exports due to Energy East is derived from results supplied by Navius Research presented in Table A.1. These numbers include changes in the net exports of crude of oil and refined petroleum products adjusted for changes in the net exports of machinery and equipment, and 90 per cent of the changes in transportation services net exports, as it is assumed that 10 per cent of the value of transportation services would be Canadian. In addition, these values have been converted to inflation-adjusted 2013 dollars for calculation purposes and consistency.

TABLE C.5:

Example of the potential estimated ripple effect in GDP of a 0.2 per cent increase rest of Canada GDP and a U.S. 1 cent increase in the Canadian-U.S. exchange rate in year one

Year	Beginning of year GDP (billions)	Marginal percentage reduction in GDP (regression coefficient)	Total percentage reduction in GDP (sum of all previous year marginal growth rates)	ROC GDP effect (per cent increase in ROC GDP, times multiplier)	End of year GDP (billions)	Opportunity cost for the year (end of year GDP minus 2018 GDP in billions)	Cumulative opportunity cost over the years (billions)
2018	$100.000	-0.086	-0.086	$0.222	$100.136	$0.136	$0.136
2019	$100.136	-0.075	-0.161	$0.000	$99.975	-$0.027	$0.109
2020	$99.975	-0.066	-0.227	$0.000	$99.748	-$0.092	$0.017
2021	$99.748	-0.058	-0.285	$0.000	$99.463	-$0.151	-$0.134
2022	$99.463	-0.053	-0.338	$0.000	$99.125	-$0.204	-$0.338
2023	$99.125	-0.050	-0.388	$0.000	$98.737	-$0.254	-$0.592
2024	$98.737	-0.049	-0.437	$0.000	$98.300	-$0.303	-$0.895
2025	$98.300	-0.050	-0.487	$0.000	$97.813	-$0.353	-$1.248

If we include these correlated variables in the figure for net exports of oil and refined petroleum products to GDP in our calculations, there would be a positive bias in the results, meaning that we could be overestimating the negative economic impacts of the pipeline. To overcome this possible bias, we need to adjust the balance of payments when calculating the impacts by removing both the transportation services and machinery imports values from the final net exports of oil and refined petroleum products values to get an accurate projection of the effect Energy East would have on the Canadian dollar.

Table C.4 shows the yearly additional exports of oil and refined petroleum products based on the Navius Research results in Appendix A, adjusted to account these correlated variables. We do this by taking the estimate of increased net exports of oil and refined petroleum products and subtracting the increase in imports of machinery as well as a proportion of the transport services net exports (the proportion used is 90 per cent of the total to account for uncertainties in the logistical process). The result of this calculation is then multiplied by the regression coefficients found in Table C.1 to calculate the effect on the exchange rate.

Using this adjusted figure for net export, we calculate the increase in net exports of oil and refined petroleum products share of Canada's 2013 GDP. Table C.4 shows the estimated increase in the exchange rate.

Table C.5 provides an example of how the potential opportunity cost of Ontario's lower GDP could be calculated. The actual calculations are much more complex because we have multiple exchange rate fluctuations that coincide with the incremental net oil exports for the different periods of operations.

In order to calculate the possible impact increases in exports of oil and refined petroleum products will have on Ontario's GDP, we need to estimate the effect of exchange rate changes and the effect of increases in rest of Canada (ROC) GDP.

The ROC GDP variable is calculate by the year over year changes in ROC GDP, multiplied by a multiplier chosen to include direct, indirect, and induced spending of the additional GDP. For our purposes, we have chosen to use the same multiplier as assumed in the Conference Board's study of 1.05.

The exchange rate impacts are calculated on a marginal and total basis. For each of the first eight years the marginal growth rate becomes less negative, while the overall growth rate become more and more negative. The total growth rate is the sum of all previous year's marginal growth rates up to that particular year.

We estimated both of these effects in Appendix C.1. Using the coefficients from Appendix C.1 with the forecasted changes in ROC GDP and the exchange

TABLE C.6:
Snapshots of the possible yearly GDP growth rates and opportunity cost over the period of operations

Year	Canadian dollar in U.S. cents	Marginal GDP growth rate per year (per cent)	Possible opportunity cost for the year (end of year GDP minus projected GDP in billions)
2015	90.00	2.00	$0.00
2020	91.44	1.90	-$0.02
2025	92.39	1.86	-$2.90
2030	91.21	2.02	-$5.29
2035	91.99	1.99	-$2.97
2040	91.80	1.96	-$5.39
2045	91.63	2.01	-$5.39
2050	91.48	2.01	-$5.40
2055	91.34	2.01	-$5.40
2060	91.21	2.01	-$5.40

rate, we can calculate the possible opportunity cost to Ontario over the different time operations horizons.

