

# Online Appendices

(Not for publication)

<b>A</b>	<b>Tariff Data</b>	<b>54</b>
<b>B</b>	<b>Administrative Data Construction</b>	<b>55</b>
B.1	Sample Selection . . . . .	55
B.2	Worker Variables . . . . .	55
B.3	Firm Variables . . . . .	56
B.4	Industry Variables . . . . .	57
<b>C</b>	<b>Additional Results</b>	<b>58</b>
C.1	CUSFTA Tariff Cuts . . . . .	58
C.2	Change in Trade Flows by Tariff Change . . . . .	59
C.3	Correlates of High Attachment Status . . . . .	60
C.4	Exogeneity of Trade Policy . . . . .	61
C.5	Probability of Non-Work-Shortage Related Separation . . . . .	62
C.6	Years Worked Results Tables . . . . .	63
C.7	Cumulative Normalized Earnings Results Tables . . . . .	65
C.8	Results Controlling for NAFTA Tariff Cuts Facing Imports from Mexico . . . . .	68
C.9	Effects by Income Level . . . . .	71
C.10	Net Effects by Industry . . . . .	80
C.11	Regional Shocks and Industrial Geography . . . . .	84
C.12	Evolution of Tariff-Cut Exposure . . . . .	95
C.13	Worker Transitions by Initial Firm Size Results Tables . . . . .	98
C.14	Cumulative Normalized Earnings by Initial Firm Size Results Tables . . . . .	101

## A Tariff Data

Our measures of the CUSFTA bilateral tariff cuts come from the statutory phase-in from the published *Canada-U.S. Free Trade Agreement*. Data from it were generously provided in digitized form by Emily Yu at Global Affairs Canada. Raw data are provided at the HS 8-digit level. We start by dropping 365 Canadian HS 8-digit codes that are specific tariffs, compound tariffs, or in which there are two entries for an 8-digit tariff with one of them being specific or compound. This reduces the number of codes from 7241 to 6876. We then take the weighted average of these tariffs within a given HS 6-digit code where weights corresponding to Canadian imports from the U.S. in 1988. We retain the import value at the HS 6-digit level as we use it below. Independently, we use the concordance from Pierce and Schott (2012) to create a many to one crosswalk between 1992 HS 6-digit codes and 1997 6-digit NAICS codes. We then using a many to one merge to merge the latter crosswalk with the HS 6-digit tariffs.

We then take the 2002 to 2007 6-digit NAICS crosswalk from the U.S. census and reshape it so that there is exactly one observation per 2002 6-digit NAICS code. This is merged (one to many) with the 1997 to 2002 6-digit NAICS crosswalk from the same source. This creates a mapping of all the 2007 6-digit NAICS codes that a given 1997 6-digit NAICS code maps into. We then merge this with the 1997 6-digit NAICS tariff data and reshape it (long) so that for a given 2007 6 digit NAICS code, there are values for each of the 1992 HS 6-digit tariffs that map into it. Finally, we take the weighted average of these tariffs for a given year within a 4-digit 2007 NAICS code where weights correspond to values of imports from the U.S. in 1988 in a given 1988 6-digit HS code that maps into the 4-digit 2007 NAICS code. This is the level at which *leapnaics* is defined at in the primary data set.

For U.S. tariffs, the procedure is similar. We start with 8-digit HS codes and then drop those that contain specific or compound tariffs. The U.S. has far more of these than Canada (1171 vs. 365). Analogously to the Canadian tariffs, these are collapsed down to the 1988 HS 6-digit level using imports from Canada as weights and converted to the 4-digit 2007 NAICS code using the same procedure as above.

Canadian MFN rates are calculated as follows. All MFN rates that are not ad-valorem were converted to ad-valorem measures by Global Affairs Canada. HS 1988 8-digit MFN rates are converted to 6-digit rates using simple averages. We then use the crosswalks defined above to convert these to MFN rates at the 4-digit 2007 NAICS level using simple averages. The change in MFN rates is defined as the 1998 MFN rate minus the 1988 tariff on U.S. exports calculated above that the U.S. faced prior to CUSFTA. For this calculation the 1988 tariff in Auto Pact sectors is the statutory rate (before waivers are granted). We use actual MFN rates and not bound rates.

We calculate U.S. MFN tariffs as follows. For 1988, we rely on TS-USA imports.<sup>69</sup> At the seven-digit TS level, we isolate total duties paid and total customs imports into from Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, and the United Kingdom, divided by total customs value of imports from those same countries. We refer to the latter countries as MFN countries. We then use a crosswalk from the same resource to merge these into the 10-digit HS level. We then sum duties paid and customs value to the 10-digit HS level. The 1988 U.S. MFN tariff is equal to total duties paid on these MFN countries divided by the customs value of imports from these MFN countries. These are then aggregated to the NAICS level

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<sup>69</sup>Available from <https://cid.econ.ucdavis.edu/usixd/wp5515d.html>

using a crosswalk constructed from the 1989 U.S. import data from the same source where weights correspond to total import value at the HS level within NAICS codes. For the years 1989-1998, we calculate the 10-digit HS tariff at the HS-country-year level for the same countries. We then take the weighted average over the remaining countries with similar weights. Time varying NAICS codes are transformed into 2007 NAICS codes using crosswalks from the U.S. Census.

## B Administrative Data Construction

### B.1 Sample Selection

We start with the raw data set *LWF\_T2LEAP\_w\_wiearn.dta* provided to us by the Economic Analysis Division at Statistics Canada. We keep workers born between 1940 and 1964 (inclusive) so that they were between 22 and 64 in all years from 1986 to 2004. We consider these to be “prime age workers.” When workers have multiple years of birth listed, we take the earliest year. We also drop workers who have an unknown province of residence in *any* year.

We also drop workers who worked for the first time after 1988 (exclusive). As we discuss below, these workers cannot be assigned to the “low attachment” or “high attachment” groups because we cannot see their 1984-1988 work histories. Using the Statistics Canada variable *earnflag*, we attribute all of a worker’s earnings in a given year to their highest paying job for the years 1984-1988. We drop workers who did not work in any of the years 1986-1988 because we cannot assign them to an initial industry or firm. However, for the years 1989-2004, earnings are attributed to the industry or sector in which they were earned, not just to the primary job’s sector. For example, if a worker separated from their initial manufacturing job in 1995, and then took a primary construction job and a side job in services, they would have earnings showing in both construction and services (e.g. Tables A6-A8). However, years worked are attributed to the primary sector of employment so that the maximum number of years worked between 1989 and 2004 (inclusive) is 16.

For a large number of “initial” outcomes (e.g. initial industry, initial firm, etc.), we require a base year. For workers with positive earnings in 1988, we set their base year to 1988. This causes all high attachment workers to have 1988 as their base year. If the worker did not have positive earnings in 1988 but did have positive earnings in 1987, we set their base year to 1987. If they did not have positive earnings in 1988 nor 1987, we set their base year to 1986. All workers have positive earnings in at least one of these years. We then define the initial industry as the industry of primary employment in the base year. The initial firm and initial province are defined analogously. For a small number of workers that we see in both 1986 and 1988, we assign the initial industry and firm based on 1986 data if the 1988 industry code is missing.

### B.2 Worker Variables

We start by describing our sample construction in detail. We define a minimum wage cutoff as total income a worker would have earned at a prevailing province-year nominal minimum wage if they worked 1600 hours a year, as in Autor et al. (2014).<sup>70</sup> We define a “high attachment” worker as one who earned more than this cutoff for *each* of the years 1985-1988.

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<sup>70</sup>These were retrieved from <http://srv116.services.gc.ca/dimt-wid/sm-mw/rpt2.aspx?GoCTemplateCulture=en-CA>.

We now have a potentially unbalanced panel with each worker having no more than one observation per year. We define the *initial industry* of employment as the industry of the highest paying job for a given worker in 1988. If there is not record for 1988 but a record with an industry code in 1987, we use 1987. If there are no records with industry codes for 1988 and, we use 1986. The *initial firm* is defined as the firm (*lbid*) of the firm at which the worker had primary employment in the year for which we assign the initial industry. Annual income is defined as total T4 earnings in a given year. Average worker earnings from 1986 to 1988 are the simple average of annual T4 total earnings during this period. Nominal values are deflated to 2002 real values using the Canadian CPI available as Statistics Canada table 18-10-0004-13. *Cumulative earnings* are total worker T4 income after and including 1989. We define a *top earner* as a worker with the 99th percentile of cumulative earnings for each final year of employment (e.g. the 99th percentile of cumulative earnings for workers who stopped working in 1989, 1990, 1991, and so on). We drop workers whose final year cumulative earnings are greater than the 99th percentile of all workers who have the same final year of work.

*Normalized cumulative earnings* are *cumulative earnings* in the final year of employment divided by the *Average worker income* for 1986-1988 only taking positive values of earnings in those years into account. *Firm tenure at the initial firm* is constructed as follows: create a dummy variable that takes a value of one for every year prior to the base year. If the sum of these dummy variables equals 0 or 1, they are defined as “low tenure”, if the sum is strictly greater than one and strictly less than four, they are defined as “medium tenure”, if the sum is weakly greater than four, they are defined as “high tenure.”

To create firm size bins, we start by taking the firm size (*nalus*) of the base firm. These are full time equivalent workers calculated by Statistics Canada as total payroll divided by average wages taking worker characteristics into account. Because we are using *nalus* from the LEAP portion of the data set, this counts *all* workers at the firm and not just those in the sample. If this average is strictly less than 100, then the firm is assigned to the “small” bin, if the average is strictly greater than 99 and strictly less than 1000, then the firm is assigned to the “medium” bin, and if the average is strictly greater than 999, then the firm is assigned to the “large” bin. The correlation between this variable and the number of workers we observe at the firm (multiplied by 10) is high.

*Experience* captures the number of years the worker was employed from 1984 to 1988 (inclusive). The experience dummy takes a value of 1 if the worker worked strictly less than three years, a value of 2 if they worked between 2 and 5 years, a value of 3 if they worked strictly greater than four years. This differs from “high attachment” as it does not account for wages earned in these jobs. It differs from the tenure variable in that it does not distinguish the firm of employment.

A worker’s average real initial income is calculated by taking the average real T4 earnings for a given worker in the years 1986-1988 for years in which they had positive earnings. The worker pre-trend is defined as the difference between a worker’s log real 1986 T4 income and their log real 1988 T4 income. When this is included as a explanatory variable, it requires that even low attachment workers work in the years 1986 and 1988 (but not necessarily 1987).

### B.3 Firm Variables

We now describe firm variables that we use as controls. We measure the average level of worker wages at firm level as a control variable. Starting with the raw data set *LWF\_T2LEAP\_w\_wiearn.dta*, we start by only keeping observations for the years 1988. We then take (unweighted) mean of log real

worker earnings for workers employed at that firm in 1988. To create the firm pre-trend, we start with the raw data set *LWF\_T2LEAP\_w\_wiearn.dta*, keep only observations for the years 1986 and 1988. We then calculate log real earnings for workers at the firm in those years, and the change in log real earnings for workers at the firm in 1986 and 1988. We then take the (unweighted) mean of that variable for the firm.

## B.4 Industry Variables

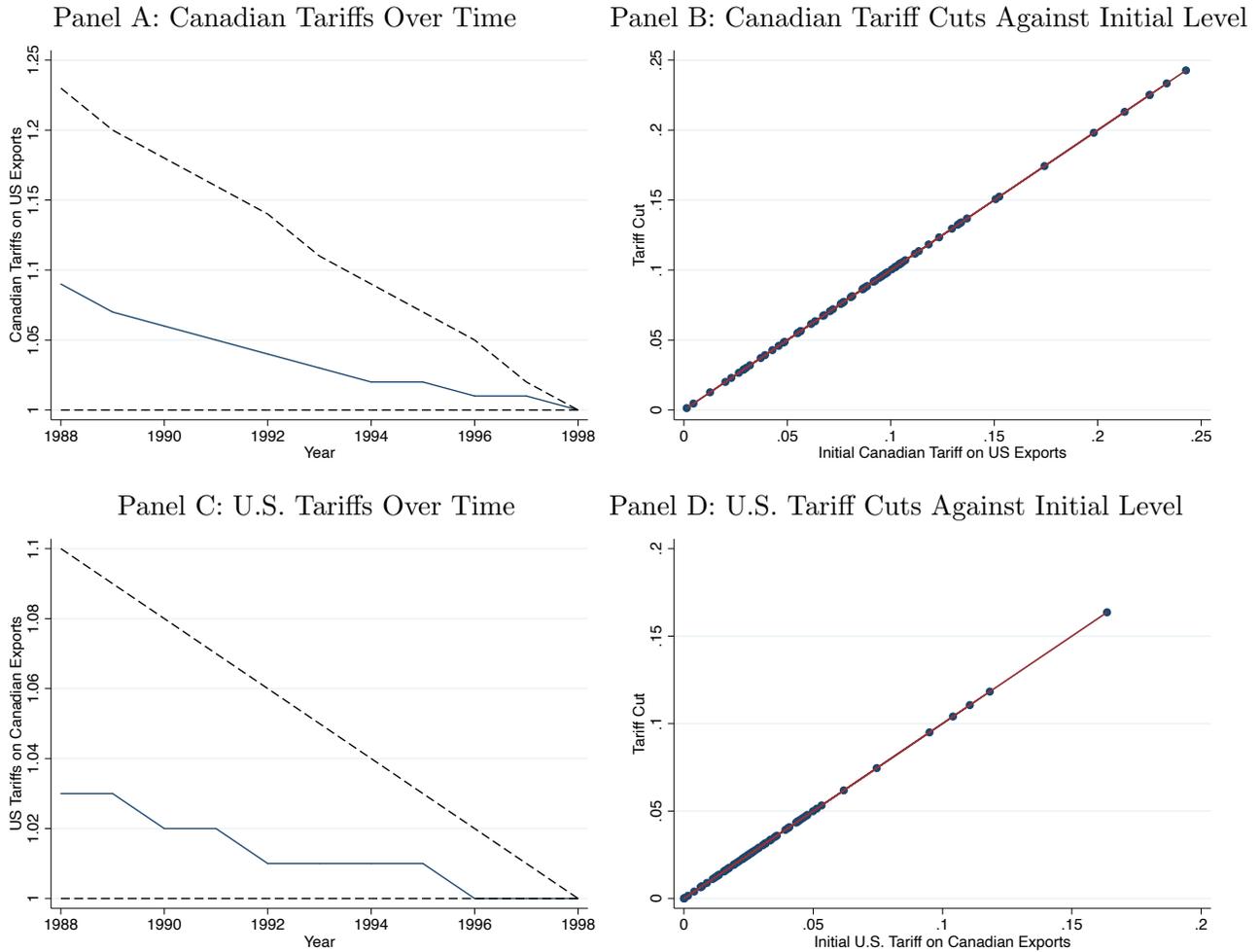
We now describe industry variables that we use as controls. To measure the average worker wages in the initial industry in 1988, we starting with the raw data set *LWF\_T2LEAP\_w\_wiearn.dta*, and keep observations for 1988. We then take the log of real t4 earnings in the industry in 1988 and take the mean of that variable for the initial industry of employment. To create the industry pre-trend, we start with the raw data set *LWF\_T2LEAP\_w\_wiearn.dta*, we take the change in the log of worker real income between 1986 and 1988 defined above and take the mean of that for the initial industry of employment.

