Border Delays Re-Emerging Priority: Within-Country Dimensions for Canada

TRIEN T. NGUYEN  
Department of Economics  
University of Waterloo, Ontario

RANDALL M. WIGLE  
Department of Economics  
Wilfrid Laurier University  
Waterloo, Ontario

The September 11, 2001, terrorist attacks in the United States caused a dramatic increase in the stringency of security at the Canada-US border. Soon afterwards, concern arose about the economic ramifications of the serious border delays that resulted and continued for some time. In the days immediately following the attack, transport trucks were backed up over 40 kilometres away from the Ambassador Bridge in Windsor, Ontario.1

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While many countries shared the concerns over tightened security, it was particularly relevant for Canada, since close to three-quarters of total Canadian trade is with the United States, much of it crossing at a small number of bridges, tunnels, and land check points.

This paper discusses the re-emergence of Canada-US border delays, and uses a computable general equilibrium (CGE) simulation model of the Canadian economy to assess how serious the impacts are. The general equilibrium methodology is particularly useful as it allows us to trace simultaneously various effects on different regions of the economy in response to shocks from changing scenarios at the border. The simulation results reported here are relevant to recent economic arguments linking delays to their economic consequences.

The structure of the remainder of this paper is as follows. We first provide some background to the issue of economic costs of border delays, including the re-emergence of delays as a concern. This is followed by a survey of some relevant literature on the economic costs of enhanced security and border delays. We present a non-technical exposition of the theory underlying our model and data and discuss key results from our simulation experiments of border delays. We conclude the paper with a summary of our findings and their relevance for policy. Most notably, the findings suggest that the economic costs of the delays may have been more severe than initially expected and, further, that they are likely to be concentrated in Canada’s two biggest provinces, Ontario and Quebec. This has a significant public policy relevance to Canada at both national and regional levels given the current renewed interests in border protection issues during recession time and political calls in the United States for treating the northern Canada-US border the same as the Mexico-US border.

BACKGROUND

In the aftermath of the 9/11 terrorist attacks, the Ontario Chamber of Commerce (2004, 2005) issued a series of reports highlighting the potential costs of border delays to Ontario. Other commercial and shipping groups also published reports on the topic. The Coalition for Secure and Trade-Efficient Borders, one of the largest business coalitions in Canada, released its final report (CME 2005) calling for urgent action to strengthen security without making the border a barrier to trade. In this report the automotive industry was given as a prime example of the border disadvantage facing North American producers. For example, an offshore shipment of 4,000 imported cars is only required to give a 24-hour advance notice and go through a single security check before rolling off a ship and on to car dealerships. On the other hand, vehicles produced in North America may have effectively crossed the border back and forth seven times during their production life cycle. In the end, the finished vehicles cross the border one truckload at a time. The automotive industry is so integrated that the production of 4,000 vehicles in North America may involve over 28,200 customs transactions. These customs rules and border delays could easily add an extra cost of C$800 per vehicle compared to imported vehicles (CME 2005).

Similarly, the Canadian Chamber of Commerce (2008) echoed the need to strike a balance between reducing border costs and addressing security concerns. Its recommendations covered a wide range of border-crossing issues affecting flows of both merchandise trade and travellers (e.g., streamlined procedures on entry rules, expanded inspection facilities, enhanced security technology, reduced processing fees, and improved risk assessments).

Initially, the concern was with the delays caused by more stringent border inspections and inadequate infrastructures. This concern even extended to the added pollution from idling of large trucks. A case study by the Canadian Centre for Pollution Prevention (2005) showed that over a four-month study period, an average truck driver could have endured up to 102 hours of idling. Out of this total, 26 hours (25.5 percent) occurred at the border with
32 instances of short idling (15 minutes to an hour) and seven instances of long idling (two hours or more). This finding underlines the need to bring information about border wait times (CBSA 2008a) to the attention of drivers so they can act accordingly (e.g., turn off engines for long stops at the border).

