Looking for Trickledown under the Peace Bridge…

Comments on the Regional Impact of an International Border Crossing

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Summary

This commentary reviews the economic impact study of the Peace Bridge (PB) Expansion Project appended to the Draft Environmental Impact Study (DEIS). It focuses on the benefits of the expansion proposal as they relate to the Buffalo-Niagara (BN) region.

The DEIS calculates the impact of the PD Expansion until 2040. While satisfactorily assessing the merit of any major project over this timescale is probably beyond any forecasting methodology, it is fair to say that the DEIS calculations offer a grossly exaggerated impression of the potential benefits of the project.

The DEIS report provides impressively high figures for the importance of the PB calculated via input-output models. Unfortunately, these are not particularly relevant to the Expansion Project given the present situation of the BN economy.

- The expansion of trade implied by the economic impact calculation is potentially quite misleading and few the benefits would accrue to the BN region.
- Beyond relatively modest contributions from construction and operation, the DEIS fails to demonstrate how the bridge might significantly promote the future development of the region.

The DEIS offers and exaggerated assessment of present value and the merit of the PB investment: this cost-benefit calculation has several serious flaws.

- It does not account for displacement effects whereby increases or decreases in the use of one border crossing will have consequences for another, or how gains in one region or locality are offset by losses in another, and so on.
- It makes tenuously optimistic assumptions of exponential growth in the volume of traffic expected for the PB from 2005 to 2040 and then channels this exclusively through the PB bottleneck, so predicting excessive congestion.

In the No-Build Alternative, combining these assumptions generate increasingly lengthy delays approaching the 2040 time horizon. The cost-benefit calculation for the Build Alternatives translates the time-saved by expanding the PB into increased income for drivers and passengers nationwide. However,

- Even when discounted, the cost of distant future delays contribute excessively to the present value derived for the project merit.
- Since only a small proportion of users reside locally, the regional benefits are again rather small.

Reasonable adjustments to the DEIS calculation, such as including the annual

operating cost, and projecting future traffic growth at the historic rate 0.8% instead of 1.8%, modify the overall Benefit/Cost Ratio from an irresistible 8.4 to a marginal 1.2. Some more plausible ball park estimates of the gains from the PB expansion and the changes in cross-border trade and associated shifts in levels of production and output in localities and regions on both sides of the border, are indicated. Using a stylized trade model, it is estimated - all else equal - that eliminating delays at the PB might increase total employment in the region about 1%. Overall, the DEIS calculations appear to be exaggerated by between 2 and 20, summarized as annual job-equivalents in the accompanying table. Such amplification is not confined to local impacts – the DEIS indicates that the new bridge, costing around $300 million would lead to a permanent annual gain of US$13b to Federal revenues!

Summary of Calculated Job Equivalent Impacts		
Item	DEIS/E&E Associated Impacts (1)	Ballpark Estimate of PB Expansion (2)
Construction (5 years only)	1,000	500-750
Border Operations	3,000	500-1,500
Exports	60,000	3-6,000
Timesaving	2,000	1-300
Total	66,000	4,100- 7,500
Benefit/Cost Ratio	8.4	0.5 -2
(1) Linked to PB and/or Expansion	(2)Rough Magnitude only ± 50%	

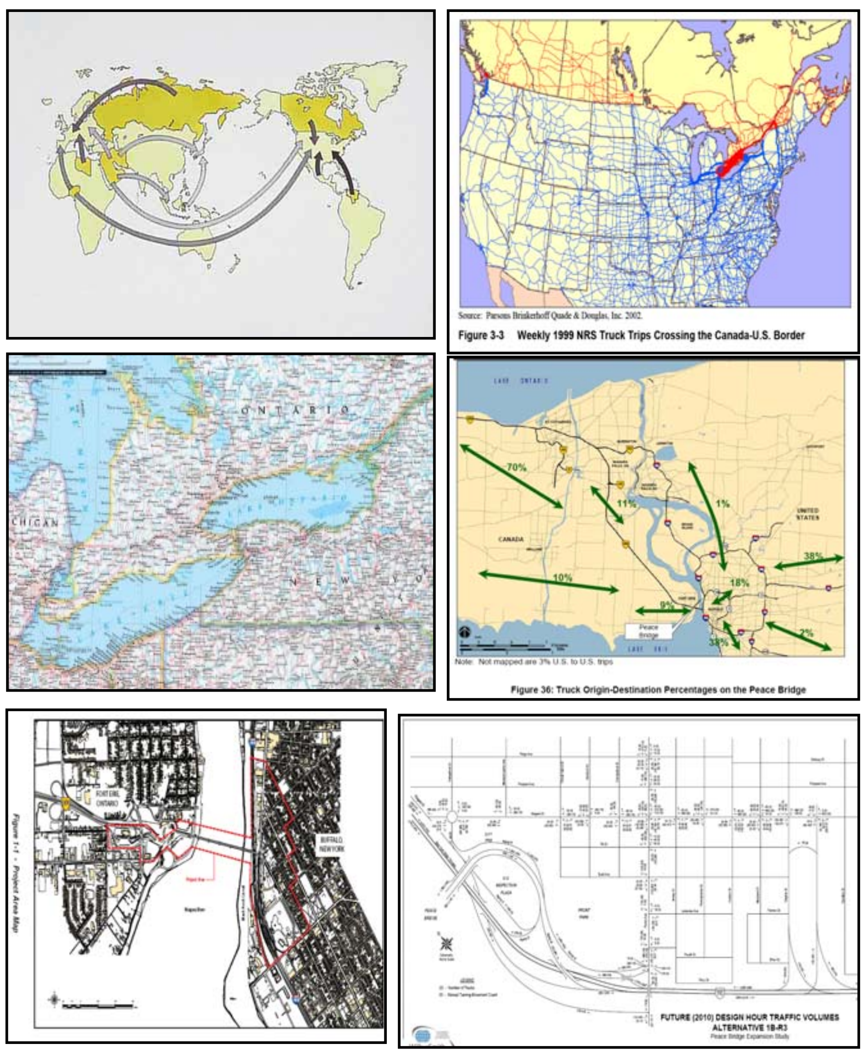
Although the DEIS utilizes "standard" models, they are generally misapplied for the PB evaluation. The problems arise from the ways that the various geographic scales associated with the PB, from the global to the local, are treated; tenuous assumptions about the future of the key industries involved; excessively elaborate models, questionable demographic and trade projections, and the project accounting and discounting used to argue the merit of the project. Equally disconcerting is that all levels of government approve these calculations, apparently making no substantive challenge!

Apart from the dubious relevance and magnitude of the DEIS calculations, their effort does not engage the central strategic questions. How expanding the PB might affect exports from the BN economy and individual major activities and businesses; how upgrading the PB fits with desired development of the BN economy; or how upgrading the PB will affect other crossings within the BN region, or how to accommodate the high level of economic uncertainty facing the region? Instead, the DEIS provides a rather narrow "looking under the bridge" assessment of its economic contribution.

1. Background[1]

The Peace Bridge (PB) between Buffalo and Fort Erie was opened in 1927 to commemorate 100 years of peace between the U.S. and Canada at a cost of $4.5 million. At the time, it was the only vehicular bridge on the Great Lakes from Niagara Falls to Duluth and Buffalo became the leading port of entry to Canada from the U.S. and remained so until 1992. Expanding the Peace Bridge has been on and off the table for 20 years, but the 2007 Draft Environmental Impact Study (DEIS) is the first comprehensive evaluation. This commentary reviews the economic impact component of the study appended to the DEIS.[2] Although this is a minor part of the DEIS in terms of length (one section and four relevant appendices), it is possibly the most significant in terms of swaying public opinion.[3] The primary purpose here is to ascertain the reasonableness of the DEIS estimates of the benefits of the Peace Bridge Expansion for the Buffalo-Niagara (BN) region.[4]

Figure 1. Peace Bridge - From the Global to the Local Scale



The novelty aspect of the project as a policy and planning issue is that the PB is an important international border crossing into a metropolitan area, so the proposed expansion has implications at all geographic scales from neighborhood communities to the global economy (Figure 1).

The author has no particular partisan interest in the PB Expansion as a regional planning issue – although, that said, a preferred approach to that adopted by the DEIS is that, at the very least changes to the PB, should follow from a candid consideration of desired and possible regional development as a whole. Some recent comments by well-respected economists about the future of Buffalo and projections of demographic trends, or marginal role in plans for the expanding Toronto region, are quite sobering.[5] Without accepting the more gloomy prognoses, it is evident that Buffalo has to provide a *somewhere* to cross a bridge to by finding its identity and purpose.[6] [7]

The technical interest of the DEIS study is that it employs four of the principal methods used in urban and regional economic analysis and compounds their findings.[8] The primary purpose here is to understand and evaluate the forecasts used to support the PB expansion. Since this exercise raises some concerns, adjustments that would bring the DEIS findings into the realm of credibility are indicated. From an institutional standpoint, a further question is why, despite protests, these concerns were not addressed in the various stages of review, from the local to the national level. Sidebar 1 summarizes debate between a concerned resident and a consultant engaged for the DIES. Such dialogue is not untypical.[9]

Sidebar 1. A not-untypical discussion between community and developer representatives
Concerned Citizen: "The Plaza Expansion DEIS Appendix G pages 3-30 through 3-32 (and your PBA presentation) is claiming over $9 Billion in direct, indirect, and induced economic effects within the Buffalo - Niagara Falls MSA from trucks crossing the Peace Bridge. Local residents and businesses are hearing this (from your presentations) as $9 Billion in direct benefit to them locally - and this is a key factor in your gaining support for the expansion project. We do not feel that this information is being presented in a responsible way. This is our concern."
Planning Consultant: "You do not understand the concept of an economic input-output model. While you may not like the $9 billion dollar figure, that is the accepted economists' methodology that is used to fully measure the economic impact. I take issue with your insinuation that I and the PBA are misrepresenting the impact that the Peace Bridge has on the economy of Buffalo and Western New York."
Concerned Citizen: "The modeling is not as complicated as you are making it out, despite the questionable extrapolation on top of extrapolation it is very clearly laid out and not at all difficult to follow. To suggest that we can't understand a little economic modeling is more than demeaning to the individuals who have every right to question the numbers being produced by the PBA."
Planning Consultant: "Let me try again. Economic modelling may be difficult to understand and by its very nature imprecise, so I hope this helps. The $ 9 billion in total economic impact of freight crossing the Peace Bridge represented the total output effect generated to the region (Buffalo Niagara MSA) attributable to freight produced regionally shown in DEIS Table 3-19, after the multiplier effects had run their course."

Although impact studies such as the DEIS are official documents for public debate, they are typically undertaken by specialist consultants on behalf of the developer. From a positional point of view the aim is to demonstrate the need, importance, and viability of the proposed project, to show that it does minimal harm to, or better, actually benefits, the affected communities by stimulating economic activity and "trickle down". For the PS study, the developer was the Peace Bridge Authority (PBA) and the lead consultant was Ecology and Environment (E&E), a locally-based national consulting group.

2. The DEIS Methods and the Focus of this Review

E&E state that the purpose of the study was to demonstrate

i) importance of PB to BN, NYS, and US economies
ii) the employment and income contribution from construction and operation of the PB including the local customs brokerage industry
iii) the overall economic merit of the PB project investment from timesaving and other efficiencies

To make their case, E&E and their sub-contractors employ variants of four "standard" approaches. First, input-output models are used to demonstrate the current economic importance of the bridge and to assess the impact of bridge construction and operation. Second, several alternative high-low projections for traffic across the bridge are composed. Third, a transportation model is used to assess the time-savings from reduced transit delays in crossing the border. Last, the present dollar value of the accumulative delays up to 2040 for Build and No-build Alternatives are compared, and used to assess the merit of the PB project.

As with any such study, the E&E report may be questioned at several levels

a) Big Picture: How does the project fit into the big picture? How does it serve the interests of the affected communities? Arguably, analysis should include a wide consideration of global, cross-border, and major industry restructuring over the life-time of the PB, and E&E have addressed a limited extent, presumably constrained by the remit of the project.
b) Key Assumptions: Are the methods or the assumptions underlying the methods, or the way they are used and their results interpreted reasonable given the "problem" at hand? Is the way that geography and economy bounded and sub-divided appropriate? If not, what are the implications of alternative assumptions or interpretations? To what extent has model selection constrained or determined the way issues are addressed
c) Necessary Details: Are data current and reliable, model specifications adequate, and used consistently, and other minutiae? The aim is not to overly quibble with the technical details of the E&E study – such studies are well recognized as messy. Nonetheless, sometimes the devil really is in the details!

d) Social Context: Planning models typically comprise data, theory, equations, and some computer simulation at varying degrees of detail. Nonetheless, what models are used, how they are used, and how the results are interpreted, depends on a complex of pedagogical, scholarly, social, and policy constructs, with embedded dogmas, goals, and authority relations, that helps explain a)-c) above.

This commentary primarily is concerned with the middle ground (b) of assumptions, interpretation, and overall conclusions. The first question is to ask here is whether the findings are in the ballpark –whether the net expected contribution to BN is significant or, in the case of the DEIS, whether the results are within an order of magnitude (i.e. ten times too large or small). Matters of wider concern (a) or detail (c) will be simply flagged or footnoted, while aspects of d) are discussed in the postscript. The actual methods used by E&E are rather simple, but appear complicated because of the amount of data used and the complexity of the issue addressed. For enthusiasts, the key underlying assumptions and equations are indicated in sidebars. The focus here is on the Buffalo-Niagara region (BN) and localized-within Buffalo impacts are not discussed. The E&E report discusses several design configurations for the PB with broadly similar outcomes in terms of their economic (as opposed to social or environmental) impact. Therefore, discussion below focuses on E&E "Alternative 1."