The NAICS four-digit industry’s log capital-labor ratio is calculated by starting with the raw data set *LWF\_T2LEAP\_w\_wiearn.dta*, removing firm-year duplicates, and then summing both *total\_assets* and *nalus* by industry, and then dividing the former by the latter. We measure the log share of workers (in our sample) at the NAICS four-digit level in 1988 who earn less than the aggregate median wage (also in 1988). Trends in the importance of the industry are captured by the trend in the log of the industry’s share of aggregate employment. It takes the number of workers (in our sample) in the NAICS industry in 1984 and divides it by the total number of workers (in our sample) in 1984. It then takes the (log) difference in this between 1984 and 1988. The cyclicity measure is as discussed in the text. Finally, we also control for the China Shock in Canada between 1989 and 2004. The numerator of this is the change in real imports into Canada from China between these years in the industry of initial employment. The denominator is real absorption in Canada in 1992 as defined as real output plus real industry imports from the world from Canada minus real industry exports to the world from Canada. 1992 is the first year for which production data are available so we scale all industries by the change in nominal aggregate manufacturing production between 1988 and 1992 before converting from nominal to real values. This actually means scaling the nominal value up by approximately 4.5% consistent with the early 1990s recession in Canada. This scaling only scales the coefficient when this industry-level variable is included in regression but does affect the level when data is presented visually.

# C Additional Results

## C.1 CUSFTA Tariff Cuts

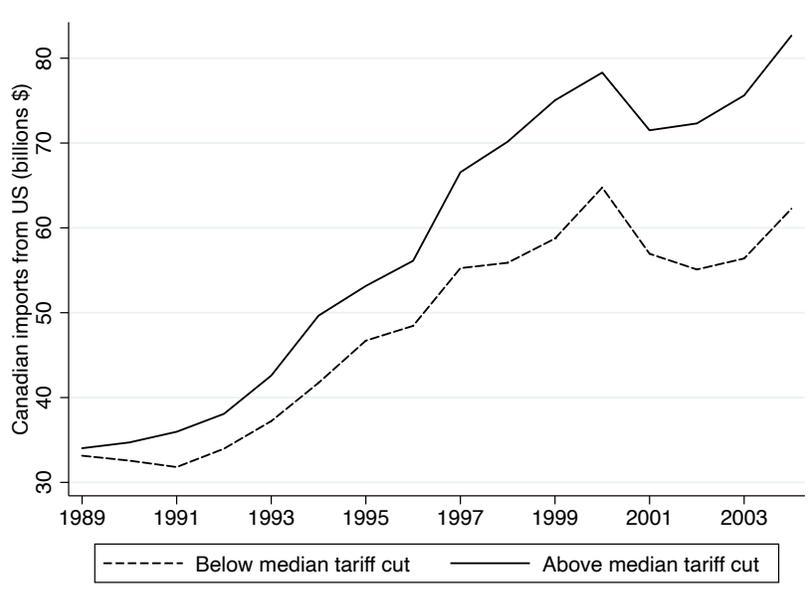
Figure A1: CUSFTA Tariff Cuts



Notes: Panel A plots the unweighted average Canadian NAICS tariff plus one against U.S. exports from 1988 through 1998. Values of 1 represent no tariff. The dotted lines represent 5<sup>th</sup> and 95<sup>th</sup> percentiles. Panel B plots the initial 1988 tariff on the horizontal axis and the cut from 1988 to 1998 on the vertical axis. Each dot is an industry and the line is a 45 degree line. Values of zero on the horizontal axis represent no tariff. Panels C and D does the same for U.S. tariffs against Canadian exports.

## C.2 Change in Trade Flows by Tariff Change

Figure A2: Change in Trade Flows by Tariff change



*Notes:* The y-axis plots the level of Canadian imports from the United States in billions of CAD for the years 1989-2004 (the x-axis). The solid line represents the level of imports in HS 6-digit codes whose 1988 tariff was above the median industry level. The dashed line represents imports in HS 6-digit codes whose 1988 tariff was below the median industry level.

Figure A2 shows that Canadian imports from the U.S. increased more quickly for 6-digit HS products that faced larger Canadian tariff cuts than for products facing smaller tariff cuts, and that the gap between these two sets of products grew steadily over time. The solid line shows Canadian imports from the U.S. in billions of CAD for products facing above-median Canadian tariff cuts, while the dashed line shows the same measure for products facing below-median tariff cuts. While both series start with quite similar trade values in 1989, at the start of the FTA, they steadily diverge throughout our sample period, with products experiencing larger tariff cuts exhibiting larger increases in trade values. We thank Teresa Fort for suggesting this figure.

### C.3 Correlates of High Attachment Status

Table A1: Correlates of High Attachment Status

	(1)	(2)	(3)
<u>Worker Characteristics</u>			
Female <sub><i>i</i></sub>	-0.189*** (0.0209)		0.0637*** (0.00596)
Age <sub><i>i</i></sub>		0.0775*** (0.00489)	0.0607*** (0.00751)
Age <sub><i>i</i></sub> <sup>2</sup>		-0.000920*** (6.56e-05)	-4.20e-05 (3.63e-05)
Age <sub><i>i</i></sub> × ln(income <sub><i>i</i></sub> ,1986–1988)			-0.00558*** (0.000822)
ln(income <sub><i>i</i></sub> ,1986–1988)			0.636*** (0.0286)
Δ <sub>1986–1988</sub> ln(income <sub><i>i</i></sub> )			-0.0753*** (0.00502)
<u>Firm Characteristics</u>			
ln(income <sub><i>f</i></sub> ,1986–1988)			0.0197*** (0.00360)
Δ <sub>1986–1988</sub> ln(income <sub><i>f</i></sub> )			-0.0230*** (0.00550)
1 (medium firm)			0.00336 (0.00590)
1 (large firm)			-0.0198** (0.00813)
<u>Industry Characteristics</u>			
ln(1 + τ <sub><i>j</i></sub> <sup>CAN</sup> ,1988)			-0.0699 (0.117)
ln(1 + τ <sub><i>j</i></sub> <sup>US</sup> ,1988)			-0.151 (0.141)
Δ <sub>1988–1998</sub> ln(1 + τ <sub><i>j</i></sub> <sup>CAN,MFN</sup> )			0.243* (0.123)
Δ <sub>1988–1998</sub> ln(1 + τ <sub><i>j</i></sub> <sup>US,MFN</sup> )			0.0436 (0.159)
ΔIPR <sub><i>j</i></sub> <sup>CHN</sup>			-0.0108 (0.0270)
Cyclicality <sub><i>j</i></sub>			8.10e-05 (0.00237)
Share below median income <sub><i>j</i></sub> ,1988			-0.0227 (0.0279)
Mean log earnings <sub><i>j</i></sub> ,1988			-0.0529* (0.0296)
Log capital-labor ratio <sub><i>j</i></sub> ,1988			-0.00618** (0.00257)
Δ <sub>1984–1988</sub> ln( $\frac{emp_j}{\sum_{j'} emp_{j'}}$ )			-0.0257 (0.0249)
Δ <sub>1986–1988</sub> Mean log earnings <sub><i>j</i></sub>			-0.227** (0.0883)
Observations	83,705	83,705	83,705
R-squared	0.039	0.048	0.437

Notes: \*\*\*:  $p < 0.01$ , \*\*:  $0.01 \leq p < 0.05$ , \*:  $0.05 \leq p < 0.1$ . The dependent variable is an indicator for workers with high attachment status. Standard errors clustered at the 2007 NAICS-4 digit level are in parentheses.  $age_i$  is the age of individual  $i$  in the initial year.

## C.4 Exogeneity of Trade Policy

Table A2: Exogeneity of Trade Policy

Dependent variable:	$\ln(1 + \tau_{j,1988}^{\text{CAN}})$		$\ln(1 + \tau_{j,1988}^{\text{US}})$	
	(1)	(2)	(3)	(4)
$\ln(1 + \tau_{j,1988}^{\text{US}})$		0.965*** (0.166)		
$\ln(1 + \tau_{j,1988}^{\text{CAN}})$				0.351*** (0.060)
$\Delta_{1988-1998} \ln(1 + \tau_j^{\text{CAN,MFN}})$		0.644*** (0.010)		-0.186** (0.073)
$\Delta_{1988-1998} \ln(1 + \tau_j^{\text{US,MFN}})$		0.007 (0.202)		-0.028 (0.122)
$\Delta IPR_j^{\text{CHN}}$	0.015 (0.029)	0.040** (0.020)	-0.012 (0.014)	-0.022* (0.012)
Separation prob. <sub>1985-1988,j</sub>	-0.143 (0.200)	0.042 (0.137)	-0.054 (0.098)	-0.042 (0.082)
Cyclicalit <sub>j</sub>	0.008* (0.004)	-0.003 (0.003)	0.008*** (0.002)	0.006*** (0.002)
Share below median income <sub>j,1988</sub>	-0.043 (0.057)	-0.006 (0.039)	-0.014 (0.028)	-0.006 (0.023)
Mean log earnings <sub>j,1988</sub>	-0.075 (0.047)	-0.023 (0.032)	-0.036 (0.023)	-0.015 (0.020)
Log capital-labor ratio <sub>j,1988</sub>	-0.005 (0.005)	0.002 (0.004)	-0.003 (0.003)	-0.003 (0.002)
$\Delta_{1984-1988} \ln\left(\frac{emp_j}{\sum_{j'} emp_{j'}}\right)$	-0.012 (0.037)	0.033 (0.027)	-0.053*** (0.018)	-0.048*** (0.015)
$\Delta_{1986-1988}$ Mean log earnings <sub>j</sub>	-0.186 (0.147)	-0.137 (0.103)	-0.114 (0.072)	-0.029 (0.063)
Observations	78	78	78	78
R-squared	0.323	0.706	0.417	0.618

Notes: \*\*\*:  $p < 0.01$ , \*\*:  $0.01 \leq p < 0.05$ , \*:  $0.05 \leq p < 0.1$ . Standard errors clustered at the 2007 NAICS-4 digit level are in parentheses. All columns estimate versions of equation (3). All variables are as described in the text. Estimation is OLS.

## C.5 Probability of Non-Work-Shortage Related Separation

Table A3: Probability of Non-Work-Shortage Related Separation from Initial Firm (1989-2003)

	Low Attachment		High Attachment	
	(1)	(2)	(3)	(4)
$-\Delta_k \ln(1 + \tau_j^{\text{CAN}})$	0.0404 (0.163)		0.0262 (0.171)	
$-\Delta_k \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$		0.207 (0.200)		-0.0546 (0.226)
$-\Delta_k \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$		0.0402 (0.221)		0.189 (0.250)
$-\Delta_k \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$		-0.181 (0.249)		0.0312 (0.231)
$-\Delta_k \ln(1 + \tau_j^{\text{US}})$	0.331 (0.302)		0.864*** (0.304)	
$-\Delta_k \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$		0.230 (0.349)		0.452 (0.324)
$-\Delta_k \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$		0.388 (0.362)		0.527 (0.365)
$-\Delta_k \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$		0.245 (0.439)		1.595*** (0.476)
Observations	20,577	20,577	63,128	63,128
R-Squared	0.057	0.058	0.034	0.035

*Notes:* Dependent variable is an indicator for experiencing a permanent non-work-shortage based separation from the worker's initial firm during 1989-2003. These separations include firing, quits, returning to school, seasonal work ending, etc., but omit layoffs, which are the focus of Table 1. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (reduced) probability of separation. Columns (1) and (3) present results of estimating equation (1) for low and high labor force attachment workers, respectively. Columns (2) and (4) present analogous regressions interacting the tariff cuts with initial firm size (small=1-99, medium=100-999, large=1000+). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## C.6 Years Worked Results Tables

Table A4: Years Worked (1989-1993)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	-0.819***	-1.268	-0.732	0.240	0.199	0.0479	-0.227	0.841*	0.0804**
	(0.299)	(0.772)	(0.443)	(0.446)	(0.245)	(0.0804)	(0.162)	(0.471)	(0.0305)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	0.319	0.933	1.890***	-1.950**	0.430	0.0248	0.0554	-1.017	-0.0481
	(0.519)	(1.204)	(0.688)	(0.839)	(0.514)	(0.120)	(0.297)	(0.905)	(0.0498)
R-squared	0.115	0.175	0.034	0.035	0.037	0.013	0.020	0.056	0.009
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	0.935**	0.575	-0.441	0.475	0.227	0.0679	-0.126*	0.142	0.0144
	(0.389)	(0.922)	(0.366)	(0.764)	(0.165)	(0.0682)	(0.0746)	(0.260)	(0.0258)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-0.685	2.377	0.723	-1.717	-0.0353	-0.115	-0.0682	-1.813***	-0.0370
	(0.577)	(1.901)	(0.762)	(1.334)	(0.364)	(0.0907)	(0.114)	(0.466)	(0.0504)
R-squared	0.037	0.111	0.017	0.039	0.020	0.012	0.009	0.054	0.004