A number of measures have been taken by the governments on both sides of the border to address the issue. For example, the four-way Border Transportation Partnership (2004) was formed by the governments of Canada, United States, Ontario, and Michigan to study long-term transportation strategies for the Windsor-Detroit and Sarnia-Port Huron gateways. Among the policy options considered were plans to expand border processing facilities, introduce alternative transportation modes (e.g., rail, marine services, new roads), and build new bridges (e.g., a second twinned span added to the existing Ambassador Bridge or a brand-new Detroit River International Crossing bridge further down the river).

There was also a joint initiative by the Canada Border Services Agency (CBSA) and US Customs and Border Protection (CBP) to expedite the inspection of pre-approved low-risk cases. For travellers who have passed a bi-country process of pre-inspection and risk assessment, the NEXUS program (CBSA 2008c) can help facilitate their entry at border checkpoints. Similarly, for pre-screened low-risk truck drivers, carriers, and importers, the FAST (Free and Secure Trade) program (CBSA 2008b) allows them more rapid clearance at pre-inspection checkpoints away from the border, reducing the wait times at the border itself.

More recently, concern has arisen that, despite these steps, border delays have risen to levels similar to those in the immediate post 9/11 period. In the spring of 2008, the Globe and Mail ran a series of articles (Beatty 2008; Manley 2008; McKenna 2008) showing a marked increase in the number of secondary inspections required at the border, added fees, and inadequate staffing of inspection points, causing additional delays.

This major newspaper series coincided with the release of a study by the Conference Board of Canada (2007) that reported 60 interviews with business executives about their experience in cross-border trade under conditions of heightened security. The report revealed an alarming trend in trading behaviours, among which were the reversions back to those that existed before the North American Free Trade Agreement (NAFTA). For example, producers on both sides of the border resorted to stockpiling inventory as a hedge against the risk of late shipments due to border delays. They routinely held higher inventories and doubled ship orders to avoid costly out-of-stock situations. Some even built backup warehouses on the other side of the border. In other words, they chose to forgo the efficiency of a “just-in-time” inventory strategy in favour of the redundancy of a “just-in-case” safe bet.4

This reversal trend in trading behaviour means that access to the US market that used to be enjoyed by Canadian exporters now has been eroded. The benefits of free trade under NAFTA may have evaporated, or at least have been negated, by the re-emerging priority of new security-driven barriers to trade at the border.

A complicating factor is the highly integrated nature of the North American auto industry (see above), where some parts for a vehicle produced in Canada will be sourced in the United States and Mexico. Many auto-part sub-assemblies cross the border more than once. For example, brake pads made in Canada can be assembled in Michigan into brake assemblies that are subsequently incorporated into a vehicle built in Ontario. As Canada’s auto industry is concentrated in Ontario and Quebec, it is not surprising that these two provinces bear a significant cost burden arising from bottlenecks at the border. Canadian producers, especially in these two provinces, have thus lost an important competitive advantage in the trading world. Against this background, we now turn to the small but growing body of literature that attempts to address this new border concern.
LITERATURE REVIEW

In this section, we first give a broad review of some cost and impact studies by government agencies and research groups and then look at academic papers of particular relevance to our topic of interest.

Costs and Impacts

The Ontario Chamber of Commerce (2004; 2005) studies mentioned earlier, for example, suggested that a four-hour delay at the Ambassador Bridge could have cost the Ontario economy as much as C$7 million in lost production. Other crossing points in Ontario experienced similar delays. The studies also highlighted possible losses to the American states neighbouring Ontario.

Martin et al. (2005) estimated the lost earnings and output from the post-9/11 delays from a Quebec perspective. Including the compliance costs associated with various newly introduced customs and border security programs, the authors estimated total costs for the Quebec economy to be as high as C$350 million a year.

The above studies were based on rough estimates of delay times and implied costs per vehicle but did not attempt to reflect the inter-industry or inter-provincial feedbacks that are likely to accompany them.

On a different thread, the recent econometric literature provides opposite views on the statistical link between tighter border security and Canadian exports to the United States. For example, using various measures of Canadian real export data (e.g., aggregate exports, exports by port, exports by commodity) and separate dummy variables for post-9/11 temporary and permanent effects, Burt (2009) reported little statistical evidence that tighter security measures after 9/11 have a permanent negative impact on Canadian exports to the United States. On the other hand, using current dollar export data and specific dummy variables for different segments of the post-9/11 period (2001–07), Globerman and Storer (2009) found statistically significant evidence of shortfalls in Canadian exports to the United States. Although the perspectives, methodology, and objectives of these econometric studies were different from those in our paper, the absence of conclusive evidence underlined our conviction that the issues of border delays are far from being settled and more research is needed.

