Notes about Trefler (AER 2004): "The Long and Short of the Canada-U.S. Free Trade Agreement"

Seminario Avanzado de Comercio

José Pulido

Universidad del Rosario

2018 Term 2

Objective

- Goal: assessing (long-run) productivity gains and (short-run) employment losses of free trade agreement (FTA) between US and Canada in 1989, using plant level data
- Advantages:
  - compared to developing countries context, trade liberalization not accompanied by other policy changes
  - change in both import tariffs and tariffs faced by exporters
  - precise measure of liberalization at the firm level
  - remember that this is an FTA, so it may induce trade creation, but also trade diversion

Tariff cuts due to the FTA

The Average Canadian Tariff Rate Against:
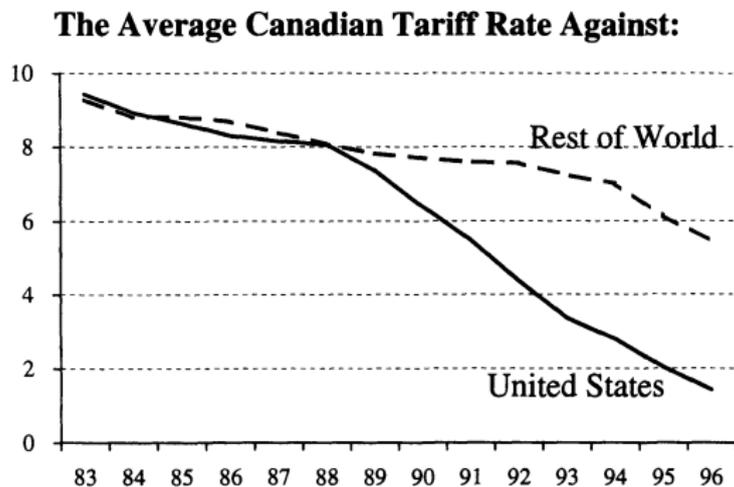
25% of Canadian industries before FTA had tariff>10%

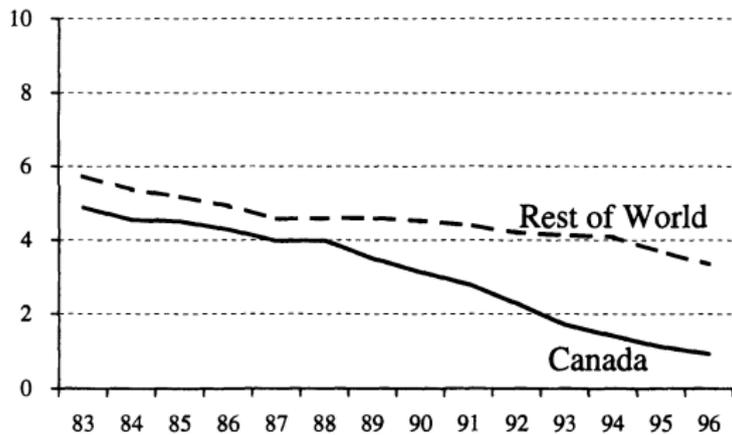**The Average U.S. Tariff Rate Against:**

Rest of World

Canada

FIGURE 1. CANADIAN AND U.S. BILATERAL TARIFFS IN MANUFACTURING
(In Percents)

Data

- Annual Survey of Manufactures: data on Canadian plants
- Labor Force Survey
- Industry level tariffs from Statistics Canada
- 213 industries, SIC (Standard Industrial Classification) 4 digit
- 3801 plants (larger than average)

Econometric specification (I)

- Indicate by y_i log of outcome of interest in industry i
- Divide period in before and after: 1980-1986 (period 0) and 1989-1996 (period 1)
- Two specifications: industry-level and plant-level
- Difference-in-difference *industry-level* specification:

$$
\begin{aligned}
(\Delta y_{i1} - \Delta y_{i0}) = & \ \theta + \beta^{CA}\left(\Delta\tau_{i1}^{CA} - \Delta\tau_{i0}^{CA}\right) \\
& + \beta^{US}\left(\Delta\tau_{i1}^{US} - \Delta\tau_{i0}^{US}\right) \\
& + \gamma\left(\Delta y_{i1}^{US} - \Delta y_{i0}^{US}\right) \\
& + \delta\left(\Delta b_{i1} - \Delta b_{i0}\right) + \nu_i
\end{aligned}
$$