*Notes:* Dependent variable is the number of years worked (with nonzero earnings) during 1989-1993. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) years worked. Column (1) examines total years worked, (2) years worked at the initial firm, (3) at firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) in a firm with unknown industry code. Each worker-year is assigned to only one category in columns (2) through (9) based on the primary (highest-earning) job, so the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A5: Years Worked (1989-1998)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Attachment (n=20,577)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	-1.015 (0.773)	-3.360** (1.678)	-1.479 (1.001)	1.299 (1.100)	0.688* (0.411)	0.215 (0.205)	-0.416 (0.368)	1.964** (0.977)	0.0728** (0.0356)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-0.996 (1.393)	2.565 (2.373)	4.038** (1.695)	-5.127*** (1.852)	0.719 (0.980)	-0.0664 (0.293)	0.154 (0.689)	-3.254* (1.899)	-0.0266 (0.0471)
R-squared	0.103	0.150	0.044	0.041	0.041	0.017	0.023	0.056	0.010
<b>Panel B: High Attachment (n=63,128)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	1.627** (0.657)	-0.536 (2.260)	-1.122 (0.901)	2.553 (1.799)	0.532 (0.381)	0.190 (0.207)	-0.349* (0.194)	0.326 (0.732)	0.0335 (0.0272)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-1.468 (0.915)	5.841 (4.557)	2.086 (2.535)	-4.836 (3.189)	0.00433 (0.829)	-0.139 (0.251)	-0.311 (0.320)	-4.071*** (1.290)	-0.0422 (0.0528)
R-squared	0.041	0.107	0.032	0.042	0.020	0.021	0.012	0.057	0.004

*Notes:* Dependent variable is the number of years worked (with nonzero earnings) during 1989-1998. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) years worked. Column (1) examines total years worked, (2) years worked at the initial firm, (3) at firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) in a firm with unknown industry code. Each worker-year is assigned to only one category in columns (2) through (9) based on the primary (highest-earning) job, so the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## C.7 Cumulative Normalized Earnings Results Tables

Table A6: Cumulative Normalized Earnings (1989-1993)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Attachment (n=20,577)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	0.683	-0.796	-1.292*	1.302	0.799**	0.175	-0.353**	1.009	0.0136
	(1.205)	(1.284)	(0.773)	(1.215)	(0.362)	(0.196)	(0.174)	(0.914)	(0.0804)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	2.385	1.388	1.364	-1.909	0.875	0.0686	0.0922	0.329	0.245
	(1.811)	(2.207)	(1.111)	(2.073)	(0.753)	(0.412)	(0.318)	(1.723)	(0.201)
R-squared	0.110	0.065	0.013	0.035	0.024	0.011	0.020	0.087	0.012
<b>Panel B: High Attachment (n=63,128)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	1.349*	1.161	-0.373	0.372	0.220	0.0743	-0.0799	0.0444	0.00394
	(0.792)	(1.091)	(0.451)	(0.806)	(0.174)	(0.0802)	(0.0659)	(0.350)	(0.0257)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-0.0916	2.413	-0.0705	-1.191	0.104	-0.212	-0.0520	-1.269***	-0.0254
	(0.936)	(1.790)	(0.788)	(1.237)	(0.362)	(0.130)	(0.0913)	(0.476)	(0.0402)
R-squared	0.076	0.077	0.016	0.039	0.019	0.009	0.008	0.055	0.005

*Notes:* Dependent variable is the sum of a worker's earnings during 1989-1993, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) cumulative earnings. Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A7: Cumulative Normalized Earnings (1989-1998)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	-1.198 (3.309)	-5.336* (2.780)	-2.418 (2.040)	3.229 (2.973)	1.688** (0.815)	0.679 (0.578)	-0.706 (0.497)	1.710 (2.308)	-0.0436 (0.111)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	7.251 (5.808)	5.960 (4.770)	1.616 (3.199)	-4.862 (5.378)	2.479 (1.590)	0.0354 (1.028)	0.0979 (0.908)	1.318 (5.314)	0.606** (0.289)
R-squared	0.115	0.059	0.014	0.030	0.025	0.016	0.019	0.105	0.010
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	0.993 (2.009)	-0.821 (2.926)	-0.688 (1.196)	2.283 (1.964)	0.467 (0.396)	0.200 (0.243)	-0.206 (0.176)	-0.270 (0.968)	0.0260 (0.0350)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	0.00475 (2.446)	7.419 (5.236)	-0.659 (2.832)	-3.909 (3.263)	0.325 (0.856)	-0.343 (0.390)	-0.328 (0.259)	-2.461* (1.302)	-0.0379 (0.0440)
R-squared	0.087	0.072	0.026	0.046	0.021	0.016	0.011	0.066	0.004

*Notes:* Dependent variable is the sum of a worker's earnings during 1989-1998, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) cumulative earnings. Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A8: Cumulative Normalized Earnings (1989-2004)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	-6.142	-13.21***	-4.455	4.314	4.311**	1.446	-1.203	2.614	0.0449
	(6.742)	(4.853)	(3.802)	(5.614)	(1.742)	(1.117)	(0.839)	(4.619)	(0.224)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	14.74	12.34	3.107	-7.687	3.783	0.263	-0.858	2.800	0.988
	(12.67)	(9.066)	(6.182)	(10.52)	(2.811)	(2.028)	(1.424)	(10.66)	(0.722)
R-squared	0.141	0.048	0.017	0.038	0.030	0.021	0.017	0.123	0.005
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	0.542	-3.007	-2.101	4.822	0.794	0.570	-0.385	-0.195	0.0435
	(3.295)	(5.698)	(2.263)	(3.649)	(0.817)	(0.591)	(0.307)	(2.108)	(0.0437)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	0.627	11.69	0.285	-8.773	1.216	-0.554	-0.803*	-2.417	-0.0213
	(4.197)	(9.409)	(5.188)	(5.849)	(1.700)	(0.847)	(0.435)	(3.020)	(0.0592)
R-squared	0.121	0.070	0.029	0.052	0.023	0.024	0.014	0.077	0.004

*Notes:* Dependent variable is the sum of a worker's earnings during 1989-2004, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) cumulative earnings. Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction (NAICS=22xx,23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

## C.8 Results Controlling for NAFTA Tariff Cuts Facing Imports from Mexico

Table A9: Probability of Separation from Initial Firm (1989-2003), Controlling for NAFTA Tariff Cuts Facing Imports from Mexico

	Low Attachment		High Attachment	
	(1)	(2)	(3)	(4)
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	0.0695 (0.206)		0.129 (0.221)	
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$		-0.729 (0.477)		-0.369 (0.401)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$		0.228 (0.254)		-0.184 (0.249)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$		0.693*** (0.230)		0.503** (0.247)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-0.159 (0.196)		-0.0219 (0.291)	
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$		0.394 (0.343)		0.402 (0.336)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$		-0.430 (0.329)		-0.0764 (0.387)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$		-0.400 (0.415)		-0.389 (0.499)
Observations	20,577	20,577	63,128	63,128
R-Squared	0.067	0.069	0.037	0.038

*Notes:* Dependent variable is an indicator for experiencing a permanent work-shortage based separation from the worker's initial firm during 1989-2003. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (reduced) probability of separation. Columns (1) and (3) present results of estimating equation (1) for low and high labor force attachment workers, respectively. Columns (2) and (4) present analogous regressions interacting the tariff cuts with initial firm size (small=1-99, medium=100-999, large=1000+). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4, along with controls for the tariff cuts facing Canadian imports from Mexico under NAFTA. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A10: Years Worked (1989-2004), Controlling for NAFTA Tariff Cuts Facing Imports from Mexico

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Attachment</b> (n=20,577)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	-0.263 (1.402)	-6.908** (3.028)	-4.721*** (1.636)	4.122** (1.831)	1.365* (0.782)	0.303 (0.345)	-0.522 (0.551)	5.967*** (1.845)	0.131*** (0.0413)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-2.161 (2.554)	4.053 (4.242)	4.424 (3.072)	-7.721*** (2.842)	0.528 (1.835)	-0.370 (0.600)	0.0903 (1.076)	-3.166 (3.059)	-0.000191 (0.0892)
R-squared	0.096	0.132	0.050	0.048	0.046	0.023	0.027	0.062	0.008
<b>Panel B: High Attachment</b> (n=63,128)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	2.794* (1.548)	-2.773 (4.755)	-4.490** (1.739)	7.632** (2.957)	1.060 (0.760)	0.241 (0.406)	-0.582* (0.313)	1.680 (1.570)	0.0257 (0.0366)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-2.398 (2.037)	6.800 (8.017)	2.743 (4.392)	-5.878 (5.347)	0.540 (1.589)	-0.615 (0.520)	-0.725 (0.581)	-5.205** (2.303)	-0.0577 (0.0591)
R-squared	0.058	0.102	0.036	0.044	0.022	0.028	0.015	0.061	0.004

*Notes:* Dependent variable is the number of years worked (with nonzero earnings) during 1989-2004. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) years worked. Column (1) examines total years worked, (2) years worked at the initial firm, (3) at firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction (NAICS=22xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) in a firm with unknown industry code. Each worker-year is assigned to only one category in columns (2) through (9) based on the primary (highest-earning) job, so the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4, along with controls for the tariff cuts facing Canadian imports from Mexico under NAFTA. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

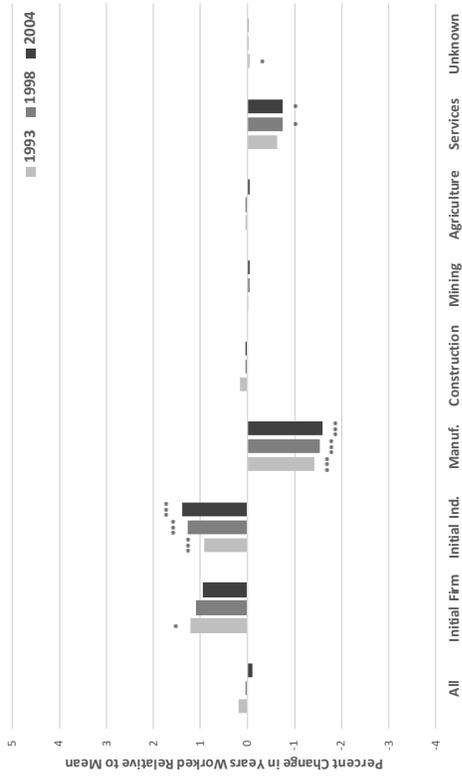
Table A11: Cumulative Normalized Earnings (1989-2004), Controlling for NAFTA Tariff Cuts Facing Imports from Mexico

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Attachment (n=20,577)</b>									
$-\Delta \ln(1 + \tau_j^{CAN})$	0.316	-12.78**	-9.092**	11.96**	4.204**	0.988	-1.059	5.903	0.199
	(7.776)	(5.442)	(3.570)	(5.403)	(1.818)	(1.267)	(0.917)	(5.160)	(0.192)
$-\Delta \ln(1 + \tau_j^{US})$	21.90	12.82	-2.033	0.786	3.665	-0.245	-0.698	6.447	1.159
	(13.52)	(10.50)	(6.512)	(10.30)	(3.112)	(1.898)	(1.477)	(10.97)	(0.736)
R-squared	0.141	0.048	0.019	0.038	0.030	0.021	0.017	0.123	0.005
<b>Panel B: High Attachment (n=63,128)</b>									
$-\Delta \ln(1 + \tau_j^{CAN})$	2.617	-2.593	-4.840**	8.196**	1.088	0.256	-0.373	0.846	0.0366
	(3.392)	(6.056)	(2.193)	(3.353)	(0.829)	(0.579)	(0.301)	(2.263)	(0.0495)
$-\Delta \ln(1 + \tau_j^{US})$	3.694	12.31	-3.764	-3.786	1.651	-1.018	-0.785	-0.878	-0.0315
	(4.709)	(10.26)	(4.986)	(5.767)	(1.826)	(0.984)	(0.491)	(2.409)	(0.0564)
R-squared	0.121	0.070	0.031	0.053	0.023	0.024	0.014	0.077	0.004

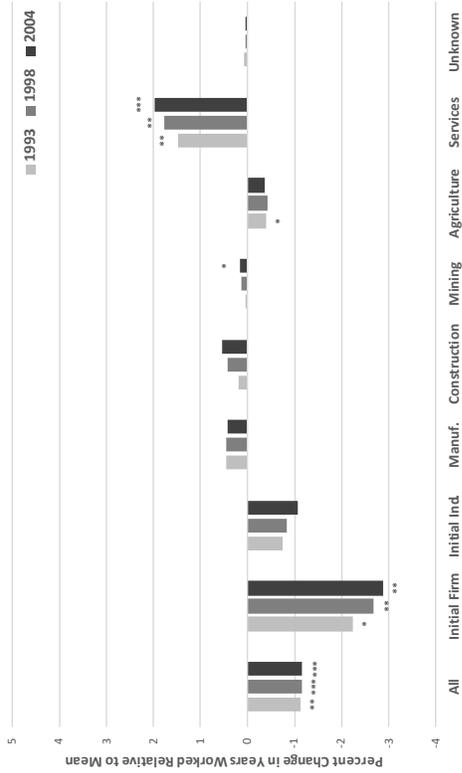
*Notes:* Dependent variable is the sum of a worker's earnings during 1989-2004, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{CAN})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{US})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) cumulative earnings. Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction (NAICS=22xx,23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS≥4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4, along with controls for the tariff cuts facing Canadian imports from Mexico under NAFTA. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## C.9 Effects by Income Level

