A Time To Sow, A Time To Reap:
The FTA and its Impact on Productivity and Employment

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* We treasure the encouragement of Industry Canada, including Renée St-Jacques (the Director General of Micro-Economic Policy Analysis) and Someshwar Rao (the Director of Strategic Investment Analysis), who encouraged us to study the FTA and who have made every effort humanly possible to breathe life back into Canadian policy research. We are also deeply indebted to our colleagues at the Canadian Institute for Advanced Research. This paper is as much our product as it is a product of their insistence on excellence, their informed criticism, and their forceful suggestions for improvement. The group has been Trefler's intellectual lifeline during a period that has seen the demise of economic policy research in Canada.

1. Competing contentions—is there now a verdict?

The Canada-U.S. Free Trade Agreement (FTA) remains one of the most contentious pieces of economic legislation ever enacted in Canada. Remarkably, the FTA is far from being viewed as a success by either end of the political spectrum. The Canadian Labour Congress fingers the Agreement as the cause of job losses that tragically racked manufacturing in the early 1990s (Jackson, 1996). And even the business community complains about the ultimate FTA failure: *lagging* productivity growth (Rubin, 1997) — in apparent contradiction to the forecasted improvements in productivity that have always been at the heart of the proclaimed benefits.

While the nay-sayers dominate public discussion, the arguments, pro and con, have often been devoid of hard facts, despite efforts taken by the research community to provide evidence and thoughtful analysis on the matter e.g., Gaston and Trefler (1994, 1997), Trefler (1997), Head and Ries (1997, 1999a, 1999b), Feinberg and Keane (1998), Feinberg, Keane and Bognanno (1998) and Beaulieu (2000). Clearly, the court of public opinion is not easily convinced. The jury remains out on whether the FTA productivity benefits live up to their promise and whether these benefits compensate sufficiently for any employment and business losses. Consequently, the question still beckons: is it possible to summon clear, convincing evidence of the FTA's impact? Is it possible to separate out the "real" from the "perceived" and facts from appearance?

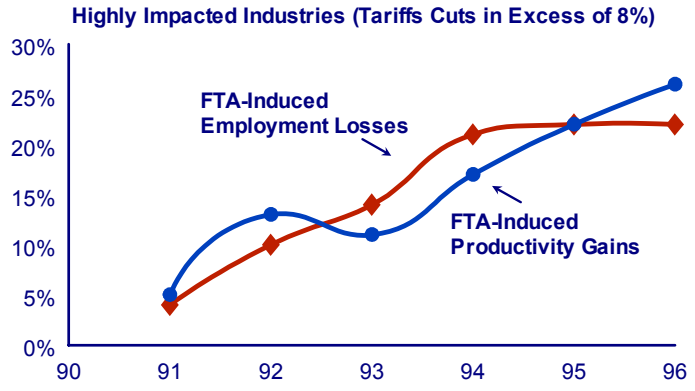
Trefler (2001) takes us a long way towards providing an answer. In particular, he calculates that the FTA reduced manufacturing employment by 5% between 1988 and 1996 — and by 15% in those manufacturing industries that experienced the deepest cuts. On the other hand, he estimates that the FTA raised manufacturing's labour productivity by 5% — and by a remarkable 17% in those manufacturing industries hardest hit by the FTA tariff cuts.

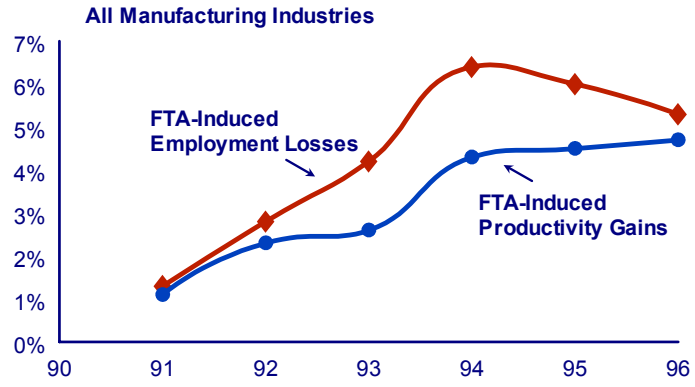
There remains, however, two unanswered questions stemming from Trefler's (2001) research. *First*, he asserts rather than establishes that the employment losses were a short-run and, by implication, temporary phenomenon. *Second*, he leaves open the question of whether there were *net* benefits accruing from the FTA. In particular, timing matters. For example, suppose the employment losses were permanent and came immediately after implementation of the FTA whereas the bulk of the productivity gains came only in 1996. Then for a policy maker with a high discount rate, the employment losses could outweigh any productivity gains and the FTA could be deemed a failure.

In this paper, we will confront these two issues left unanswered by Trefler's (2001) analysis. *First,* we will provide evidence that the employment losses did not significantly predate the productivity gains. The argument is illustrated in figure 1 which plots our estimates of the FTA impact on employment and labour productivity. (We emphasize that these plots are the output of a complex estimation procedure.) Recall that the FTA was implemented on January 1, 1989. Figure 1 tracks FTA effects starting in 1991. The top panel plots the FTA impacts for those industries that by 1996 had experienced FTA-mandated tariff cuts in excess of 8%. As can be seen, the employment losses arrived early and plateaued by 1994. However, the productivity gains also arrived early and, unlike the employment losses, continued accruing throughout the period. Even for all of manufacturing, illustrated in the bottom part of figure 1, the employment losses did not arrive much earlier than the productivity gains.[1] There is thus no sense in which the employment costs were front-ended relative to the productivity gains. It follows that even our fictitious high-discount-rate policy maker should not worry about the timing of the FTA costs and benefits. *Since the FTA-*

1 The analysis for all of manufacturing is trickier since, as we will discuss in the next paragraph, the employment losses plotted in the bottom panel of figure 1 are overstated.

Figure 1
Timing of Employment Losses and Productivity Gains





Source: Authors' calculations from Tables 7 and 9 below.

induced employment costs and productivity benefits accrued at roughly the same rate, any assessment of the FTA must be independent of the discount rate used.

Second, we will provide evidence that while the industries that experienced the deepest tariff cuts reduced employment levels, the remaining industries increased employment levels. Part of the evidence for this is the fact that over the 1988-2000 period, Canadian manufacturing employment rose by 0.7%. In contrast, manufacturing employment declined in almost all of the most industrialized nations. For example, it fell by 4.4% in the United States. This implies that *the FTA did not induce any permanent job losses in manufacturing*. The observation of no net employment losses is entirely consistent with standard Ricardian trade theory. The theory predicts that free trade will shift employment out of low-end, protected industries and into high-end, unprotected industries. Re-framing our facts using this theory, the permanent effect of the FTA on employment was not a reduction in employment, but a reallocation of workers into more productive activities.

Figure 1 also provides a nice way of seeing Trefler's (2001) results on employment and productivity. Trefler was only interested in the 1996 results. From the top panel of figure 1, which deals with the highly impacted industries, we see that the FTA reduced employment by an unimaginable 22% and raised productivity by a remarkable 26%. These numbers represent both the huge costs and huge benefits of the FTA.[2]

The paper is organized as follows. Section 2 provides a broad overview of Canada's key manufacturing performance indicators since the implementation of the FTA. Section 3 develops a modification of Trefler's (2001) methodology for assessing the impacts of the FTA. The

2 These numbers differ from the 15% reduction in employment and the 17% increase in productivity cited in Trefler (2001). The difference is one of definition rather than substance. In Trefler (2001), the numbers refer to the group of 71 industries with tariff cuts in excess of 5%. In our paper, the numbers refer to the more narrowly focused group of 34 industries with tariff cuts in excess of 8%. These industries experienced deeper cuts and hence larger FTA impacts.

modification allows us to look at the timing issues that are at the heart of this paper. Section 4 presents the results that underlie figure 1. Section 5 critiques our approach by observing that it ignores the effect of the FTA in reallocating workers from high-tariff to zero-tariff industries. It then provides evidence on the magnitude of this effect. Conclusions appear in section 6.

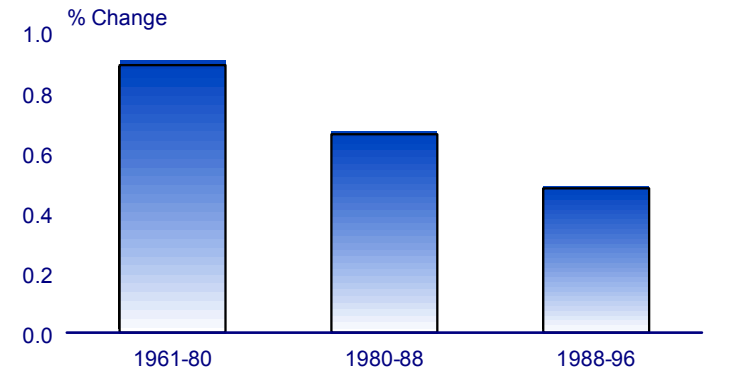
2. What do simple time series comparisons show?