The actual calculations of the opportunity cost of permanently lower GDP have been completed in a similar form, with the results presented in net present value (NPV).

C.3 Comparison of model results

To check the validity of our model's results, we compare the findings from the two components — first the effect of net oil exports on the Canadian-U.S. exchange rate, and second the effect of the Canadian dollar on Ontario's GDP, holding all other factors constant — to relevant existing research.

To verify the accuracy of our findings regarding the potential effect of net oil exports on the Canadian dollar, we look at how changes in the price of oil impact the value of net oil exports and, subsequently, the Canadian dollar. Since a rise in the price of oil would increase the value of net oil exports — just as an increase in the quantity of oil exported would, as we modelled it above — the effect on the exchange rate from either a change in the price or a change in the quantity should be similar.

The Energy East pipeline is expected to increase the price that Canadian oil producers can get for their product by reducing the large discounting of Canadian crude that has been seen over the last several years. In essence, the price of Canadian crude should move closer to that of other international benchmarks, such as West Texas Intermediate (WTI), a North American oil price benchmark, allowing for quality price differences.[95]

TD Economics has estimated a 10 per cent decline in the price of WTI would lead to a 1 per cent decline in the Canadian dollar.[96] If we assume that with the Energy East pipeline, Canadian crude prices and WTI would be comparable, allowing for a discount due to quality, we can also assume that such a change in the price of exported Canadian oil would lead to a similar change in the Canadian dollar. We can also assume that a 10 per cent decrease in the oil price would be equivalent to a 10 per cent drop in value of net export dollars, holding the volume of net oil exports constant.

The results from our model estimate that a 10 per cent increase in the value of net oil exports would lead to a 0.3 per cent increase in the share of net oil exports in GDP in 2013, holding all else constant.[97]

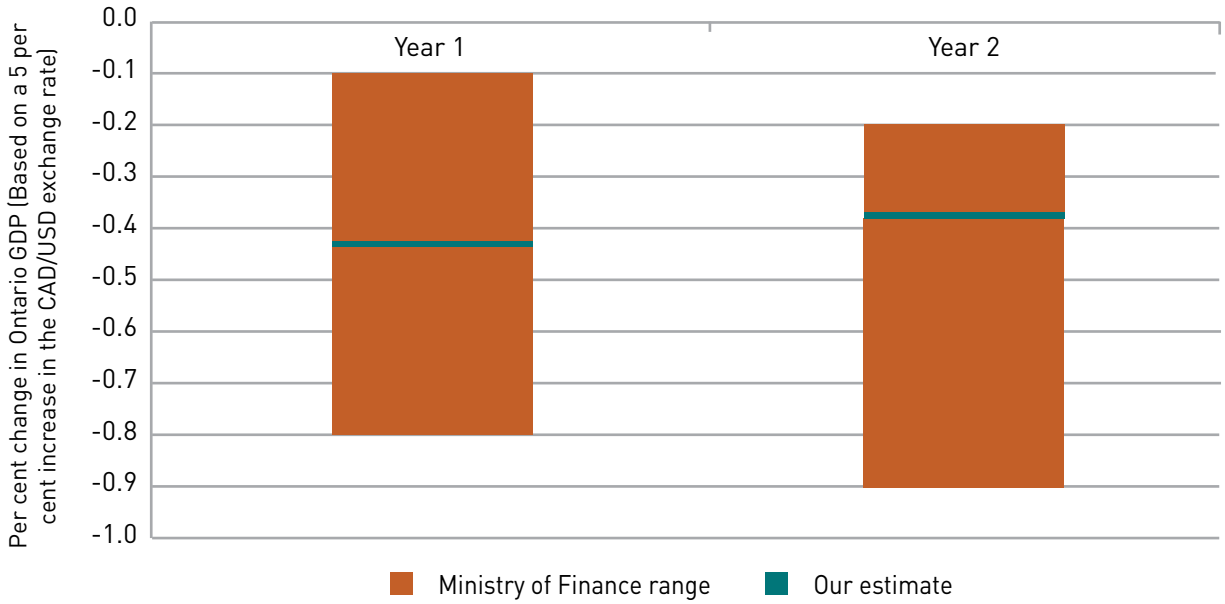
95 This is can be seen in Section 4 of Conference Board of Canada, *Energy East Pipeline Project: Understanding the Economic Benefits for Canada and its Region,* Appendix Vol 1-1, October, 2014, pp. 48-52. At https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/2432218/2540913/2543426/2541562/Vol_1-Energy_East_Project_and_Asset_Transfer_Applications-Appendix_1-1_CBoC_Report_-_A4D8R3.pdf?nodeid=2541125&vernum=-2; Navius Research results also confirms this.