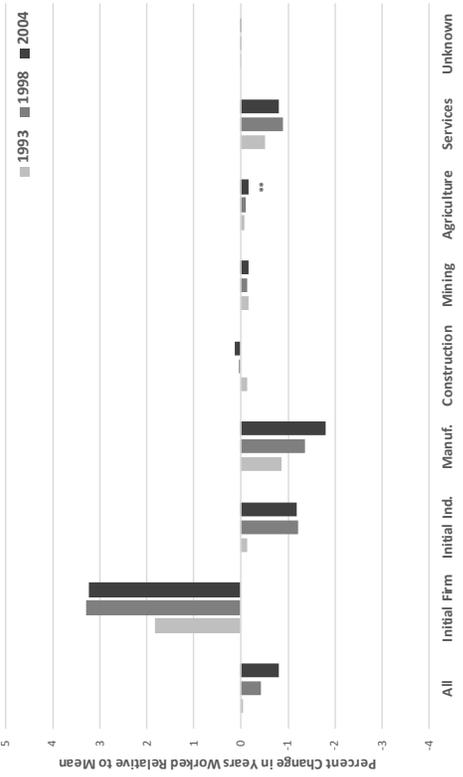
Figure A3: Evolution of Effects on Years Worked by Income



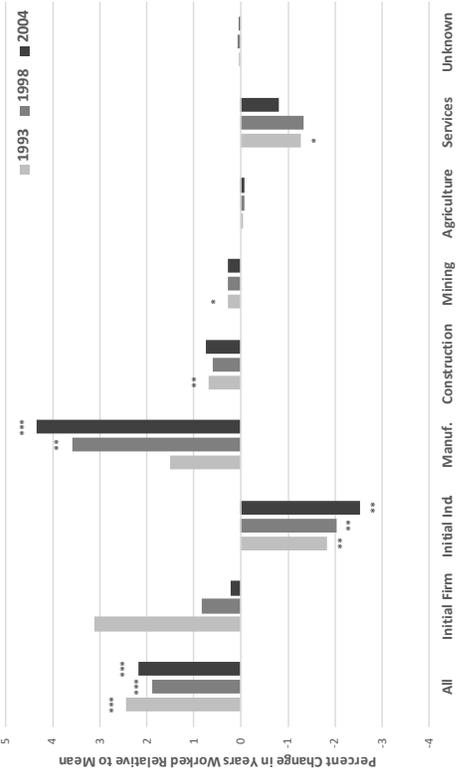
(a) Effect of Canadian Tariff Cuts - Low Income Workers



(b) Effect of US Tariff Cuts - Low Income Workers



(c) Effect of Canadian Tariff Cuts - High Income Workers



(d) Effect of US Tariff Cuts - High Income Workers

Notes: The figures present scaled estimates from regressions paralleling those in Table A8. The bars show predicted differences in cumulative normalized earnings when facing tariff changes that differ by the interquartile range, expressed as a percent of the group's mean cumulative normalized earnings. To make results comparable to the 16-year 1989-2004 timeframe, the 1989-1993 values are multiplied by 16/5, and the 1989-1998 values are multiplied by 16/10. See Table A8 note for category definitions. Stars indicate statistical significance based on standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A12: Years Worked, by Income Group (1989-1993)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Income (n=27,902)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	-0.709**	-1.414*	-0.474	0.292	0.127	0.0205	-0.248*	0.938**	0.0496
	(0.294)	(0.788)	(0.341)	(0.566)	(0.201)	(0.0455)	(0.146)	(0.450)	(0.0301)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	0.326	1.949*	1.500***	-2.311***	0.253	-0.0185	0.0693	-1.037	-0.0798*
	(0.433)	(1.170)	(0.561)	(0.783)	(0.358)	(0.0698)	(0.273)	(0.644)	(0.0442)
R-squared	0.105	0.182	0.031	0.041	0.036	0.010	0.020	0.064	0.008
<b>Panel B: High Income (n=27,901)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	1.539***	1.978	-1.161**	0.944	0.432**	0.169*	-0.0286	-0.810*	0.0152
	(0.496)	(1.233)	(0.556)	(0.801)	(0.216)	(0.100)	(0.0456)	(0.476)	(0.0285)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-0.0978	2.948	-0.207	-1.389	-0.201	-0.262	-0.118	-0.851	-0.0167
	(0.914)	(2.988)	(1.052)	(2.553)	(0.441)	(0.159)	(0.0851)	(0.873)	(0.0535)
R-squared	0.040	0.086	0.025	0.038	0.021	0.015	0.006	0.037	0.005

*Notes:* Dependent variable is the number of years worked (with nonzero earnings) during 1989-1993. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) years worked. Column (1) examines total years worked, (2) years worked at the initial firm, (3) at firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) in a firm with unknown industry code. Each worker-year is assigned to only one category in columns (2) through (9) based on the primary (highest-earning) job, so the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A13: Years Worked, by Income Group (1989-1998)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Income (n=27,902)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	-1.449*** (0.447)	-3.394** (1.600)	-1.066 (0.841)	0.564 (1.290)	0.548 (0.387)	0.157 (0.113)	-0.524 (0.325)	2.221** (0.938)	0.0461 (0.0365)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	0.150 (0.905)	3.535 (2.273)	4.082*** (1.370)	-4.986*** (1.680)	0.0654 (0.708)	-0.133 (0.162)	0.0838 (0.628)	-2.443* (1.364)	-0.0544 (0.0457)
R-squared	0.092	0.154	0.049	0.047	0.041	0.014	0.024	0.063	0.008
<b>Panel B: High Income (n=27,901)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	2.390*** (0.711)	1.034 (2.784)	-2.564** (1.179)	4.540** (1.925)	0.756 (0.479)	0.363 (0.376)	-0.114 (0.152)	-1.696 (1.305)	0.0712 (0.0454)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-1.394 (1.551)	10.67 (7.429)	-3.933 (3.468)	-4.379 (6.008)	0.0255 (1.014)	-0.412 (0.442)	-0.381 (0.264)	-2.938 (2.433)	-0.0471 (0.0666)
R-squared	0.053	0.101	0.049	0.044	0.020	0.028	0.008	0.043	0.006

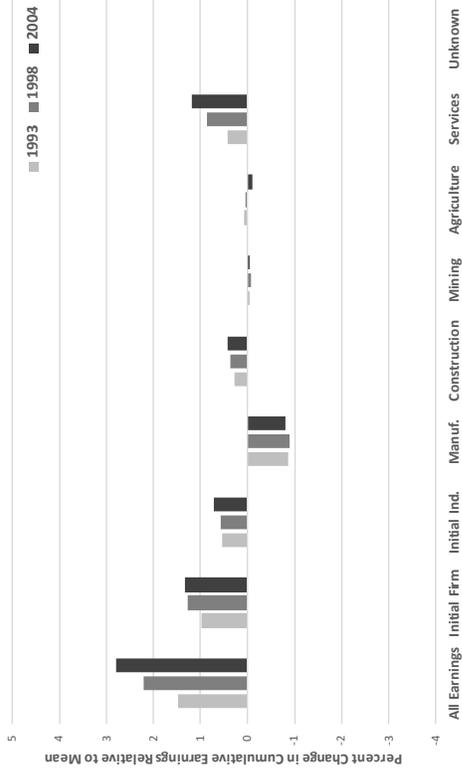
*Notes:* Dependent variable is the number of years worked (with nonzero earnings) during 1989-1998. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) years worked. Column (1) examines total years worked, (2) years worked at the initial firm, (3) at firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) in a firm with unknown industry code. Each worker-year is assigned to only one category in columns (2) through (9) based on the primary (highest-earning) job, so the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A14: Years Worked, by Income Group (1989-2004)

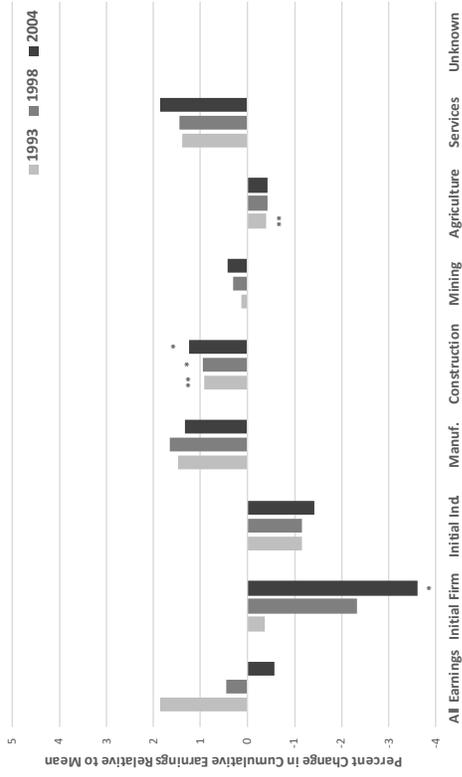
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Income (n=27,902)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	-2.351*** (0.803)	-5.834** (2.808)	-2.182 (1.508)	0.866 (2.109)	1.110 (0.698)	0.345* (0.202)	-0.734 (0.496)	4.015*** (1.422)	0.0641 (0.0462)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-0.596 (1.787)	4.887 (3.991)	7.261*** (2.578)	-8.287*** (2.590)	0.0845 (1.271)	-0.254 (0.300)	-0.291 (0.950)	-3.919* (2.169)	-0.0781 (0.0604)
R-squared	0.091	0.134	0.056	0.051	0.046	0.019	0.027	0.066	0.006
<b>Panel B: High Income (n=27,901)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}})$	4.409*** (1.414)	0.448 (4.649)	-5.150** (2.129)	8.765*** (2.912)	1.508 (1.004)	0.567 (0.853)	-0.182 (0.285)	-1.640 (2.394)	0.0920 (0.0699)
$-\Delta \ln(1 + \tau_j^{\text{US}})$	-4.159 (3.009)	16.68 (12.15)	-6.198 (6.297)	-9.408 (9.316)	0.699 (2.023)	-0.847 (0.903)	-0.892** (0.377)	-4.165 (4.635)	-0.0264 (0.0898)
R-squared	0.083	0.108	0.055	0.046	0.020	0.039	0.011	0.049	0.005

*Notes:* Dependent variable is the number of years worked (with nonzero earnings) during 1989-2004. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) years worked. Column (1) examines total years worked, (2) years worked at the initial firm, (3) at firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) in a firm with unknown industry code. Each worker-year is assigned to only one category in columns (2) through (9) based on the primary (highest-earning) job, so the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

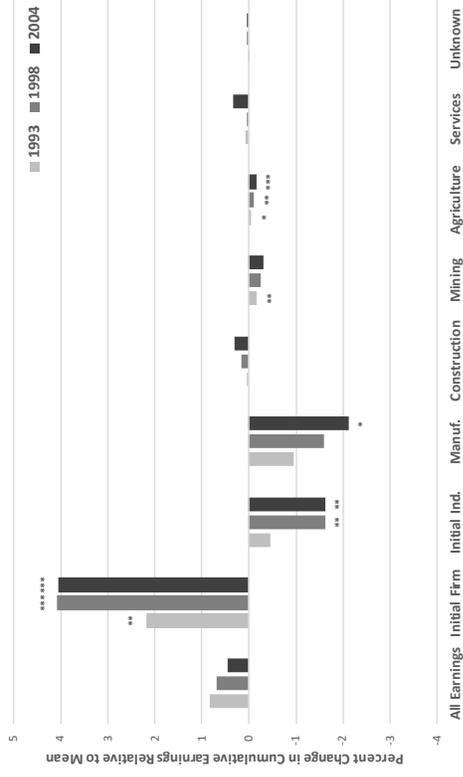
Figure A4: Evolution of Effects on Cumulative Normalized Earnings by Income



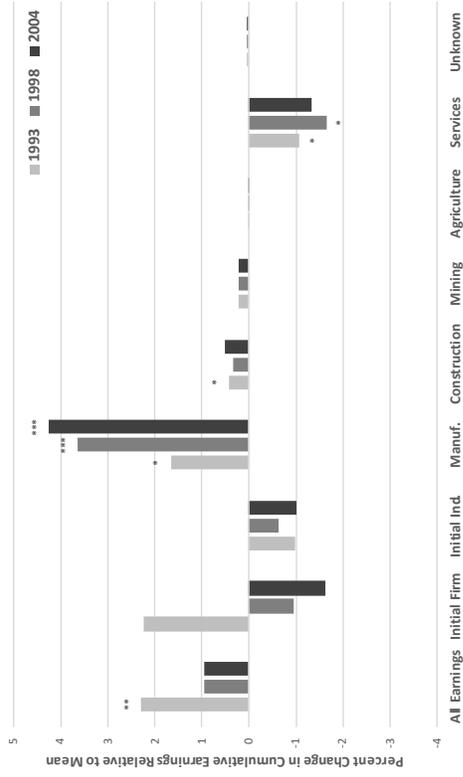
(a) Effect of Canadian Tariff Cuts - Low Income Workers