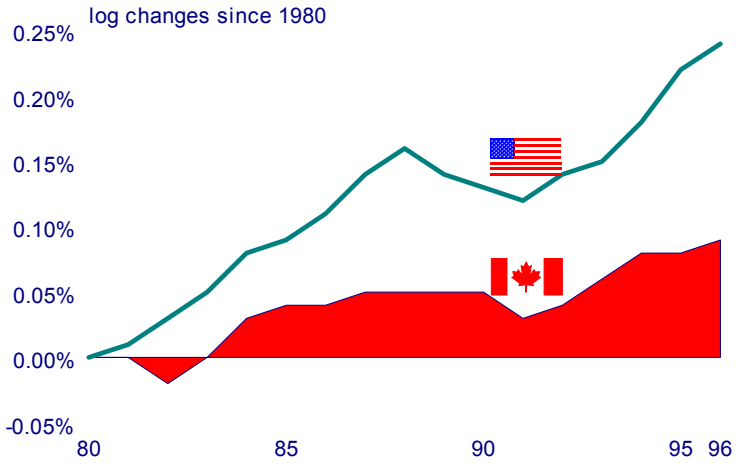
Canada's recent productivity performance

Productivity is commonly measured in one of two ways. Total factor productivity (TFP) measures the difference between output and the inputs of capital, labour, energy, materials and services. The top panel of figure 2 displays movements in manufacturing TFP growth. The FTA was implemented on January 1, 1989. The figure looks at changes over the 8-year FTA period (1988–96)[3], the 8-year pre-FTA period (1980–88), and the remaining period for which data are available (1961–80). 1980 and 1988 were chosen as base years for changes over the periods because each marks the peak of a business expansion. From figure 2, productivity growth in the FTA period has been weak relative to past performance. The bottom panel displays the now famous observation about diverging Canadian and U.S. TFP growth. In the bottom panel, we have chosen 1980 as the base year since up until then Canadian labour productivity had tracked its U.S. counterpart very closely. (Indeed, the picture is identical if 1961 is chosen as the base year.) Whatever the productivity gap was in 1980, by 1988 it had widened by 11 percentage points, and by 1996 it had

3 The FTA period is 1989–96. *Changes* over the FTA period are percentage changes using 1988 as the base year. Thus, even though the FTA period is 1989–96, we sometimes write 1988–96 as the FTA period in order to emphasize the use of 1988 as the base year.

Figure 2
Multifactor Productivity Growth in Manufacturing





Canadian and U.S. TFP Growth

Source: Canadian data are the Fisher value-added mulitfactor productivity measure from CANSIM as updated on March 23, 1999. The U.S. data are the MFP series from http://www.bls.gov/news.release/prod3.t01.htm as updated on February 11, 1999.

widened another 4 percentage points. Annualizing these numbers for the FTA period, Canadian productivity growth of 0.5% was overshadowed by U.S. productivity growth of 1%.

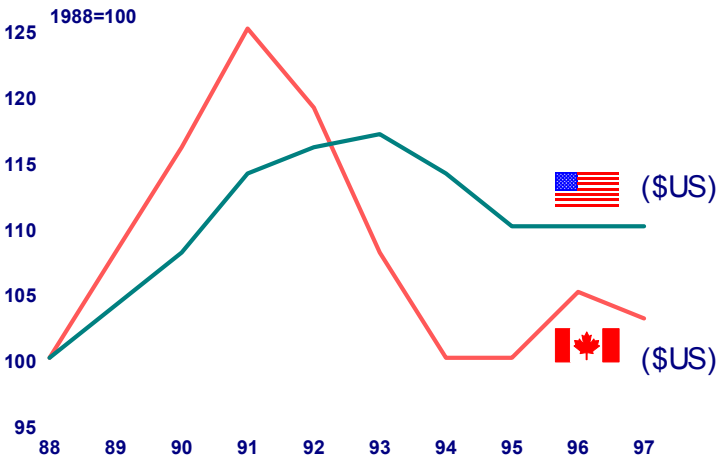
Since the Agreement was expected to force Canadian firms into a more competitive position vis-à-vis U.S. firms, figure 2 is often used to argue that the Agreement was a failure. In this view, the devaluation of the Canadian dollar is the only reason why Canada has stayed competitive (Rubin, 1997). Figure 3 lends partial support to this argument. Between 1988 and 1996, Canadian relative to U.S. unit labour costs (both in U.S. dollars) fell by 7%. However, the data series that are discussed next paint a picture of more solid Canadian competitiveness.

Other economic indicators

Early on in the debate about the merits of the FTA, interest was focused on the collapse of manufacturing employment. The top panel of figure 4 shows the enormous employment losses experienced in manufacturing. The left-hand scale shows the cumulative reduction in manufacturing employment since 1988. In 1993, there were almost 400,000 fewer employees in manufacturing than in 1988. This amounted to a staggering loss of 17% of the 1988 work force. Many have blamed the FTA for these lost jobs. From the current perspective these losses appear to be short-lived (which is not to minimize them). Manufacturing employment in 2000 was 0.7% higher than it was in 1988. And the middle panel of figure 4 reveals there has been no long-run impact on the unemployment rate for Canada overall. We also plot the unemployment rate for manufacturing. This is defined as those unemployed whose last job was in manufacturing divided by manufacturing employment. Both overall and for manufacturing, unemployment rates were actually lower in 2000 than in the boom year 1988 that immediately preceded implementation of the FTA.

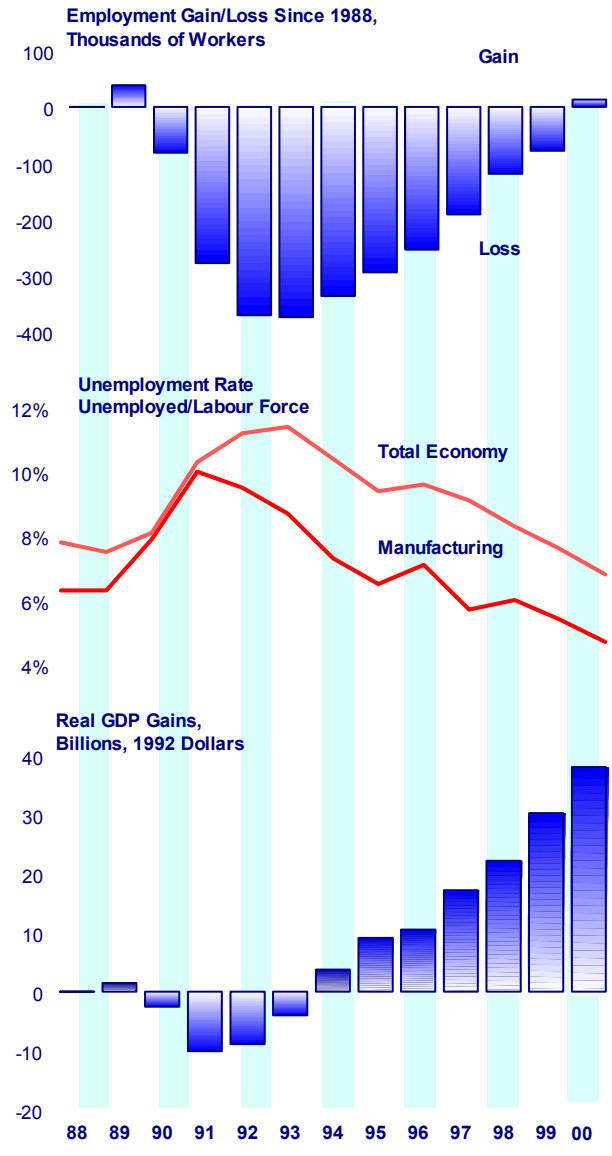
Figure 3

Unit Labour Costs in Canda and the U.S.



Source: Data are from the U.S. Bureau of Labor Statistics, foreign labor statistics home page, as updated on June 23, 1999.

