A Review of Two Economic Impact Studies of Calgary Hosting the 2026 Winter Games

Trevor Tombe, University of Calgary, Department of Economics and the School of Public Policy

As the City of Calgary considers a bid to host the 2026 Winter Olympic Games, the Calgary Bid Exploration Committee (CBEC) is gathering relevant analysis for Council and the public. To explore the potential economic effect on the city, the province, and the country, CBEC procured analysis from Deloitte and the Conference Board. To support this work, CBEC also requested independent peer reviews of this analysis. I am pleased to provide one such review.

Overall, I find the 3rd-party analysis rigorous and, in many ways, informative. The level of detail within the Conference Board report regarding the effect on tourist visit is particularly impressive. Overall, both reports apply standard tools, clearly summarize their results, and provide interesting contributions to the debate.

That being said, I have some concerns regarding the scope of the analysis, the validity of the chosen methods, and potential risk that policy makers and the public may misinterpret the results. But, to be clear, while most of my report is a critical examination of the two studies, it shouldn't be viewed as a judgement on the quality of their work. Both organizations are leaders in their fields and their work for CBEC reflects this.[1] Instead, my report should be viewed as providing additional considerations that will help inform decision makers and potentially improve the CBEC's evaluation of Calgary 2026. To that end, I aim my discussion at a general audience and not just the report authors. I therefore provide more detailed descriptions, background information, and plain-language intuition than would typically be necessary.

I arrange my review as follows:

1. **Narrow Assessment of Results:** I compare the 3rd-party estimates to my own estimates (based on Statistics Canada's Input-Output Simulation Model[2]). Though my estimates are extremely naive and overly simplistic, I find both 3rd-party estimates correspond closely to them -- at least with respect to the Canada-wide impacts. This confirms their results are reasonable, given the methodology used.

2. **Review of Existing Research:** The two reports extensively review the research literature on the economic effect of the Olympics. I find this largely well done, though I

[1] The School of Public Policy, where I hold an affiliation, is also working with Deloitte on certain ongoing research projects. I have no direct involvement in those projects.
[2] For details, see Statistics Canada, *Input-Output National Multipliers 2010*, Catalogue no. 15F0046XDB, Industry Accounts Division, Statistics Canada.

will clarify some of the cited results and present additional research that may be informative.

3. **Critical Review of the Modelling Analysis:** In their modelling, both 3rd-parties abstract from two important factors: the source of funds and source of resources (workers, capital, etc) required to host the Games. In effect, their estimates do not incorporate the alternative uses to which the funds and workers could have been employed. The funding is effectively manna from heaven, and there is a limitless supply of unemployed workers and machinery available for production.

   A comprehensive analysis would attempt to explore the opportunity costs of the resources required to host the Games. Public funds could have been allocated elsewhere (on spending initiatives or tax reductions, for example) and the labour and capital employed in Olympic-related activities come from elsewhere in the economy. I discuss these points in detail, and argue incorporating labour market and budget constraints into the analysis would shrink their GDP estimates to zero -- or less.

4. **Critique of the Core Methodology:** I end the review with a critical evaluation of the core method. Both studies employ Input-Output Models that are poorly suited to quantifying the likely effect of Calgary 2026 on the economy. In general, one should not interpret results from an Input-Output Model as suggesting that GDP will actually rise from additional spending. The models are also highly sensitive to certain underlying assumptions. I show reasonable modelling adjustments lead to arbitrarily large effects -- this is a particular problem for “induced effects”.

I end with some recommendations, some of which can be addressed and some of which cannot be. My primary message is a simple one: We should not consider the two economic impact studies as capturing the true incremental effect of the Games on the economy. That being said, they may serve a useful role in highlighting spatial and sectoral shifts in economic activity, despite providing limited information about any changes in the aggregate total.

In the end, the decision to host the games should be based less on estimates such as these, but more on a full and complete cost benefit analysis. There will be economic costs, but those costs may indeed be worth paying. The CBEC should consider procuring such a study.[3] In any case, in what follows I focus on the two 3rd-party studies and do not consider the overall pros and cons of Calgary hosting the 2026 Winter Games.

[3] For example, a detailed “multiple account cost-benefit analysis” of the Vancouver 2010 Games can be found in Shaffer, Greer, and Mauboules (2003), “Olympic Costs and Benefits: A Cost-Benefit Analysis of the Proposed Vancouver 2010 Winter Olympic and Paralympic Games,” *Canadian Centre for Policy Alternatives*, February 2003. A detailed review of the methodology can be found in Shaffer (2010), *Multiple Account Benefit-Cost Analysis: A Practical Guide for the Systematic Evaluation of Project and Policy Alternatives*, University of Toronto Press, Scholarly Publishing Division: Oct 2010.