(b) Effect of US Tariff Cuts - Low Income Workers



(c) Effect of Canadian Tariff Cuts - High Income Workers



(d) Effect of US Tariff Cuts - High Income Workers

Notes: The figures present scaled estimates from regressions paralleling those in Table A8. The bars show predicted differences in cumulative normalized earnings when facing tariff changes that differ by the interquartile range, expressed as a percent of the group's mean cumulative normalized earnings. To make results comparable to the 16-year 1989-2004 timeframe, the 1989-1993 values are multiplied by 16/5, and the 1989-1998 values are multiplied by 16/10. See Table A8 note for category definitions. Stars indicate statistical significance based on standard errors clustered by 4-digit NAICS industry. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Table A15: Cumulative Normalized Earnings, by Income Group (1989-1993)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Income (n=27,902)</b>									
$-\Delta \ln(1 + \tau_j^{CAN})$	1.469	-0.293	-0.919	1.172	0.735**	0.100	-0.326**	1.086	-
	(1.412)	(1.377)	(0.605)	(1.234)	(0.352)	(0.119)	(0.153)	(0.822)	
$-\Delta \ln(1 + \tau_j^{US})$	2.992	1.953	1.118	-1.735	0.585	-0.110	0.115	0.830	-
	(1.971)	(2.111)	(0.911)	(1.760)	(0.629)	(0.283)	(0.284)	(1.300)	
R-squared	0.118	0.061	0.012	0.038	0.024	0.008	0.019	0.095	0.011
<b>Panel B: High Income (n=27,901)</b>									
$-\Delta \ln(1 + \tau_j^{CAN})$	1.809**	1.775	-0.780	1.316*	0.332*	0.162	-0.00131	-0.855*	0.0217
	(0.832)	(1.288)	(0.590)	(0.753)	(0.194)	(0.0991)	(0.0316)	(0.502)	(0.0262)
$-\Delta \ln(1 + \tau_j^{US})$	1.670	4.418**	-0.899	-1.950	0.0844	-0.354**	-0.115*	0.142	-0.0115
	(1.305)	(1.909)	(0.890)	(1.685)	(0.336)	(0.176)	(0.0635)	(0.530)	(0.0341)
R-squared	0.069	0.076	0.027	0.038	0.020	0.013	0.006	0.035	0.005

*Notes:* Dependent variable is the sum of a worker's earnings during 1989-1993, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{CAN})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{US})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) cumulative earnings. Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Estimates suppressed due to data confidentiality concerns are shown as -. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A16: Cumulative Normalized Earnings, by Income Group (1989-1998)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Income (n=27,902)</b>									
$-\Delta \ln(1 + \tau_j^{CAN})$	0.719 (3.532)	-3.682 (2.997)	-1.834 (1.653)	2.626 (3.052)	1.504* (0.759)	0.492 (0.353)	-0.675 (0.437)	2.277 (2.079)	-
$-\Delta \ln(1 + \tau_j^{US})$	8.985 (5.790)	5.094 (4.677)	2.342 (2.513)	-3.652 (4.587)	1.477 (1.376)	-0.328 (0.710)	0.135 (0.818)	3.541 (4.079)	-
R-squared	0.124	0.053	0.014	0.033	0.025	0.013	0.019	0.114	0.009
<b>Panel B: High Income (n=27,901)</b>									
$-\Delta \ln(1 + \tau_j^{CAN})$	1.482 (1.714)	-1.514 (2.965)	-1.010 (1.191)	5.752*** (2.015)	0.532 (0.475)	0.326 (0.354)	-0.0307 (0.111)	-2.611* (1.426)	0.0382 (0.0283)
$-\Delta \ln(1 + \tau_j^{US})$	2.808 (2.728)	16.47*** (5.686)	-6.550** (2.790)	-6.498 (4.444)	0.655 (0.849)	-0.976 (0.654)	-0.448** (0.197)	0.154 (1.644)	0.00419 (0.0409)
R-squared	0.081	0.087	0.057	0.044	0.017	0.026	0.008	0.044	0.005

*Notes:* Dependent variable is the sum of a worker's earnings during 1989-1998, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{CAN})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{US})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) cumulative earnings. Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Estimates suppressed due to data confidentiality concerns are shown as -. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A17: Cumulative Normalized Earnings, by Income Group (1989-2004)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Income (n=27,902)</b>									
$-\Delta \ln(1 + \tau_j^{CAN})$	0.719 (3.532)	-3.682 (2.997)	-1.834 (1.653)	2.626 (3.052)	1.504* (0.759)	0.492 (0.353)	-0.675 (0.437)	2.277 (2.079)	-
$-\Delta \ln(1 + \tau_j^{US})$	8.985 (5.790)	5.094 (4.677)	2.342 (2.513)	-3.652 (4.587)	1.477 (1.376)	-0.328 (0.710)	0.135 (0.818)	3.541 (4.079)	-
R-squared	0.124	0.053	0.014	0.033	0.025	0.013	0.019	0.114	0.009
<b>Panel B: High Income (n=27,901)</b>									
$-\Delta \ln(1 + \tau_j^{CAN})$	1.482 (1.714)	-1.514 (2.965)	-1.010 (1.191)	5.752*** (2.015)	0.532 (0.475)	0.326 (0.354)	-0.0307 (0.111)	-2.611* (1.426)	0.0382 (0.0283)
$-\Delta \ln(1 + \tau_j^{US})$	2.808 (2.728)	16.47*** (5.686)	-6.550** (2.790)	-6.498 (4.444)	0.655 (0.849)	-0.976 (0.654)	-0.448** (0.197)	0.154 (1.644)	0.00419 (0.0409)
R-squared	0.081	0.087	0.057	0.044	0.017	0.026	0.008	0.044	0.005

*Notes:* Dependent variable is the sum of a worker's earnings during 1989-2004, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{CAN})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{US})$ ) in the worker's initial industry. A positive (negative) coefficient means that larger tariff cuts in the worker's initial industry lead to increased (decreased) cumulative earnings. Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Estimates suppressed due to data confidentiality concerns are shown as -. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

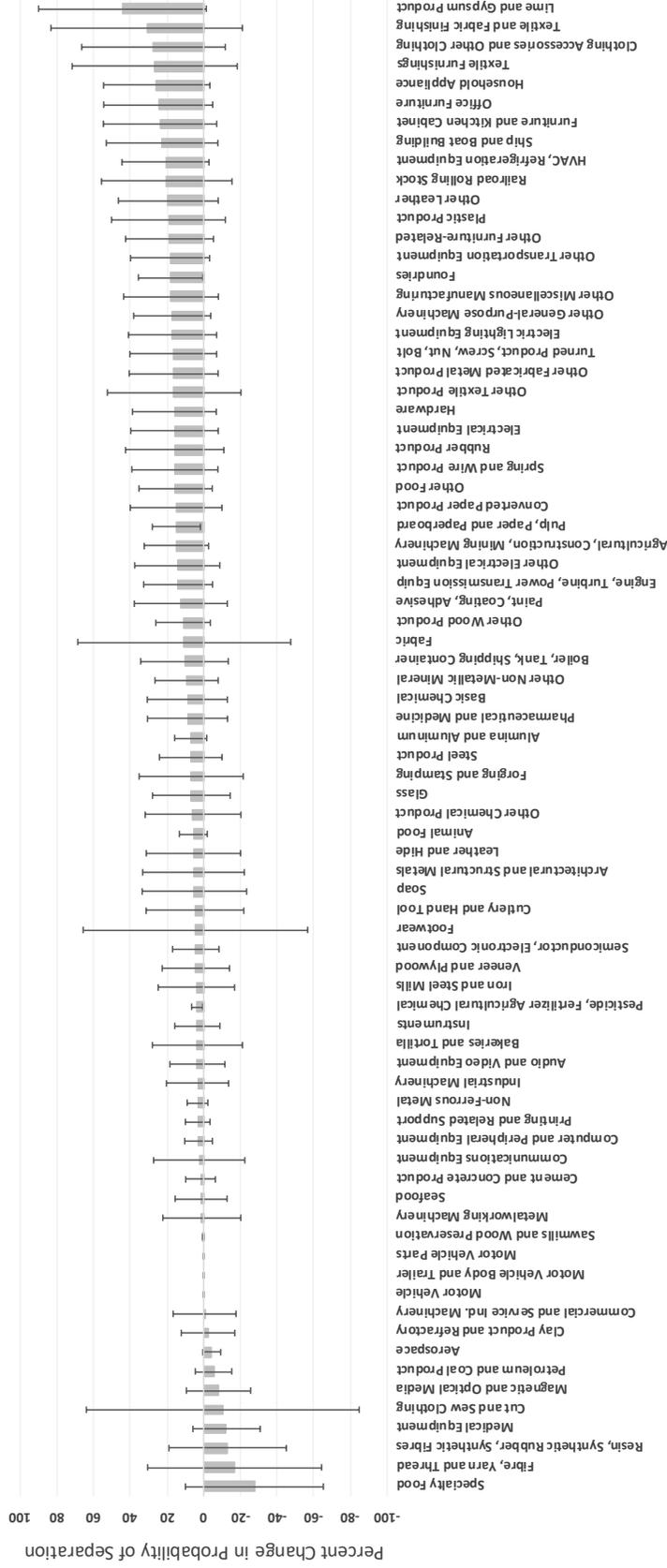
## C.10 Net Effects by Industry

In Figures A5-A7, we present the net effects of Canadian and U.S. tariff cuts on the probability of experiencing a work-shortage related separation (layoff), on overall cumulative earnings, and on cumulative earnings from the initial firm. We present results for low attachment workers initially at large firms because this worker group generally exhibits the largest point estimates. The predicted effects are evaluated at the particular Canadian and U.S. tariff cuts facing each industry and divided by the average outcome for low attachment workers initially at large firms, so the predicted values are expressed as proportional differences from the average outcome. Each figure sorts industries on the x-axis from most negative to most positive net effect.

Figure A5 shows the net effects for permanent work-shortage related separations. In spite of focusing on the worker group with the largest point estimates, the majority of predicted net effects are small, with magnitudes less than 20 percent, and only 3 out of 78 manufacturing industries exhibit effects that are statistically different from zero at the 5 percent level. The results for cumulative earnings in Figure A6 are similar. Only 4 industries exhibit point estimates with magnitudes above 10 percent, and again only 3 are statistically different from zero. These findings make clear that even though low attachment workers at large firms have nontrivial predicted effects of each individual tariff change, the net effects are relatively small because the effects of Canadian and U.S. tariff cuts generally offset each other.

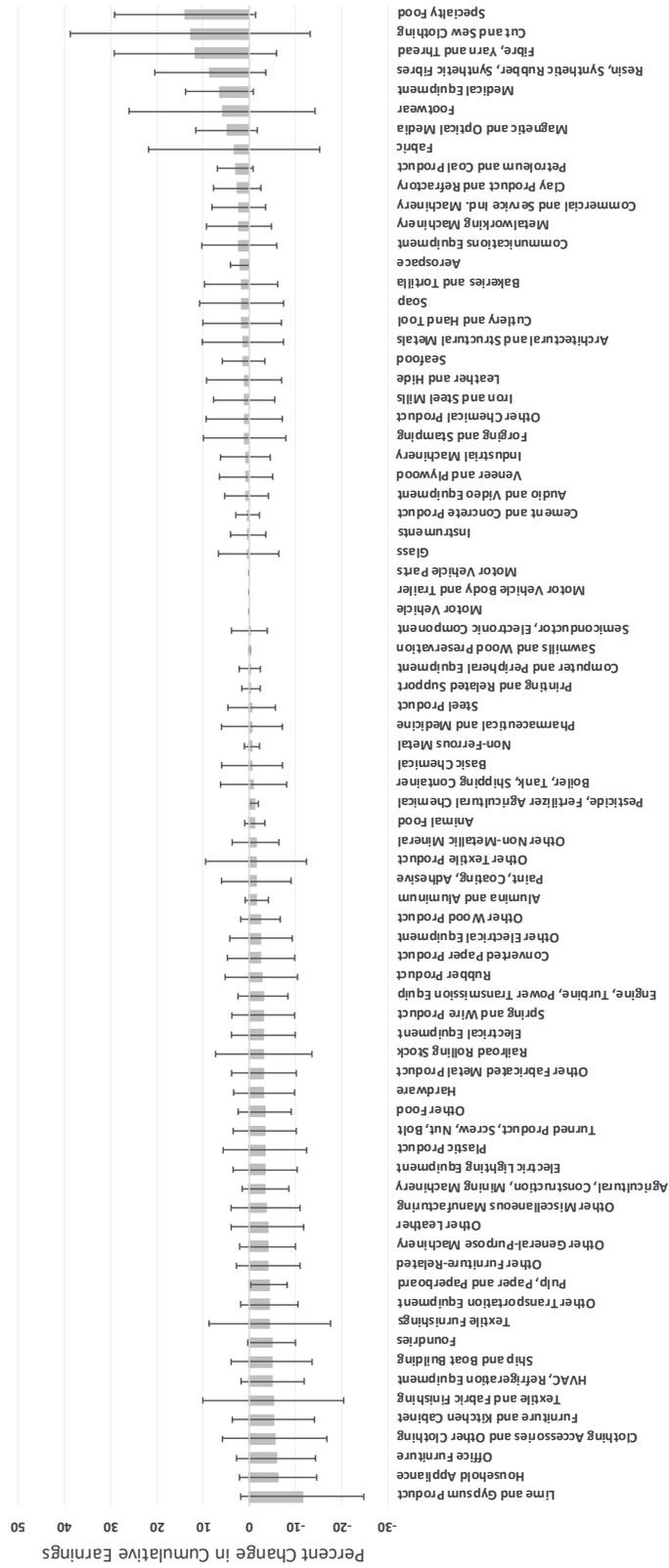
Figure A7 shows the net effects on cumulative earnings from the worker's initial firm. Consistent with the overall estimates shown in the main text, these effects are substantially larger than the overall earnings estimates, reflecting Canadian workers' ability to recover lost earnings at the initial firm by transitioning into other positions. In this case 25 industries exhibit net effects that are distinguishable from zero, all of them with negative point estimates.