Figure 4
Manufacturing
Employment, Unemployment Rate and Real GDP



Source: CANSIM

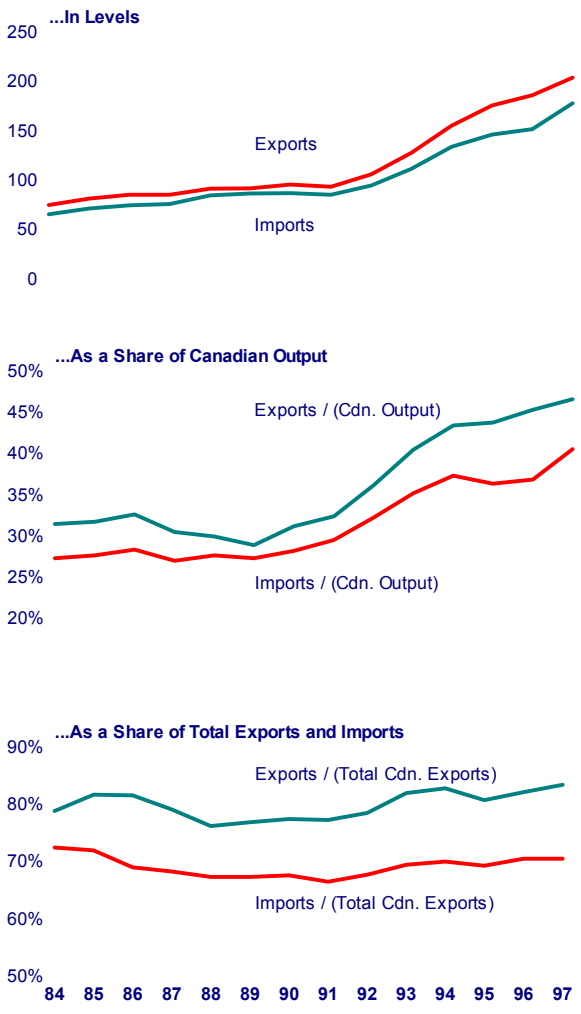
Some commentators have argued that the unemployment rate is not relevant because the FTA forced a rise in part-time employment. Given the rise of part-time employment in Canada, so the argument goes, many of those who worked full-time in 1988 may now be working part-time because of the FTA. This possibility is not backed up by the data on average weekly hours in manufacturing. Weekly hours stood at 38.9 in *both* 1988 and 2000.[4]

The bottom panel of figure 4 plots real GDP for manufacturing. One can again see the large hit to manufacturing of the early 1990s followed by a strong recovery. At the trough in 1991, manufacturing GDP was down 10% from its 1988 level. By 2000 it was up 36% from its 1988 level. The information about employment and real GDP do not sit well with indicators of poor Canadian productivity growth. Figure 4 tells a story of rising GDP per worker. The fact that manufacturing employment, output and unemployment rates have all sharply improved since the recession of the early 1990s is suggestive of an FTA-induced restructuring of Canadian manufacturing. This strengthens the economic outlook for Canada's manufacturing sector under free trade.

Another piece of evidence that is hard to reconcile with the contention that the FTA had a negative impact on employment and productivity appears in figure 5. There was unprecedented export and import expansion throughout the 1990s (see the top panel of figure 5). This growth cannot be explained by exchange rate movements because imports should have declined as a result of the Canadian dollar devaluation. The middle panel of figure 5 shows that trade growth outstripped growth in manufacturing output. The Canadian ratio of trade to output of close to 40% makes Canada one of the most open economies in world history. One would not expect lagging productivity to be associated with an export boom. The bottom panel shows that since 1988, the

4 Data are from CANSIM matrix L97800.

Figure 5
Canadian Imports from and Exports to the U.S.



Source: Authors' calculations.

United States has increased its share of Canadian trade. This trade-diversion effect is precisely what the FTA is expected to do.

To recap, a simple time series comparison of productivity in the years before and since the implementation of the FTA may lead to an unjust indictment of the FTA's impact. Many other series, such as the enormous manufacturing boom in GDP, GDP per worker, and exports to the United States all actually paint a picture of strong productivity performance.

3. Isolating the FTA effect — Method of analysis and data

A defect of the previous section's analysis was its reliance on aggregate time series. By implicitly attributing all post-1988 trends to the FTA, the analysis ignored the role of other sources of change. In this section, we will use more sophisticated econometric techniques to isolate the role of the FTA. Let $i = 1, \ldots, 213$ index the 213 industries in our sample, let t' index years, and let $Y_{it'}$ be employment or labour productivity of industry i and year t'. The FTA was implemented on January 1, 1989. Define

$$\Delta y_{i1}(t) \equiv (\ln Y_{i,1988+t} - \ln Y_{i,1988})/t \qquad \text{and} \qquad \Delta y_{i0}(t) \equiv (\ln Y_{i,1980+t} - \ln Y_{i,1980})/t\,. \tag{1}$$

$\Delta y_{i1}(t)$ is the average log point change in $Y_{it'}$ over the first t years of the FTA period. $\Delta y_{i0}(t)$ is the average log point change in in $Y_{it'}$ over the first t years since 1980. Note that t' is a year while t is the number of years since either 1980 or 1988. We have data for the FTA period (1989–96) and the pre-FTA period (1980–88). Let s index periods with $s = 1$ being the FTA period and $s = 0$ being the pre-FTA period. Then we may compactly capture the above with the notation $\Delta y_{is}(t)$, $s = 0$, 1 and $t = 1, \ldots, 8$. Note that $\Delta y_{is}(t)$ is expressed as an annual compound growth rate.

Let $\tau_{it'}^{US}$ be the Canadian tariff against the United States in industry *i* in year t' and let $\tau_{it'}^{ROW}$ be the Canadian tariff against the rest of the world. Then $\tau_{it'}^{US} - \tau_{it'}^{ROW}$ is the FTA-mandated preferential tariff concession extended to the United States. Its average annual change during the first *t* years of the FTA period (*s* = 1) is

$$\Delta\tau_{i1}^{FTA}(t) \equiv \left((\tau_{i,1988+t}^{US} - \tau_{i,1988+t}^{ROW}) - (\tau_{i,1988}^{US} - \tau_{i,1988}^{ROW})\right)/t\,. \tag{2}$$

For the pre-FTA period, tariff rates were extended on a Most-Favoured Nation (MFN) basis, at least for industries that were not covered by the Auto Pact. Mathematically, for non-Auto Pact industries *i* and for years $t' \leq 1988$, $\tau_{it'}^{US} - \tau_{it'}^{ROW} = 0$ and $\Delta\tau_{i0}^{FTA}(t) \equiv 0$. We will not need to define $\Delta\tau_{i0}^{FTA}(t)$ for Auto Pact industries because these industries will be eliminated when it comes to estimating our econometric model. We do this in order to ensure that our results are not driven by the automotive sector. As it turns out, however, our results are the same whether or not the sector is included in the econometric work. We will return to this point below.

Examining the FTA-mandated tariff concessions ($\Delta\tau_{i1}^{FTA}$)

It is natural to ask whether the FTA tariff cuts were deep enough to have mattered. After all, the average tariff rate against the United States in 1988 in manufacturing was 4.5%, a level too low to have had much effect. However, Trefler (2001) makes the following points.

- Tariffs tend to be lowest on less-processed manufactures and highest on processed ones. For Canada this means that the tariff rate understates the effective rate of protection. Indeed, Canada's average manufacturing tariff rate has historically been half that of its effective rate of protection.

- The pre-FTA distribution of tariff rates across industries was highly skewed, with many industries facing steep tariff rates. For example, of the 213 4-digit Standard Industrial Classification (SIC) industries in Canadian manufacturing, 54 of them were sheltered behind a tariff in excess of 10%. By 1996 no industry had tariffs in excess of 10%. For low-end manufacturing with its tight profit margins, this represents very steep tariff cuts indeed.
- The FTA called for reductions not only in Canadian tariffs against the United States, but also in U.S. tariffs against Canada, and various forms of non-tariff barriers to trade between the two countries. In this regard it is important to note that the structure of tariffs across industries is similar in both Canada and the United States and that industries receiving protection often receive both tariff and non-tariff protection. Thus, the FTA-mandated Canadian tariff cuts are highly correlated both with cuts in non-tariff barriers to trade and with U.S. tariff cuts. In a regression setting, this means that the coefficient on $\Delta\tau_{i1}^{FTA}$ will also be picking up these other effects. That is, our tariff variable will be capturing the broader aspects of the FTA.

The bottom line is that $\Delta\tau_{i1}^{FTA}$ will be capturing FTA effects that are far from being too small to matter.

Inference in a non-experimental setting

The econometric work in this paper is all about correlating the $\Delta\tau_{i1}^{FTA}$ with Δy_{i1} where Δy_{i1} is the FTA period change in either employment or labour productivity. In studying this issue it is tempting to draw an analogy with a clinical drug trial. In such a trial, patients are randomly allocated between the treatment and control groups. In our setting, industries facing steep tariff cuts are being

treated to the 'drug' of free trade. However, the analogy does not go very far because industries that receive the drug (mainly low-end manufacturing) are and were very different from those that faced no tariff cuts (high-end manufacturing). Restated, there is no randomization of industries into the treatment and control groups. As a result, any difference between the 'treated' and 'un-treated' industries may be spurious: The industries that experienced the deepest tariff cuts may have had non-FTA related characteristics that may have led to falling employment and rising productivity. Ignoring the difference in group characteristics may lead one to incorrectly attribute falling employment and rising productivity to the FTA.