  ▸ where $\Delta\tau_{i1}^{CA}$ is change of tariff between 1989 and 1996,
  ▸ $\Delta\tau_{i0}^{CA}$ change tariff 1980-1986
  ▸ Δy_{i1}^{US} US shock in sector i (variable y growth over the period)

Econometric specification (II)

- Double differencing benefits in this context:
  - take care of industry specific trends (potentially correlated with tariff changes)
  - correct for serially correlated error terms (e.g. employment is highly serially correlated)

- Difference-in-difference *plant-level* specification (plant k):

$$
\begin{aligned}
(\Delta y_{ik1} - \Delta y_{ik0}) &= \theta + \beta^{CA}\left(\Delta\tau_{i1}^{CA} - \Delta\tau_{i0}^{CA}\right) \\
&\quad + \beta^{US}\left(\Delta\tau_{i1}^{US} - \Delta\tau_{i0}^{US}\right) \\
&\quad + \gamma\left(\Delta y_{i1}^{US} - \Delta y_{i0}^{US}\right) \\
&\quad + \delta\left(\Delta b_{i1} - \Delta b_{i0}\right) + \phi x_{ik,1980} + \nu_i
\end{aligned}
$$

where $x_{ik,1980}$ plant controls in 1980 (employment, labor productivity, earnings, plant age)

Econometric specification (III)

- Control Δb_{i1}:
  - b_{i1} determined as the sensitivity of a given variable y to the cycle movement in GDP and real exchange rates, including lags (regression run industry by industry)
  - $\Delta b_{i1} =$average $\sum\limits_{t=89}^{96} \widehat{\Delta y_{it}}/8$
- Instrument for tariff changes: 1980 log values of hourly wages, employment level, Canadian imports from US, US imports from Canada

Effects on employment

TABLE 1—DETAILED RESULTS FOR EMPLOYMENT

Construction of Δb	Canadian tariffs $\Delta\tau^{CA}$		U.S. tariffs $\Delta\tau^{US}$		Business conditions Δb		U.S. control Δy^{US}		Adjusted R^2	OverId/ Hausman	Total FTA impact	
	β^{CA}	t	β^{US}	t	δ	t	γ	t			TFI	t
Industry level, OLS												
1 gdp, rer (2)	−0.12	−2.35	−0.03	−0.67	0.29	6.96	0.15	2.21	0.24		−0.05	−2.66
2 gdp, rer (0)	−0.11	−2.03	−0.04	−0.91	0.30	3.66	0.21	2.75	0.12		−0.06	−2.58
3 gdp (2)	−0.11	−2.08	−0.03	−0.66	0.37	6.60	0.15	2.16	0.23		−0.05	−2.41
4 —	−0.14	−2.40	−0.02	−0.52			0.20	2.58	0.07		−0.06	−2.58
5 gdp, rer (2)	−0.13	−2.48	−0.02	−0.39	0.28	6.74	0.29	3.00	0.24		−0.05	−1.71
6 gdp, rer (2)	−0.14	−2.75	−0.03	−0.80	0.30	7.12			0.23		−0.06	−3.16
7 —	−0.17	−2.88	−0.03	−0.66					0.04		−0.07	−3.15
8 gdp, rer (2)	−0.14	−2.24	−0.02	−0.53	0.29	6.89	0.15	2.11	0.24		−0.06	−2.65
9 gdp, rer (2)	−0.12	−2.30	−0.06	−1.45	0.30	7.23	0.14	2.04	0.27		−0.06	−3.24
Plant level, OLS												
10 gdp, rer (2)	−0.12	−3.76	0.00	0.15	0.13	4.59	0.25	5.29	0.04		−0.04	−3.26
11 gdp, rer (2)	−0.12	−3.60	−0.01	−0.26	0.16	5.63	0.25	5.21	0.02		−0.04	−3.51
Industry level, IV												
12 gdp, rer (2)	−0.24	−1.45	0.09	0.66	0.29	6.68	0.15	2.06	0.22	0.60/0.65	−0.04	−1.26
13 gdp, rer (2)	−0.24	−1.43	0.04	0.29	0.31	6.37	−0.16	−0.50	0.20	0.67/0.57	−0.05	−1.57
Plant level, IV												
14 gdp, rer (2)	−0.19	−2.40	0.07	0.94	0.13	4.30	0.24	4.96	0.04	0.14/0.99	−0.04	−2.55
15 gdp, rer (2)	−0.19	−2.44	0.07	0.92	0.13	4.17	0.16	0.95	0.03	0.10/0.89	−0.04	−3.10