While there is no surefire way of answering the question as to the economic impact of the PB Expansion precisely or even satisfactorily, it is fair to say that the E&E study has serious flaws, at least from the perspective of BN communities. The overall conclusion is that, whilst the E&E report provides impressively high figures for the importance of the PB and the merit of the investment, neither are particularly relevant to the BN region. Beyond relatively modest contributions from construction and operation, the DEIS fails to demonstrate how the bridge might significantly promote the future development of the region. Problems stem from how the multiple and interrelated geographic scales from the global to the local associated with the PB are treated: lack of specificity about the key industries and activities involved; excessively elaborate models, questionable demographic and trade projections, and the project accounting and discounting used to argue the merit of the project. A secondary purpose of this commentary therefore is to indicate how some of the limitations with the E&E economic study, especially as they relate to the BN regional economy might be addressed.

3. The Economic Importance of the Peace Bridge

International trade between the Buffalo MSA, NYS, and USA, For ease of comparison, the discussion here follows the order of presentation and calculation presented by E&E. The first section of the E&E study based on research by FXM offers an account of the importance of PB using 80-sector input-output models (IO) of the BN, NYS, and US economies. IO analysis combines data from many sources to describe the structure of an economy and assess the economy-wide impacts of secular changes (see Sidebar 2). A key concept here is the "multiplier" that measures the extent to which income from exports from a region benefits other businesses and households.

The principal criticism of the FXM calculation is that, whether or not the calculations the present-day "importance" of the PB for the BN region are sound, they cannot be used to gauge the benefits of the PB Expansion Project. However, *even in its own terms*, the calculation is unconvincing due to uncertainties in the estimates of current exports, lack of specificity about the actual cost and distribution allocations by major local exporters, and the corresponding input-output multipliers. Given past variability and future uncertainty about most of the variables, a less detailed, more industry specific impact model provides a more robust, more transparent, estimate.

FXM estimate the exports across the PB from the available US and Canadian customs data. They remark that assembling data "proved to be a much more formidable task than originally anticipated".[10]

Table 1. DEIS Direct Contribution to BN Income and Employment

Item	US$k Output	Jobs	Jobs/US$m Output
Chemicals	1,008,498	3,080	3.05
Rubber and Plastics	937,590	3,440	3.67
Transport Equipment	2,184,492	7,056	3.23
Sub-Total	4,130,580	13,576	3.29
Other Manufactures	2,649,715	19,052	7.19
All Manufacturing	6,780,295	32,628	4.81
Non-Manufacturing	7,877	31	3.94
Total	6,788,172	32,659	4.81
Based on FXM Table C1			

These exports become the direct income injected into the IO tables in order to calculate the total direct and indirect "trickle-down" impact on the economy (see Table 1).E&E employ three separate IO tables for the BN, NYS, and US economies, showing significant multiplier effects for production, employment, and income, as shown in Table 2. Thus, BN-produced exports across the PB are "linked to" a total US $9.10b of production, other NYS produced exports across the PB to $12.30b, and all US-produced exports to $166b.

On the face of it, and several caveats notwithstanding, this is a more or less standard procedure. The underlying theory of IO asserts, first, that regional exports drive an economy (whether a locality or a nation) and, second, that as exports increase, so will the rest of the region's economy. With respect to the first, E&E (Appendix G Table 3-18) asserts that some US$77b of US annual production is linked to, or may be attributed to, the PB and that this production adds some US$13b in Federal revenues (about 0.5% of total). It shows also that 60,000 jobs in the BN area (about 11.5% of total non-farm employment) are attributable to the PB.

The critique given next renders this part of the DEIS impact study almost irrelevant in terms of the likely impact of the PB Expansion Project. It nonetheless should be pointed out that the E&E/FXM calculation probably carries considerable errors, even in terms of what it aspires to do.[11]

Table 2. DEIS Total Direct, Indirect, and Induced Economic and Tax Effects of Freight Transported Across the Peace Bridge (2005)

	Buffalo-Niagara Falls MSA	Rest of New York State	U.S. Overall
Direct (Exports from 3-19,20,21))	$6.487	$5.849	$77.014
Output ($U.S. b)	$9.10	$12.30	$166
Employment Levels	60,330	73,593	1,088,000
Household Income ($U.S.b)	$2.65	$3.60	$48.40
Taxes			
Local	$233 m	$309 m	$2.8 b
State	$191 m	$298 m	$2.8b
Federal	$579 m	$1.3 b	$13.1 b

Source: E&E Table 3-18 based on CCMTA 1999; U.S. Census Bureau; R/Econ Input-Output Model, FXM Associates. m = million, m= billion)

Whether or not E&E subscribe to the second assertion, that a marginal improvement in border facilities will lead to a pro-rata increase in trade, is not clear, but the matter clearly needs to be addressed since the allusion is certainly there.[12]

The fallacy in accepting this assertion is seen by considering the following. If it could be confidently assumed that a building a new bridge (such as the PB) that costs well under (say) US$1b to construct would lead to a permanent annual gain of US$13b to Federal revenues then the Niagara Gorge and every other potential crossing between the US and Canada would be paved. Clearly whether or not the PB is *linked* to a significant amount of trade, it is evident that all the benefits from that trade cannot be *attributed* to the PB. This applies both to the existing situation and to marginal changes. At the local level, if doubling the size of the PB alone really would leverage another 60,000 jobs for the proposed US$300m investment, at an average cost per job of US$5,000, this would be a bargain, and Buffalo would once again become a boom city. This link is quite tenuous, whatever the historic prominence of the PB.[13] If, for example, there is already excess bridge capacity or competitive alternative crossings then expanding the bridge will have very little effect on trade levels.

Table3. DEIS Total 5-year Impacts for Alternative 1			
	Buffalo-Niagara	NYS	USA
Construction Cost	334	334	334
Total Economic Output $m	476	1016	**3249**
Income $m	217	399	1089
Employment	4,844	9,626	**21,505**
Taxes $m	91.2	255.8	661.2
Local $m	15.5	45	87.2
State $m	14.4	43.7	96.8
Federal $m	61.3	167	**477.1**
Source: E&E Appendix G Tables 4-4, 5,6, and 7			

E&E (E&E Table 3-13) suggest that recent improvements to the Lewiston Bridge might have played a role in shifting truck volume across the Niagara Frontier in favor of the Lewiston Bridge. Improvements to the PB might reverse this second trend, but there is no guarantee that total exports of BN-produced goods across all local bridges into Canada will be enhanced significantly. E&E do not address this central question.[14] Indeed, on the basis of the cross-border trends indicated by E&E and their caveats about the future of the auto- and other industries in the region, and recent industry studies, and expectations for the US and international economies, suggests re-evaluation before undertaking the PB Expansion.[15]

An assumption made in the E&E calculations is that all the exports (mainly manufactures) are produced in the area in a manner typical of that sector as a whole with characteristic labor costs, import propensities, and the like - as revealed in the relevant IO tables. The data in these tables are scaled from national survey data, with comparatively little local data. This makes the simplification of taking the average data highly questionable when only a few key exporters are involved. This is because there are considerable variations in the production methods and cost structures of the plants producing similarly categorized products (such as motor vehicle components), especially when plants are engaged in integrated cross-border production[16] Thus, the estimates of even <u>current</u> export level and cost structures contain considerable uncertainty.

The "text book" reasons for using IO is to reveal the inter-industry structure of an economy, identify its strategic sectors, and highlight opportunities for strengthening the regional economy. The E&E calculation does none of these things. It takes rather highly questionable estimates of the possible levels or imports, construction, and operation and multiplies these by more-or-less relevant sector multipliers.

Since there are almost no inter-industry linkages in the Buffalo economy and most major firms are subsidiaries of national or international firms, practically all the downstream impacts on non-manufacturing sector come through household purchases[17] Thus, the key E&E finding can be approximated by a simplistic "economic base" calculation such as

Trickledown to BN economy = Marginal Increase in Exports due to PB Expansion x Multiplier x Share of Industry Expenditures to Households

For example, if new exports really were $6.5b, the manufacturing multiplier was 1.4, and the household share was 30%, then the trickle-down is $2.6b. Quite coincidentally, this corresponds to the downstream benefit calculated by E&E ($9.1-6.5b in Table 3-18) However, since the <u>additional</u> trade from expansion of the PB is much less than the linkage implied by E&E (a few percent), the trickle-down should be reduced accordingly.

Moreover, the uncertainty on projections over the next decades (see later) of this contribution and the total volume (even ignoring major breakthroughs and disasters) may be plus or minus 30-50%. The wage share of expenditures also varies with type of firm, and here again may be another plus or minus 50% variation from the average. Given these uncertainties, whether, the aggregate multiplier used for manufacturing is 1.3, or 1.6, or 2 is irrelevant[18] <u>For the purposes for which the E&E calculation is used</u>, the result would be as "in the ball park" using a simple multiplier equation such as that shown, without the 88 sectors of the FXM calculation, provided the likely changes in cross-border trade due to the PB expansion were better known.

In any operation where overall demand is limited there are displacement effects with gains in one locality being offset by losses in another, so increased use of one border crossing will have consequences for another, and so on. Thus, increased use of PB might results in a decline in the use of other ports, including Lewiston *within* the BN region.[19] Similarly, if trade expanded the pro-rata increase in employment from operations, border, and brokerage activities would be the same, but at different locations within the BN region. There are also opportunity costs of losing use of the PB site for other purposes.[20]

<u>Contribution of Construction and Operation</u>

E&E use a similar IO method to estimate the contribution of the construction and operation of the bridge to the BN, NYS and US economies. This is a more straightforward application of this type of analysis since the activity is more localized. Discussion here will focus on the construction operation, illustrating the above cautions further and others related to this type of impact analysis.

The estimated construction cost for the PB expansion (Alternative 1) is US$334m spread over 5 years. This expenditure creates direct jobs and income to workers and local suppliers that, in turn, creates a downstream or trickle-down effect in the rest of the economy (Table 3). E&E (Tables 4-4, 5,6, and 7) estimate that the US$334m will generate total increases in output of US$476m and US$1016 m for BN and NYS respectively.[21]

DEIS Appendix I details costs of construction for the various PB expansion alternatives. They do not however provide the key information required to assess the multiplier effects of the project – what proportion of the total cost will likely be spent in the local economy. This can vary considerably, for example if most materials (such as girders and other hardware) are imported into the region, this will not contribute to the multiplier effect and the principal contribution will come from spending by workers employed on the project. If these workers are only temporarily resident in the region then a fair proportion of earnings will be repatriated. Similarly, if construction is undertaken by non-local firms there is a lesser likelihood that profits will be recycled locally, and so on. All these factors are typical of large construction projects such as the PB.[22]

E&E (G4-20) recognize that "It is possible that certain specialized materials, components, and resources will be imported from outside of the region" but say that "this form of impact leakage is accounted for within the economic model applied". This is not strictly correct: as noted above, even across large projects and business within a rather narrowly defined sector there can be very wide variations in employment and income multipliers – downstream effects within a relatively small area such as BN can easily vary by a factor of two.[23] Moreover, E&E state G4-20) that "It is reasonable to assume that the expenditures will be evenly distributed given the capacities of firms within the Niagara region (U.S. and Canada)." With this assumption it is reasonable to suggest that only half of the initial US$344m should be used as the primary (direct) construction expenditure injection into the US economy.

Table 4.DEIS Contributions of Border Activities to BN Employment

	Direct	Total	Multiplier
Operations	168	302	1.80
Border Control	291	524	1.80
Brokerage	1141	2053	1.80
Total	1600	2879	1.80

Source: E&E Tables G 2-22, 3-25, and 3-29

The larger the region encompassed the larger will be the downstream effects since there is a greater chance that inputs are sourced there, or that workers will reside and spend within that boundary. This important empirical observation embodied in the above calculations – that multiplier effects increase with the size of region considered that all else equal, "rational" economic actors spend at the closest opportunity, measure in terms of physical-, time-, or cost-distance. This assumption underlies the E&E method for estimating the "merit" of the expanded PB, and is used in the suggestion later in the appendix to this commentary as to how their estimates might be improved.