1 Narrow Assessment of Results

Though a full replication is beyond the scope of this review, it is important to know whether the 3rd-party estimates are reasonable or not, given their methods. To that end, I compare the Deloitte and Conference Board nation-wide estimates to simplistic ones based on Statistics Canada's Input-Output Simulator. I'll call these my *Naive Estimates*. I find the two 3rd-party estimates are remarkably similar to these naive estimates at the national level, which lends credibility to their results overall.

Constructing a set of naive estimates from an Input-Output Model to quantify the effect of Calgary 2026 spending is straightforward. Statistics Canada has long operated its own input-output model, and regularly reports its high-level results. In particular, Statistics Canada publishes the model-implied estimates of the effect of $1 in additional spending on output, GDP, jobs, and so on.

The Model can further separate effects into three broad categories: *direct effects*, which capture the immediate effect of new spending; *indirect effects*, which estimate amount of intermediate inputs required to produce the goods and services demanded by the new spending; and *induced effects*, which estimate the effect of workers re-spending some of the additional income they receive. Statistics Canada's model implies $1 in additional economy-wide spending increases GDP by $0.53 due to the direct effect alone, by $0.84 due to the direct and indirect effects, and by $1.09 due to the combined direct, indirect, and induced effects.[4]

Given these multipliers, and $3.3 billion in spending associated with Calgary 2026 (following the Deloitte report), I quantify the national changes in output, GDP, labour income, and employment implied by an Input-Output Model. I call these "naive" since I cannot account for the detailed composition of spending, so use only the total. I summarize the results in Table 1.

Table 1: Comparing 3rd-Party Estimates to Quick-and-Dirty Ones

	Output ($B)	GDP ($B)	Labour Income ($B)	Jobs
Naïve Estimates				
Direct Effects Only	$3.3	$1.7	$1.0	17,391
Direct + "Indirect" Effects	$5.2	$2.8	$1.6	27,488
Direct + "Indirect" + "Induced" Effects	$6.6	$3.6	$2.0	35,140
3rd-Party Estimates				
Deloitte Estimates	--	$2.7	$1.9	27,614
Conference Board Estimates	--	$3.5	$2.3	35,714

[4] Statistics Canada, *Input-Output National Multipliers 2010*, Tables 1.1, 1.2, and 1.3.

Deloitte estimated only direct and indirect effects, so readers should compare their numbers to the second row of the naive estimates. The Conference Board included induced effects as well, so readers should compare their numbers with the third row of the naive estimates. Both are remarkably close to my naive estimates -- which is reassuring and suggests there is unlikely to be any large devil hiding in their modelling details.[5]

2 Review of Existing Research

A valuable contribution by both the Deloitte and Conference Board reports is their summary of the existing research attempting to estimate the economic effect of hosting the Olympics. Overall, the evidence is mixed about the effect of the Olympics on economic activity. Some find positive gains to GDP and employment, others find little to no change, and some even find negative effects. The lack of clear consensus in the literature is also evident in the two 3rd-party reports. Deloitte, for example, concludes there is little clear evidence for a boost in tourist travel from hosting the Games while the Conference Board argues there is evidence for a boost.

As the literature reviews were well done, I have only two brief comments related to papers that they cite. I further discuss an additional field of research that is relevant, but was not explored in the reports. Overall, a fair reading of the literature suggests that the Olympics *may* boost economic activity, but it is not at all obvious.

Perhaps the most rigorous empirical work on the subject is by Bruckner and Pappa (2013), which is cited in the Conference Board report. Brucker and Pappa (B&P) conduct a detailed cross country study that compares outcomes of countries over time that bid, and those that bid and won, to other countries -- controlling for a variety of factors. It is a very interesting and well done paper, but some caveats to the Conference Board summary of B&P results are in order. While B&P find that there are generally positive effects of hosting the Olympics, and that these gains accrue prior to the actual hosting date, they find much smaller gains for open economies. That is, countries open to trade -- such as Canada -- gain less than more closed economies.[6] Further, B&P find gains are smaller for Winter Games than Summer Games. Finally, the cumulative effects are also not estimated with sufficient precision to draw strong conclusions. B&P's main results in Figure 1, for example, show no statistically significant cumulative effect of hosting the games in the long-term. Taken at face value, this study suggests Canada should expect little if any boost from hosting the games.

[5] Note, however, that the Conference Board uses a larger initial spending shock -- of $4 billion -- as they include tourism and legacy spending that Deloitte does not. On the other hand, they only simulate one round of worker income re-spending -- more on this in Section 4.3 -- which is less than what Statistics Canada does for their induced effects.

[6] See Table 8 in B&P, combined with an openness level of 0.8 for Canada. This is a point to which I will return later. The effect of new government spending on an economy's GDP is smaller the more open an economy is and the more flexible one's currency and capital markets are.