96 Randall Bartlett, *Of Oil and Output: An overview of the impacts of falling oil prices on the Canadian economy,* TD Economics. October 17, 2014. At http://www.td.com/document/PDF/economics/special/OilAndOutput.pdf.

97 The share of net oil exports in GDP in 2013 was 2.9 per cent. Therefore, a 10 per cent decline in the value of exports would be equivalent to an approximate 0.3 per cent decline in the share of net oil exports in GDP in 2013.

FIGURE C.2:

Comparing findings on impact of exchange rate on Ontario's GDP to Ontario government estimates



Note: Our regression model uses real exchange rate changes, while the Ontario Ministry of Finance does not appear to do so. This difference in approaches, however, would likely not lead to a significant difference in results.
Soure: Ontario Ministry of Finance, "Chapter II: Ontario's Economic Outlook and Fiscal Plan," *2014 Ontario Budget*, p. 205. At http://www.fin.gov.on.ca/en/budget/ontariobudgets/2014/papers_all.pdf.

This 0.3 per cent increase in the share of net oil exports in GDP would lead to an estimated rise in the value of the Canadian dollar of 2.28 cents U.S. In comparison, TD Economics estimate a 1 cent U.S. increase. Although the impact of a 10 per cent increase between our estimate and TD Economics' differ, they are in the same directional impact, and close enough for comparison purposes.

In addition to the TD report, the Ministry of Finance estimates that a U.S. $10 increase in the price of oil per barrel would lead to a decline in Ontario's GDP by 0.1 per cent to 0.3 per cent in the first and second years following. If we make the same assumption from the TD case, and assume that a U.S. $10 increase in the price of oil would be equivalent to a 10 per cent increase in the value of net oil exports, the effect would be equal to a 0.3 per cent increase in the share of net oil exports in Canada's GDP. By our estimates, this would lead to a 0.2 per cent decline in Ontario's GDP in year one, and a 0.37 per cent decline in Ontario's GDP in year two, results that fall close to the Ministry of Finance's range.

In order to verify the accuracy of the second part of our model and our findings regarding the effect of a rise in the exchange rate on the economy, we can compare the effect of the changes in the exchange rates on Ontario's GDP to estimates made by the Ontario Ministry of Finance.

In the Ontario budget and economic statement, the Ministry of Finance says that a five U.S. cent depreciation in the Canadian dollar would increase Ontario's GDP by 0.1 per cent to 0.8 per cent in the first year, and 0.2 per cent to 0.9 per cent in the second, assuming that all else remains equal.[98]

Figure C.2 compares our results from a similar change in the exchange rate to the range provided in the Ontario budget. As can be seen the results from our model correspond with, and are in the middle to low end of, the range provided by the Ministry of Finance. An important difference, however, is that our results continue for eight years, compared to the Ministry's two.

As the models used to derive these impacts differ in assumptions and methodology, comparing the findings should be done very carefully. However, that two separate models came to very similar

98 Ontario Ministry of Finance, "Chapter II: Ontario's Economic Outlook and Fiscal Plan," 2014 Ontario Budget, p. 205. At http:// www.fin.gov.on.ca/en/budget/ontariobudgets/2014/papers_all.pdf.

results only emphasizes the validity of our findings. A sensitivity analysis is performed on the coefficient estimates of our regression results in Appendix C.4.

C.4 Sensitivity analysis of the model results

This appendix will focus on varying the regression estimates from Table C.1 and Table C.2 to produce a range of possible dollar impacts. This range is based on a 95 per cent confidence interval of the coefficient estimates. The confidence interval calculation is completed by taking the standard error of each coefficient, multiplying it by 1.96, and adding (or subtracting) it to the coefficient estimate. This will provide the end points of the confidence interval.

There is a 95 per cent chance that the confidence interval calculated contains the true population mean. There is only one population mean, and thus the coefficient estimate in the regression is the sample mean. Typically, the larger the sample, the closer the sample mean comes to the population if all assumptions in the model are valid.