The magnitude of the E&E impact on the US economy as a whole at US3249m is especially difficult to understand since it corresponds to an output multiplier of 9.72. This is exceptionally high and deserves explanation. The Federal revenues associated with this amount total US$661m of which the Federal share is US$477m.[24] This implies that (if it were a fully-Federally-funded project) the entire construction cost of the PB project would be recovered from the direct and indirect impacts of the construction project even before it began operations. This appears slightly improbable.[25]

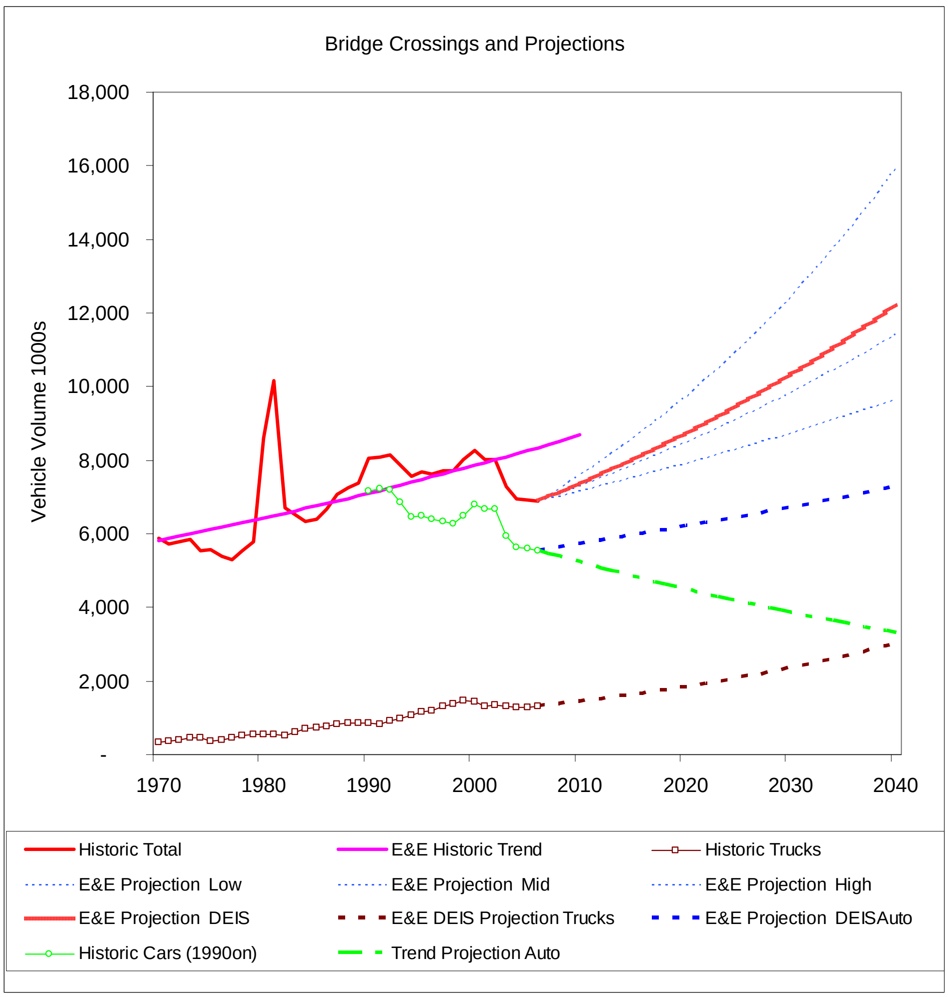
E&E also assess the impact of existing non-Commercial traffic across the PB on the BN, NY, and US economies (Table 2-22), Customs and Security, (Table 3-25), and Brokerage (Table 3-29) using similar IO methods and undifferentiated multipliers (Table 4). All are judged by E&E to contribute considerably less income and employment than is commodity trade.[26] While the same critique given above applies to these calculations, these activities are even more localized, and therefore relatively more affected by changes in border crossings. Non-commercial sales (including tourists, shopping expeditions, and employees) across the PB contribute about US$186m and 4,388 jobs out of a total US$506m and 11,015 for the US as a whole. The total contribution to employment from these activities is given as 2,879 jobs. Presumably, Build-Alternative 3 (that shifts border operations into Canada) would reduce these figures somewhat. Their estimate is for the BN region as a whole and this is unlikely to change greatly if traffic shifted to other WNY crossings, and so again is less relevant than the marginal impact of the PB Expansion.

4. Forecasts of Traffic Volume and Delays

Projections of Future Traffic

The projections of future traffic flows across the PB presented by E&E are confusing, if not contradictory. The E&E forecasts are preceded by a review of recent studies.[27] These provide a wide range of projections. Based on this survey E&E offers several projections of expected auto and truck traffic across the PB, and then selects a single forecast for comparison of the various Expansion alternatives (E&E I 94). They say, *"Examining the historical traffic data, reviewing projections from other studies, and performing the high, medium and low projections, a consensus was reached that a combination of low and medium growth rates should be used to for design of new facilities. The low growth scenario was considered most appropriate for projecting future automobile traffic. This trend closely follows the extrapolated trend line of historical data and follows projected population and employment growth in the region"*.[28]

This gives the impression that the DEIS projections are rather conservative. However, the low growth variant indicates an approximately 35% increase over this period (Figure 3) which is actually faster than the average growth rate from 1970-2000. Thus, even this "low growth" forecasts could be overly optimistic in the light of historic trends, and without some convincing explanation for a new wave of expansion in cross-border trade. The high variant indicates a doubling of traffic between 2005 and 2040, which is even more unlikely. (see DEIS Appendix D Fig 46).



Elsewhere in the DEIS, the overall conclusion about the possible impact of the expansion (see 4.3.3.1 Expanded Volume of Trade from Bridge Improvements) again appears far more cautious, if not contradictory. They explain that *"As more lanes/area are added and potential bottlenecks are removed, it is expected that greater volumes of traffic can be accommodated without hindering throughput. It is likely that that the Peace Bridge's share of commercial traffic using Great Lakes border crossings will increase, or at least remain stable over the medium term. Increased capacity and physical* *improvements will allow the Bridge entity to be more competitive on a regional basis for available bridge traffic. There is the potential for the Peace Bridge to capture traffic that was formerly relying on the Detroit/Windsor and Ambassador Crossings".* This seems to suggest almost negligible confidence that traffic volume will indeed rise.

Although E&E indicate (see above) that their projected trend "closely follows" the extrapolated historical trend the growth rate of PB traffic implied by their figures suggests a growth from 6 million in 2007 to 11 million in 2040 averages 1.7% (Appendix D Tables 42 and 43). The historical trend (shown in Figure 2) at 6 million in 1970 to 8 million in 2005 is about half this rate.[29] The latter rate would therefore seem an appropriate benchmark projection. That said, with such uncertainty and options, a suitably wide range of scenarios should be explored in order to develop an efficient, robust, composite strategy.

The historic growth for trucks and passenger vehicles (auto and bus) vary dramatically and for different reasons. Truck volume has grown in the wake of the circa 1990 Free Trade Agreements (FTA) although some studies consider expansion due to lower tariffs is exhausted. E&E acknowledge that "while trade conditions between the US and Canada have improved over the last 30 years, the major improvements to trade may have already been made and incremental improvements, while still possible would not be as great as in the past (Appendix D 92). There certainly appears to be a slowdown, beginning in 2000 (i.e. prior to 911). Auto traffic is extremely sensitive to the Canada-US exchange rate.[30] None of this is readily forecast, thus, it is essential to work through a reasonable range of options, especially since the growth rate of vehicles is only one component of the convoluted calculation presented in the DEIS.

Forecasts are equally sensitive to the composition of trade and other activities. Of the US$6.8b annual exports to Canada, 99.9% are manufactures (FXM Table C-1), of which about half are transport equipment (US$2.18b) and chemicals (US$1.0b). Given their importance, it is essential to explore a range of contingencies for individual key sectors such as automobile that are undertaking massive reorganization. Obviously, any major decline or recovery in these industries could have an impact on cross-border trade that would negate any of the DEIS growth forecasts.[31] Such changes are only one aspect of the structural and dynamic relationships between the Buffalo and Toronto regions. Temporally, cross-border trade varies markedly with exchange rates, energy costs, and border security. Structurally, the moribund BN region (with a projected population decline of around 7% by 2030) engages the still-dynamic Toronto region (with a planned increase of 40-50%). While it may be correct that a declining area (WNY) sandwiched between the Golden Horseshoe and the Atlantic States – especially in an era of generally expanding trade – might expect some absolute increase in the volume of trade, many structure-related factors beyond border-related questions such as agglomeration and intervening opportunities, come into play.[32]

Projections of Future Delays

The E&E projections of trade and traffic are used as the basis to estimate the discounted additional cost to users of delays at the PB over the next 35 years. The calculation of traffic projections, delays, and discounted costs is highly detailed and unnecessarily convoluted. The following explains how that the favorable "merit" calculation by E&E arises from the projections just described, the highly failure to considering alternative border crossings, and the adopted discount rate and project horizon.

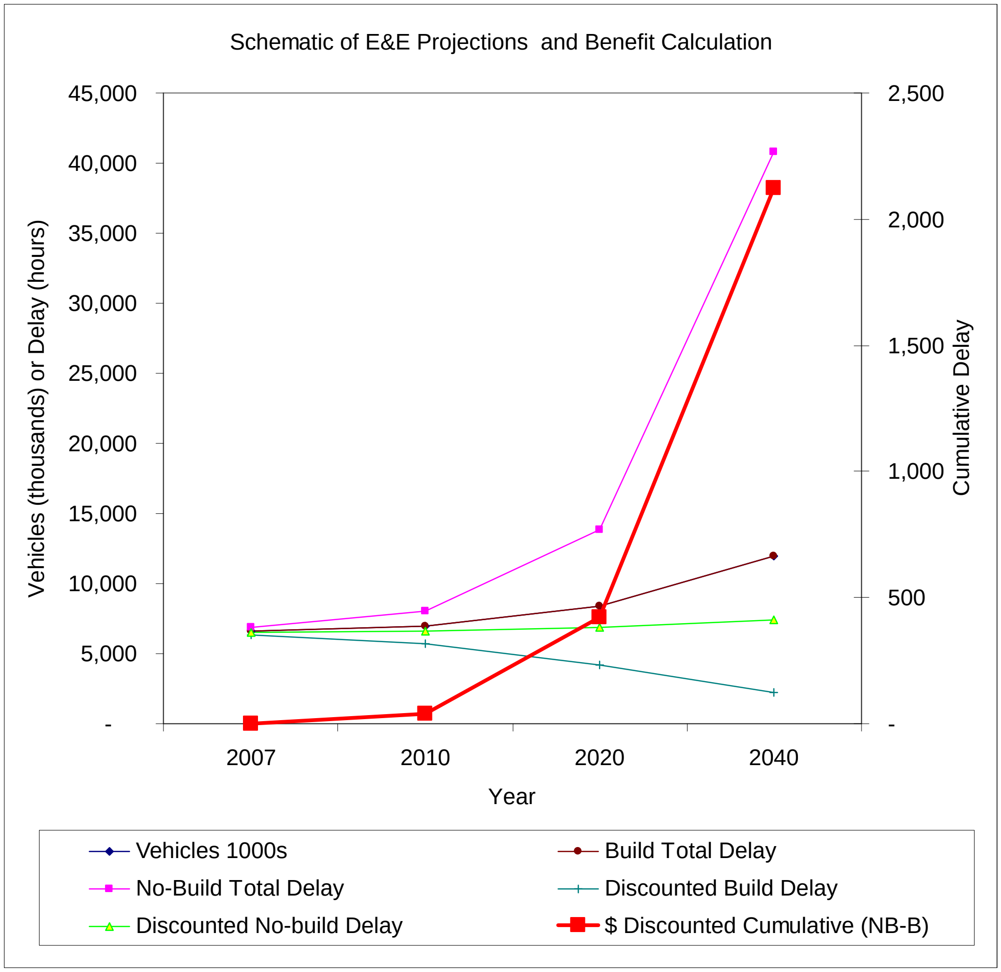
The estimates of future traffic delays at the PB presented in the DEIS come from a remarkably detailed vehicle-by-vehicle, street-by-street, moment-by-moment traffic-flow calculation over a period of 35 years.[33] This micro-simulation (CORSIM) is used to compare a No-build alternative (present PB with small modification) against the various Expansion alternatives (additional span, inspection areas, etc).

Table 5. DEIS Estimates of PB Design-hour Traffic at PB

Year	Passenger Cars			Commercial Vehicles		
	Annual Increase	Travel Time (mins)	Delay Time (mins)	Annual Increase	Travel Time (mins)	Delay Time (mins)
2007	0.90%	39.1	35.55	3.00%	33.1	28.05
2010	0.90%	49.2	45.95	3.00%	43.6	38.75
2020	0.90%	*21.6*	*18.2*	3.00%	*19.9*	*12.1*
2040	0.50%	189.15	182.55	2.00%	192.95	185.8
2007-2040 average annual rate		*4.8%*	*5.0%*		*5.3%*	*5.7%*

Figures in italic are author interpolations. Other data from E&E Appendix D and DEIS Tables 2-8 and 2-11 & 12 Friday design hour (peak) traffic

A problem with such detailed models is that only snippets of the calculation and results are presented (see E&E Appendix I). In this case, the exercise becomes something of a forensic reconstruction. A second problem, with such detailed models is that they are seldom – for time, cost, or other reasons – "run" sufficient times to test a sufficient range of alternatives. The E&E model includes assumptions traffic volume growth rates, social and commercial discount rates, the management of congestion. With exponential growth rates, a judicious choice of independently plausible parameters, can provide almost any desired outcome. A third problem – actually the major problem in this case – is that the model is applied to the wrong problem (to the streets adjacent to the PB rather than the region including highways and border crossings). One reason for this may be that the model package cannot accommodate the extra detail, or modified to include only the relevant details. Even though the actual E&E calculation is somewhat convoluted, the key elements may be simplified (see Sidebar 3) so that the implications of adopting different parameters (such as growth and discount rates) may be explored, and understood.



From the results presented in the DEIS, the following may be deduced. It appears that major delays due to road and bridge configuration are not expected for some years DEIS Table 2-12 tabulates data for the rush-hour evening delay for 2007 as 8.5 minutes, rising only to 10.9 by 2010, and to 218.6 by 2040 (Table 5). The increasingly large delays approaching 2040 are due to the tenuously optimistic assumptions of exponential growth in the traffic volume forecasts. With a more or less fixed (no-build) configuration, the estimated delays increase very rapidly as traffic volumes rise. According to E&E "Back of queue extends approximately 3 miles on I-190 up to the Buffalo Skyway" (DEIS Table 2-12). This is a 20-fold increase in delay-time. Even though E&E discount the cost of future delays at a 5% rate, with delays increasing at an even faster rate, these future amounts contribute excessively to the present value derived for the project merit.