Rose and Spiegel (2011), which is cited by the Deloitte analysis as evidence that hosting the games boosts international trade, find no such effect exists for the Winter games. In addition, their results may be driven not by the Olympics themselves, but by the signal that hosting provides to international markets. To essentially signal that an otherwise unfamiliar country is "open for business". But Canada is already a generally open economy and needs no such signal. Further, Bruckner and Pappa (2013) provide other evidence that while there may be a short-run effect there is no cumulative increase in exports or imports.

Beyond the narrower research on the effect of hosting the Games, there is another literature to which one might turn for insight. In many ways the effect of Olympic spending on overall GDP can be treated much like any other type of large increase in government spending. A large, active, and growing research literature on the so-called "government spending multiplier" does not unambiguously suggest Canada should expect to see gains. Most high-quality research in this area is for the United States, and a reasonable range of multipliers may be between 0.5 and 1.5.[7] That is, each $1 of government stimulus spending may increase GDP by between $0.5 and $1.5 dollars. But it is a complex literature and the effect likely differs dramatically across countries.

Of particular relevance for Canada is that small open economies with flexible exchange rates (like Canada) should expect to see much smaller effects than less open and larger economies like the United States. Indeed, some high-quality recent research finds that the multiplier may indeed be zero for such countries[8] although other research for Canada suggests our multiplier may also vary between 0.4 to 1.6 depending on whether our unemployment rate is low or high.[9] That is, the more "slack" there is in the economy, the more effective stimulus spending may be.

In short, the empirical literature is mixed and any particular estimate of the effect of Olympic spending on GDP should be interpreted cautiously.

3 Critical Review of the Modelling Analysis

Ideally, to estimate the economic effect of Calgary 2026 one must quantify the *incremental* effect of hosting the games relative to what would have otherwise occurred. The 3rd-party analysis neglects other activities that are foregone by hosting the Games.

[7] For a detailed discussion, see Ramey (2011), "Can Government Purchases Stimulate the Economy", *Journal of Economic Literature* 49 (3): 673-685.
[8] Ilzetzki, Mendoza, and Vegh (2013), "How big (small?) are fiscal multipliers?" *Journal of Monetary Economics* 60: 239-254.
[9] Owyang, Ramey, and Zubairy (2013), "Are Government Spending Multipliers Greater During Periods of Slack? Evidence from 20th Century Historical Data," *American Economic Review* 103 (3): 129-134.