Using the low and high estimates from Table C.8 we calculate a new possible reduction in Ontario's GDP over the different project life spans given by the impact reports. In Table C.9 these calculations are completed in the same fashion outlined in Appendix C.1.

TABLE C.7:
Sensitivity analysis of regression Table C.1

	Coefficient estimate	Standard error	T-statistic	Low estimate	High estimate
Oil exports as a share of GDP	7.60941	2.33482	3.25911	3.03317	12.18565

*High and low estimates are based on a 95 per cent confidence intervals

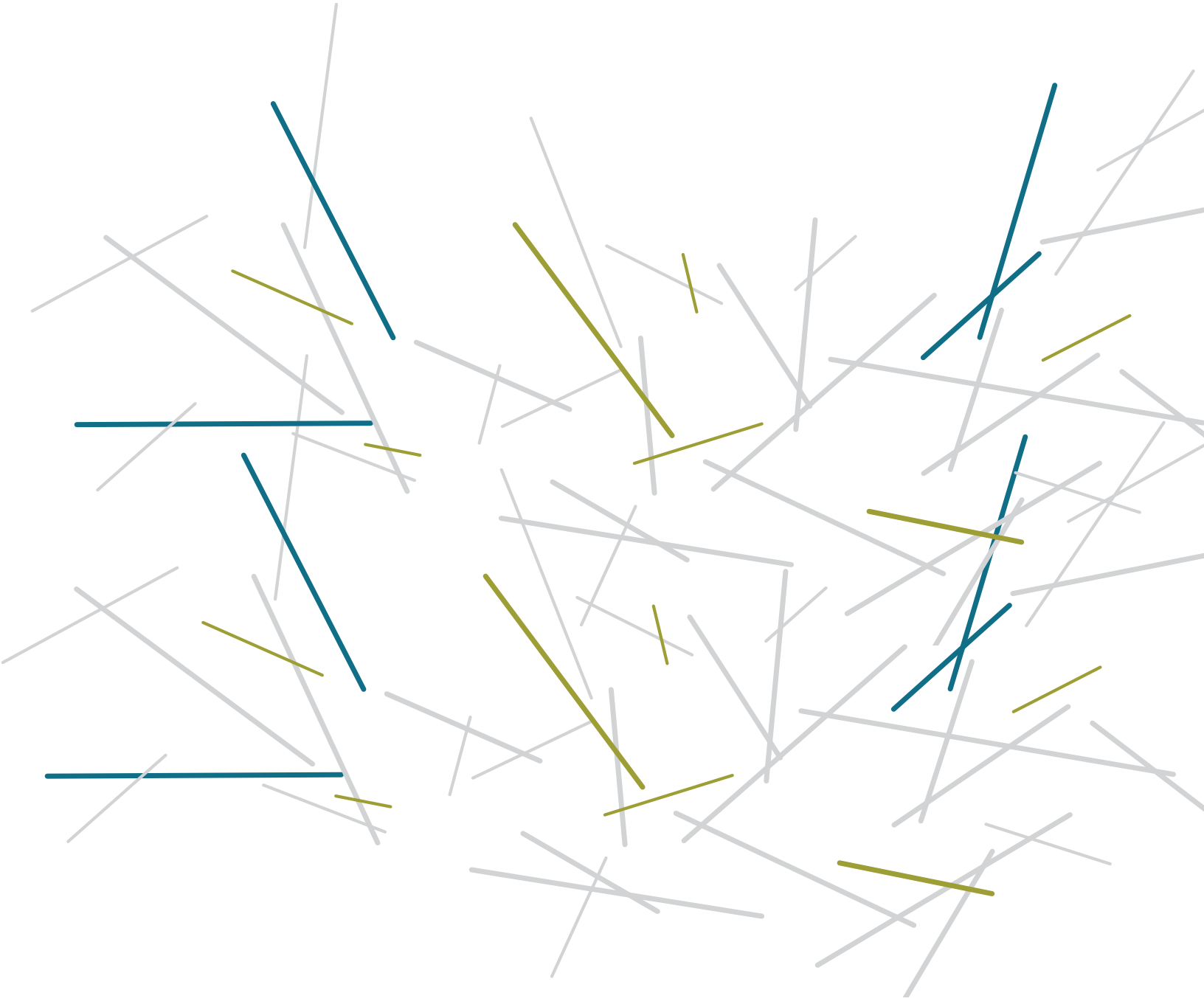
TABLE C.8:
Sensitivity analysis of regression Table C.2