For the Build alternative, since capacity is designed to cope with the highest expected (peak-hour) traffic load, the average delay in crossing the bridge remains steady (or even declines). In the No-build alternative expanding traffic volume (because of the forecast growth) pushes up against the bottleneck of the PB creating ever-increasing delays. Thus, for the No-build calculation the expected delays grow significantly faster than the expected volume of traffic as the present PB over-extends its current capacity.

As noted above, the key findings of this section of the DEIS may be reproduced through the comparatively straightforward set of equations given in Sidebar 3. These summarize the main assumptions underlying the E&E calculation and so approximate their essential behavior and results. The same approach is used to condense the discounted benefit analysis undertaken by E&E and the comparison between the Build and No-Build Alternatives. Figure 3 summarizes this calculation. The items on the left (shown by thin lines) match the figures given in the DEIS for vehicle, total No-build delays, and discounted Build and No-build delays. The key outcome here is the escalation of delays in future decades.

E&E assess the "merit" of the project by comparing the discounted cumulative value of the Build and No-build alternatives (Table 6). Again, this may be achieved using the approach in Sidebar 3. The results are given in Figure 4. The scale on the right shows the contribution to the present value of delays up to the years shown, matching the E&E figure for total discounted dollar amount (about $2.1 billion).[34] Selecting a different growth rate or social discount rate changes the outcome. For example, it is halved if the expected growth rate of traffic averages 0.8% instead of 1.8%, and halved again if it is assumed also that the social discount rate is 10%, instead of 5%. On balance, the question of social discount rates is a minefield, but given the sensitivity of findings to the rate, the singular choice adopted in the E&E study appears arbitrary.[35]

Table 6 DEIS Build versus No-Build Delays

	No Build	Alternative 1	Difference
Move Time (mins)	15.76	15.76	0
Delay (mins)	89.33	46.25	-43.1
Travel Time (mins)	105.1	62	-43.1

From E&E Appendix D Tables 54 and 55.

As shown in Sidebar 3, the key to the "problem" with the E&E discount calculation is that the present value of future contributions depends on a net rate given by

The Projected Growth of Traffic x the Escalation or "Bottleneck" Parameter - the Discount Rate.

If this rate is negative, the present-value contributions eventually fall to zero (which is normal in such calculations). In contrast, with a growth rate of 2% and a delay parameter of 3, discounting at 5% leads to ever increasing future contributions to present value. Without the fixed horizon (2040), the present value would become infinite!

The discounting of future escalating costs, as calculated by E&E for the No-build PB Alternative, is not unlike that for global warming – with costs rapidly outstripping economic growth over a generational timescale. The appropriate discount rate might be equally hotly debated.[36] For such cases, it seems arbitrary, in any case, quite unnecessary to reduce the costs and benefits to a single "present –value" figure. A better approach would be to assess the profile of possible alternatives over a sufficient time-horizon in terms of their social, economic, and environmental profile, to assess the real costs (e.g. construction and operation), and use expected interest rates (such as treasury) current borrowing rates and other budgetary considerations to assess whether or how they can be afforded.[37]

Table 7. DEIS and Revised Cost-Benefit Analysis

Item	E&E Table 4.8	Revised E&E (A)	Revised E&E (B)
Costs	million	million	million
Capital Costs	265	*301*	*301*
Annual Lifecycle Maintenance Costs	10	*365*	*365*
Total Costs	275	666	666
Benefits			
Travel Time Savings	2124	2124	*1380*
Fuel (VOC)	7	7	7
Inventory (VOC)	179	179	179
Total benefits	2310	2310	1565
Net Benefits	2035	1644	900
Benefit/Cost Ratio	8.4	3.5	2.4
VOC =Vehicle Operating and Ownership Savings			
Cumulative Present Value 2006-2040 Alternative 1 (from E&E G Table 4-8)			

The problems appear to arise, in part, from the complexity of the method E&E used to predict the escalating traffic delays. Rather than employ a less detailed "macro-model" that could address the geographic scale and multiple scenarios required for analysis the PB, E&E *reduced the problem to fit the model*. Micro-simulation may work well for considering the implications of new traffic signals at a major intersection, but omitting alternative regional border crossing points from their analysis of the PB Expansion Project makes the results quite misleading.[38] Arguably, E&E simply picked the wrong model for this type of analysis, at least at its present stage of development. The main role of the model for a strategic calculation is to estimate the value of the delay parameter. While some of the charts indicate that the E&E accumulated sufficient information to tackle this in plausible fashion, a likely explanation is that including the full-geography is beyond the current capacity of the CORSIM model. There was no other technical reason not to consider two or more crossings, minimally for truck traffic the PB and Lewiston. Since most long-distance (i.e. non-local) traffic has viable alternatives should the PB become a severe bottleneck - the tight geographic boundary set for the analysis, increasing traffic volume, and the implied capacity limitations of the PB exaggerate potential future delays, especially since there are likely to be steady incremental improvements in vehicle management that will moderate bottlenecks.[39] Beyond that, the more serious delays appear to arise from organizational and institutional factors.

The policy logic of expanding the PB that is formalized in the E&E calculation - to be able to cope with a rather low expectation of a high traffic-volume scenario some 35 years into the future - is also questionable. While one aspect of this ironically might be a "best-case" economic development scenario (significant increase in cross-border trade), it also employs a "worst-case" traffic scenario (no significant improvement in traffic technology, pricing policy, or alternative border-crossings).

5. Cost-Benefit of "Project Merit"

The approach used by E&E to justify the capital expenditure is to assess the financial saving to users of the Expanded PB relative to the No-Build Alternative and to compare these with the capital and operating costs over an extended lifetime of the project (E&E G4.4).[40] Again, E&E say this is a standard method used by, among others, the USDOT. E&E estimate the PB Expansion to offer a net discounted benefit of US$2,124m for a capital outlay of US265m (G Table 4-8) a benefit/capital ratio of 8.4. Before asking the key question of what, if anything, does this result mean to the BN region, a number of modest adjustments to the cost-benefit analysis are indicated.

Construction Costs

The capital cost stated appears to correspond to the US270m "order of magnitude cost estimate" in Appendix I. This includes property acquisition costs (US$29m) but community enhancement and mitigation costs (US$38m) are not included. Assuming this is not a donation from the City or demolished residents, adding this amount brings construction costs to US$301m.The entry for operating costs in E&E Table G4-8 refers to annual lifecycle maintenance costs of US10.3m. Since these are recurrent they should be charged for all years with the same present value.[41] Thus the operating cost up to the time horizon is US$365m (i.e. 10.3mx35). These adjustments modify the E&E Benefit/Cost Ratio from 8.4 to 3.5 (Table 7, Revision A). Another adjustment is to project future traffic growth at 0.8% instead of 1.8%. In this case, the Benefit/Cost ratio falls to 1.2, i.e. marginal merit.

It is not clear whether E&E Table G4.8 reflects the internal cost-benefit of the PBA comparing tolls charged (based on value of time saved) versus operating costs and cost of capital, and hence profitability. If this is the case, or if the table is designed to show the merit of the project as a *social investment*, then it is reasonable to include the opportunity cost of capital, or the interest on a long-term bond (LTB) typically from 10-15%. If the PB is not expanded, presumably, US$265m might be profitably invested elsewhere, in WNY or elsewhere depending on the financing and responsibilities of the developer, in this case the PBA.

Table8. Social Merit with Opportunity Cost			
LTB%-5%	5%	10%	15%
Costs	million	million	million
Cost of Capital	***526***	***1052***	***1578***
Annual Lifecycle Maintenance Costs	***365***	***365***	***365***
Total Costs	891	1417	1943
Benefits			
Travel Time Savings	2124	2124	2124
Fuel (VOC)	7	7	7
Inventory (VOC)	179	179	179
Total benefits	2310	2310	2310
Net Benefits	1419	893	367
Benefit/Cost Ratio	2.6	1.6	1.2

Including the net cost of capital in the cost benefit analysis for LTBR (using illustrative rates of from 5 to 15%) dramatically changes the outcome (Table 8). Cost of capital is approximated here as *construction cost x annual net interest rate x time horizon*, and for purposes of comparison is accounted as an annualized recurrent cost. This calculation suggests that the Benefit/Cost ratio is considerably less that that derived by E&E, even assuming that the estimated travel time saving is a reflection of potential income from the PB, even accepting their forecast traffic volume projection.

Table 9. BN Share of Timesaving	
BN share of PB crossings	8%
BN Travel Time Savings US$m	178.9
Annual BN Saving US$m	5.11
FTE Jobs @ $30k annually	170

User Benefits

As explained earlier, the user-benefit of the PB Expansion is based largely on an estimate of the time-saving from the Expanded PB. [42] Of the US$2.31b total net benefits estimated for the PB, Travel Time Savings between the Build and No-Build alternative are $2.124b. This represents about 92% of total benefit so clearly this is the item of most interest.[43]

The precise time-delays and imputed costs of time for travelers used by E&E are not given, but Appendix G Tables 54 and 55 indicate a saving of about 43 minutes per crossing. [44] At $15 per hour (or US30k per year) this is a saving of $10 per person crossing, at $30 a saving of $20, and so on. Thus, for a vehicle with 4 occupants, the presumed saving is $40-$80, or more.[45] Multiplied by the total number of persons projected to cross the PB each year over the next 35 years and discounted at 5% per annum, this gives the total present value of the time-saving.

Again, the basic difficulty lies with the way a seemingly straightforward formula is interpreted. First, there is an assumption that the time-saving translates into increased income for the driver and passengers. This is only the case if there is indeed new remunerative economic activity (for travelers) or alternative employment opportunities (for truck drivers) to be engaged in. Second, only a small proportion of the drivers and passengers are based locally, so most benefits from timesaving will not accrue to the BN region.

In the context of the entire and expanding US-Canada economy, and with the above empirical issues addressed, the approach might well offer a plausible approach for assessing the national economic merit of the project. But, even under these favorable circumstances, only a relatively small proportion – comparable to the BN share of cross-border trade - will accrue to BN. This is roughly 8% of total benefits, or about US$179m over 35 years. This is an annual average time saving of US$5.11m which translates back to 170 full-time jobs at, say, $30k per year (Table 9).

These jobs may be added to the 2,879 contribution to employment from operation, border and brokerage activities given earlier. Thus while E&Es estimate may indicate that the project has exceptional merit sufficient to satisfy DOT concerns within the context of the national economy, on the basis of their calculations, it really offers little to the BN region, even accepting that the US$2.124b is a reasonable estimate of the present value of the time-saving.

6. The PB Expansion Component of Trade

While the E&E study discusses some aspects of the traffic across between the localities proximate to the border, and of the inter-regional and US-Canada context, and presents some relevant data (Table 10), it does not estimate the marginal effect of the proposed PB Expansion on the regional pattern of trade. In consequence, their calculation gives a misleading impression of the merit of the PB Expansion project (see Sidebar 1).

Table 10 DEIS Origin/Destination of Border Bridge Traffic						
	Trucks		Passenger cars			
	Peace	LQ	Peace	Rainbow	Whirlpool	LQ
United States						
Buffalo	18%	17%	33%	1%	5%	10%
Niagara	1%	15%	4%	36%	70%	27%
East (NY, NJ, New England)	38%	43%	37%	23%	12%	33%
South (Erie, PA, Ohio)	38%	10%	24%	10%	4%	7%
W/A/C Counties	2%	-	1%			
Northern Erie	-	3%		17%	8%	21%
US to US	3%	12%	1%	1%	1%	2%
Canada						
Fort Erie	9%	1%	53%	2%	5%	2%
Niagara	11%	14%	20%	81%	85%	36%
SW Ontario	10%	10%	5%	2%	2%	7%
Toronto Area/Rest of Canada	70%	75%	22%	15%	8%	55%
Source: DEIS Appendix I Tables 3-33&34						

Assessing the merit of the PD Expansion over a timescale of 30 years satisfactorily is probably beyond present modeling abilities. It involves a wide range of variables (such as exchange rates, economic structures and productivity, consumption habits, risk factors, to name but a few) across a variety of characteristic geographic scales, against a background of a rapidly shifting global economy (see Figure 1).[46] Nonetheless, this surely is the central question, at least to show the ball park "importance" of the project and its associated uncertainties.[47]

Table 11. Stylized Cross-Border Regions								
Parameters	US				Canada			
	E	NF	NY	US	FE	N	TO	C
Size	2	0.5	20	100	0.1	1	5	10
X	0	0	10	50	1	0	5	30
Y	0	2	10	50	0	1	5	30
Bridges	PB Capacity 8				LQ Capacity 8			
Note Stylized areas A and locations X & Y arranged to distinguish relative scales and distances. Initial bridge capacity matches the level prescribed by the trade matrix.								

A more appropriate method than the micro-simulation used by E&E for this type of analysis would be some kind of macro-economic approach. Some of the issues above such as exchange rates and competitiveness traditionally are addressed by so-called trade models that focus on market competitiveness: others are addressed by so-called gravity models that focus on the pattern of spatial interactions. The former have generally been applied to international trade issues, to understand, for example, the implications of the CANAM and NAFTA policies, the latter to more local and regional issues (such as the location of regional distribution centers), but have become more popular in recent years as a means to comprehend trade between globalizing regions.[48] In particular, such models simulate trade displacement due to changing economic configurations or distance effects (including delays) such as those discussed earlier within WNY and the US, and across the border.