Comments on effects on employment

- Various specifications with (or without) controls for sensititivity to business cycle

- Reported are not the coefficients in the above specifications, but total effect of FTA changes, i.e. $\widehat{\beta}^{CA} \Delta \overline{\tau}_{.1}^{CA}$ where $\Delta \overline{\tau}_{.1}^{CA}$ is the average tariff change in the top third industries (as ranked by tariff changes)

- t-stats refer to coefficients

- TFI is the overall effect on all industries

- Overall 5% employment decline due to FTA (or 12% in most impacted industries)

- Short-run costs since employment rate has not declined overall 1988-2002 and manufacturing employment growth in canada higher than in US and Japan (but hard to know the counterfactual)

- Overid tests indicate valid instruments, but Hausman test reject endogeneity of tariffs (against Trefler 1993)

Effects on productivity

TABLE 2—DETAILED RESULTS FOR LABOR PRODUCTIVITY

	Construction of Δb	Canadian tariffs $\Delta\tau^{CA}$		U.S. tariffs $\Delta\tau^{US}$		Business conditions Δb		U.S. control Δy^{US}		Adjusted R^2	OverId/ Hausman	Total FTA impact	
		β^{CA}	t	β^{US}	t	δ	t	γ	t			TFI	t
Industry level, OLS													
1	gdp, rer (2)	0.15	3.11	0.04	1.14	0.25	8.30	0.16	1.99	0.31		0.058	3.79
2	gdp, rer (0)	0.15	2.77	0.02	0.40	0.13	1.79	0.28	3.05	0.09		0.050	2.87
3	gdp (2)	0.17	3.21	0.04	1.17	0.25	5.19	0.21	2.43	0.18		0.065	3.87
4	—	0.16	2.85	0.01	0.34			0.29	3.23	0.08		0.051	2.89
5	gdp, rer (2)	0.14	2.79	0.05	1.36	0.26	8.77	0.05	0.31	0.29		0.058	2.46
6	gdp, rer (2)	0.14	2.96	0.05	1.44	0.27	8.82			0.30		0.059	3.89
7	—	0.15	2.58	0.03	0.76					0.04		0.053	2.98
8	gdp, rer (2)	0.17	2.97	0.04	0.98	0.26	8.34	0.16	1.95	0.30		0.061	3.76
9	gdp, rer (2)	0.16	3.27	0.02	0.49	0.26	8.61	0.18	2.24	0.33		0.051	3.36
Plant level, OLS													
10	gdp, rer (2)	0.08	1.70	0.14	3.97	0.12	3.95	0.11	1.51	0.06		0.074	4.92
11	gdp, rer (2)	0.09	1.92	0.11	3.02	0.10	3.18	0.14	1.79	0.01		0.066	4.39
Industry level, IV													
12	gdp, rer (2)	0.15	1.10	0.10	0.86	0.26	8.09	0.14	1.53	0.30	0.86/0.43	0.081	3.41
13	gdp, rer (2)	0.13	0.89	0.13	1.01	0.28	6.99	−0.08	−0.28	0.28	0.87/0.51	0.083	3.40
Plant level, IV													
14	gdp, rer (2)	0.22	1.67	0.05	0.49	0.11	3.20	0.17	1.80	0.06	0.06/0.77	0.082	2.53
15	gdp, rer (2)	0.79	2.58	−0.49	−1.73	−0.19	−1.29	2.07	2.29	0.05	0.76/0.52	0.050	0.39

Comments on effects on productivity

- Take productivity as value added per hour of production worker labor deflated by SIC output deflator to get a measure of output
- No data on capital stock in Canadian firm level data so not possible to calculate TFP
- Canadian tariff cut:
  - 15% growth in most affected industries $\implies$ 1.9% yearly growth rate in productivity
  - in plant-level regression smaller effect (row 10)
  - Trefler infers that industry-level result is driven by reallocation of market shares from low- to high-productivity plants
  - but what about row 15? (large and significant plant-level effect). Why not run a regression of change in outcome on interaction of tariffs and plant size?
- Drop in US tariff:
  - generates large growth within plant (row 10), but effect disappears in rows 14-15
  - no growth at industry level (entry of low productivity firms balances growth by high productivity ones?)
  - total impact is 7.4% growth in productivity for all firms