Social Costs of Delays

A small number of studies have highlighted the nature of costs associated with heightened security, and especially with delays. Bergeijk (2006) set out to provide a theoretical discussion of the general relationship between terrorism and the economy generally, but then mostly argued for more attention to the issue.

Brück’s key point (2005) was that the costs of border delays or increased security should be broken down into three components: the compliance costs borne by private agents, the delay cost of individuals and carriers at the border, and the cost to governments of increased surveillance and inspections.

Huang and Whalley (2008) pointed out that the usual way of measuring the economic cost of border delays might have missed another important cost element, namely, inventory consideration. They argued that higher inventories are needed to avoid extremely costly plant closures due to shipments of parts being held up at the border. Using the basic Baumol-Tobin inventory theoretic framework, they showed that the cost of backup inventory holdings could be as much as the conventional delay cost itself. This added cost dimension thus could raise the total cost to business by a factor of two (i.e., twice the usual cost amount). The authors’ theoretical analysis seemed to fit the observed trend of holding more inventories as a “just-in-case” precaution to border uncertainty.

While these papers provided some theoretical understanding of the cost burden associated with border delays, Walkenhorst and Dihel (2006) offered an empirical simulation exercise to evaluate the magnitude of the impacts. Using the GTAP (Global Trade Analysis Project) numerical modelling
framework of the world economy (Hertel 1997), they were able to simulate the impact of border delays on key variables such as trade flows, incomes, and economic welfare. Economic welfare is a summary measure used to reflect the overall impact of the time costs, income losses, and changed relative prices on individual real incomes. Numerical simulation models as such are often used to investigate the impacts on resource allocation of trade policy measures.

Walkenhorst and Dihel (2006) modelled the effect of post-9/11 border delays on the global economy by supposing that the delays raised the cost of imports and exports by between 0.5 percent and 1.6 percent. They found that the tightened security caused global trade to decline about 1 percent for every 1 percent increase in trade costs, and that worldwide welfare losses were about 0.2 percent of GDP (gross domestic product) for North America and as high as 0.6 percent GDP elsewhere (e.g., South Asia).

It is important to note that in the Walkenhorst and Dihel analysis the border delays were formulated as what economists call a price wedge. That is, the delays act like a tariff or a tax, keeping import prices lower and export prices higher. The delays do not, however, involve any direct resource costs. The authors did not take into account drivers and trucks being idled, fuel burned while inching along the highway, or the additional infrastructure and backup inventory buildups. Moreover, delay costs on travellers, business trips, and services should have been modelled (e.g., Ueda et al. 2005).

In summary, our short review finds intense interest in the issue of border delays and ample reason to suggest that the conventional measurement of those costs may have significantly underestimated the actual economic cost figures.

**Methodology**

In this paper, we use an empirical simulation methodology to evaluate the consequences of border delays. Unlike Walkenhorst and Dihel (2006), whose emphasis is on global trade, our primary focus is on a regional small open economy, which we find most suitable to a country like Canada.

The basic structure of the model used in this paper highlights a single-period static multi-sector multi-household economy with constant returns to scale technology and perfect competition. Basic models are often used to investigate the impacts on resource allocation of trade policy measures.
Input-Output Division of Statistics Canada. Raw data were assembled, aggregated, and balanced to produce a final benchmark consistent dataset satisfying all conditions of a general equilibrium system (e.g., producer zero profits, consumer budget constraints, market equilibrium, factor endowments, government budget, and trade balance). Model parameters were calibrated from this benchmark dataset and extraneous key elasticity parameters. Policy changes were then introduced, the model was solved for counter-factual solutions, and welfare comparisons were evaluated for before-change and after-change scenarios.