A relatively straightforward gravity model is sufficient to give a ball-park estimate of the gains from the PB expansion, and the changes in cross-border trade and associated shifts in levels of production and output in localities and regions on both sides of the border, and the degree of uncertainty associated with the estimate. As with IO, and the other methods discussed, a distinction again is drawn here between a model that can provide useful ball-park (but nonetheless strategy-relevant) estimates of likely impacts, and those that might include relationships that are more sophisticated, secular and geographic detail, and understanding and development (but not necessarily give more reliable aggregate estimates).[49] [50]

Table 12. Stylized Cross-Border Transaction Matrix

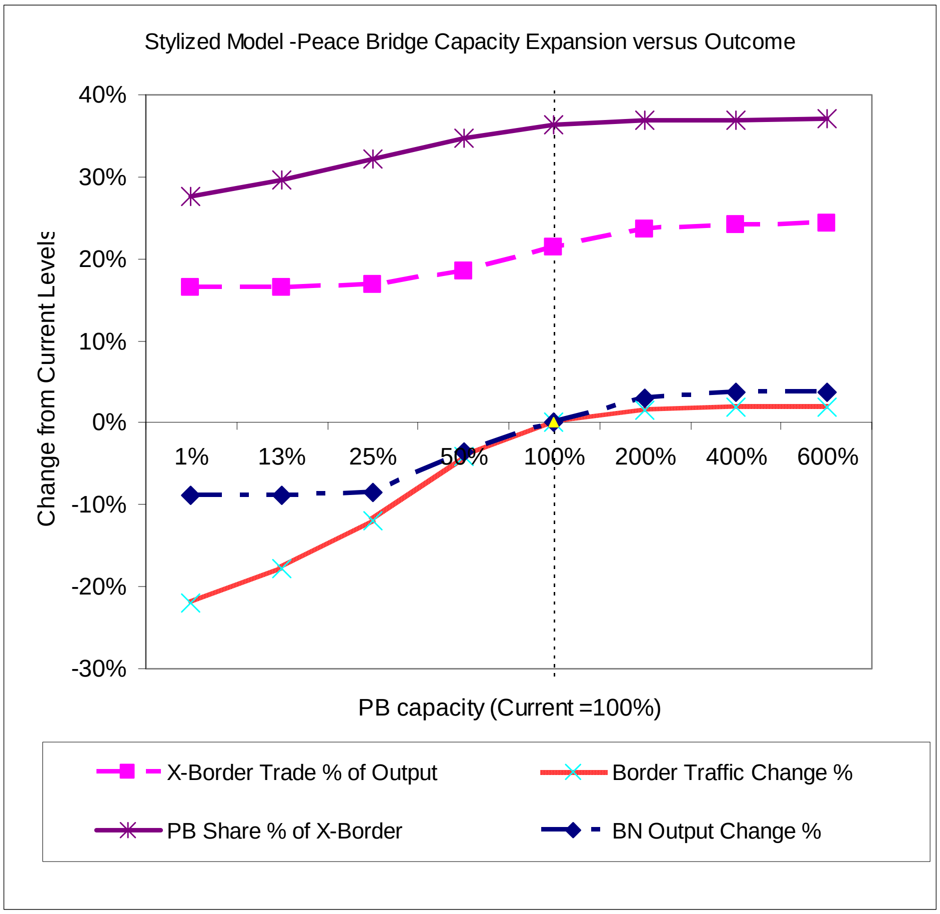
	US				Canada			
Income (Rows) Expenditures (Columns)	E	NF	NY	US	FE	N	TO	C
E	0.8	0.1	0.3	0.1	0.0	0.2	0.2	0.1
NF	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0
NY	0.3	0.1	14.1	1.6	0.0	0.2	1.9	1.3
US	0.2	0.0	2.0	94.9	0.0	0.2	1.0	2.7
FE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N	0.2	0.1	0.3	0.2	0.0	0.3	0.1	0.0
TO	0.3	0.1	2.2	1.1	0.0	0.1	1.8	0.1
C	0.1	0.0	1.2	2.0	0.0	0.0	0.1	5.8

Note: this trade matrix is also a compact "nested" inter-regional input-output table showing local purchases (diagonal entries) and import and export amounts (off-diagonal entries). The underlined entries are combined for PB and LQ cross-border transactions.

The gravity model is explained in Sidebar 4. Table 11 shows the stylized data for the size and distance between regions. These nominally correspond to those in the

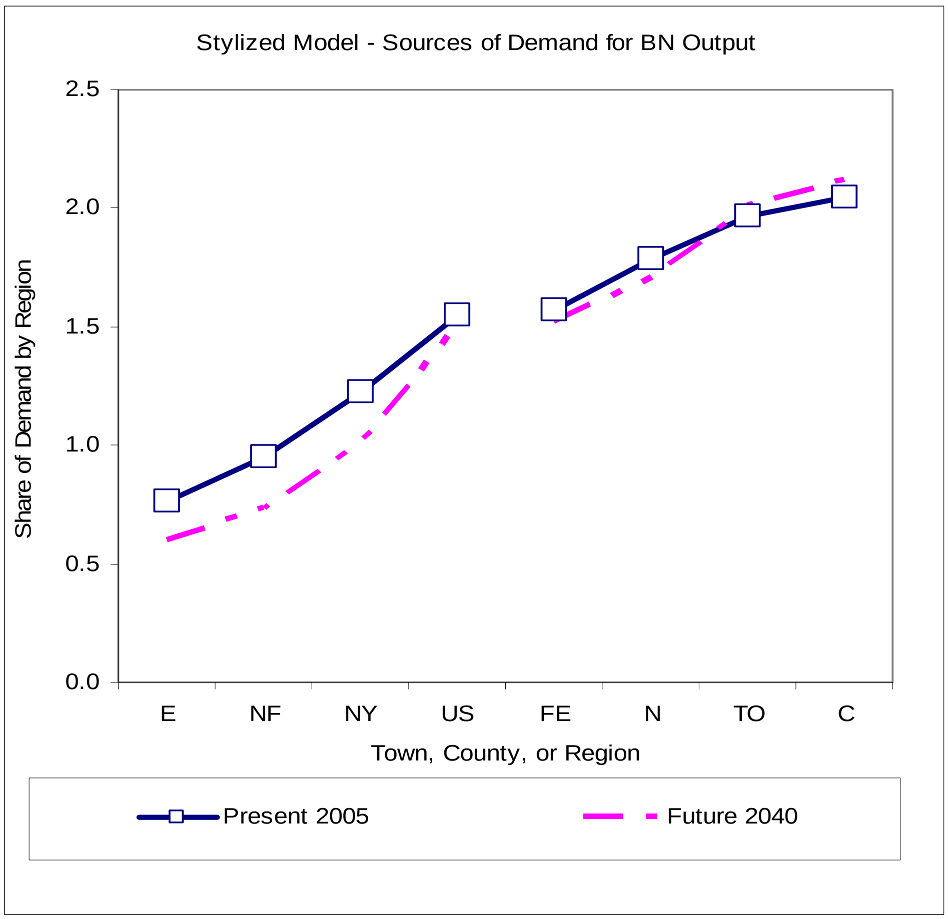
E&E study: Erie (E), Niagara Falls (NF), rest of NYS (NY), and the rest of US (US) on one side of the border, with Fort Erie (FE), Niagara (N), Toronto and Southern Ontario (TO) and the rest of Canada, (C) on the other. These are plausible in the light of Table 10 above and other information in the DEIS. The modification from a standard gravity model here is that bridge delays vary with the volume of traffic depending on the capacities of the Peace Bridge (PB) and Lewiston-Queenston Bridge (as explained in Sidebar 4).[51]

Table 12 shows the level of trade between these areas based on the equations of the model and the data used. Again, these are approximate, but plausible. Given this, changes in the elements of the table as parameters (such as the capacity of the PB) or the relative size of the regional economies, should reflect both the direction of change and the relative change in trade levels.



The model takes account of displacement as well as multiplier effects, for example, when the border time-distance is reduced (by an increased bridge capacity) regional trade within the US decreases in favor of cross-border trade, and net BN income rises (or vice versa). Changes in the level of total cross-border traffic and the share across the PB, total output in the BN region (E and NF combined) and the share due to cross-border exports are shown in Figure 5. Doubling the capacity of the PB (200%) raises output by only a few percent. Doubling again hardly affect this result, since traffic already flows without severe bottlenecks. Halving the capacity of the PB has a greater impact since this promotes bottlenecks. But, even reducing the capacity more dramatically has further has limited impact since trade is reduced or diverted to other regions and border-crossings. [52]

The results suggests that with border delays of approximately 1 hour about 7.6% of all BN employment is due to durable and non-durable manufactures exports to Canada (similar to the 10.9% estimated by E&E). Of this about 5.9% is exported from Erie County. Assuming that changes to the PB have only marginal impact on Niagara County, then eliminating delays at the PB will increase total employment in BN by 0.8%. This indicates that increased manufactures exports due to the PB expansion would provide directly and indirectly, about 4-5,000 jobs (not counting those due to construction, operation, and timesaving discussed earlier).[53] Increasing average delays at the PB to four hours (e.g. due to worsening security concerns etc.) reduces total BN employment by 2.6%, or about 15,200 jobs.[54]



The top two rows in the transaction matrix (Table 12) show the sources of income for the BN region - reading from left to right – first, the local demand for WNY-produced durables, then the incremental contributions from "exports" to other county, region, state, US, and cross-border Canadian markets, illustrated by Figure 6. While the Canadian contribution matches that from the rest of NYS, regional exports eastwards well exceed those across the border.

One way to assess the overall present-day importance of the PB is to ask what would happen if the PB was temporarily or permanently closed? In the short-run there would be considerable disturbance. Over the longer run one might expect that, between the US and Canada as a whole there would be a marginal impact as traffic switched to other routes, border crossings, and modes of transportation; at the local level there would be a greater relative impact but most traffic would divert to the LQ, with additional net delays. While there would be some substitution of sourcing between producers and locations, it is likely that only a modest fraction of exports from the local, state, and national economies would be lost. The trend in Figure 5 indicates this would be less than 10% of trade-induced output.

In contrast, to the detailed E&E calculation, even a stylized model, such as that just described, may be used to sketch how the regions economy might plausibly change with expectations for regional growth over the lifetime of the bridge. For example, over the next 30 years the population of WNY is expected to remain steady or even fall by about 5%, while that of the Golden Horseshoe (Toronto region) is expected to growth by up to 50%. The US and Canada populations are expected to rise by about 25-30%. Assuming that this growth is reflected in the relative sizes of their economies, and the capacity of the PB is doubled, then the pattern of trade for the BN regions would be modified as shown in Figure 6.

Table 13. Summary of Calculated Job Equivalent Impacts

Item	E&E Associated Impacts (1)	Ballpark Estimate of PB Expansion (2)
Construction (5 years only)	1,000	500-750
Border Operations	3,000	500-1,500
Exports	60,000	3-6,000
Timesaving	2,000	1-300
Total	66,000	4,100- 7,500
Benefit/Cost Ratio	8.4	0.5 -2
(1) Linked to PB and/or Expansion		
(2)Rough Magnitude only +/- 50%		

This shows a shift to more distant, more rapidly growing markets in the US, and shift in cross-border trade towards Toronto, but with only a marginal increase in overall output. Thus, the model "predicts" both that Buffalo shrinks to stay the same, and strengthens its links with the growing Toronto metro area, meeting the expectations of its more pessimistic and optimistic commentators! This is also shown in Figure 6. Obviously, such changes depend on a host of other variable such as regional competitiveness, fuel costs affecting transport modes and technologies, and so on including mutual "feedback" effects between changes in the size of the economy and its population that potentially could lead to the "spiraling down" of the BN economy. That said a range of possibilities and policy options can be reviewed, with results that are more plausible than those in the DEIS, and hopefully leading to strategies that are more economical and robust.

Given the uncertainty in future flows, dubiousness of the project impacts and merits, possibilities for directional flow management in peak traffic hours, and the fact that the PB could be expanded within any future 5-year period, does not demonstrate a pressing need for expansion at this time. Other border "effects", such as delays due customs and security, fluctuations in exchange rates, restructuring of regional economies and population, and so on are likely to be far more significant.

With respect to the border, it may be posited that Buffalo's best hope for the future is to discover a means to engage more fully in the cross-border economy, identifying the markets and market niches where BN has competitive advantage and opportunities. For this would come a more realistic assessment of implications for trade in manufactures transported by truck or rail across the border, as well as other non-manufactures, services, information, or other exchange.

Whatever the merits of expanding the PB may be, the E&E analysis is flawed – impacts are inflated by between 2 and 20 (Table 13). Apart from the dubious relevance of the calculated economic impacts, their effort does not engage the central questions. How expanding the PB might affect exports from the BN economy and individual major activities and businesses; how upgrading the PB fits with desired development of the BN economy; or how upgrading the PB will affect other crossings within the BN region? Instead, E&E provide a rather narrow "looking under the bridge" assessment of its economic contribution.[55]

Sidebar 2. An Exposition of the Multiplier

Input-Output Tables: These tables introduced by Wassily Leontief in the 1930s are a way of setting out the economic transactions between all groups in an economy. The are produced at many levels of detail and applied to national, regional, and even the world and inner-city economies. They allow data from many different surveys of business, households, trade, and so on to be organized in a consistent fashion. They are expensive and slow to produce so tables such as those used by E&E are generally manufactured by scaling-down national tables to match available local information. both the supply and the demand sides of the economy can be described as a network that can be mapped onto its physical and social counterparts. In a multi-regional table (not used by E&E) some transactions in the input-output tables explicitly represent. flows of goods and services between regions.