	Coefficient estimate	Standard error	T-statistic	Low estimate	High estimate
Year 1	-0.08600	0.03110	-2.76447	-0.02502	-0.08600
Year 2	-0.07480	0.01758	-4.25434	-0.04034	-0.07480
Year 3	-0.06561	0.01561	-4.20301	-0.03501	-0.06561
Year 4	-0.05842	0.01788	-3.26793	-0.02338	-0.05842
Year 5	-0.05324	0.01772	-3.00417	-0.01851	-0.05324
Year 6	-0.05006	0.01527	-3.27849	-0.02013	-0.05006
Year 7	-0.04889	0.01766	-2.768	-0.01428	-0.04889
Year 8	-0.04973	0.03185	-1.56124	0.01270	-0.04973
Sum of coefficients	-0.48673	0.08508	-5.72096	-0.40165	-0.57181

*High and low estimates are based on a 95 per cent confidence intervals
Note: It must be noted that the eighth year is not statistically significant at the 0.025 level. As such, creating a confidence interval for this coefficient estimate is likely to cause concern. However, because the sum of the coefficients is significant at the 0.025 level, varying the sum over a 95 per cent confidence interval is reasonable. In this calculation, one would then have to decide how to distribute the range amongst the individual yearly coefficients. Instead we have chosen to simply use a 95 per cent confidence interval for the eighth year and use those results as our new values for calculation of dollar impacts.

TABLE C.9:
Comparing adjusted coefficient results for a 95 per cent confidence interval ($ billions)

Report		Conference Board		Deloitte		CERI	
Project Lifespan		26 years		46 years		28 years	
Discount rate (%)		2.5	5	2.5*	5	2.5	5
Benefits		$13.75	$10.29	$13.03	$8.54	$8.81	$6.84
GDP reduction	Low	$30.29	$22.45	$50.84	$31.89	$31.63	$21.21
	High	-$183.69	-$128.88	-$376.54	-$217.33	-$252.56	-$162.47
Total impacts	Low	$44.04	$32.74	$63.87	$40.43	$40.44	$28.05
	High	-$169.94	-$118.59	-$363.51	-$208.79	-$243.75	-$155.63



Appendix D:
Comparison of implied multipliers in the three economic impact analyses

TABLE D.1:
Multipliers used in the economic impact analyses for Ontario

Stage	Construction and development						Operations (20 years)*			
Impact report	Project capital expenditure in Ontario (billions)	Predicted GDP impact (billions)	Implied multiplier	Total FTEs	Ratio of induced to total FTEs	Implied GDP per FTE	Total GDP impact (billions)	Total FTEs	Implied GDP per FTE	Ratio of induced to total FTEs
Conference Board	$3.72	$3.73	1.05	41,270	0.28	$94,815	$15.02	51,398	$292,151	0.28
Deloitte	$2.17	$2.69	1.24	24,288	0.27	$110,919	$5.17	36,120	$143,134	0.30
CERI	$1.47	$2.60	1.77	N/A	N/A	N/A	$9.20	N/A	N/A	N/A

* The comparison is approximate, as Deloitte provided a 40 year GDP impact with discounted values. The figures shown here for Deloitte are half the 40 year value from their Table 2. To adjust for CERI's 25-year operational lifespan, a factor of 0.8 was applied to their GDP impacts.

TABLE D.2:
Multipliers used in the economic impact analyses for Canada

Stage	Construction and development						Operations (20 years)*			
Impact report	Project capital expenditure in Ontario (billions)	Predicted GDP impact (billions)	Implied multiplier	Total FTEs	Ratio of induced to total FTEs	Implied GDP per FTE	Total GDP impact (billions)	Total FTEs	Implied GDP per FTE	Ratio of induced to total FTEs
Conference Board	$12.74	$11.51	0.90	128,337	0.25	$89,685	$24.90	88,193	$282,062	0.26
Deloitte	$11.30	$10.05	0.88	91,848	0.24	$108,875	$12.70	85,040	$148,753	0.30
CERI	$11.28	$13.60	1.21	N/A	N/A	N/A	$20.00	N/A	N/A	N/A

* The comparison is approximate, as Deloitte provided a 40 year GDP impact with discounted values. The figures shown here for Deloitte are half the 40 year value from their Table 2. To adjust for CERI's 25-year operational lifespan, a factor of 0.8 was applied to their GDP impacts.

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