Before reviewing these differences, table 1 describes the classification of industries into groups that will be used throughout this paper. We divide the industries into 4 groups, depending on the depth of the FTA-mandated tariff cut between 1988 and 1996. Note that we put a minus sign in front of $\Delta\tau_{i1}^{FTA}$ in order to convert it into a positive number.

Table 1. Description of Industry Groups

Group Description	Minimum Tariff Cut $(-\Delta\tau_{i1}^{FTA})$	Maximum Tariff Cut $(-\Delta\tau_{i1}^{FTA})$	Number of Industries (Observations)
Heavily Impacted Industries	8%	33%	34
Moderately Impacted Industries	4%	8%	51
Lightly Impacted Industries	1%	4%	56
Non-Impacted Industries	0%	1%	72

We now turn to examining the differences between these 4 groups. We know that if there were random assignment of industries into the 4 groups, then the characterisitics of the 4 groups

would be identical. However, table 2 shows that this is not the case. In fact, each indicator trends strongly with the depth of the tariff cut. Consequently, we can focus our attention solely on the heavily impacted versus non-impacted industries (and not be troubled with reporting results for the moderately and lightly impacted industries). From table 2, it is clear that the deeper the FTA-mandated tariff cut, the lower was the industry's labour productivity, capital-labour ratio, and output per plant in 1988. Table 2 also reports results for production and non-production workers. Production workers are involved in shop-floor activities and are less educated on average than non-production workers. Non-production workers include employees in management and other activities that are not directly related to production. From table 2, we can see that the deeper the tariff cut, the lower were (1) the 1988 wages and weekly hours of production workers, (2) the 1988 annual earnings of non-production workers, and (3) the ratio of non-production workers to total workers. Finally, the deeper the tariff cut, the lower the 1988 level of imports from the United States. This is true relative to total imports and relative to Canadian (domestic) production. Clearly, in 1988 the heavily impacted industries looked very different from the non-impacted industries.

Testing the Efficacy of the Free Trade 'Drug'

In a clinical trial setting, the average characteristics of patients in the treatment group are identical to the average characteristics of patients in the control group. This is the result of random assignment. In our non-experimental setting there is a commonly used strategy for dealing with the fact that groups differ in their characteristics. We turn to this now.

We are interested in a regression model explaining the impact of FTA tariff cuts on the growth rates of employment and productivity. For each t, we will examine a model of the form

Table 2. Average Industry Characteristics by the Size of the Tariff Cut

	Heavily Impacted Industries	All Industries	Non-Impacted Industries
Industry Characteristics			
Labour Productivity	.029	.043	.050
Capital/Labour	.015	.044	.061
Output per Plant	.008	.027	.052
Employment and Earnings			
Hourly Wages of Production Workers	$10.92	$14.04	$15.26
Weekly Hours of Production Workers	41.4	41.8	42.2
Annual Earnings of Non-Production Workers	$39,017	$42,950	$44,303
(Non-Production Workers)/(All Workers)	18%	25%	29%
Trade Characteristics			
Imports from U.S. Relative to Total Imports	31%	61%	69%
Imports from U.S. Relative to Cdn. Production	9%	28%	51%

Notes: All data apply to 1988. Cell entries are unweighted averages across all industries in the group. See table 1 for a definition of the groups.

$$\Delta y_{is}(t) = \alpha_i + \alpha_s + \beta \Delta \tau_{is}^{FTA}(t) + \gamma \Delta y_{is}^{US}(t) + \delta_i \Delta z_s(t) + \varepsilon_{is}, \qquad s = 0, 1 \text{ and } i = 1, \ldots, N. \quad (3)$$

α_i, α_s, Δy_{is}^{US}, and $\delta_i \Delta z_s$ are regressors that control for the fact that heavily impacted industries are different from non-impacted industries. We will turn shortly to explaining each of these regressors. However, before doing so note that equation (3) will be estimated separately for each *t* i.e., for each choice of number of years into the FTA period (1988, 1988 + *t*). This will allow us to investigate the timing of the effects of the FTA. It is this that is our new econometric contribution.

Controlling for secular growth (α_i)

Figure 6 illustrates a potential pitfall for efforts to assess the FTA. The figure plots the evolution of employment in some fictitious industry, say women's garments, from 1980-1996. Looking just at the FTA period, one sees that as the tariff came down, so did employment. The obvious inference is that the FTA reduced employment. Clearly, this inference is misleading: a look at the pre-FTA period shows a secular downward trend that is independent of the FTA.

If all the industries that experienced deep tariff cuts just happened to look like our figure 6 industry then we would mistakenly attribute employment losses to the FTA. What makes this possibility worrisome is that there is every reason to think that figure 6 is representative. Sluggish growth or even decline is an important factor determining an industry's ability to lobby successfully for protection. This political economy effect is well documented (e.g. Trefler 1993). Thus, industries that declined in the pre-FTA period likely had high tariffs in 1988 and hence deep FTA period tariff cuts. Table 3 provides examples of these industries.

Figure 6
Secular Growth

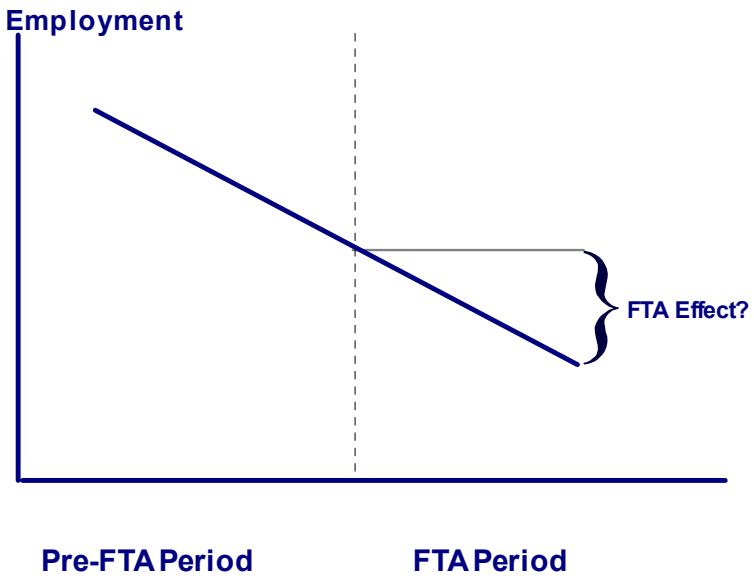


Table 3. Examples of Highly Impacted Industries Displaying Secular (Figure 6) Behaviour

Industry (4-digit SIC)	FTA Period Employment Growth (Δy_{i1})	Pre-FTA Period Employment Growth (Δy_{i0})	FTA Period Tariff Cut ($-\Delta \tau_{i1}^{FTA}$)
Women's Blouse and Shirt Industry	-17%	-19%	9%
Women's Dress Industry	-12%	-6%	16%
Women's Coat and Jacket Industry	-10%	-10%	16%
Shipbuilding and Repair Industry	-8%	-8%	24%
Men's and Boy's Coat Industry	-6%	-6%	14%

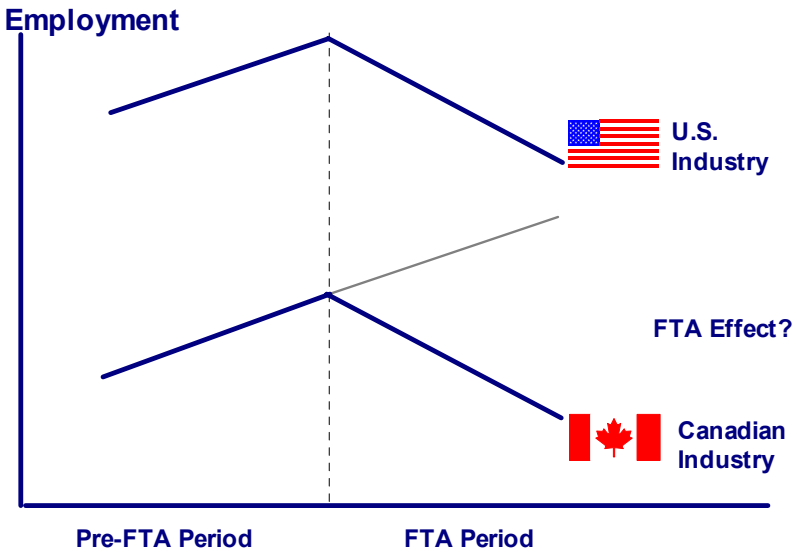
Notes: (*a*) Industries are defined at the 4-digit SIC level. (*b*) Δy_{i1} and $\Delta \tau_{i1}^{FTA}$ uses changes over 1988-96. Δy_{i0} uses changes over 1980-86.