Figure A5: Net Effects of Canadian and U.S. Tariff Cuts on the Probability of Separation for Low Attachment Workers Initially at Large Firms (1989-2003)



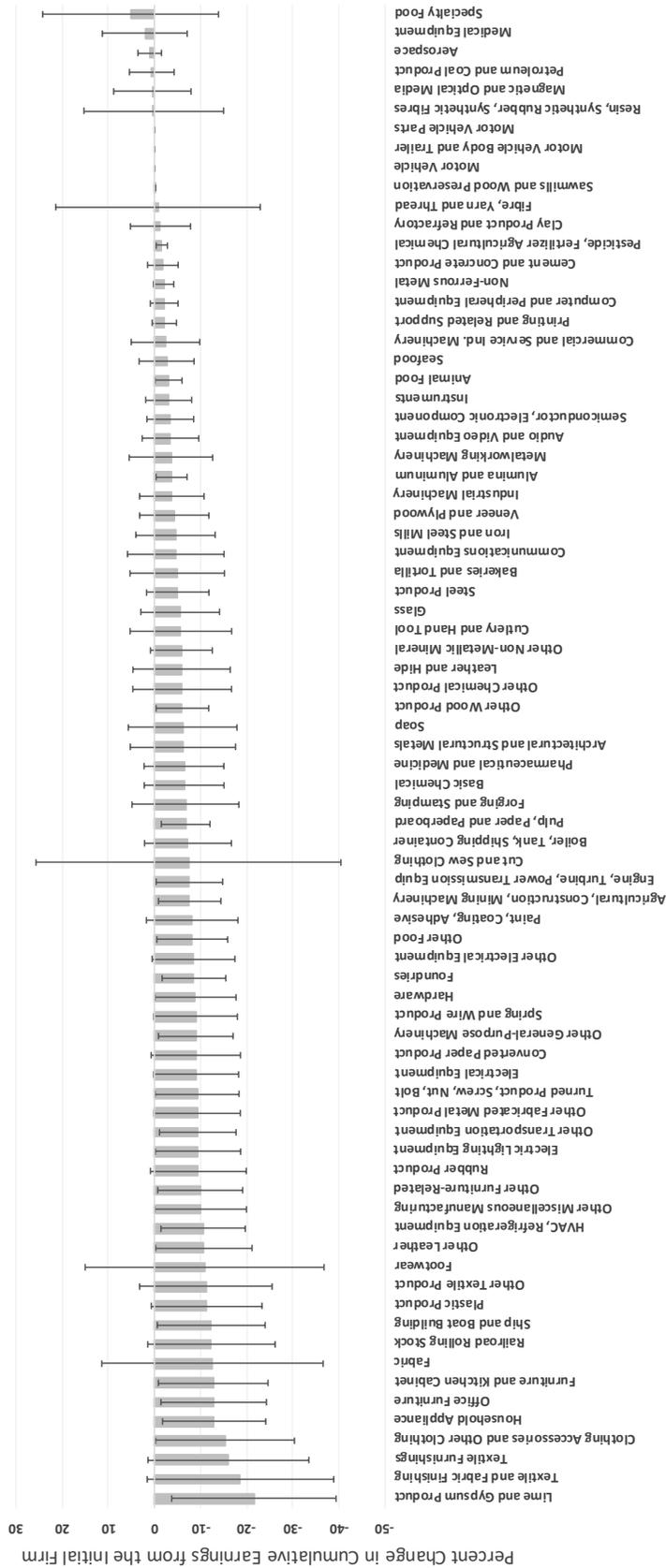
Notes: Each bar represents the predicted net effect of the Canadian and U.S. tariff cuts on the probability of experiencing a work-shortage related separation for low attachment workers initially at large firms in the industry listed on the x-axis. The predicted values are expressed relative to the worker group's unconditional average separation probability: 0.167. Industries sorted from most negative to most positive net effect estimate. Error bars reflect 95 percent confidence intervals. Out of 78 industries, 3 net effect estimates are statistically distinguishable from zero at the 5 percent level.

Figure A6: Net Effects of Canadian and U.S. Tariff Cuts on Cumulative Normalized Earnings for Low Attachment Workers Initially at Large Firms (1989-2004)



Notes: Each bar represents the predicted net effect of the Canadian and U.S. tariff cuts on cumulative normalized earnings for low attachment workers initially at large firms in the industry listed on the x-axis. The predicted values are expressed relative to the worker group's unconditional average cumulative earnings: 21.0. Industries sorted from most negative to most positive net effect estimate. Error bars reflect 95 percent confidence intervals. Out of 78 industries, 3 net effect estimates are statistically distinguishable from zero at the 5 percent level.

Figure A7: Net Effects of Canadian and U.S. Tariff Cuts on Cumulative Normalized Earnings From the Initial Firm for Low Attachment Workers Initially at Large Firms (1989-2004)



Notes: Each bar represents the predicted net effect of the Canadian and U.S. tariff cuts on cumulative normalized earnings from the initial firm for low attachment workers initially at large firms in the industry listed on the x-axis. The predicted values are expressed relative to the worker group's unconditional average cumulative earnings: 21.0. Industries sorted from most negative to most positive net effect estimate. Error bars reflect 95 percent confidence intervals. Out of 78 industries, 25 net effect estimates are statistically distinguishable from zero at the 5 percent level.

## C.11 Regional Shocks and Industrial Geography

This Appendix explores what role geography plays in generating the results in this paper. Because the T2-LEAP-LWF data set from Statistics Canada includes only very coarse province-level geographic information, we are unable to observe worker outcomes by Canadian local labor market. This data limitation precludes the implementation of a local-labor-markets analysis along the lines of Topalova (2010), Kovak (2013), or Autor et al. (2013a). However, using data in the public domain, we can construct regional tariff shocks paralleling those used in these local-markets analyses in an effort to understand whether features of Canadian industrial geography may have facilitated Canadian worker adjustment to its CUSFTA tariff concessions. For example, if a large share of the Canadian population lives in cities or otherwise industrially diverse regions, then workers facing unfavorable shocks may be able to find employment in favorably affected industries without having to relocate.

In order to assess if Canadian geography is special in some way, we require a benchmark for comparison. We choose the US as a natural comparison. Our strategy is to calculate actual regional shocks associated with the Canadian CUSFTA tariff cuts using Canadian industrial geography, and then to calculate a hypothetical set of regional shocks using the same industry tariff cuts but US industrial geography. We emphasize that this is not a counterfactual experiment but rather an attempt to examine whether and how Canadian industrial geography might have affected regional shocks.

We emphasize three findings. First, using the same set of industrial shocks, fewer Canadian regions than US regions would face large shocks. Second, we find no evidence that this is because Canadian regions are more industrially diversified. Third, we show that randomly generated industry-level shocks do not generate systematically different regional shocks in Canada and the US. Together, these findings provide little evidence in support of observable differences in industrial geography as a main driver of the relatively smooth and speedy reallocation of Canadian workers away from industries facing large increases in import competition. Rather, *this particular set of tariff changes* would have generated more large-shock regions in the US than it did in Canada, but a similar comparison should not be expected for other arbitrary industry shocks.

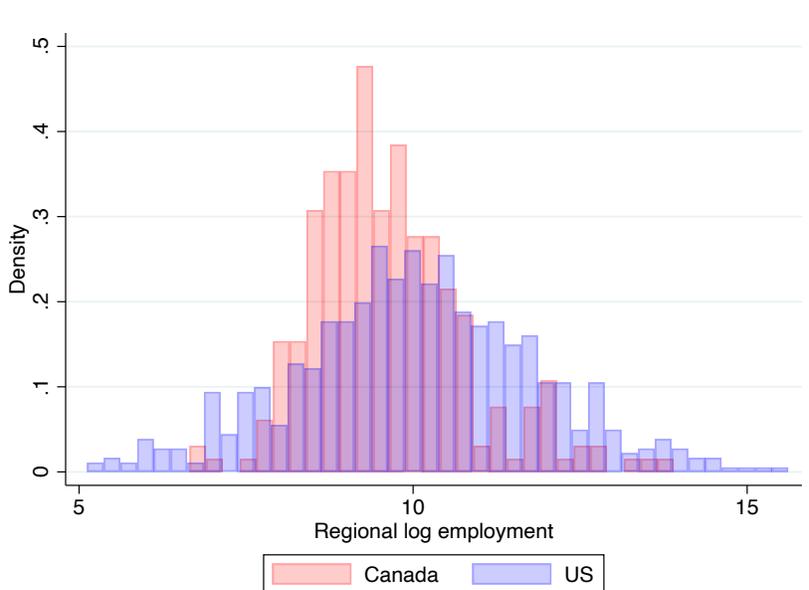
### C.11.1 Local Labor Markets

We define Canadian local labor markets based on the Census Division classification from Statistics Canada. This definition allows us to use a custom tabulation from the 1986 Canadian Census of Population reporting the industry distribution of regional employment. Jeff Chan uses these data in Chan (2019), and we thank him for generously providing this tabulation. We follow the literature by defining US local labor markets based on Commuting Zones. It is important that these two levels of geographic aggregation (Census Division vs. Commuting Zone) are comparable across the two countries. Figure A8 confirms this comparability by plotting a histogram of regional log employment in 1986 using employment data for Canadian Census Divisions from Chan (2019) and for US Commuting Zones from the 1986 County Business Patterns (CBP), with imputed values from Eckert et al. (2020).<sup>71</sup> The two distributions have extensive common support, with the US having both smaller and larger locations than those seen in Canada, indicating that neither country's

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<sup>71</sup>We aggregate from counties to commuting zones using the concordance provided by David Dorn: [https://www.ddorn.net/data/cw\\_cty\\_czone.zip](https://www.ddorn.net/data/cw_cty_czone.zip).

Figure A8: Histograms of 1986 Employment by Canadian Census Division and US Commuting Zone



*Notes:* The red histogram plots log employment across Canadian Census Divisions from a special tabulation of the 1986 Canadian Census of Population generously provided by Jeff Chan. The blue histogram plots log employment across US Commuting Zones from 1986 County Business Patterns with imputed values from Eckert et al. (2020). The bars are semi-transparent, so the overlap appears purple. The extensive common support between the two distributions implies that neither country’s regions are systematically more aggregated than the other’s.

locations are systematically more aggregated than the other’s on average.

### C.11.2 Regional Tariff Reductions

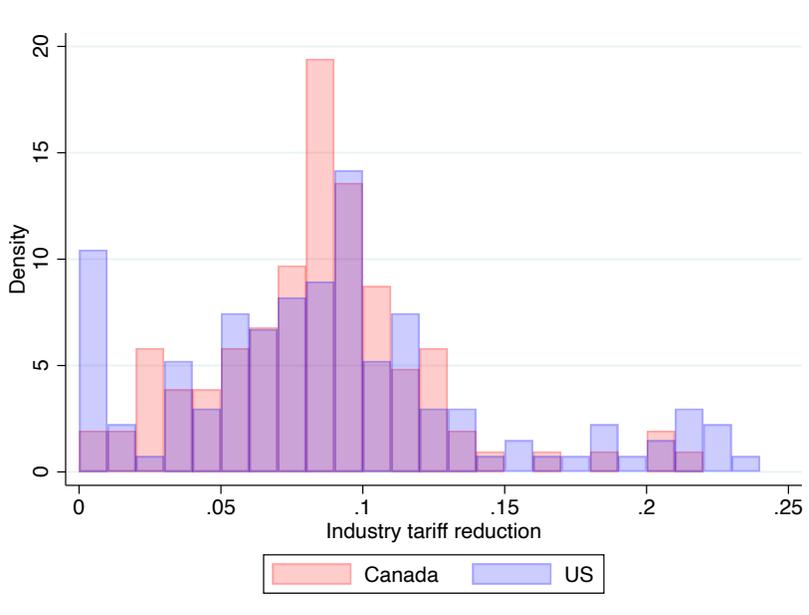
Regional tariff reductions reflect the regional employment-weighted averages of industry-level tariff reductions. Industry  $i$ ’s share of 1986 employment in region  $r$  in country  $c \in \{\text{CAN}, \text{US}\}$  is given by  $\varphi_{ri}^c$ . Note that  $\varphi_{ri}^c$  is the share of *all* employment in region  $r$ , including non-manufacturing and nontradable industries. For each country, we calculate two versions of the regional tariff reduction: one reflecting the average regional tariff reduction within manufacturing (M),

$$s_r^{c,M} \equiv - \sum_{i \in \text{M}} \frac{\varphi_{ri}^c}{\sum_{j \in \text{M}} \varphi_{rj}^c} \Delta \ln(1 + \tau_i^{\text{CAN}}) \quad \forall r \in c \text{ and } c \in \{\text{CAN}, \text{US}\}. \quad (4)$$

and one averaging across all industries, with zero tariff reduction outside manufacturing:

$$s_r^c \equiv - \sum_i \varphi_{ri}^c \mathbf{1}(i \in \text{M}) \cdot \Delta \ln(1 + \tau_i^{\text{CAN}}) \quad \forall r \in c \text{ and } c \in \{\text{CAN}, \text{US}\}. \quad (5)$$

Figure A9: Histograms of Tariff Reductions by US and Canadian 3-digit SIC Manufacturing Industries



Notes: The red histogram plots tariff reductions ( $\Delta \ln(1 + \tau_i^{\text{CAN}})$ ) across Canadian 3-digit SIC industries, while the blue histogram plots tariff reductions across US 3-digit SIC industries. The bars are semi-transparent, so the overlap appears purple. The similarity between the two distributions implies that the two SIC definitions are comparable.

Because our focus is on industrial geography, the regional tariff reductions for both Canada and the US use the *same* vector of tariff reductions. We choose the CUSFTA tariff reductions facing US exports to Canada, i.e.  $\tau^{\text{CAN}}$ . By using the same tariff changes in all of the measures, we isolate the implications of differences the industrial geography across the two countries.

To match the level of industry detail available in the Canadian Census data and the 1986 US CBP regional employment data, we use tariff changes at the 3-digit SIC level.<sup>72</sup> Because the Canadian and US versions of the SIC classification differ somewhat, we are concerned that shocks derived from the same HS-level data might generate different SIC-level shocks. Figure A9 assuages this concern by showing that the cross-industry distribution of tariff reductions is similar across the two versions.