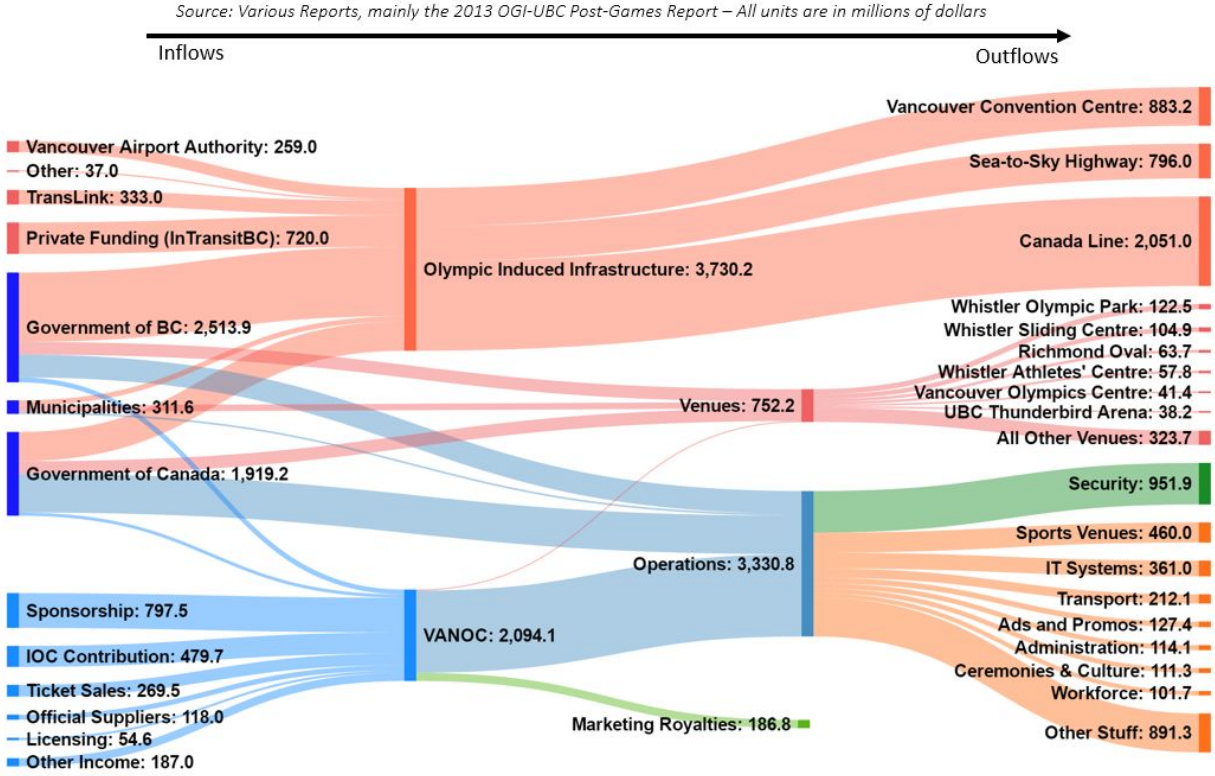
3.1 The Source of Funds

New Olympic-related spending is not necessarily incremental or additional spending for the economy as a whole. The dollars have to come from somewhere. Money that households use to buy event tickets, for example, is money not spent on other goods and services. Public funds allocated to new facilities and operations is money not spent on other public services or money not returned to taxpayers. If all Olympic spending is simply shifted from other uses, then there would be no aggregate spending increase at all and an Input-Output Model would imply no change in GDP.[10]

Funding sources also matter. Ticket sales, IOC contributions, and various other non-governmental sources fund a non-trivial share of Olympic expenditures, but public funding is substantial. To see this, I plot in Figure 1 the financial flows for the Vancouver 2010 games. Combining the contributions to VANOC, to Olympic operations, and to venue construction, governments contributed nearly $2.4 billion. This does not include peripheral infrastructure spending -- which ought to be evaluated on its own merits, separate from any Olympic bid.

Figure 1: Vancouver 2010 Olympics - Financial Flows

Source: Various Reports, mainly the 2013 OGI-UBC Post-Games Report – All units are in millions of dollars



[10] This is true even if funds come from outside of Canada -- our exchange rate is flexible, so international payments always balance.

Why does it matter how much public funds are used? Simple: tax revenue costs the economy more than one dollar for each dollar raised, as taxes distort economic activity. Researchers measure the magnitude of this effect in what is called the "marginal cost of public funds" -- if the marginal cost is 1.5, then raising $1 in government revenue costs the economy $1.50. A large empirical literature in public finance consistently finds these costs can be very large.[11] In the latest research available for Canadian provinces, for example, Prof. Bev Dahlby of the University of Calgary -- a leading researcher in this area -- finds a typical dollar raised through corporate taxes costs the economy $3.93 dollars. Personal income and sales taxes have lower costs, at $2.86 and $1.59 dollars, respectively.[12] Provinces differ, and such costs are lower in Alberta, but the general principle is sound: there is a cost of raising public funds.

This matters for quantifying the effect of Olympic spending on GDP. If the marginal cost of public funds is, say, 1.5, then the $2.4 billion in public funds allocated to operations and sports venues for Vancouver 2010 had a total economic cost of $3.6 billion overall. A complete analysis of Olympic spending should reflect this. Indeed, an otherwise standard Input-Output Model that incorporates spending shifts plus distortions from public funds will imply that GDP actually falls as a result of Olympic spending. To be sure, I'm not suggesting GDP will fall or not, but merely noting that one cannot ignore the alternative uses to which spending could be allocated and that the potential distortionary effect of the higher taxes necessary to fund such spending are real.

3.2 The Supply of Labour, Capital, Etc.

Just as spending has alternative uses, so too do the real resources necessary to produce the goods and services associated with the Olympics. That is, workers employed in Olympic-related activities could have worked elsewhere. To understand the economic effect of the Games, we must account for this.

A key assumption of Input-Output models is that there is an unlimited supply of workers available for production. Expanding production in one sector need not come at the expense of contracting another elsewhere. A more reasonable estimate of the effect on employment of hosting the games is for a change in the *type of jobs* in which people work, not a change in the *total number of jobs*.

To illustrate, consider the employment increase for Calgary reported by the Conference Board. Their analysis suggests just over 9,000 additional jobs in 2026 -- or an employment rate increase of roughly one percentage point. This is large. Indeed, it's roughly one-third of the total peak-to-trough change observed during this past recession, with which saw Alberta's economy (nominal GDP) shrink by roughly $100 billion relative to trend.