To prevent secular growth trends from being imputed to the FTA tariff cuts, we introduce a growth fixed effect α_i into equation (3). As a result, our analysis only picks up growth effects that are departures from trend growth. This is important. *The aggregate times series trends in employment and labour productivity that drove the analysis of section 2 will be irrelevant for the following econometric analysis.*

Taking into consideration "idiosyncratic shocks" (Δy_{is}^{US})

Figure 7 illustrates a different type of problem, one that arises from putting too much stock in secular trends. In the fictitious Canadian industry illustrated in figure 7, there is employment growth up to implementation of the FTA and decline thereafter. The secular trend argument of figure 6 leads one to think that in the absence of the FTA, the industry would have continued growing at a rate given by the grey line. That is, the difference between the Canadian and grey line would be viewed as employment losses attributable to the FTA. Now consider the top line in figure 7, which

Figure 7
Idiosyncratic Shocks



shows the U.S. counterpart of our fictitious Canadian industry. This fictitious U.S. industry takes a sharp employment hit during the FTA period. Perhaps this was due to technical change that made the product obsolete, or to new competition from Korea or to one of many other possible demand and supply shocks that were *idiosyncratic* to the industry in that period.

Examples of industries that behaved as in figure 7 are common. Table 4 lists a number of such industries that are members of the highly impacted group. In each of these cases, failure to control for idiosyncratic shocks would have led one to incorrectly attribute Canadian labour productivity gains to the FTA. To avoid this we control for idiosyncratic supply and/or demand changes by introducing a U.S. control Δy_{is}^{US} into regression equation (3). Δy_{is}^{US} is the U.S. counterpart to Δy_{is}. For example, if Δy_{is} is Canadian employment growth, Δy_{is}^{US} is U.S. employment growth. Trefler (2001) examines the endogeneity of Δy_{i1}^{US} and provides abundant evidence that endogeneity is not important empirically.

Table 4. Highly Impacted Industries Displaying Idiosyncratic (Figure 7) Behaviour

	FTA Period Cdn. Labour Productivity Growth (Δy_{i1})	FTA Period U.S. Labour Productivity Growth (Δy_{i1}^{US})	Pre-FTA Period Cdn. Labour Productivity Growth (Δy_{i0})	FTA Period Tariff Cut ($-\Delta \tau_{i1}^{FTA}$)
Fur Goods Industry	-15%	-12%	5%	10%
Luggage and Handbag Industry	-8%	-9%	0%	8%
Footwear Industry	-8%	-8%	1%	13%
Children's Clothing Industry	-7%	-10%	2%	16%
Other Clothing and Apparel	-5%	-4%	3%	10%
Sweater Industry	-5%	-9%	6%	16%
Other Office Furniture	-1%	-3%	10%	9%

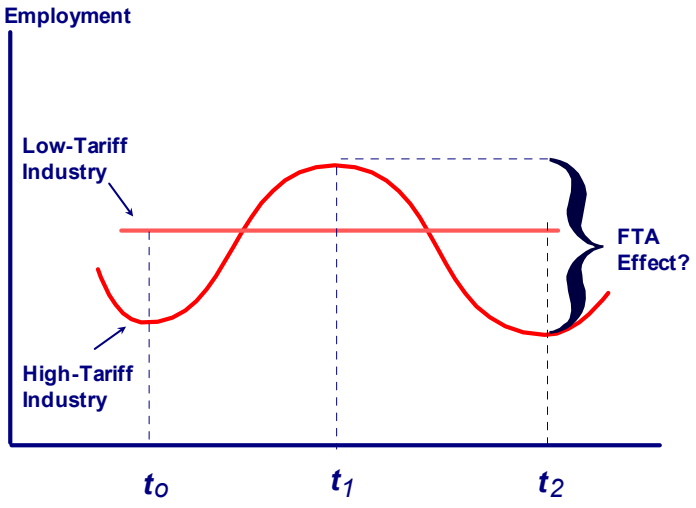
Notes: (*a*) Industries are defined at the 4-digit SIC level. (*b*) Δy_{i1}, Δy_{i1}^{US} and $\Delta \tau_{i1}^{FTA}$ uses changes over 1988-96. Δy_{i0} uses changes over 1980-86.

Cyclicality and business conditions (Δz_s)

A key issue for examining the FTA is the treatment of the early 1990s recession. The recession started in 1989 and GDP did not recover to 1988 levels until 1993. A major problem arises from the fact that industries differ both in terms of their sensitivity to business cycles and in terms of the peak-to-peak timing of their cycles. Figure 8 illustrates the problem using two fictitious industries. To make matters as clear as possible, our fictitious low-tariff industry features no cyclicality and is represented by a straight line in figure 8. In contrast, our figure 8 high-tariff industry is cyclical. Suppose we examined employment changes over the period from t_1 to t_2. We would observe no employment losses in the low-tariff industry and large employment losses in the high-tariff industry. However, if we compared year t_2 with a comparable point on the pre-FTA business cycle (i.e., year t_0), a different conclusion emerges. Again to keep things simple, we have drawn figure 8 so that employment is down by the same amount at both t_0 and t_2. In this case, the correct inference is thus that the FTA had no impact.

In practice, as opposed to our fictitious example, it is not possible to guess at the direction of bias introduced by cyclicality. The main message is only that one must control for cyclicality. General business conditions can be introduced into equation (3) by including a regressor $\Delta z_s(t)$ that measures movements in GDP, the exchange rate, Canada-U.S. interest rate differentials, and other macro variables. The s subscript indexes the period while the t argument indexes the number of years into the period. $\Delta z_s(t)$ has no industry subscript. However, the impact of these macro variables will vary from industry to industry. Thus in equation (3), $\Delta z_s(t)$ has a coefficient δ_i that varies across industries.

Figure 8
Cyclicality and Business Conditions



Double Differencing

We have now finished explaining equation (3). We repeat it here for reference. For each t,

$$\Delta y_{is}(t) = \alpha_i + \alpha_s + \beta \Delta \tau_{is}^{FTA}(t) + \gamma \Delta y_{is}^{US}(t) + \delta_i \Delta z_s(t) + \varepsilon_{is}, \qquad s = 0, 1 \text{ and } i = 1, \ldots, N. \quad (4)$$

With N industries and 2 periods, there are $2N$ observations. However, there are $2N + 4$ parameters for each t.[5] To eliminate the α_i, we follow the usual approach of differencing across periods. Further, by judicious choice of t's, we can also eliminate the $\delta_i \Delta z_s(t)$. The argument is as follows.

From table 5, the 1980-86 and 1988-96 periods had many common elements. The start year of each was the end year of a prolonged expansion. The second year of each ushered in a deep recession that reduced manufacturing GDP by 10%. The major difference between the two recessions is in their length. After these recessions, GDP growth was similar in both periods. Since our sample ends in 1996, this means that GDP growth was similar over the 1983-86 and 1993-96 periods.

Table 5. Matching the Business Cycles

Panel A. Comparison Across Periods

Pre-FTA Period	FTA Period	Comments
1980	1988	A year of robust growth
1981	1989	The peak of the business cycle
1982	1990-92	A deep recession. Manufacturing GDP off by 10% in both periods.
1983-86	1993-96	Expansionary period. Manufacturing GDP growth similar in both periods.

Notes: The FTA was implemented on January 1, 1989. 1988 appears in the FTA period column because it is used as a base year for calculating FTA period changes.

5 The $2N$ parameters are the α_i and the δ_i. The 4 parameters are β, γ, and the α_s for $s = 0, 1$. Note that all parameters should be indexed by t. We forgo this additional notation.

Panel B. Year-by-Year Match

Pre-FTA Period	FTA Period
1980-83	1989-93
1980-84	1989-94
1980-85	1989-95
1980-86	1989-96

The upshot of all of this is that we have identified common periods in the two business cycles. These are given in panel B of table 5. First, 1980 and 1988 were comparable points on the two cycles. Second, 1980+t−2 and 1988+t (for t = 5, 6, 7, 8) were comparable points on the two cycles. It follows that $\Delta z_1(t) = \Delta z_0(t-2)$ for t = 5, 6, 7, 8.