We used this numerical modelling framework to assess the impacts of external shocks such as border delays on various key variables (e.g., sectoral outputs, trade flows, relative prices, welfare, and real incomes) at both provincial and national levels. In contrast to the studies cited in the literature review section above, our general equilibrium model can trace the complex interactions and feedbacks across both sectors and provinces. For example, a shock to the auto sector in Ontario can have repercussions in the metals or plastics sector in Quebec, which in turn affects other sectors of the Quebec economy, and vice versa.

We designed two experiment simulations of the impacts of border delays on the regional trade economy of Canada. They provided bounds for a range of possible scenarios as follows:

a. In the first experiment, we introduced an ad-valorem trade cost equal to 1 percent of the value of all trade flows (i.e., on both merchandise and services). For services trade, the added costs reflected trade cost arising from security delays associated with the provision of cross-border services. This base run provided a lower bound of normal cases and was comparable to the basic experiment of 1 percent increases in trade cost across the board globally in Walkenhorst and Dihel (2006).

b. In the second experiment, we doubled the trade cost to a high level of 2 percent on merchandise trade but still kept 1 percent on services trade as before. This high run was designed to explore the upper bounds and reflect the additional inventory costs arising from business “just-in-case” strategy in response to border uncertainty (Huang and Whalley 2008). It was also worth noting that high delay costs are not uncommon for certain types of border-sensitive exports such as highly perishable delicacy seafood (e.g., fresh live lobsters must be quickly delivered to the US restaurant market before losing their culinary value).

Our experiments essentially differ from Walkenhorst and Dihel’s (2006) in that our trade costs are assumed to be real costs, as opposed to a price wedge. In earlier studies (like Walkenhorst and Dihel’s) on the border costs of delays, the delays caused a price wedge to occur in the model. The wedge drove up the cost of traded goods, but did not directly involve any resource cost. This effect is illustrated in Figure 1 as follows:

a. In the price wedge case, if exporters charge a price $P_x$ and there is a delay cost $d$ (like a tax), this causes importers to face the higher price of $P_x + d$. In that case, the aggregate economic cost (called deadweight welfare loss) of the delay amounts to triangular area $B$ in the diagram. This triangle of loss arises because the delay cost represents the losses resulting from the reduction of trading opportunities, and output falls from $Q_n$ (no delays) to $Q_d$ (delays).

b. In our experiments, the delay cost $d$ corresponds to actual resources wasted by the delays. In particular, the cost is composed of transportation and storage services. As such, it implies expenditures on fuel, drivers, and warehousing. In this case, the economic cost of the delays equals the triangle $B$ plus the rectangle $A$. The latter amounts to the added resources used up by trucks and drivers idling as well as added warehousing for inventories of parts.
from delays to be higher than the usual welfare calculations, including those in Walkenhorst and Dihel (2006) (see Table 1). The difference is mainly attributable to the added resource costs of border delays, the nature of our experiments, the relative openness of Canada and exposures to external shocks, and the highly integrated production and trade structure of the North American economy.

**Base Case: Delay Costs of 1 Percent on Merchandise and Services**

We found that a 1 percent delay cost on all merchandise and services trade caused an aggregate welfare loss of 1 percent of GDP for Canada as a whole, which was significantly higher than the 0.2 percent figure reported by Walkenhorst and Dihel (2006) even though our experiment used the same delay cost as theirs. The difference arises for two main reasons. Firstly, in our experiments, there was an additional cost dimension of resources being wasted and driving up the cost of a given size of delay. Secondly, Walkenhorst and Dihel modelled North America as a whole, whereas our national results were for Canada alone, which is a much more open economy than the United States (a major part of North America). As such, a given delay will be more costly.

Trade volume effects (measured as the total values of imports plus exports at original prices) were also much more severe for Canada as a whole for similar reasons. In Walkenhorst and Dihel (2006), North American trade fell by 0.5–1.5 percent. Here, international trade fell by 3.6 percent for Canada as a whole.