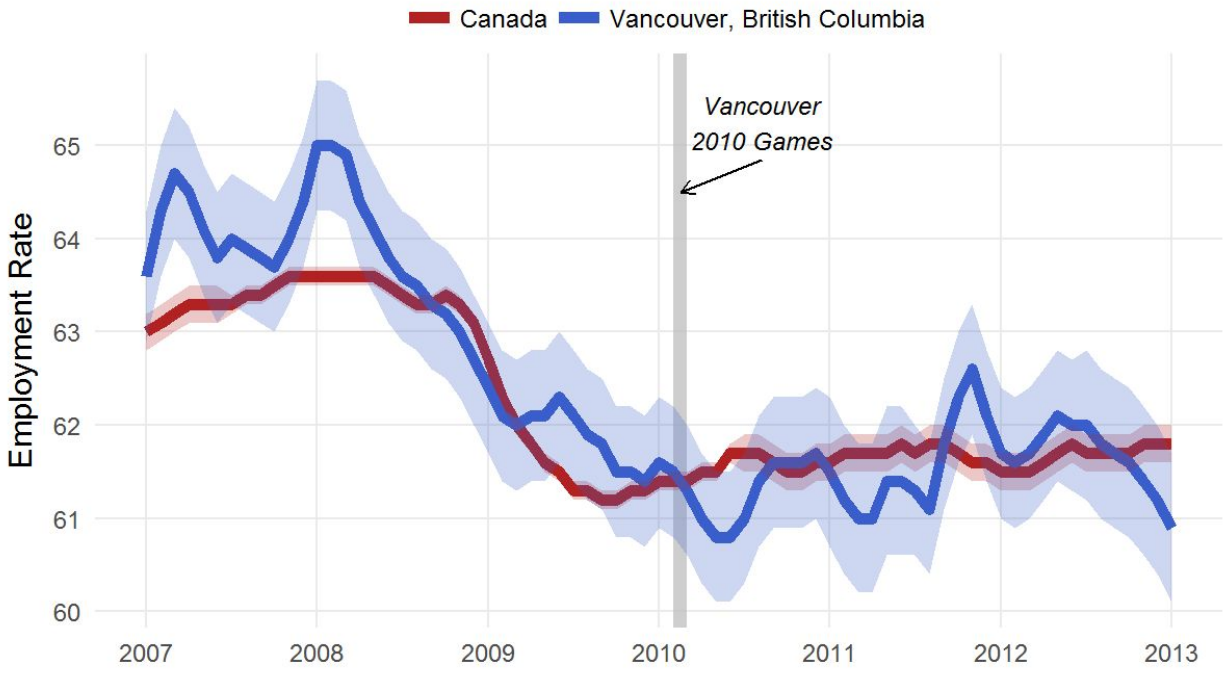
---

[11] For an extensive review, see Bev Dahlby (2008), *The Marginal Cost of Public Funds*, MIT Press.
[12] These are average MCPFs across provinces. For detailed results, by province, see http://www.policyschool.ca/wp-content/uploads/2016/05/estimating-tax-base-ferede-dahlby.pdf

Is there evidence from Vancouver of such a large effect from hosting the Winter Olympics? I plot in Figure 2 Vancouver's employment rate against Canada's national average over 2007 to 2013. If the Olympics boosted Vancouver's employment rate by a similar magnitude as what the Conference Board suggests is in store for Calgary, that should be visible in the data.

Figure 2: Employment Rates in Vancouver and Canada, 2007-2013

Source: CANSIM 282-0087 -- Shaded area is margin of error in the data



As the figure makes clear, there is no apparent change in Vancouver's employment rate before, after, or during the Games relative to Canada as a whole. One must be cautious concluding too much from this data, since the proper question is what would Vancouver's employment rate have been otherwise (which isn't observable), but it is nonetheless interesting that Vancouver saw no change in its employment rate relative to the rest of the country. To be sure, many workers were employed in Olympic-related projects but if they merely shifted from other activities then the aggregate employment rate would be unchanged -- which is exactly what we see. Thus, suggestions that Calgary may expect a one percentage point increase in its employment rate from hosting the Games must be taken with a rather large grain of salt.

There is another important point to take away from Figure 2. The margin of error in Statistics Canada's employment data is very large at the city-level. The above plot for Vancouver illustrates this with a fairly wide error band. For Calgary, the margin of error in Statistics Canada's Labour Force Survey employment data is over 12,000. Thus, *even if* employment rose by 9,000 there will be little credible way of testing this afterwards. The noise in the data is just too large.

4 Critique of the Core Methodology

I have already mentioned two important shortcomings of Input-Output Models -- the lack of budget and labour market constraints -- but my concerns run even deeper.

Understanding what these models are, how they work, and what they assume is also critically important to fully appreciate the implications of the reports. To that end, I'll provide plain-language primer to input-output models, and identify the significant shortcomings inherent in using such models to quantify the effect of mega-projects like the Olympics. I argue that these models are less than informative at best and highly misleading at worst.

4.1 A Brief Primer

Imagine a simple world where hosting the Games required no goods at all, only the services of workers. All payments to such workers would then be their new income, and we could call this "GDP".[13] An Input-Output Model takes this all quite literally. If spending for Calgary 2026 is $3.3 billion, the Model would conclude GDP would rise by $3.3 billion as a result. The model does not ask how production takes place, where workers or capital come from, or where the funding for the new spending comes from.