Output Multiplier: The "multiplier" is the outcome of the repeated circulation of income from export earnings through the economy of a given geographic region, such as BN, NYS, or the US. At its simplest, the output multiplier $m_o = 1 + a + a^2 + ..a^n + .. = 1/(1-a)$ where a is the proportion of income that is recycled through spending of wages and local inputs to exporting industries. Thus, the total increase in output from an increase in exports $X = m_oX$. The amount $(1-a)$ is the leakage – payment for imports. In an IO model this simple idea is elaborated using matrix multiplication to many sectors.

Type II Multipliers: With the Type II multipliers used by E&E, household expenditures are included in the circulation of income, and taxes and investment are included in the leakage. While this again is standard, in this reviewer's opinion, it underestimates the multiplier effects of long-run investments such as major infrastructure and production, typically by about 25-50%.

Employment Multipliers: The employment multiplier accounts for differences in labor productivity between the exporting sector and the rest of the region's economy. If these are l_x and l_r respectively, then the employment multiplier $m_e = m_o \, l_x / l_r$ so if the export industry has high labor productivity and correspondingly high wages relative to the rest of the economy, the job multiplier can be quite high (imagine Bill Gates personal employment multiplier).

Regional Multipliers: In general, the smaller the region, the larger the leakage. For the US as a whole leakage is around 30% so output multipliers greater than three are rare.

Multipliers come in all Shapes and Sizes: While there are almost an infinity of articles on multipliers (and even infinite multipliers) the above suffices to explain the E&E results. Studies that compare competing IO-based models find differences of around 20-50% in aggregate multipliers. Differences are explained in terms of what precisely is included, data, etc. Differences are much greater for the disaggregated downstream consequences for sectors or households). With additional behavioral assumptions (such as models with price adjustment or capacity constraints) the direction of change may differ.

Economic Impacts: A reasonable rule of thumb in calculating economic impacts is that about half the impact and half the error comes from the IO table and the rest comes from the direct impact inputted into the model. (With CGE models another half comes from the estimated supply-demand-price elasticities). Thus, it is important to make sure that these amounts (typically business or visitor expenditures) are surveyed (not average or pre-packaged amounts).

Sidebar 3. An explanation of the DEIS Bottleneck Forecasting and Present Value Discounting

Extrapolation and Discounting. To assess the present value of future impacts the DEIS interweaves three methods – exponential forecasting, a traffic model, and discounting. These models use a variety of assumptions that, for present purposes may be simplified as follows. This illustrates the "extrapolation on top of extrapolation" referred to in Sidebar 1.

In the DEIS calculation the value of time-saving is derived from a detailed version of the simple formula,

Cumulative Benefit = Discounted Sum over Lifetime of

[Projected number of crossings in both directions by year x Reduction in transit time because of expansion x effective wage rates of drivers and passengers]

Traffic Projection: Traffic volume in year t (measured from the bridge opening) $v(t) = v(0)exp(at)$ where a is the steady annual growth in volume. In the DEIS two periods of exponential growth up to and after 2020 are used. Interpolation suggests delays increase at an annual average rate of around 10% for Westbound traffic from 2010 and 2040 and 3-4% for Eastbound, averaging from 5-6%.

Traffic flow Micro-simulation: The CORSIM model equations used by E&E are not given, but rationale for the type of model used is as follows: "Macroscopic models lack the capability of modeling complicated roadway geometry changes and detailed functions and features of traffic control and management types such as actuated control and freeway ramp metering.

Rough Approximation for Traffic Delays The following equations appear to provide a fair approximation to the macro- results from the E&E model. For the Build alternative (with little or no change in delays) the total delays in hours each year $D(t) = v(t)d(0) = v(0)d(0)\ exp(at)$ growing at the same rate as traffic volume. With the No-build alternative delays grow disproportionally (for simplicity at some power β of the volume growth). For example, if volume grows by 1% each delays grow by 2%. Thus, $D(t) = v(0)d(0)\ \{exp(at)\}^{\beta} = v(0)d(0)\ \{exp(\beta at)\}$.

Discounted Cost of Delays: For the project merit calculation, the total time delay up to a time horizon of $T=35$ years and a discount rate of $\mu = 5\%$ are used as the basis for estimation the present economic value to PB users. The standard year-on-year formula for discounting to the income from year t to the present income is $I/(1+\mu)^t$ which becomes messy when multiple years with varying income are involved. Fortunately, an exponential equation gives a sufficient approximation for present purposes. If the cash value of delays is \$$c$ per hour, the approximate discounted present value of the delays at time t is $D(t)exp(-\mu t) = c\ v(0)d(0)\ \{exp([\beta a-\mu]t)\}$.All else equal, the present value of future contributions depends on the net growth rate $\sigma = \beta a-\mu$.

Build Alternative: If the discount rate μ is greater than the growth rate of delays βa then the present value of contributions in future years will steady fall and become negligible. This is usually the case with discounted cash flow calculations so it is reasonable to set some arbitrary discount horizon (such as 35 years). This is so with the Build alternative since the average growth rate in traffic is from 0.5-3.0% and the discount rate is 5%.

No-Build Alternative: For the No-build alternative, in contrast, the growth rate of annual delays may exceed the discount rate, especially as the traffic volume approaches some notional "carrying capacity". This appears to be the case with the E&E model. Matching the average time delay estimated for the No-build alternative in 2040 suggests a value of around 3 for the parameter β so that $[\beta a-\mu]$ = 3x2% -5% =1% with an average traffic volume growth of 2%. If indeed this is the case then the time-horizon of 35 years used becomes quite arbitrary since – and somewhat inexplicable, given that a 75-year lifespan is assumed in estimating the cost of the PB project (E&E Appendix I).

Cumulative Build-No Build Comparison: For this the annual discounted contributions of each alternative are added up over 35 years and the build alternative value subtracted from the No-Build alternative (NB-N). The approximate cumulative discounted delay (or difference) is derived from the above formulae. The integral (sum) to time T of the expression $exp(\sigma t)$ is $\{exp(\sigma T) -1\}/\sigma$.

Sidebar 4. Gravity Model and Cross-border Trade

Gravity models are a simple spatial interaction model use Newton's gravitational force concept as an analogy to explain the interaction between consumers and suppliers based on their relative size and distance. The usual form balances total supply and demand across all suppliers and consumers in order to take account of displacement as well as distance effects Thus, the economic exchange between two trading partners depends on some measure of the size of supplier A_i and market A_j, the distance between them, d_{ij}, is proportional to A_iA_j/d_{ij}^{α}. Various balancing constraints are applied and parameters may be fitted to available data. The "impedance" parameter α gauges how rapidly the cost of travel increases with distance. A naïve approach sets α=2 (as in Newton's Gravitational Law).

Bridge Expansion. A modified gravity model using stylized equations and data gives an approximate, but moderately robust, ballpark estimate of the current importance of cross-border trade. The above formula is modified to include delays at bridges b_{ij} and other local structural congestion and l_i, for example, $A_iA_j/(l_i+d_{ij}+b_{ij})^{\alpha}$. Changes from PB Expansion are introduced so that, as the capacity c_i of a bridge is increased the delay reduces, so that $b_{ij} = (t_i/c_i)^{\beta}$ where β determines the bottleneck effect (see Sidebar 2). The base capacity is set to match current traffic volumes. Since this changing the capacity, changes relative output levels, the calculation is iterated.

Empirical Many-county model: The stylized model explained above was used to prepare the charts shown in the main text. A more detailed model - a 3000+ county model of the US, cross-border locales in and Canadian provinces - was also adapted to cross-check the findings. Each diagonal cell is replaced by a 24x24 social accounts matrix and each of-diagonal cell by a 24 trade or finance items. Many of these cells are zero. This model prescribes that the proportion of competing purchases y_{ij} from locality i by locality j with output X_i is given by $y_{ij} = X_i^{\beta}/d_{ij}^{\alpha} / \Sigma_j X_j^{\beta}/d_{ij}^{\alpha}$ where α and β are parameters used to calibrate the distance decay and the attractiveness of the activity. Since parameters vary by type of sector (minerals versus retailing), transport system (interstate highways versus city streets), they are fitted to data such as levels of demand and output estimated from input-output tables to include direct and indirect effects.

Model Estimation: Since data are not available on trade at this level, the inter-regional transactions in the social accounting matrix (an IO that elaborates the household and public side of an economy in greater detail is estimated by fitting the gravity model to the previously-estimated supply and demand. Since data on demand at a county level are patchy, some are imputed for each production sector and commodity from household and public consumption using national earned income by sector of activity, and personal income by composition, with factor income re-scaled to match the surveyed local total. In this case, $Y_{li} = Y_{ln}\, r_{li}/r_{ln}$ and $X_{li} = \Sigma_m a_{lm} Y_{mi}$, where Y and X are supply and demand respectively for commodity l in region i, r are the levels of item l and m in region i, and in the nation n, while a are the coefficients of the US national social accounting matrix (i.e. the technical and consumption propensities). The initial assumption behind this scaling is that technologies (measured in terms of total factor and commodity inputs) across similar production sectors are rather uniform nationwide. A similar assumption is used for household consumption propensities.

Modifications for PB Exemplars

Bridge Delays: The travel distance includes an additional distance equivalent to account for the delay $d(t) \rightarrow d(t) + d_B$,

Exchange Rates: The US value/output is fixed and the relative level of overseas trade is adjusted.

Population Growth and Technical Change: For the examples economic output is assumed to increase with population and labor productivity growth rates, e.g. $O(t+1)= O(t)(1 + p + l)$.

Footnotes

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[1] The author is grateful to Mark Mitskovski and Harvey Garrett for introducing the author to the topic and providing documentation and contextual insights. Thanks are also due to Professors Alan McPherson and Vigdis Wang Chou Boasson for theoretical suggestions, and to R. H. Cole for policy and stylistic advice. The usual disclaimers apply.

[2] The impact study was undertaken by Ecology and Environment (E&E) and appended to the Draft Environmental Impact Study (DEIS). This commentary covers mainly the calculations contained in Appendices G, including relevant inputs from Appendix D (traffic flows) sub-contracted to Synectics and Appendix I (construction costs), and economic impact analysis memorandum from FXM Associates. Draft Environmental Impact Statement (September 2007) Peace Bridge Expansion Project: Capacity Improvements to the Peace Bridge, Plazas and Connecting Roadways City of Buffalo, Erie County, NY, Town of Fort Erie, Ontario Canada, PIN 5753.58. Appendix D: Traffic Analysis, Appendix G: Socio-Economic Analysis, Appendix I: Cost Estimates Buffalo and Fort Erie Public Bridge Authority, U.S. Department of Transportation Federal Highway Administration, New York State Department of Transportation.

[3] This comment refers to the economic impacts only. The PB Expansion has been challenged by the National Trust, Olmsted Conservancy, Preservation League of New York State, Partners for a Livable Western New York, Preservation Coalition of Erie County, Landmark Society of the Niagara Frontier, Campaign for Greater Buffalo, Coalition for Economic Justice, Partnership for the Public Good, West Side Community Collaborative, Buffalo's Waterfront Coalition, among others.

[4] In 1997, the Buffalo and Ft. Erie Public Bridge Authority, announced plans for the building of a twin second Peace Bridge to be situated to the North of and beside the existing Peace Bridge in order to alleviate traffic congestion. The project was estimated to cost $65 million dollars with a completion date of 2002. The present proposal is estimated at over $300 million.

[5] Can Buffalo Ever Come Back? Probably not—and government should stop bribing people to stay there. Edward L. Glaeser City Autumn 2007. "The best scenario would be for Buffalo to become a much smaller but more vibrant community—shrinking to greatness, in effect. Far better that outcome than wasting yet more effort and resources on the foolish project of restoring the City of Light's past glory."

[6] The Buffalo Mega-Region: Bigger Than We Know. Richard Florida. Buffalo News. 06/17/08. "The key to the future is to focus on and strengthen your [Buffalo's] internal assets while linking to and leveraging your position as the key American hub of one of the world's largest and most dynamic mega-regions." This may be wishful thinking since cross-border development presumably requires that both sides of the border be engaged. the Proposed Growth Plan for the Greater Golden Horseshoe "Better Choices: Brighter Future" (Ontario Ministry of Infrastructure Renewal, November 2005) makes no mention of Buffalo, Niagara Frontier, or Peace Bridge. On the WNY side of the border, past opportunities have been squandered; see e.g. Cole, S. 1992 The Outlook for Western New York, Rockefeller Institute, Albany, Economic Recovery for New York State: When and How? (Rockefeller monograph series).

[7] Otherwise, the touted "signature bridge" is as economically untenable as the infamous "bridge to nowhere" and serves to further segment the city. An onlooker might ask, what could be more of a signature as a gateway to the self-professed "City of Good Neighbors" than The Peace Bridge? A modest proposal is to paint half in Canadian colors and the rest US as suggested by Figure 1 (source: PB image farm4.static.flickr.com/3060/2427575241_49a3a97076.jpg originally uploaded by poetdiva. Composition by THC.)

[8] While the author has been involved in reviews of model based-forecasts at geographic varying from local retailing to the forecast for world economy, such studies are usually based on a single technique. See e.g. Cole, S. 1979 Social Welfare, Uncertainty and Arbitrariness in Planning Models The Case of Urban Shopping; in The Uses and Abuses of Forecasting; (ed. Whiston T.) Cambridge University Press, Cambridge. Cole, S. 1987. World Economy Forecasting and the International Agencies, International Studies Quarterly. Dec 1987. Cole, S.1997. Input-Output Forecasts and Empirical Testing: The Economic Impact of the Ravenscraig Steelworks Shutdown, Regional Science Review, 1998.