Given comparable industry definitions and levels of geographic aggregation, we calculate the regional tariff reductions in (4) and (5) using the industrial geography of Canada ( $\varphi_{ri}^{\text{CAN}}$ ) or the US

<sup>72</sup>We begin with CUSFTA tariff reductions provided by Global Affairs Canada at the 8-digit Harmonized System (HS) level. For Canada, then truncate to 6-digit HS codes, map to 5-digit NAICS-1997 codes using the concordance from Pierce and Schott (2012), and then map from 5-digit NAICS to 3-digit 1980 Canadian SIC-E codes using the Statistics Canada crosswalk available here: <https://www.statcan.gc.ca/eng/subjects/standard/concordances/concordance1997-1980>. For the US, we truncate to 6-digit HS codes and then map to 3-digit 1980 US SIC codes using the “H0 to SIC” concordance available here: [https://wits.worldbank.org/product\\_concordance.html](https://wits.worldbank.org/product_concordance.html). Once we have HS codes mapped to SIC industries, we aggregate the tariff levels, weighting HS codes based on 1988 Canadian imports from the US.

$(\varphi_{ri}^{\text{US}})$ .<sup>73</sup> The resulting shocks appear in Figure A10. The shocks calculated using manufacturing industries only in panel (a) are of higher magnitude than those for all industries in panel (b) because the latter averages in zero tariff changes for non-manufacturing industries. In both cases, it is clear that a number of US regions would have faced larger regional tariff reductions than any of the Canadian regions. Since the tariff reductions are all based upon the vector of Canadian CUSFTA tariff cuts, the differences between Canada and the US are solely due to differences in the industrial geography of employment in each country's regions.

Figure A11 corroborates Figure A10's maps by plotting the distributions of regional tariff reductions across Canadian and US regions, weighted by total employment in each region. Many US regions would have faced substantially larger tariff reductions than the most heavily shocked Canadian regions. For example, for manufacturing-only regional shocks, only 1 percent of the Canadian population lives in regions facing shocks of at least 10 percent, while 11.3 percent of the US population lives in regions facing these large shocks. Similarly, for all-industry shocks, only 5 percent of Canada's population lives in regions facing shocks of at least 2.5 percent, while 19.9 percent of the US population lives in regions facing these large shocks.

One important point to note when considering the all-industry shocks is that the US CBP data omit a number of industries in agriculture and government, which artificially inflates the US manufacturing share of employment observed in the CBP by omitting some non-manufacturing employment that would fall in the denominator of the manufacturing share. Although we have restricted the sample of Canadian industries in an attempt to cover an identical set of industries, it is possible that we nonetheless overstate the manufacturing share by more in the US than in Canada. If so, the all-industry regional tariff reductions will be systematically overstated in the US relative to Canada. In fact, although national data suggest the manufacturing share of employment is extremely similar in Canada and the US (17.1 in Canada and 17.6 in the US in 1986), our sample finds a manufacturing share of employment of 20.1 percent in Canada and 23.4 in the US.<sup>74</sup> This potential measurement issue will become important in interpreting the all-industry results based on the tariff simulations below. This concern does not apply to the manufacturing-only regional tariff reductions.

### C.11.3 Regional Industry Concentration

A potential explanation why Canadian regions do not face particularly large tariff reductions is that they are more industrially diverse than their US counterparts. This can be because either a larger share of Canadians lives in industrially diverse cities, or because Canadian locations are more industrially diverse than US locations, conditional on size. We check this possibility directly by calculating the Herfindahl-Hirschman Index (HHI) of industry employment shares in each Canadian and US region. Figure A12 shows the distributions of HHI values across regions within each country, weighting by total regional employment. For both manufacturing industries (panel a) and all industries (panel b), the HHI distributions between Canada and the US are not systematically

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<sup>73</sup>The US County Business Patterns data report the vast majority of county employment at the 3-digit SIC or more detailed level, but a portion of employment is reported at the 2-digit SIC level. We apportion this 2-digit employment to underlying 3-digit industries based on each 3-digit industry's share of national employment within the corresponding 2-digit industry.

<sup>74</sup>National statistics based on the BLS International Comparisons of Annual Labor Force Statistics program, as reported by FRED.

different. While Canada has more locations with low concentration, it also has higher density than the US in more concentrated locations. This suggests that Canadian regions are not systematically more industrially diverse than US regions and that differences in regional shocks are not coming from systematic differences in regional concentration.

#### C.11.4 Tariff Change Simulations

Given the apparent similarity between industry concentration in Canadian and US regions, we seek to understand whether there are other systematic differences between the industrial geography of Canada and the US that might drive the apparent differences in regional shocks in Figures A10 and A11. To do so, we fit the observed distribution of Canadian CUSFTA tariff changes across manufacturing industries to a 2-parameter Weibull distribution and use this distribution to generate 1000 simulated IID tariff change vectors. We then calculate regional tariff reductions for the US and Canada using each simulated tariff change vector and the real-world industrial geography of each country. For each simulation we calculate i) the share of national population living in regions facing large shocks (10 percent for the manufacturing-only shock and 2.5 percent for the all-industry shock) and ii) the population-weighted inter-quartile range of regional tariff reductions.

Figures A13 and A14 present histograms of these statistics across the 1000 simulations to see whether systematic differences emerge across countries. Figure A13 shows the results for the manufacturing-only shocks, which are influenced only by differences in the composition of manufacturing employment across regions in each country. The distributions are extremely similar across countries for both statistics, implying that the industrial geographies of manufacturing in Canada and the US yield similar regional tariff reductions across simulated industry tariff reductions.

This conclusion contrasts with the larger tariff reductions facing many US regions in Figure A11 panel (a). While the particular tariff reduction vector employed in Figure A11 (the Canadian CUSFTA tariff cuts) implies large regional tariff reductions in a number of US regions, this feature is specific to that particular vector of tariff changes and not the systematic result of differences in Canadian and US industrial geography.

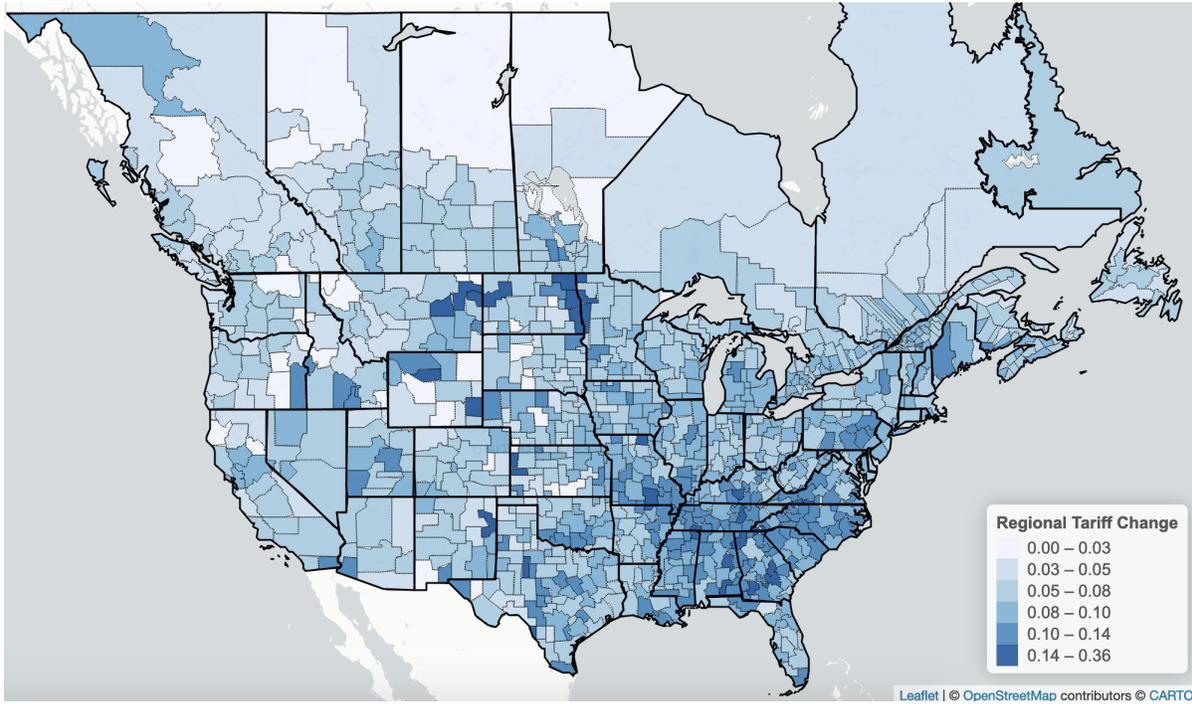
The results for the simulated all-industry regional tariff reductions in Figure A14 show more substantial differences, but these should be interpreted with care. In particular, the share of the population in regions facing large shocks is substantially larger across simulations in the US than in Canada. In all simulations (as in the actual tariff changes) the tariff reductions outside manufacturing are set to zero, so the difference between the all-industry and manufacturing-only results are driven by differences in the manufacturing share of employment. As mentioned above, although comprehensive national data report very similar manufacturing shares of employment in Canada and the US, the region-by-industry employment data used to construct the regional tariff reductions imply a higher manufacturing share in the US than in Canada. It is therefore likely that the differences between the US and Canada in Panel (a) of Figure A14 are driven by this data artifact. Panel (b) of Figure A14 shows that, if anything, the inter-quartile range in Canada is systematically larger than in the US.

#### C.11.5 Regional Shocks Summary

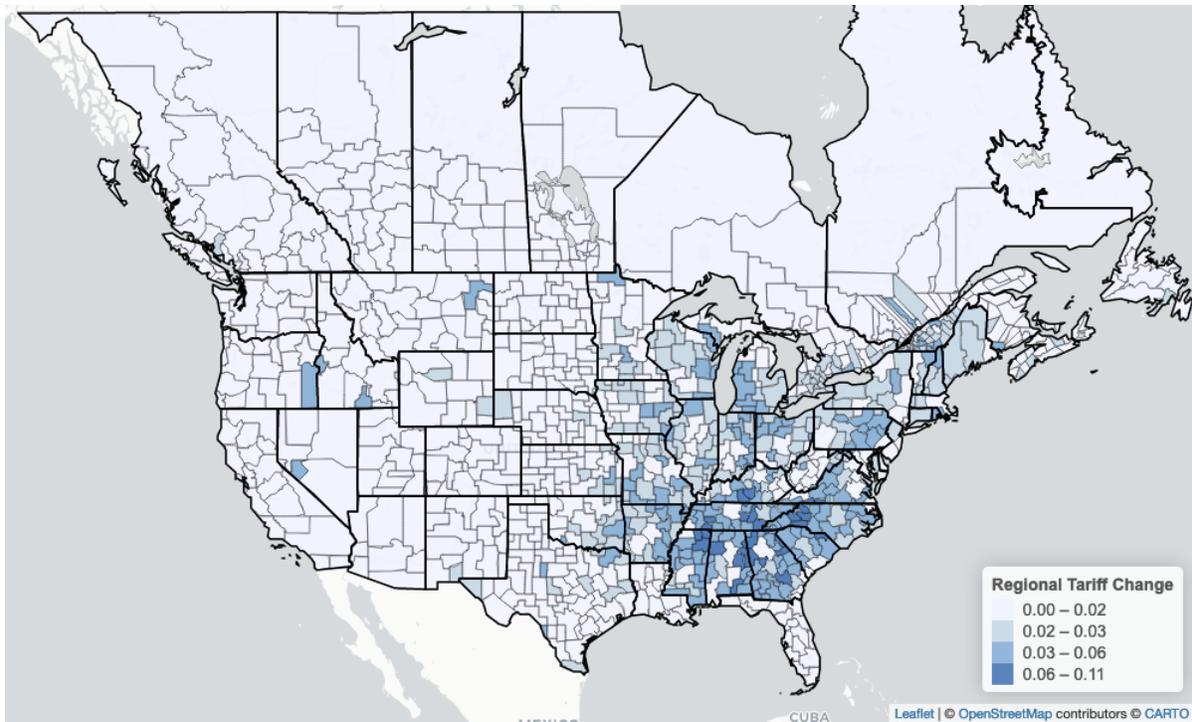
Together, these results provide little evidence in support of the hypothesis that Canadian industrial geography accounts for the relatively smooth and speedy reallocation of workers from industries

facing more import competition to more favorably affected industries. Canadian workers are not systematically more likely to live in industrially diverse regions than are workers in a natural comparison economy, the US. Nor are Canadian workers systematically less likely to face large shocks or large differences in shocks across regions when facing arbitrary tariff changes.

Figure A10: Regional Tariff Reductions



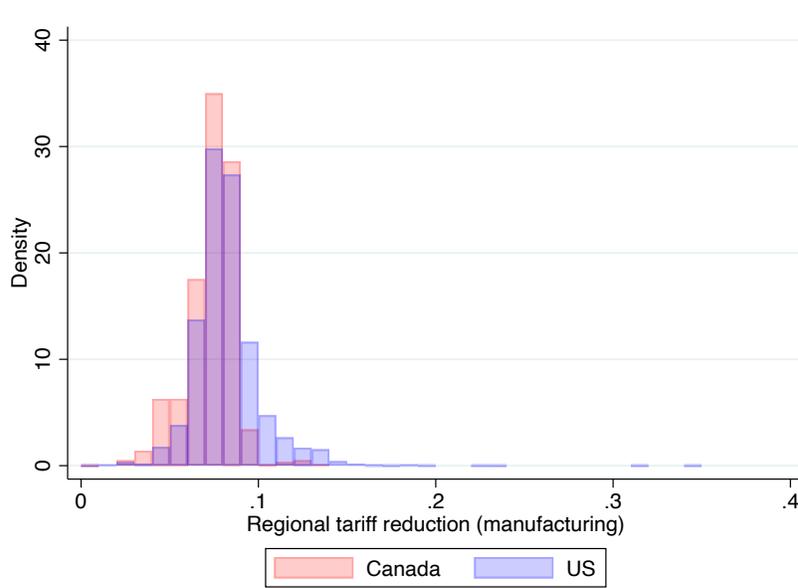
(a) Manufacturing Industries Only



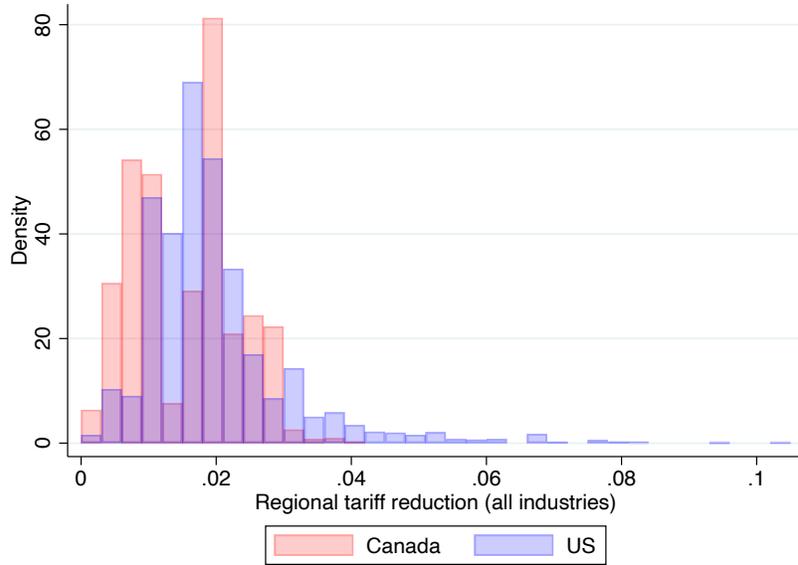
(b) All Industries

Notes: Panel (a) shows regional tariff reductions calculated using only manufacturing industries as in equation (4). Panel (b) shows regional tariff reductions calculated using all industries, with those outside manufacturing facing zero tariff reduction, as in equation (5).