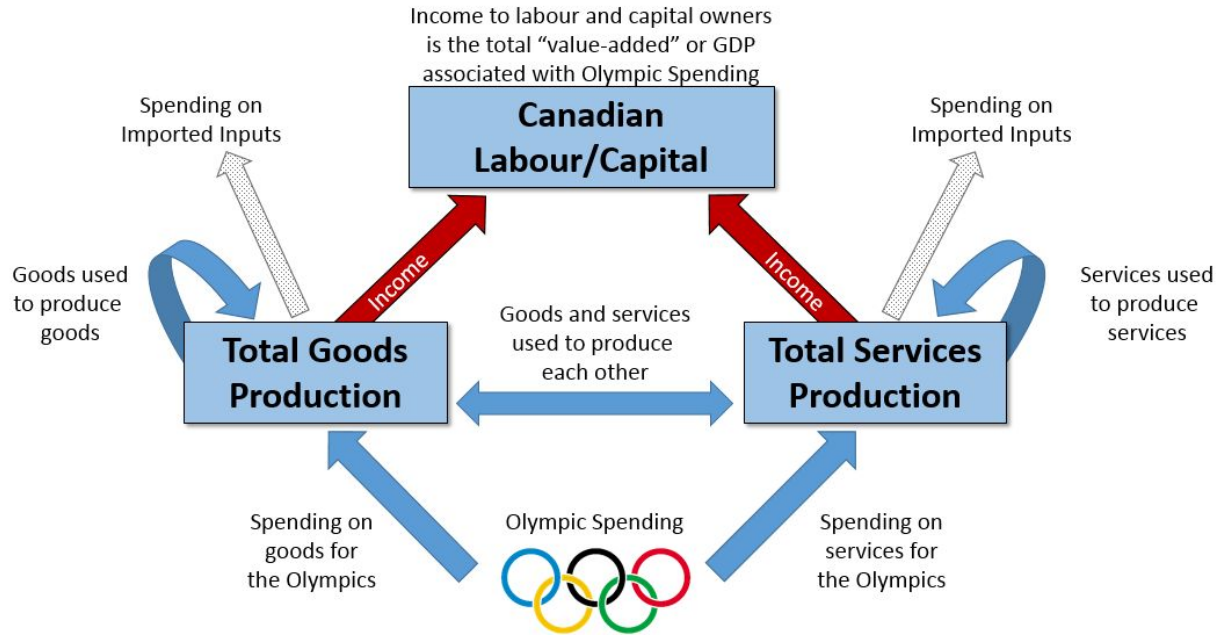
Of course, the economy is a complex web of interrelationships. Output from one sector is used as an input by many others. Increased demand for one sector's output therefore results in increased demand for another's, and another's, and so on. Thus, the total amount of new output produced will exceed that demanded by the Games. In addition to labour, other inputs such as land, buildings, machinery, and so on, have a claim to income generated by all such activities. Finally, many inputs are also imported, so increased output here also affects economic activity elsewhere. I provide a stylized representation of these linkages in Figure 3.

Input-Output Models attempt to quantify all of these interrelationships. And the effect on GDP of new Olympic spending is captured by the red arrows. For employment effects, the Models use data on the number of workers per dollar of production to infer "job creation" from the total change in goods and services production.

The direct effect is the Olympic spending itself. The indirect effects consider the feedback loops in the input markets (as goods and services need output from each in order to produce). And the induced effects (not illustrated) result from some fraction of income (the red bars) being recycled as additional spending on goods and services at the bottom of the figure.

[13] I use this language loosely, but for the purpose of this example GDP and income may be treated synonymously.

Figure 3: Stylized Input-Output Model



Such representations of Canada's economy lead to datasets that are incredibly useful for economic policy and research, but there is a fundamental difference between an *accounting exercise* and *a counterfactual estimate*. To say "spending on the Olympics would account for $3.5 billion of Canada's GDP" does not imply "spending on the Olympics *would increase* Canada's GDP by $3.5 billion". Strictly speaking, input-output models are at best useful for accounting (but even this must be done with care). To reconcile them with a model able to perform counterfactuals requires one make extreme assumptions about the nature of the economy. Namely, that prices, wages, and interest rates are fixed, that there is an unlimited supply of workers and capital available, and that funds for Olympics spending does not come at the expense of lower spending elsewhere.

These assumptions lead to highly problematic predictions.