[9] A further question addressed in an appendix, is what, if anything, university planning programs can do about it. To this end, the commentary serves as both a clinic and a vehicle to address the more general planning and planning education issues involved.

[10] The data are based on US and Canadian customs information and were scaled to convert volumes of shipment to the dollar values required for the impact analysis. FMX (p1) say that assembling data "proved to be a much more formidable task than originally anticipated" because of statistical reasons such as apparent systematic and

random errors. E&E Appendix G and FMX supplementary documents provides their estimates of the current value of exports across the PB and their direct and indirect employment and income contributions. FXM Tables C-1, 2, and 3 give the breakdowns of shipments of Buffalo, NYS, and US-produced freight shipped over the PB as US$6.49b, US$5.85b, and US$77.01b respectively. E&E state that the US$6.5 in annual manufacturing output within the BN region that is shipped across the PB supports nearly 31,000 manufacturing jobs in the BN economy and US$1.7b in household income, not counting indirect effects (throughout the economy) and induced effects within the manufacturing sector. Although E&E use the FXM data (see E& Tables 3-19,20,21), it is not clear how these correspond to other data on shipments discussed by E&E. Table 3-16 shows that US$28.7bn of US $151.2bn (about 19%) truck of all US exports by value to Canada in 2005 passed through BN. This is considerably less (about 37%) than used in the impact study. The 1999 TSTD survey indicates approximately US$38bn as the annual value of freight at the BN frontier (TSTD Table 3, Can$1.062bn x52/1.45). It is possible that FXM assumed an expansion in exports over the lifetime of the expanded PB, indicated in Appendix D, although that is not stated. However, it is noted that while the value of exports has begun to rise after a leveling off after 2000, the number of trucks has remained steady. Any discussion of bridge capacity and congestion is more sensibly related to the latter. Some indication of the uncertainty in cross-border trade volumes and values comes from a recent study on US-Canada border costs and their causes (USDOT, 2003). See also Trends in Border Crossing Volumes 1994-2005. Beningo, S. 2006. USDOT/RITA/BTS Presentation to the Transportation Border Working Group Niagara Falls, Ontario, October 23, 2006.

[11] That this is the case is not at all evident in the FXM Memorandum, or the citations therein. With regard to accuracy, there are comments in several impact studies using variants of the model such as "not only is the CUPR's RPC-estimating approach the most sound, but it is also widely acknowledged by researchers in the field as being state of the art". This author has attempted to track the claims made in the references cited in the PB and other technical appendices. The claims ultimately appear to rest on findings in a paper at the state-level in Massachusetts in 1980's based on 1977 data. No evidence is presented to show their current validity or that they are valid at the county or metropolitan level. Even in 1986 West observed "Empirical economic analysis is inevitably accompanied by limitations on the accuracy or precision of results. Input-output analysis is no different. The results of input-output studies are almost always expressed as point estimates, and an assessment of the reliability of these estimates is left to the reader". West, G. 1986. A Stochastic Analysis of an Input-Output Model. Econometrica. 54:2, 363-374. There are almost no studies that address the implications of these combined questions for impacts studies. His study showed that the error in the indirect effects due to plausible variation in the entries in an input output table averaged from 40-50% (i.e. an agriculture given multiplier might range from 1.6-2.3 or a manufacturing multiplier from 2.2-3.2). However, this is only one source of error. West concludes, "The huge data requirements of the input-output model, and the logistics involved in collecting these data raises the more fundamental question of the accuracy of the parameters of the input coefficient distributions themselves." A recent candid recent account of the sources of uncertainty from IO-based environmental impact calculations is given by Hendrickson (2006). The suggestion of the authors is "never to cite a result to more than two significant figures". Even this may be generous. Hendrickson, C., B. L. Lave, H. S. Matthews. 2006. Environmental Life Cycle Assessment of Goods and Services: An Input-output Approach. Resources for the Future, Washington.

[12] E&E variously refer to the "economic effects of the current configuration" (3-17), "macro-economic importance of trade to the project region" (3-18), "estimate (of) the economic impacts related to these freight movements" (3-29). FMX (October, 2003, p1), while seeking to answer the question of "what relationship does traffic across the PB have to the Buffalo economy?" emphasize that their Technical Memorandum "is *not* an assessment of the impact of building or not building additional capacity" or "to analyze the effects of congestion or reduced travel time." This caveat appears to be omitted from the DEIS.

13 Even the historic role of the PB may be questioned: decennial census show that the population of the BN grew steadily from 1860 to 1930, with almost no growth from 1930-40, the decade following the opening. Strangely, the only reference to the PB in the excellent is that, after 1927, it "quickly became the primary pipeline for bootleg liquor trucked into Buffalo from Canada." Goldman, M. 1983, High Hopes: The Rise and Decline of Buffalo, New York. (p210)

[14] The E&E study assumes that changes are incremental rather than discrete. This is hardly the case in any manufacturing area such as BN with only a few relatively large ("lumpy") producers. For example, a recent survey of customers of a major public utility in the BN region showed that raising the cost of power would cause those operating on the edge of viability to close down completely: for a significant number a small increase in overall production costs would cause all production to be lost. It is possible that a survey of

businesses on both sides of the border would show that, if the PB is not expanded, then plants will precipitously close for want of better access, or if the PB is expanded, then new plants would be opened, and cross-border shipments might rise significantly. In either case, one would still need insights into how the costs and benefits are distributed within the firm and across the border, in order to assess the downstream implications.

[15] Western New York's automotive components industry comprises primarily Delphi, General Motors, Ford, American Axle & Manufacturing and Visteon. A recent Center for Automotive Research Report (McAlinden, S., CAR, 2007) lists GM, Ford, Chrysler, Delphi & ACH U.S. and Canadian Plant Shutdowns and Line Trimmings Announced and Executed, 2005-2009 totaling over 129 thousand jobs, including plants in New York State and Southern Ontario. Moody's Economy.com remark that Buffalo's economy shows "…few signs of life and the metro area's reliance on the declining auto industry puts Buffalo at risk of further backsliding." WNY Economic News 9:2, June 2006.

[16] The figures used by E&E appear to be based on aggregate labor-output ratios derived from the input-output tables used. Although business within sectors such a agriculture, manufacturing, services, and their sub-divisions share many characteristics, productivity varies dramatically across businesses, especially in some of the key industries such as vehicle production (for example a highly automated plant versus an old-style production-line). The average labor/output (jobs/US$m) for major exporting sectors used by E&E is 3.29 compared to 4.81 for the sector average. A 2000 survey of WNY exporting firms showed a range of 0.44 to 17.4. Whatever the current figures, job/output ratios are likely to decline incrementally and sometimes dramatically over a 35 year time horizon.

[17] Comparing the US$6.6 B in cross-border manufacturing exports (FXM Tables C-1&2)with the total manufacturing impact of $7.4B shows only a 12% multiplier effect within the BN economy's manufacturing sector – showing that the BN the economic base is almost disintegrated and exhibits almost no inter-industry transactions, and associated interconnectedness, agglomeration, and so on advocated in strategic development.

[18]Input-output modelers might brawl over the size of the multiplier, and rightly so when the merits of alternative integrated strategies are discussed, but, that is not point for the E&E economic impacts study and (say) 95% of similar calculations. Overall, FXM used a sledgehammer to crack a nut leaving the overall impression that there was an authoritative analysis. Recognizing the many uncertainties, and the 40-year timeframe applied to the PB Expansion merit analysis - more transparent, temporally-stable, sensible results could have been obtained by a simpler IO model, but with more attention to the key exports. This less elaborate accounting, discounting, and bottleneck analysis, together with the method for estimating the changes in exports due to the PB Expansion, provides a more balanced approach and a more credible estimate.

[19] This is recognized in the DEIS but not in the calculations. "Companies engaged in bilateral international trade between the U.S. and Canada can choose the most efficient and cost-effective travel mode and particular bridge crossing between the Province of Ontario and the U.S. Great Lakes region. Both the quality and efficiency of competing bridge crossing and highway infrastructure can influence how freight shippers choose trade routes between the U.S. and Canada. Industrial and commercial urban locational patterns, the types of freight and commodities being moved, relative distances, and transportation costs all influence how these modal and crossing decisions are made". (Appendix G. 3.3.1 Great Lakes Area Truck Traffic Flows by Major Bridge Crossings).

[20] This is not considered further here, but for example, even without the proposed demolition of many homes to make way for activities associated with the expanded PB, the location of a transition zone at the gateway to a historic city could detract, for example, aspirations as a tourist destination.

[21] In this case, the figures presented are for the entire NYS, rather than the non-BN residual. For BN, the amounts estimated by E&E correspond to output multipliers of 1.42 and 3.04 for NYS. The multiplier for NYS is in the ballpark, but somewhat high..

[22] An ongoing Route 219 bridge construction project in the BN region across the border of Erie and Cattaraugus countries is a case in point.

[23] E&E G4-20 also recognize " that some indirect and induced effects can take several additional years to trace through the regional and national economies." Use of Type II multipliers tends to exaggerate short-run effects but underestimates long-run effects, each by as much as 50%.

[24] The BEA RIMMS II construction output multiplier is 3.45 with a total employment/US$m = 27.5 compared with the E&E estimate of 64.4 jobs/US$m (Urbanchuk, LECG-2007). For the auto- and auto parts industry US wide average employment multipliers are claimed as 7.5 and 5.7 respectively (CAR, 2007).

[25] Because the direct employment for construction are not given in the E&E report, the employment multipliers are not clear (see Sidebar 2). However, assuming that the BN construction job multiplier is 1.5, the NYS and US

multipliers implied by the E&E results are 2.98 and 6.66 respectively(based on the total impacts of 4,844, 9,626, and 21,505 jobs estimated for the three economies). The figure for the US, again, appears inexplicably high.

[26] E&E Appendix G4-33 explain "The purpose of the total economic impact estimate is to show that the most immediately visible industry directly related to and associated with Peace Bridge operations provides a significant, annually recurring spending stimulus to the regional economy".

[27] Greater Buffalo and Niagara Region Transportation Council, the Ontario Ministry of Transportation, two traffic growth models (GBNRTC and MTO), some economic factors including national and regional growth. Robert O'Dell, Management and Strategic Projections, Inc., Vollmer Associates, and DeLeuw, Cather and Company. E&E Appendix D 81-86.

[28] "To summarize, the growth rate for automobile traffic is assumed to be 0.9% per year from 2006 to 2020. From 2021 to 2040, this annual growth rate decreases to 0.5% per year. For truck traffic, the annual growth rate is assumed to be 3.0% per year until 2020, and then 2.0% per year from 2021 to 2040". E&E Appendix D 94.

[29] These amounts are calculated here as $\log_e(11000/6100)/(2040-2007)$ and $\log_e(8000/6000)/(2005-1970)$ from the data given in E&E I Fig 46.

[30] Here one may pick and choose studies to cite. For example, the DEIS notes that Peace Bridge: Traffic and Revenue Report including Review of Non-Toll Revenues and Operating and Maintenance Expenses, Vollmer Associates finds that there is not a strong correlation between the exchange rate and traffic growth. Other studies argue much greater sensitivity – even that the number of US-Canada day-trip exhibits tipping points when rate differentials reach specific levels. Matteo, L. 1999. Using alternative methods to estimate the determinants of cross-border trips. Applied Economics, 1999, 31, 77± 88.

[31] The short- and longer-run outlook for the North American auto industry is extremely fraught. Using the residuals from an estimated gravity model of world auto industry and trade as a guide, Peridy abnd Abedini (2008), suggest that the USA and Canda are the only Northern Countries that enjoy significant export potential because their current exports are low compared to their large output. Obviously, whether realizing this potential would impact WNY or the PB would depend on specific changes. Peridy N. and J. Abedini. 2008, The Growing Influence of Emerging Countries in the World Car Industry: An Estimation of Export Potentials in a World Trade Model. Global Economy Journal. 8:3. 5.

[32] How individual producers respond depends on a variety of factors relative importance of shipping costs, demand and price elasticity, economies of scale, and so on.

[33] E&E give only the following explanation "Using the traffic volumes generated above, the Peace Bridge, key intersections, interchanges, and highway segments were analyzed. As under existing conditions, LOS analysis was performed using CORSIM. This analysis software allows for a dynamic analysis of traffic flow along arterials, freeways, ramps, and intersections, accounting for upstream and downstream events which may affect traffic flow." E&E Appendix D 106. CORSIM and Sim Traffic appear to be the principle "micro-simulation packages models for traffic analysis. As with IO the results are comparable with the same caveats. A recent study concluded "On the surface, the simulation models seem to report rather different results, but once the correct results are compared with each other, both simulation models seem to produce very similar outcomes." "The heart and soul of a microscopic traffic simulation is the car-following and lane-changing logic.

[34] The E&E amount of $2.1 billion has been used to impute the cash value of time delays used in their calculation, since this is not explicit in the DEIS report.

[35] The appropriate selection of a social discount rate is crucial for cost-benefit analysis. Discounting is mechanically easy, but no agreement exists on what the correct discount rate is. A recent survey of by Symons http://development.asia/issue01/analysis-04.asp Asian Development Bank 2008 Working Paper 94) explains that the rate is a reflection of a society's relative valuation on today's well-being versus well-being in the future.. There is wide diversity in social discount rates, with developed nations typically applying a lower rate (3–7%) than developing nations (8–15%). Rates differ between benefits and costs: within the US, figures range from between 3% and 7% on CAIR benefits and costs and 10% and 2% on the benefits and costs of drilling in the ANWR.