If we now difference equation (4) across periods we obtain

$$\left(\Delta y_{i1}(t) - \Delta y_{i0}(t-2)\right) = \alpha + \beta \Delta \tau_{i1}^{FTA}(t) + \gamma\left(\Delta y_{i1}^{US}(t) - \Delta y_{i0}^{US}(t-2)\right) + v_i$$

$$t = 5, 6, 7, 8 \text{and } i = 1, \ldots, N \qquad (5)$$

where $\alpha \equiv \alpha_1 - \alpha_0$ and we have used the fact that $\Delta \tau_{i0}^{FTA}(t) = 0$. In words, by judicious choice of periods we have placed industries at about the same point on the business cycle in each of the two periods. In this way, the pre-FTA period data on each industry's business cycle sensitivity has been used to control for its FTA period cyclical sensitivity.

Inspection of equation (5) reveals that we have eliminated all but 3 unknown parameters, α, β, and γ. At the same time, we have controlled for secular trends, idiosyncratic demand and supply

shocks, and differential business cycle sensitivity. Equation (5) is far more complex than its parsimonious specification suggests. It will be our estimating equation.[6]

Data

A word about the database. It spans the years 1980-96 and combines detailed industry data from a large number of disparate sources. Canadian data came from Statistics Canada. The variables include: imports and tariff duties from special tabulations of the International Trade Division; employment of all workers, hours worked by production workers, and value added in production activities from special tabulations by the Canadian Annual Survey of Manufactures (ASM) Section; output deflators from the Input-Output Division and the Prices Division; and concordances from U.S. SIC (1987) and Canadian SIC (1970) to Canadian SIC (1980), from the Standards Division. Most of the U.S. data are from the National Bureau of Economic Research (NBER) Manufacturing Productivity Database (Bartelsman and Gray, 1996). See Trefler (2001) for details.

A key issue deals with the measurement of productivity. It would be ideal to look at total factor productivity (TFP) using detailed 4-digit SIC data. Unfortunately, the Canadian ASM does not record the capital stock or investment information necessary for calculating 4-digit SIC level TFP. We therefore must use labour productivity i.e., value added per unit of labour.

There remain 2 issues. First, it is better to measure labour by hours worked rather than by employment. Such information is available for production workers only. Recall that the Canadian data distinguish between workers employed in manufacturing activities and non-manufacturing activities. We have been referring to these as production and non-production workers since the

6 We will not discuss the issue of the endogeneity of tariffs. For all the specifications we report we have tested for endogeneity using a Hausman test. In every case, endogeneity is rejected. Details of the endogeneity test appear in Trefler (2001).

distinction broadly follows that used in the U.S. ASM. We therefore define labour productivity as value added in production activities divided by hours worked in production activities. As Trefler (2001) shows, our results are robust to redefining labour productivity as value added in all activities divided by total employment. Second, one must deflate value added. We deflate by output deflators rather than by the preferred, but unavailable, value added deflators. Trefler (2001) provides some evidence at the 2-digit SIC level that this does not matter for the purposes at hand. Finally there are a number of other more standard issues to be dealt with that are described in Trefler (2001). One issue not dealt with there has to do with the treatment of purchased services. This is discussed in appendix 1.

4. Findings —Productivity Growth and Employment Losses

Labour Productivity

Table 6 reports the estimates of equation (5) for labour productivity. There are 3 parameters, α which is the intercept, β which is the coefficient on $\Delta\tau_{i1}^{FTA}(t)$, and γ which is the coefficient on $\Delta y_{i1}^{US}(t) - \Delta y_{i0}^{US}(t-2)$. The parameter of interest is β which gives the impact of the tariff cuts on labour productivity. Each row corresponds to a different end-point of the pre-FTA and FTA periods i.e., to a different *t*. For example, row 1 corresponds to pre-FTA changes over 1980-86 and FTA changes over 1988-96. This is the longest horizon that we can consider because 1996 is the last year for which we have data. Row 4 corresponds to pre-FTA period changes over 1980-1983 and FTA changes over 1988-1993. This is the shortest horizon that we can properly consider because of the timing of the 2 business cycles. See table 5 for further details.

Table 6. Regression Estimates for Labour Productivity

Row	FTA Period Horizon	$\Delta \tau_{i1}^{FTA}(t)$		$\Delta y_{i1}^{US}(t) - \Delta y_{i0}^{US}(t-2)$		Intercept		$\overline{R}^2$
		β	s.e.	γ	s.e.	α	s.e.	
1	1996	-1.56 **	0.49	0.32 **	0.09	0.01 *	0.00	0.09
2	1995	-1.43 **	0.52	0.15	0.10	0.00	0.00	0.04
3	1994	-1.32 *	0.54	-0.04	0.10	-0.01	0.01	0.02
4	1993	-0.79	0.64	-0.15	0.11	0.00	0.01	0.01
5	1992	-0.75 *	0.34	0.17	0.12	0.00	0.01	0.02
6	1991	-0.59	0.62	0.04	0.12	-0.01	0.01	-0.01

Notes: This table reports estimates of equation (5). There are 202 observations. The FTA period horizon is the end year chosen for the FTA period. See table 5 for details. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

Rows 1-4 of the table provide a strong sense of the timing of the labour productivity effects. The clear feature is that the estimated β rise and their standard errors fall as the FTA period horizon grows from 1993 to 1996. *That is, the labour productivity impact of a given tariff cut strengthens as the adjustment period lengthens.*

It would be nice to push the analysis back to the early years of the FTA before any significant adjustment period had elapsed. In other words, it would be nice to consider the labour productivity effects for horizons ending in 1990, 1991, and 1992. As discussed earlier, this is not possible because of business cycle timing issues. Indeed, because of this, we did not even collect the 1981-82 data that would have allowed for a crude examination of this issue. This said, a very crude but feasible approach for 1992 matches the 1989-92 and 1980-84 periods (row 5 of table 6). Likewise, a very crude approach for 1991 matches the 1989-91 and 1980-83 periods (row 6). From the table, the estimated β do fit the pattern described above in which the estimated β do grow as the time horizon grows.

Trefler (2001) only reports the results for a single specification, namely a specification similar to that of row 1 of table 6. This is because he was not interested in the timing issues that are at the heart of our paper. Also, Trefler's results corresponding to row 1 are slightly different, reflecting the fact that, unlike Trefler, we have omitted the nine 4-digit SIC industries corresponding to the automotive sector. Finally, Trefler considers a considerable number of specification checks. We have examined all of those checks here only to arrive at the same conclusion as Trefler (2001): our estimates are robust to a wide variety of alternative specifications.

We are interested in the timing of the labour productivity impacts. This is not completely answered by our estimated β. For one, β is an elasticity whereas we are interested in the total impact. For another, even if β were constant over time the FTA impact would rise over time because the size

of the tariff cut deepens as the FTA horizon lengthens. To get at the impact of the FTA on labour productivity we need 2 definitions. Let *Observed Change* be the log or percentage change in labour productivity over the first *t* years of the FTA period. The percentage change is calculated as the weighted average of the percentage changes in each industry. The weights used are the industry's share of value added in production activities (the numerator of labour productivity). Let *Change Due to FTA* be the log or percentage change in labour productivity estimated to be caused by the FTA. Appendix 2 provides exact formulas for *Observed Change* and *Change Due to FTA*.

The top and bottom panels of table 7 report *Change Due to FTA* and *Observed Change*, respectively, for different values of the horizon *t*. Consider first the 'All Industries' column. The FTA had raised labour productivity by 1.1% as of 1991, by 2.6% as of 1993, and by 4.7% as of 1996. Further, these figures rise at each horizon *t*, indicating that the productivity benefits of the FTA have not plateaued. The results are even more striking when one considers the highly impacted industries (those with tariff cuts in excess of 8% over 1988-96). For this group, the FTA had raised labour productivity by 5% as of 1991, by 11% as of 1993, and by an extraordinary 26% as of 1996. Further, growth in the productivity gains shows no sign of abating.

This paper implicitly compares several hypotheses. The first states that because of agglomeration economies, all productivity gains from the FTA flow to the United States. This is obviously incorrect. The second states that there are productivity gains, but that these are small and come only after a long period of incubation. This is also incorrect. Table 7 demonstrates that *the labour productivity affects of the FTA were enormous, arrived quickly, and continue to accrue*.