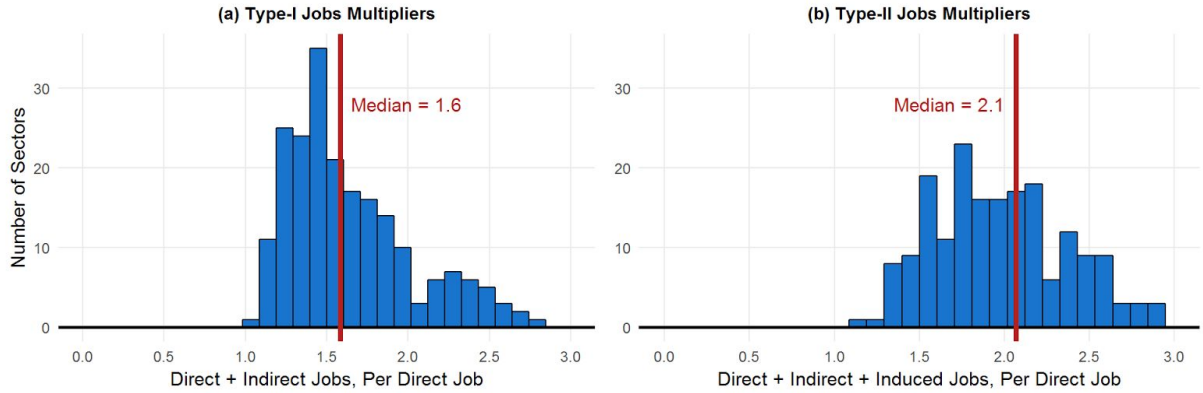
First, it is not possible for a new project to lower GDP or shrink employment. Due to the underlying assumptions of the model, all spending is good spending. Second, many of the results of such models are not interpreted in an internally consistent way and necessarily overstate the true effect. I document this double counting in (hopefully) a simple and transparent way in the next section. Finally, the model predictions are completely unbounded -- that is, the model can deliver any result an analyst might want, depending on which tweaks are made to the model structure. I will show that this is a particularly acute problem for "induced effects".

4.2 Double Counting Workers

Input-Output Models all imply that indirect and induced jobs are double (and sometimes triple, or more) counted. This is most clearly seen by looking at how many direct and indirect jobs an input-output model implies for each of Canada's sectors. Statistics Canada produces such estimates for a highly detailed set of over 200 sectors, and reports the ratio of direct plus indirect jobs to the number of direct jobs as the so-called "Type-I Jobs Multiplier". I plot the distribution across sectors in panel (a) of Figure 2.

Figure 4: Distribution of Jobs Multipliers Across Sectors of Canada (2010)

Source: Statistics Canada Input-Output National Multipliers, 2010, Catalogue no. 15F0046XDB
The x-axis is truncated at 3, though there are sectors with higher multipliers



Notice that *every* sector has a value above one. Thus, the implied total number of direct and indirect jobs in Canada's economy is *larger than the number of workers*. As each sector claims "responsibility" for the activities of another, the double counting can be substantial. This becomes increasingly problematic when induced effects are included. Again, Statistics Canada produces such estimates, known as "Type-II Jobs Multipliers". I plot them in panel (b), and they imply there are well over twice as many jobs in Canada's economy as there are workers.

The second problematic implication of a limitless supply of workers is particularly important for large mega-projects. Model-implied job creation estimates are *entirely* staffed by workers that would have no other employment prospect. Any expansion in activity in one sector necessarily draws from an infinitely large reserve army of unemployed workers. Indeed, the 9,000 new jobs created in Calgary in 2026 implied by the Conference Board analysis are entirely filled by workers that would have no other employment opportunity anywhere else in the economy -- at all. This is not credible.

Once a labour market is included in an Input-Output Model, where there are only so many workers to go around, one can show that the Olympic-related expenditures then imply no change in real GDP. Wages and prices simply rise to fully offset increased spending. Expanding output in activities to supply the Olympics comes at the direct expense of workers shifting away

from non-Olympic goods and service production. Roughly speaking, a more accurate view of the effect of Olympic spending is that economic activity *shifts* and is not *increased*.

And such shifts can potentially even lower GDP. I won't dwell on it here, but there is a strong theoretical and empirical research literature that finds labour allocations across sectors and regions matter for productivity. Shifting workers from one sector to another, absent some clear reason why markets have initially allocated employment poorly, typically lowers productivity and therefore GDP. Put another way, not all labour allocations are created equal, and distorting the allocation through government spending decisions must be approached cautiously. In many situations, market allocations are not efficient and intervention can boost the economy. But the Olympics is not likely one of those situations. In any case, there is no notion of optimal allocations within Input-Output Models. This is a problem.

4.3 "Induced Effects" are Potentially Unlimited

To estimate induced effects, an Input-Output Model takes wages and salary income and recycles that into additional rounds of spending. Intuitively, this is like the workers re-spending what they earn as a result of Olympic-related spending, which then becomes production and income elsewhere in the economy (say, at restaurants).

There are various approaches one might take to accomplish this. The Conference Board essentially conducts two stages of analysis: (1) estimate the direct and indirect effect of the new Olympic-related spending, recording the change in wage and salary income; and (2) estimate the direct and indirect effect of the wage and salary income.

The analysis need not stop with just one stage, and could continually recycle new wage and salary income through an infinite loop of recycling (much like how indirect effects are estimated). This is no less reasonable than the Conference Board approach. After all, the second stage in the Conference Board analysis creates its own additional wage and salary income that can -- within the logic of an Input-Output Model -- be spent on additional goods and services. In fact, all "Type-II" estimates (such as what Statistics Canada's model produces to quantify induced effects) are based on an infinite loop of recycling.