It is also worth pointing out that there were considerable variations in the welfare and trade impacts across the regions. At the top of the list was Ontario with its welfare loss at 1.3 percent of GDP and a 5.1 percent drop in trade volumes. Quebec was next with a welfare loss at 0.9 percent of GDP and a 2 percent drop in trade volumes. Other provinces fell within the usual range of under 1 percent. Thus, the two biggest provinces in Canada, with the highest level of economic integration with the United States economy, seemed to suffer the most.
By contrast, British Columbia experienced the smallest welfare loss (0.6 percent of GDP), which was well below the national figure of 1 percent for Canada as a whole. Although its trade loss (1.6 percent) was much smaller than Ontario’s, its welfare loss was within the range of 0.5-1.5 percent for North America as reported in Walkenhorst and Dihel.

High Case: Delay Costs of 2 Percent on Merchandise and 1 Percent on Services

This experiment provided an extreme case, as we introduced a very high trade cost to explore the inventory-theoretic argument of Huang and Whalley (2008) by doubling the effective delay cost for merchandise trade. This added cost reflected the increase in backup inventory holdings.

In this case, the aggregate welfare loss for Canada was 1.8 percent of GDP, now almost at ten times the 0.2 percent value in Walkenhorst and Dihel (2006). The added welfare cost came from the added inventory holding as suggested by Huang and Whalley (2008). The other differences (i.e., resource costs versus price wedge, and Canada versus North America) were still relevant. As expected, the trade volume effects were also much more severe, with trade volumes falling by as much as 6.8 percent for Canada as a whole and almost by 10 percent for Ontario alone. The pattern and variation of welfare and trade effects by province were quite similar. The welfare loss for Ontario was 2.4 percent of GDP (about double the 1.3 percent figure of the first experiment).

To show how important the distinction is between delays constituting a real resource cost versus a “wedge,” we considered two sensitivity runs for this high case. In all the experiments so far, the delays

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**TABLE 1**

**Simulation Overview**

<table>
<thead>
<tr>
<th>Region</th>
<th>Welfare Change (%)</th>
<th>International Trade Change (%)</th>
<th>Interprovincial Trade Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base Run: Impacts of Border Delay Costs of 1% on Merchandise and 1% on Services</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atlantic Canada</td>
<td>-0.9</td>
<td>-5.3</td>
<td>-1.4</td>
</tr>
<tr>
<td>Quebec</td>
<td>-0.9</td>
<td>-2.0</td>
<td>-0.2</td>
</tr>
<tr>
<td>Ontario</td>
<td>-1.3</td>
<td>-5.1</td>
<td>-0.2</td>
</tr>
<tr>
<td>Prairie Provinces</td>
<td>-0.8</td>
<td>-1.4</td>
<td>-0.5</td>
</tr>
<tr>
<td>British Columbia</td>
<td>-0.6</td>
<td>-1.6</td>
<td>-0.5</td>
</tr>
<tr>
<td>Canada as a whole</td>
<td>-1.0</td>
<td>-3.6</td>
<td>-0.4</td>
</tr>
<tr>
<td><strong>High Run: Impacts of Border Delay Costs of 2% on Merchandise and 1% on Services</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Atlantic Canada</td>
<td>-1.5</td>
<td>-9.6</td>
<td>-2.5</td>
</tr>
<tr>
<td>Quebec</td>
<td>-1.7</td>
<td>-4.0</td>
<td>-0.3</td>
</tr>
<tr>
<td>Ontario</td>
<td>-2.4</td>
<td>-9.9</td>
<td>-0.3</td>
</tr>
<tr>
<td>Prairie Provinces</td>
<td>-1.5</td>
<td>-2.7</td>
<td>-0.9</td>
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<tr>
<td>British Columbia</td>
<td>-1.0</td>
<td>-3.0</td>
<td>-0.8</td>
</tr>
<tr>
<td>Canada as a whole</td>
<td>-1.8</td>
<td>-6.8</td>
<td>-0.6</td>
</tr>
</tbody>
</table>

Source: Authors’ compilation from Nguyen, Snoddon, and Wigle (2007), Nguyen et al. (2007).
limited the volume of trade that could cross the border in a given period of time by requiring additional resources (e.g., drivers and trucks idled waiting for inspectors) to complete the task of crossing the border. In the first sensitivity run, denoted Half Wedge, just half of the delay cost was composed of increased resource costs (idling trucks and drivers), with the other half a limit on volume of trade. In the second sensitivity run, the border delays merely limited the volume of trade. In this case, a limited number of trucks could cross the border in a given period, but that limited number of trucks was cleared through without any delay.