Table 7. The Labour Productivity Impacts of the FTA

Horizon	β	All Industries	Highly Impacted Industries	Moderately Impacted Industries	Lightly Impacted Industries	Non-Impacted Industries
Change Due to FTA						
1988-1996	-1.56	4.7%	26%	9%	4%	-1%
1988-1995	-1.43	4.5%	22%	8%	4%	-1%
1988-1994	-1.32	4.3%	17%	8%	4%	1%
1988-1993	-0.79	2.6%	11%	4%	2%	0%
1988-1992	-0.75	2.3%	13%	3%	2%	0%
1988-1991	-0.59	1.1%	5%	2%	1%	0%
Observed Change						
1988-1996		20%	28%	16%	25%	18%
1988-1995		17%	25%	10%	19%	17%
1988-1994		16%	23%	8%	19%	15%
1988-1993		9%	19%	4%	16%	5%
1988-1992		2%	16%	1%	6%	-2%
1988-1991		-2%	12%	-3%	1%	-6%
$\Delta \tau_{i1}^{FTA}$			> 8%	> 4%	> 1%	< 1%
Observations			34	51	56	72

A Note on the Size of the Labour Productivity Gains

From the *Observed Change* panel of table 7, the FTA labour productivity effect has been a major contributor to rising productivity. For example, the FTA explains 4.7 percentage points of the 20 percentage point increase in labour productivity experienced by all of manufacturing as of 1996. *That is, manufacturing experienced substantial productivity benefits in the FTA period, about one quarter of which are due to the FTA.*

This 4.7% labour productivity effect is large when one considers that most industries had very low tariffs going into the FTA. The average tariff cut was only 4.5%. For the highly impacted industries the FTA-induced productivity gains as of 1996 were a huge 26 percentage points and account for almost all of the productivity gains in those industries.

Finally, it is helpful to present the 1996 productivity gains on an annual basis since then they are in units comparable to more familiar indicators such as GDP growth. Since we are working in log changes, the numbers can be put into compound annual changes simply by dividing by 8. For all of manufacturing, the FTA tariff concessions raised labour productivity by 0.6% per year. For the highly impacted industries, *the tariff concessions raised labour productivity by 3.3% per year. These are enormous changes, large enough to wipe out differences between Canadian and U.S. productivity growth. We find it amazing that a government policy could be so effective in raising labour productivity.*

Employment

Table 8 reports the estimates of equation (5) for employment and for various horizons *t*. The coefficient β on $\Delta\tau_{i1}^{FTA}(t)$ is statistically significant for almost every horizon *t*, indicating that the FTA-mandated tariff cuts reduced employment. Most interesting for our purposes is the time profile

Table 8. Regression Estimates for Employment Growth

Row	FTA Period Horizon	$\Delta \tau_{i1}^{FTA}(t)$		$\Delta y_{i1}^{US}(t) - \Delta y_{i0}^{US}(t-2)$		Intercept		$\overline{R}^2$
		β	s.e.	γ	s.e.	α	s.e.	
1	1996	1.57 **	0.55	0.20 *	0.08	-0.01 **	0.00	0.08
2	1995	1.76 **	0.55	0.22 **	0.08	-0.01	0.01	0.10
3	1994	1.75 **	0.59	0.22 **	0.08	0.00	0.01	0.08
4	1993	1.21 *	0.62	0.27 **	0.07	0.00	0.01	0.09
5	1992	0.99 **	0.34	0.21 *	0.08	-0.02 **	0.01	0.07
6	1991	0.66	0.59	0.24 **	0.07	-0.01	0.01	0.05

Notes: This table reports estimates of equation (5). There are 204 observations. The FTA period horizon is the end year chosen for the FTA period. See table 5 for details. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

of these employment reductions. From table 8, the estimated β increase only up to 1994. That is, the impact of a given tariff cut diminishes after 1994 as the sector adjusts.

As before, one must distinguish between the impact for a *given* tariff cut (i.e., β) and the change due to the FTA as tariffs were cut year after year. Table 9 provides the information on *Change Due to FTA* and on *Observed Change*. From the 'All Industries' column, the FTA had reduced employment by 1.3% as of 1991, by a peak 6.4% as of 1994, and by 5.3% as of 1996. The evidence is quite clear that the employment losses have already peaked. This is as true for all of manufacturing as it is for each group of industries. For example, the highly impacted industries had lost an incredible 21% of their employment by 1994. This was vividly shown earlier in Figure 1.

The size of the employment losses is alarming. From the bottom panel of table 9, the FTA-induced employment losses account for a third of all lost employment as of 1996. It is, though, of some interest that the employment losses do not explain all of the employment losses in the highly impacted industries. Early on, in 1992, these industries had taken a big employment hit that appears to have been independent of the FTA. This casts doubt on whether the recession was induced by the FTA.

To summarize, the industries that were heavily impacted by the FTA suffered staggering employment losses. Further, the timing of these losses was not straightforward: most of the losses came after the recession (i.e., after 1992) and by 1994 these losses had peaked.

5. General Equilibrium Considerations

A major problem with this study is that it does not take into account the general equilibrium interactions between industries. These interactions are the primary channel through which

Table 9. The Employment Impacts of the FTA

Horizon	β	All Industries	Highly Impacted Industries	Moderately Impacted Industries	Lightly Impacted Industries	Non-Impacted Industries
Change Due to FTA						
1988-1996	1.57	-5.3%	-22%	-9%	-4%	1%
1988-1995	1.76	-6.0%	-22%	-10%	-5%	0%
1988-1994	1.75	-6.4%	-21%	-10%	-6%	-1%
1988-1993	1.21	-4.2%	-14%	-7%	-4%	-1%
1988-1992	0.99	-2.8%	-10%	-4%	-2%	0%
1988-1991	0.66	-1.3%	-4%	-2%	-1%	0%
Observed Change						
1988-1996		-16%	-36%	-20%	-16%	-8%
1988-1995		-15%	-33%	-18%	-15%	-7%
1988-1994		-17%	-32%	-18%	-18%	-11%
1988-1993		-18%	-30%	-18%	-20%	-14%
1988-1992		-17%	-29%	-15%	-23%	-11%
1988-1991		-13%	-21%	-9%	-19%	-9%
$\Delta \tau_{i1}^{FTA}$			> 8%	> 4%	> 1%	< 1%
Observations			34	51	56	72

international trade is expected to affect domestic economies. In the standard trade model, tariff reductions lead to a shift of employment from the least competitive to the most competitive sectors. This mechanism cannot be captured by our methodology. Indeed, it is not easily or obviously captured by any known methodology.

However, we can sign the bias associated with this elusive general equilibrium effect. Consider employment and figure 9. The top line plots employment for some fictitious industry that had zero tariffs going into the FTA period. The bottom line plots employment for some fictitious industry that lost employment as a result of FTA-mandated tariff cuts. Our methodology implicitly compares the performance of the two industries and attributes the difference to the FTA. (See *Estimated FTA Effect* in figure 9.) However, a different interpretation is that the FTA shifted employment out of the less-competitive industry (the high-tariff industry) and into the more-competitive industry (the zero-tariff industry). In this case, the FTA induced employment losses in one industry, employment gains in another, and only modest net employment losses.

Is there any evidence of this possibility? Between 1988 and 2000, U.S. manufacturing employment contracted by 4.4%. Using this as a benchmark, we expect Canadian manufacturing to have also contracted by 4.4%. In fact, it expanded by 0.7% i.e., Canadian manufacturing growth did 5.1 percentage points better than its U.S. counterpart. Similar conclusions emerge from the spotty data available on manufacturing employment in other countries. The International Labour Organization has a project that puts manufacturing employment on a consistent basis across countries and time. The data are limited. For example, the most recent year is 1994 and Canada is excluded from the sample. Table 10 reports the compound annual rates of change in manufacturing employment for all the countries included in the project. (For reference, Canada is also included in the table.) The table places the growth of Canadian manufacturing employment in a favourable light.

Figure 9
General Equilibrium Effects

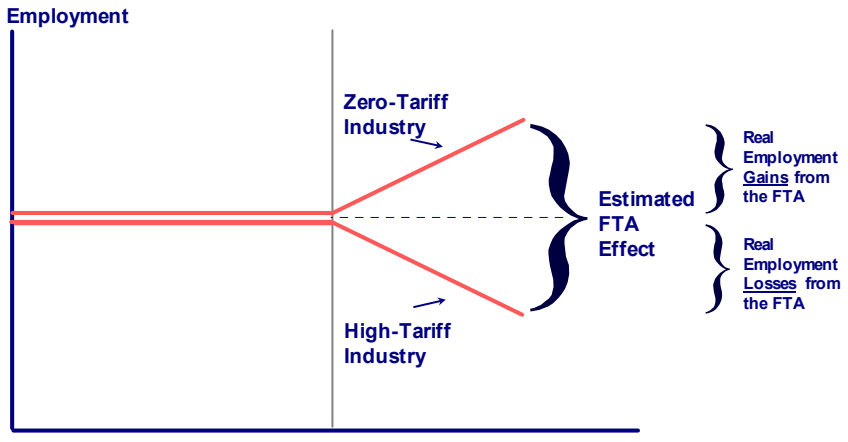


Table 10. Compound Annual Changes in Manufacturing Employment

Country	Employment Change	Period
Hong Kong	-7.1%	1988 - 1994
Germany	-6.1%	1991 - 1994
Finland	-5.7%	1989 - 1994
Sweden	-4.6%	1988 - 1994
Spain	-2.1%	1988 - 1994
France	-1.8%	1988 - 1994
Norway	-1.8%	1988 - 1994
Australia	-1.8%	1988 - 1993
United States	-1.7%	1988 - 1993
Korea	-0.8%	1990 - 1994
Japan	0.5%	1988 - 1994
New Zealand	0.5%	1988 - 1994
Canada	**0.7%**	1988 - 2000
Turkey	0.8%	1989 - 1993
Netherlands	1.2%	1988 - 1992
Portugal	1.4%	1988 - 1991
Singapore	1.5%	1988 - 1994
Philippines	2.4%	1988 - 1994
Indonesia	9.9%	1988 - 1994

Source: International Labour Office. "ILO-Comparable Annual Employment and Unemployment Estimates (No. 6)," *Bulletin of Labour Statistics* , 1996-2, pp. XI-XLVI. The Canadian data are not available from this source. Instead, CANSIM data have been used.