Moreover, why recycle just wage and salary income? Business owners will re-spend the higher profits that result from Olympic-related spending, either as private consumption or as additional investment. And higher incomes abroad (through imported inputs) will be recycled back into Canada's economy (in the model) through higher exports. Canada's exchange rate is flexible, after all, so its international balance of payments must always equal (inflows always equal outflows). Including additional rounds of induced effects, and more sources of income to recycle, will clearly increase the effect of Olympic spending on the economy.

In Table 2, I demonstrate this and show how different assumptions can lead to dramatically different results. Row (2) corresponds closely to the Deloitte estimates of direct and indirect

effects. But had Deloitte incorporated a balanced trade condition into their analysis, they could have increased their estimates to $3.3 billion increase in GDP and 32,500 new jobs. Add in some income recycling to capture induced effects and these effects could grow dramatically.

Table 2: Illustrating The Unboundedness of Input-Output Models

No.	Modelling Assumptions	Output ($B)	GDP ($B)	Labour Income ($B)	Jobs
(1)	Direct Effects Only	$3.3	$1.7	$1.0	17,391
(2)	(1) + Indirect Effects	$5.2	$2.8	$1.6	27,488
(3)	(2) + Balanced Trade (Exports=Imports)	$6.2	$3.3	$1.9	32,579
(4)	(3) + One Round of Labour Income Recycling	$9.8	$5.2	$3.0	51,499
(5)	(3) + Two Rounds of Labour Income Recycling	$11.9	$6.3	$3.7	62,486
(6)	(3) + Full Labour Income Recycling	$14.7	$7.9	$4.6	77,706
(7)	(6) + One Round of Non-Labour Income Recycling	$20.9	$11.2	$6.5	110,285
(8)	(6) + Two Rounds of Non-Labour Income Recycling	$27.1	$14.5	$8.4	142,863
(9)	(6) + Full Non-Labour Income Recycling	$ Inf	$ Inf	$ Inf	Inf

In principle, any row in this table is as reasonable as any other row, yet the effect of Olympics-related spending on output, GDP, labour income, and employment are dramatically different. Indeed, an Input-Output Model can effectively deliver any result one wants, depending on the number of feedback loops one includes.[14]

The lesson here is a simple one: *Induced effects within Input-Output Models are just far too poorly specified to be taken seriously as tools for counterfactual analysis.*

5 Conclusion and Recommendations

Key recommendations to improve the analysis:

1. Remove induced effects. They are too poorly specified to be taken seriously and allow for results as large as one might wish, depending on the modelling assumptions made. To their credit, Deloitte did not include induced effects into their analysis so this comment applies primarily to the Conference Board report.

2. Be clear about displacement effects in the labour market. Analysis must be clear about where incremental workers come from. To the extent that Canada may be at or near full employment in the early 2020s (as the recovery from the oil shock is well underway)

[14] As a technical aside, it helps to consider Input-Output Models like a complex geometric series. Money inserted at one end (the Olympic spending) flows through an endless sequence of feedback loops until the system converges. Like any geometric series, we require values shrink sufficiently quickly in order for a result to exist. If no leaks exist at all, the sequence never converges. Thus, one can arrive at any arbitrarily large total change from any initial Olympics-related spending by tweaking leakage rates.

higher Olympic-related employment means lower employment elsewhere in the economy.

3. Be clear funding sources. Spending on Olympic-related activities necessarily comes at the expense of lower spending elsewhere, whether it is funded from private or public sources.

4. Account for distortionary effects of taxes. A large research literature provides a wealth of estimates one can use to perform this analysis. In fact, reasonably conservative estimates from this literature quickly result in GDP losses that swamp any benefit implied by a standard Input-Output Model.

5. Refine the language to avoid leading readers to interpret the results as causal. Neither the Conference Board nor the Deloitte reports makes clear the various shortcomings inherent in Input-Output Models. As I see it, the main contribution of the 3rd-party analysis is to decompose the potential spatial and sectoral shifts of economic activity. Resources are almost surely going to shift into Alberta and Calgary, even if national-level changes in GDP are negligible (or even negative).

Moving beyond specific recommendations for the reports, I would strongly recommend CBEC supplement the two 3rd-party reports with a thorough cost-benefit analysis. The multiple-account cost-benefit approach, cited in Footnote 3 earlier, is a particularly useful framework to guide policy decisions.

In the end, there will be economic costs of hosting the games. If the benefits in terms of civic pride, community engagement, promotion of sports, and so on, is worth the cost, then hosting the games makes sense. But, to claim that GDP and employment will increase -- at all, but especially by the magnitudes suggested in the 3rd-party reports -- is to go far beyond what the evidence suggests.