Effects on skill upgrading

TABLE 4—EMPLOYMENT AND SKILL UPGRADING

Variable	Canadian tariffs		U.S. tariffs		Total FTA impact		Business conditions	U.S. control	Adjusted R^2	OverId/ Hausman
	β^{CA}	t	β^{US}	t	TFI	t	δ	γ		
Employment—Production workers										
1 Industry	−0.14	−2.44	−0.07	−1.56	−0.08	−3.44	0.37*	0.16	0.33	
4 Industry	−0.13	−1.99	−0.07	−1.36	−0.08	−2.89		0.21	0.07	
6 Industry	−0.16	−2.93	−0.08	−1.71	−0.09	−4.08	0.37*		0.32	
12 Industry	−0.20	−1.28	0.03	0.17	−0.06	−1.60	0.37*	0.16	0.32	0.59/0.70
10 Plant	−0.09	−2.58	−0.03	−0.87	−0.04	−3.01	0.17*	0.29*	0.04	
Employment—Nonproduction workers										
1 Industry	−0.06	−0.71	0.05	0.79	0.00	0.02	0.36*	0.07	0.26	
4 Industry	−0.07	−0.77	0.05	0.73	−0.00	−0.09		0.14	0.00	
6 Industry	−0.06	−0.79	0.04	0.71	−0.00	−0.12	0.36*		0.26	
12 Industry	0.01	0.06	0.11	0.52	0.05	1.22	0.36*	0.11	0.25	0.18/0.36
10 Plant	−0.14	−3.02	0.04	1.19	−0.03	−1.72	0.02	0.15	0.01	
Skill upgrading										
1 Industry	0.11	1.41	0.10	1.67	0.08	2.72	0.47*	0.24	0.48	
4 Industry	0.08	0.79	0.11	1.26	0.07	1.81		0.24	0.01	
6 Industry	0.12	1.63	0.10	1.56	0.08	2.82	0.47*		0.48	
12 Industry	0.11	0.50	0.15	0.74	0.10	2.21	0.47*	0.25	0.48	0.11/0.83
10 Plant	−0.01	−0.30	0.04	1.48	0.01	0.96	0.05*	0.17	0.01	

Comments on skill upgrading

- Production worker employment decreases in response to tariff cuts (both CA and US)
- Non-production worker employment unchanged
- Skill upgrading (increase of ratio of production to non-production workers), but not significant
- Nex table (Table 5) shows additional results on workers' earnings:
  - modest rise in earnings for both production and non-productin workers (less productive workers laid off? selection of higher skill workers within both categories?)
- Output per plant unaffected by CA tariff cuts, but rises as a result of US tariff cuts

Effect on earnings and scale

TABLE 5—EARNINGS, WAGES, HOURS, INEQUALITY, AND OUTPUT

Variable	Canadian tariffs		U.S. tariffs		Total FTA impact		Business conditions	U.S. control	Adjusted R^2
	β^{CA}	t	β^{US}	t	TFI	t	δ	γ	
Earnings—All workers									
1 Industry	0.05	2.43	0.03	1.92	0.03	3.80	0.34*	0.25*	0.20
10 Plant	0.04	2.92	0.04	3.60	0.03	5.64	0.17*	0.19*	0.03
Earnings—Production workers									
1 Industry	0.04	2.12	0.00	−0.02	0.02	3.61	0.16*	0.11	0.07
10 Plant	0.05	3.25	0.03	2.57	0.03	4.74	0.12	0.21	0.02
Earnings—Nonproduction workers									
1 Industry	0.01	0.30	−0.01	−0.29	0.00	0.02	0.18*	0.12	0.08
10 Plant	0.04	1.48	0.06	2.87	0.03	3.67	0.11	0.11	0.01
Hourly wages of production workers									
1 Industry	0.05	3.15	0.03	1.84	0.03	4.37	0.60*	0.13	0.33
10 Plant	0.06	3.23	0.02	1.40	0.03	4.04	0.20	0.16*	0.01
Annual hours of production workers									
1 Industry	−0.01	−0.48	−0.02	−1.75	−0.01	−1.94	0.02	0.14	0.01
10 Plant	−0.02	−0.90	0.01	0.80	0.00	−0.12	0.03	0.07	0.00
Earnings inequality									
1 Industry	−0.04	−1.32	−0.01	−0.55	−0.02	−1.66	0.42*	0.05	0.21
10 Plant	−0.01	−0.46	0.02	0.97	0.00	0.41	0.13*	0.08	0.00
Gross output per plant in production activities									
1 Industry	−0.05	−0.65	0.03	0.54	0.00	−0.05	0.30*		0.18
10 Plant	−0.05	−1.36	0.06	2.01	0.01	0.72	0.16*		0.05