Among the G8 countries in table 10, Canada has the best performance. Indeed, most countries in the table experienced significant employment contractions. *This leads us to believe that the FTA did not reduce employment in Canadian manufacturing. Rather, the FTA induced a shift of employment from high-tariff industries to low-tariff industries, just as predicted by trade theory. Nevertheless, the large employment losses for high-tariff industries are indicative of large transition costs associated with moving out of low-end, heavily protected industries and into high-end, competitive industries.*

We next turn to productivity. Our results suggest that the FTA induced productivity growth *within* industries. However, the results say nothing about the general equilibrium impact of the FTA on aggregate productivity. From table 2 we know that the highly impacted industries tend to have below-average labour productivity. If the FTA shifted output away from these industries and towards less-impacted, high-productivity industries, then the FTA should have raised labour productivity in a way not captured by our results.

We can analyze this imperfectly by asking whether the FTA period was accompanied by a rise in the between-industry component of productivity growth. In fact, there has been no such trend. During a period in which productivity grew by 20% (see table 7), the between-industry component of productivity growth was effectively 0% at each horizon *t*. *Thus, we have the surprising and puzzling result that the FTA re-allocated labour out of low-productivity industries and into high-productivity industries, but that this reallocation did not contribute to rising productivity.*

6. Conclusions

What are our main findings? Our estimates show that between 1988 and 1996, the FTA reduced employment by 5% for manufacturing as a whole and by 22% for the manufacturing industries that experienced the deepest cuts. On the other hand, the FTA raised manufacturing labour productivity by 5% and, for those industries experiencing the deepest cuts, by a remarkable 26%. These numbers would seem to suggest that the FTA involved heavy employment adjustment costs and huge productivity benefits. This paper addresses two issues raised by these costs and benefits.

First, there is a question about the timing of the employment losses. We offer strong evidence that the employment losses were both temporary and concentrated early on. That they were concentrated early on is crystal clear from figure 1: employment losses peaked, or at least plateaued, by 1994. That the employment losses were not permanent is less clear; however, the fact that Canadian manufacturing has returned to its 1988 employment levels whereas U.S. and other G8 manufacturing sectors have not suggests to us that the FTA had no net employment effects. Of course, this is not meant to minimize the adjustment costs borne by labour as the FTA shifted employment out of low-end, high-tariff industries and into high-end, low-tariff industries.

Second, there is a question about the *net* benefits accruing from the FTA. With discounting, the more 'front-ended' are the employment costs relative to the productivity benefits, the lower are the net benefits from the FTA. Thus we need to know the timing of the costs and benefits before we can properly past judgement on the achievements of the FTA. As shown in figure 1, these costs and benefits accrued at roughly the same rate. For the highly impacted industries especially, there is no sense in which the employment costs were front-ended relative to the productivity gains. Thus, any assessment of the FTA must be independent of the discount rate used. It should focus instead on

winners and losers, on those workers and industries that bore the brunt of the short-run employment losses *versus* those workers, industries, and consumers that garnered the benefits of long-run productivity gains.

Without in any way denigrating the employment losses, we conclude by focussing on the productivity gains. The reason is simple. Despite the many claims about the productivity benefits of freer trade, the econometric evidence is entirely unpersuasive. Our work thus fills an important gap in the literature. This paper implicitly compared several hypotheses. The first states that because of agglomeration economies, all productivity gains from the FTA flow to the United States. We showed this to be incorrect. The second states that there are productivity gains, but that these are small and come only after a long period of incubation. We also showed this to be incorrect. *In fact, we showed that the FTA induced enormous labour productivity gains. Further, these gains arrived quickly and continue to accrue*. This finding is an important contribution to discussions concerning the net benefits of tariff concessions, discussion that are bound to be revisited as we debate the merits of a Free Trade Area of the Americas.

Appendix 1. A Data Issue Relating to Labour Productivity

We saw that there were data limitations preventing us from using a TFP definition of productivity. But there are also a large number of data issues to be aware of when using a labour productivity definition of productivity. Some of these are taken up in Trefler (2001). However, there is one other—the data problem created by benchmarking purchased services and the inclusion of purchased services in the definition of value added. In fact, this problem plagues all productivity research. Basically, firms do not report all purchased services in the ASM questionnaires of either country. Instead, the data are benchmarked using separate surveys. In Canada, the last survey is now 15 years old. Given that Canada invests more in timely input-output tables, we can only guess that the U.S. benchmark is even older. Benchmarking means that the measure of purchased service inputs in period t is $S_t = \sigma Q_t \varepsilon_t$ where Q_t is output, $\sigma = S_0 / Q_0$ is the ratio of purchased services to output in the benchmark year, and ε_t is the benchmarking error. Using obvious notation and simplifying to avoid issues of chaining, deflation, and multiple inputs, define $TFP_t \equiv \ln Q_t - \alpha \ln X_t - \beta \ln S_t$ where X_t collects all non-service inputs. Then the change in TFP_t is $\Delta TFP = \Delta \ln Q - \alpha \Delta \ln X - \beta \Delta \ln Q - \beta \Delta \ln \varepsilon$ and what researchers are reporting is not ΔTFP, but $\Delta TFP + \beta \Delta \ln \varepsilon$. Thus, sectoral TFP growth includes trends in the contracting out of services which benchmarking fails to pick up. This raises a set of important issues. Its relevance here depends on whether the $\Delta \ln \varepsilon$ are correlated with the tariff cuts and if so, whether the trends in the $\Delta \ln \varepsilon$ are captured by our secular growth and idiosyncratic controls.

Appendix 2. The Definition of *Observed Change* and *Change Due to FTA*

Let *I* be a group of industries e.g., the highly impacted group. Recall that $Y_{i,1988}$ is the level of, say productivity, in industry *i* in 1988. The percentage change in the productivity of industry *i* over the first *t* years of the FTA period is given by $\Delta y_{i1}(t)t$ where $\Delta y_{i1}(t)$ is the average annual log or percentage change in productivity over the first *t* years of the FTA. The industry *i* change in productivity over the first *t* years of the FTA period is approximately $(\Delta y_{i1}(t)t)Y_{i,1988}$. That is, it is the log or percentage change in the initial level times the initial level. The change in productivity among industries in any group *I* is approximately $\sum_{i\varepsilon I}(\Delta y_{i1}(t)t)Y_{i,1988}$. The percentage change in productivity is approximately $\sum_{i\varepsilon I}(\Delta y_{i1}(t)t)Y_{i,1988} / \sum_{j\varepsilon I} Y_{j,1988}$. This can be rewritten as $\sum_{i\varepsilon I}(\Delta y_{i1}(t)t)\omega_i$, where

$$\omega_i \equiv Y_{i,1988} / \sum_{j\varepsilon I} Y_{j,1988}.$$

(In the case of labour productivity, ω_i is industry *i*'s share of value added in production activities i.e., the numerator of labour productivity.) Using the fact that $\hat{\beta}\Delta\tau_{i1}^{FTA}(t)$ is the prediction of the impact of the tariff concessions, the predicted tariff-induced log change in productivity is $\sum_{i\varepsilon I}\hat{\beta}\Delta\tau_{i1}^{FTA}(t)t\omega_i$. We collect these observations in the following equations.

$$\textit{Observed Change in the first t years of the FTA period} \equiv \sum_{i\varepsilon I}\Delta y_{i1}(t)t\omega_i$$

$$\textit{Change Due to FTA in the first t years of the FTA period} \equiv \sum_{i\varepsilon I}\hat{\beta}\Delta\tau_{i1}^{FTA}(t)t\omega_i$$

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