Sensitivity results showed that the welfare cost of the delays depended a lot on the extent to which delays were directly costly to exporters and importers. For example, in the case of hardest-hit Ontario, the welfare cost of the delays was only 0.2 percent of GDP if they were merely volume limiting, compared to almost 2.5 percent if they were all resource using. In all cases, the Half Wedge results were close to halfway between the two extremes.

We feel that the concerns about a thickening border are with an increased share of delays of the type we are portraying as involving real resource costs. As such, we would argue that concerns with alleviating delays are well justified.

**Summary**

There is increasing concern about rising border delays at the Canada-US border. Our findings suggest that the cost of border delays could be much higher than previously thought. In terms of public policy relevance, we also note how the overall picture of losses due to reduced employment opportunities and increased costs of imports fails to reflect the fact that highly trade-dependent provinces like Ontario and Quebec are likely to suffer particularly high economic costs.

In addition to the role played by added resource costs associated to border delays, we find another key element of the cost is attributable to the high degree of economic integration of the manufacturing industries in Canada and the United States. The concern about border delays also has an international trade competitiveness angle for many Canadian manufacturing industries. For example, whereas finished manufactured goods like motor vehicles imported from Asia are inspected only once, the parts and sub-assemblies of vehicles assembled in Ontario may have been subject to additional five to six inspections due to back-and-forth border crossings.

In summary, the main policy message of this paper is that the economic consequences of border delays may have been seriously underestimated. Further, in the Canadian context, avoiding a repeat of the late 2001 border delays and reducing existing delays can yield significant economic benefits, particularly for the two major provinces of Ontario and Quebec.

**Notes**

The authors would like to thank Nabil Annabi, Simon Harvey, two anonymous referees, and participants at the 2010 APCGI conference in Toronto for helpful comments that greatly improved the paper.

1 Built in 1929, the Ambassador Bridge between Windsor, Ontario, and Detroit, Michigan, is the biggest commercial gateway between the two countries, taking more than 11 million vehicles each year with an average of 10,000 trucks a day. This single bridge handles more than a quarter of total trade across the border.

2 Ontario is Canada’s most populous province, accounting for over one-third of the population and economic activity in the country. The Ambassador Bridge in Windsor is the most vital artery of commercial trade between Canada and the United States.

3 A single truck idling for an hour could burn up to 4 litres of fuel and release 11.2 kg of greenhouse gases, 1.5 g of particulate matter, and 140 g of nitrogen oxide into the atmosphere. The environmental impact could become significant, given the large number of commercial vehicles idling daily at the border.
“Just-in-time” (JIT) refers to the inventory strategy (first used by Henry Ford of Ford Motor Company) that keeps inventory costs at the lowest level possible by only ordering the exact amount of supplies required by production. This aggressive technique depends critically on the condition that supplies can be shipped fast enough to be delivered “just-in-time” as needed. On the other hand, “just-in-case” (JIC) refers to the traditional strategy that keeps large inventories of supplies to meet production requirements and avoid costly shortages.

Interested readers can find detailed descriptions of the model structure, methodology, and data collection in the model and data documentations (Nguyen, Snoddon, and Wigle 2007, Nguyen et al. 2007). The technical appendix in Nguyen and Wigle (2009) gives a brief mathematical description of the basic model structure.

To put it a different way, drivers and trucks previously providing valuable services (e.g., moving goods from producer to consumer) are now waiting at the border. The workers are still paid wages in the normal way, but their productivity is effectively zero while they wait to be cleared through the border.

We model Canada as a small open economy (SOE). That is, the world price of imports and exports is unchanged in response to the border delays. This means that the full cost of border delays is paid by Canadians in terms of lower producer prices for exports and higher consumer prices for imports. While the SOE assumption seem a reasonable approximation for most of Canada’s trade, Canada’s welfare costs will tend to decline to the extent that Canada’s trade departs from being an SOE.

Common to all our simulations is the finding that the inputs into the transportation and storage sector expand even as the sector’s effective output declines. The explanation for this is that more inputs are required for a given volume of kilogram-kilometres and “border-crossing” services provided.

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