[36] "Discounting is sensible behavior. Common sense also suggests that technologies will be much improved in the future, including those that can improve health, income, and the environment." Gary S. Becker An Economist Looks at Global Warming SCIENCE:

[37] The real rate of interest is the appropriate discount rate for benefit cost analysis. Market interest rates should be used for discounting because they reflect the rate at which those in the economy are willing to trade

present for future consumption. Market rates reflect social preferences. Nominal market interest rates are equal to the sum of the real rate of interest (i.e., the rate of return on capital) and inflationary expectations. Most variations in nominal rates are due to changes in inflationary expectations since the rate of return on capital (e.g., factories, equipment) is fairly stable over time. The real rate of interest is equal to the market interest rate minus inflationary expectations. Most discount rates used for benefit cost analysis are based on U.S. Treasury borrowing rates since they are virtually default risk free. See e.g. Dan Phaneuf. Discount rates for benefit-cost analysis http://www.env-econ.net/2005/08/discount_rates_.html

[38] The scholarly modesty for the model gives pause: "With a rich feature set CORSIM provides users with a versatile tool to conduct simulation in various traffic engineering studies. With constant effort being put on feature enhancement, validation, calibration, interfacing and software engineering development, CORSIM will play an even bigger role in the decision making process of developing advanced transportation systems. Traffic Flow Simulation using CORSIM from Intelligent Transportation Systems (ITS) Department and Federal Highway Administration. More sanguine, a recent Transportation Research Board RFP for a Methodology for Determining the Economic Development Impacts of Transit Investments observes that "While much work has been done describing the relationship between transit system investment and economic development, it is not clear how an approach to prepare a reliable forecast of economic development benefits of transit projects can be applied systematically to all proposed projects. A critical problem is that methodologies currently used to measure economic impacts are not able to distinguish the degree to which the measure of broader effects exceeds or is distinct from those associated with mobility effects. Research is needed to develop an improved methodology for estimating economic impacts of transit investments". TCRP H-39

[39] The accident-cost component of the traffic analysis is not reviewed here since E&E indicate that it is far less significant to their merit calculation as follows: "To encompass that existing bias with collision rates and to provide a broader and deeper understanding about the study corridor, Synectics [the sub-contractor for this part of the study] uses the Empirical Bayes statistical approach to analyze the overall safety performance of the corridor". The equations used are presented and explained. Interestingly, the accident rate decreases with volume as traffic slows to a standstill, so one might expect the relative cost/saving between accidents and delays to vary over time.

[40] Financial benefits consisted of travel time savings, vehicle operating and ownership cost (VOC) savings, accident savings, and other external benefits (avoided emissions damages). Only travel-time savings and VOC savings were quantified and monetized. These benefits were aggregated in each anticipated year out to 2040, compared to the costs, discounted to 2007 and summed to measure the cumulative net present value of all incremental net benefits per each alternative. A given project alternative is considered justified if the cumulative discounted benefits measured annually over the evaluation period (2007 to 2040) exceed the cumulative costs. (E&E G4.4)

[41] The source of this annual $10.2n is not clear but may correspond to the $18m recurrent operating expenses in E&E G Table 2-23 or the $11.73 expensed incurred in the US (E&E G Table 3-24) or the $6.4m core operating expenses (E&E Table 2-25). This commentary has not reviewed the itemized costs of PB construction and operation *per se* except to note these possible discrepancies and that the geographic distribution of expenditures affects local income and employment impacts.

[42] For the design-hour (rush-hour) period, the DEIS summary (II.C.2.k Conclusions and Tables 2-10 and 2-11) observes "Currently in the design hour, wait times in excess of one hour are experienced by eastbound traffic. These delays extend from the US Plaza across the Peace Bridge and on to the QEW. By 2040, the No Build eastbound wait time is anticipated to exceed two and one-half hours. The westbound wait times are anticipated to exceed three hours in the design year and the No Build westbound queues are predicted to back up far onto I-190, contributing to safety and operational problems and delays on I-190". In contrast peak travel-time delays of more than 20 minutes in westward direction due to bridge configuration are not expected until at least 2020. The situation cries out for directional flow management during peak hours?

[43] E&E Appendix G 4-26. The largest category of user benefits, travel time savings, was measured from the projected incremental person and vehicle hours saved per each respective alternative compared with the No Build Alternative, for both eastbound and westbound annual passenger and commercial traffic.

[44] E&E (G 4-7) say "The formulas used were based on combining data estimated by Wilbur Smith (presumably responsible for Appendix D) for each Build Alternative and the No Build Alternative (see Appendix D of the DEIS), with the standard travel time savings formulas applied by the USDOT (USDOT 2003). E&E Appendix G 4-26 say only that "Average hourly values of passenger and commercial travel time savings were calculated from weekly earnings data for truck drivers and median household income using established USDOT

procedures." As explained earlier, the imputed cost of each *vehicle-hour* delay that matches the simple-exponential growth model to the results presented in the E&E report is around $20. A recent study (Maring and Lambert 2003) estimates total back-up costs at US$150/hour for trucks at the US-Canada border.

[45] Whether or not this unreasonably high is a moot point. Another way to estimate such values is via hedonistic analysis - asking travelers what they would be prepared to pay for such time-saving before choosing an alternative. At these rates, a sample of one traveler would select an alternative crossing point or cancel his trip altogether.

[46] A recent review notes that "Methods used for assessing economic impacts of proposed transportation projects have continually evolved over time. Whereas they once focused largely on the economic benefit of time and cost savings for travelers, they may now encompass broader factors such as accessibility roles in supply chains, labor market expansion, global trade growth, and their economic development implications. This broader view can be particularly important when considering transportation projects affecting network connectivity and activities of logistics centers, inter-modal terminals, and international gateway facilities. Using examples throughout history, a generalized description is developed of the range of access, reliability, quality and cost factors that can affect the nature of economic growth impacts of transportation projects. While the set of factors is consistent with both theory and research findings, there has been a significant shortfall in their coverage by applied computer analysis models used for transportation decision-making".
Weisbrod, G Models to predict the economic development impact of transportation projects: historical experience and new applications. Annals of Regional Science Issue Volume 42, Number 3 / September, 2008

[47] Some perspective on the significance of US-Canada border crossings, the relative importance of infrastructure versus management, and the associated imponderables comes from a recent study on US-Canada border costs and their causes (USDOT, 2003). This report states that *"Crossing roadbed capacity is generally not a major cause of problems."* The range given for the total US-Canada border cost was a factor of 2 - probably a fair indicator of the reliability to be expected from cross-border studies of the *existing* (typically 5-years out-of-date) situation, let alone for 30-plus years into the future! This study based on 2001 data and surveys found that primary and secondary inspection time were found to be major cost components - about US1079m out of a total of $1,867m transit time related costs. Transit-time costs are matched by manufacturer-related transit costs of sourcing and inventory giving a total of US$4014m. This amount is only part of total border costs that include border administration and inspection, and manufacturer costs (brokerage, duties) together totaling US$10,294m. This represents 2.7% of total (2001) US-Canada trade in goods and 4% of truck-based trade US$382b and US$235b respectively. The estimated range for the total US-Canada border cost was from $7,517b to US$13,189.

[48] The most appropriate starting point for this analysis would have been a so-called "gravity" model since this takes explicit account of distance and delays, the relative size of regions and may be adapted to other variables. This model has regained prominence as the model of choice in international trade analysis as global-regions supersede nations as the geographic unit of analysis for understanding the dynamics of the world economy (see Sidebar 4). The model was introduced into urban analysis by von Thunen and others - used especially in urban analysis for retailing and commuting. For international trade, the first global economy models constructed by Nobel Laureate Tinbergen used gravity model concepts but, given the fairly rigid hierarchy of nations that evolved after WWII, gave way to price-driven CGE models. They appear to be regaining favor as this post-war structure breaks down. The basic idea has been incorporated into contemporary market analysis within so-called New Trade Theory. Krugman, P. 1991. Increasing Returns in Economic Geography. Journal of Political Economy. 90. 5. 483-499. Estimating Protectionism through Residuals from the Gravity Model. Andrew K. Rose (2002). WEO. Gravity Models of the Intra-EU Trade: Laura Serlenga and Yongcheol Shin, (2004) School of Economics, University of Edinburgh. Anderson J. and E. van Wincoop (2000). Gravity with Gravitas: A Solution to the Cross-border Puzzle. Federal Reserve Bank of New York. Wall H (2000) Gravity Model Specification and the Effects of the Canada-U.S.Border. Federal Reserve Bank of St Louis. Peridy N. and J. Abedini. 2008, The Growing Influence of Emerging Countries in the World Car Industry: An Eestimation of Export Potentials in a World Trade Model. Global Economy Journal. 8:3. 5. Cole, S. (1996). Across the State and Across the Border - Spillover, Feedback, and Agglomeration in Many-Region Economies. Great Lakes Geographer. 3(2). For example, gravity models establish a baseline for trade-flow volumes as determined by gross domestic product (GDP), population, and distance. The effect of policies on trade flows can then be assessed by adding the policy variables to the equation and estimating deviations from the baseline flows. In many instances, gravity models have significant explanatory power, leading Deardorff (1998) to refer to them as a "fact of life." Gravity models increasingly are used for estimating non—commodity flows, Lueth,

Erik and Ruiz-Arranz, Marta (2008) find that some of the variables commonly used in gravity equations are very powerful in explaining remittance flows. Lueth, E. and M. Ruiz-Arranz (2008) "Determinants of Bilateral Remittance Flows," The B.E. Journal of Macroeconomics: Vol. 8 : Iss. 1 (Topics), Article 26. An advantage for present purposes is that the model already implicitly accounts for, or may be modified to explore, several of the key issues relevant to the PB such as displacement, agglomeration, changing border distance, and so on.

[49] From the information shown in the DEIS (Appendix G) it appears that data sufficient for a ball park estimate were available to E&E, but not presented in the DEIS a way that necessary information can be extracted and matched to other available data. This is largely a matter of how data are "aggregated" (i.e. combined). For example, the DEIS shows useful additional data on local area (say Buffalo versus Northern Erie County), and the competing border crossings, but combine s NY, NJ, and NE, and so on.

[50] The results from the stylized model were cross-checked against those from a more empirically-based gravity-IO model designed for another purpose. While this more elaborate, data-intensive model is overkill in terms of evaluating the PB study, it goes some way towards addressing the more complicated regional development issues and policy choices. Cole, S., 1997 Decision Support for Calamity Preparedness: The Socio-Economic and Inter-Regional Impacts of an Earthquake on Electricity Lifelines in Memphis, Tennessee. In Engineering and Socio-Economic Analysis of Electricity Lifelines in Memphis, Tennessee, National Center for Earthquake Engineering Research, University at Buffalo, published in A. Rose, M. Shinozuka, and R. Eguchi. Electricity Lifeline Disruptions in the Memphis Area; Cole, S. 2001. Socioeconomic Impact of the Niagara Power Project. New York Power Authority. Center for Development Analysis. Across the State and Across the Border - Spillover, Feedback, and Agglomeration in Many-Region Economies. Great Lakes Geographer. 3(2) 1996.

[51] Demographic data from a variety of sources: Population Trends in New York State's Cities, 1:1, Dec 2004. NYS Division of Local Government Services. Toronto Official Plan, July 2006/April 2007. Toronto City Planning and Research. www.toronto.ca/planning/pdf/grow.pdf

[52] Within the framework of the approximate model shown in Sidebar 3, for example, for local users the time cost of diverting is relatively high within the context of their journey; for long-distance travelers rather little. Increasing traffic volume overall will increase average delays at both bridges, but in a far less dramatic fashion than indicated by E&E. In this case, users compare total time-distance, and if $d_{PB}(t) > d_L(t) + d_{PB-L}$, they divert their route, and so on, if other crossing-points are invoked This again, more or less mimics the presumed overall characteristics of the detailed street-level local area model used by E&E. However, a makeshift model that allows many alternatives to be explored and the causes and range of uncertainty to be understood might be appropriate.

[53] This last calculation makes the same kind of assumptions about production technologies, sourcing and distribution, and multipliers as in the FXM study (see Section 3).

[54] The figures are in line with estimates of the costs of US anti-terrorism policies on Canada-US cross-border commerce -an empirical range of US$7.5b to US13.2 of "at least US$5b" out of US$235b cross-border truck trade (CUSTAC, 2005) The model suggests a loss of income to the US of about 2%..

[55] The Peace Bridge expansion project is documented in the Greater Buffalo-Niagara Regional Transportation Council's (GBNRTC) approved 2030 Long-Range Transportation Plan (LRTP) as a regionally significant transportation project expected to impact area travel patterns and to be financed with non-federal revenue sources. One last question for the E&E study is whether the prime question about the costs and benefits of the PB Expansion was properly posed. As noted at the outset, the economic impact component of the E&E study may be the most effective for swaying public opinion. However, the most contentious issue in public debate is the PBA justification for the demolition of a heritage neighborhood to accommodate extra security facilities required for border security in the wake of 911. Thus, the benefits of the PB Expansion might be justified as part of national security arrangements, rather than local development, and the social benefits and capital costs of the PB Expansion project allocated accordingly. Consider, for example, an incident making the PB inoperable for 3 months, with a corresponding loss of export and downstream income to the US economy. Figure 5 suggests that the annual loss in border trade would be about 15% so the impact on US output, assuming an export multiplier of 2.5 would be approximately 15% x $100b x ¼ x 2.5 = $9.4b. Assuming the additional risk of such an incident over the next 40 years is 1%, if the PB Expansion is not undertaken, the undiscounted value of the project is $100m. While the risk estimates here are pure conjecture, the calculation suggests that a significant component of the PB project – whatever Alternative is selected – might be better justified in such national security terms and so funded as a Federal project.