Figure A11: Regional Tariff Reductions



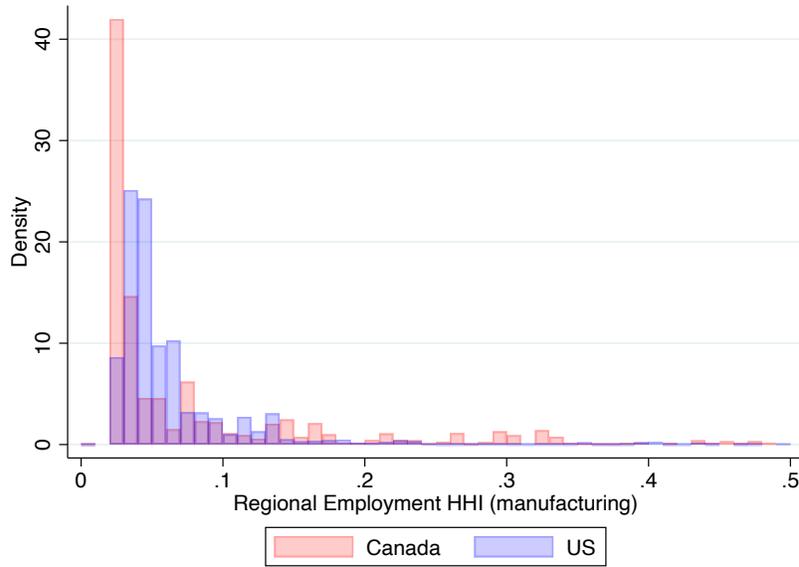
(a) Manufacturing Industries Only



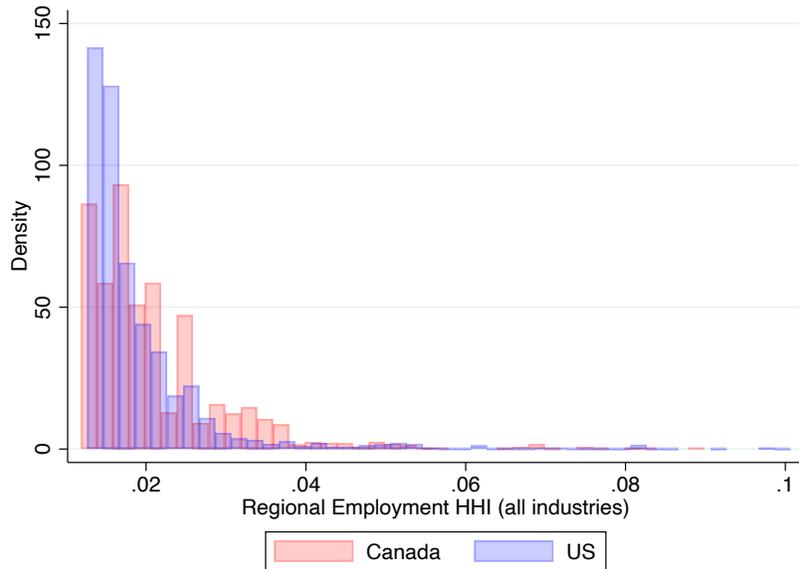
(b) All Industries

*Notes:* Panel (a) shows the within-country distributions of regional tariff reductions calculated using only manufacturing industries as in equation (4). Each distribution is weighted by total regional employment. Panel (b) shows the within-country distributions of regional tariff reductions calculated using all industries, with those outside manufacturing facing zero tariff reduction, as in equation (5).

Figure A12: Regional Industry Concentration of Employment (HHI)



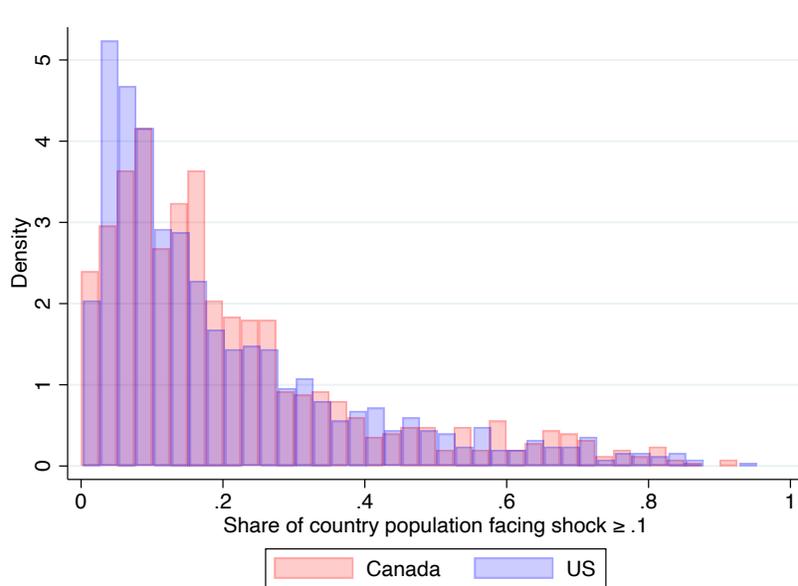
(a) Manufacturing Industries Only



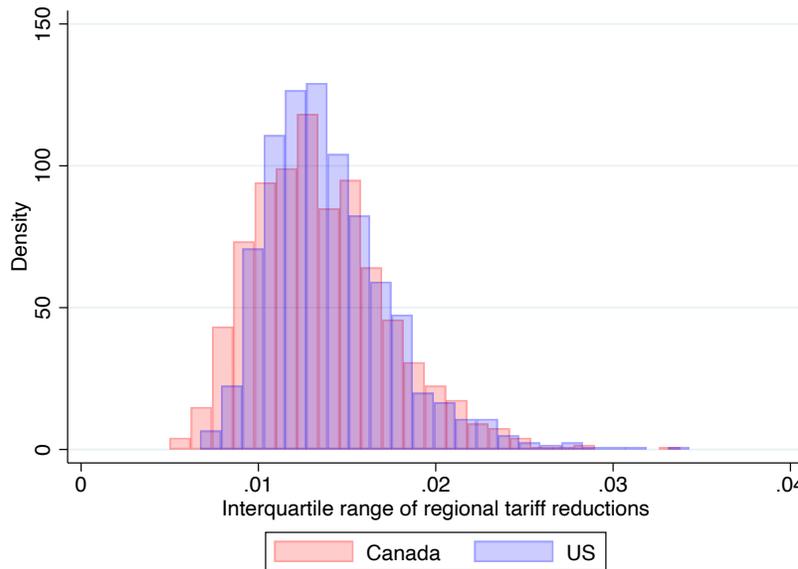
(b) All Industries

*Notes:* Both panels show the within-country distributions of the Herfindahl-Hirschman Index (HHI) of industry employment concentration within each country. Panel (a) shows industry concentration of employment within manufacturing, while Panel (b) shows industry concentration across all industries. To enhance readability, panel (a) restricts to HHI values of 0.5 or less and panel (b) restricts to HHI values of 0.1 or less, omitting an extremely small share of employment in both cases.

Figure A13: Simulation Results - Manufacturing-Only Regional Tariff Reductions



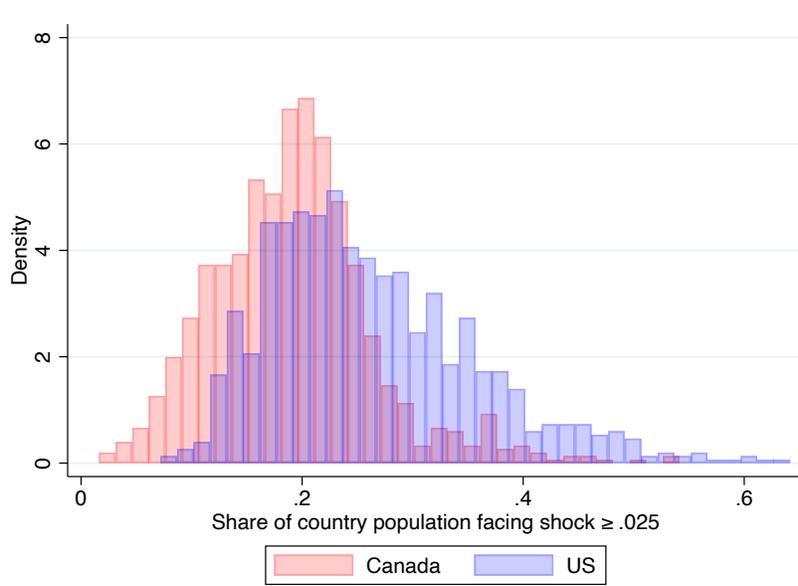
(a) Share of Population in Regions Facing 10 Percent or Larger Tariff Reduction



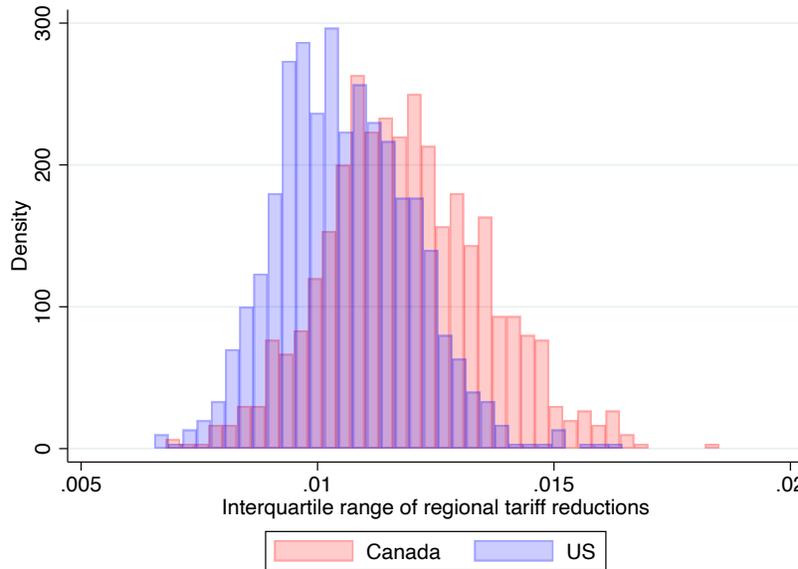
(b) Population-Weighted Inter-Quartile Range of Regional Tariff Reductions

*Notes:* Summary statistics from manufacturing-only regional tariff reductions based on 1000 simulated vectors of industry tariff changes. Panel (a) shows the share of the relevant country's population facing regional tariff reductions of 10 percent or more. Panel (b) shows the population-weighted inter-quartile range of regional tariff reductions. In both cases, the close agreement between the distributions implies that the industrial geography of manufacturing industries does not lead to systematic differences in the distributions of regional tariff reductions in Canada and the US.

Figure A14: Simulation Results - All-Industry Regional Tariff Reductions



(a) Share of Population in Regions Facing 10 Percent or Larger Tariff Reduction

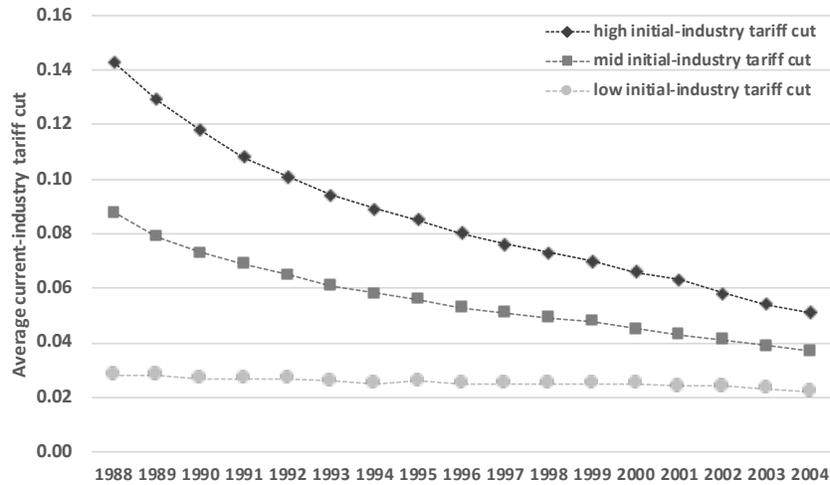


(b) Population-Weighted Inter-Quartile Range of Regional Tariff Reductions

*Notes:* Summary statistics from all-industry regional tariff reductions based on 1000 simulated vectors of industry tariff changes. Panel (a) shows the share of the relevant country's population facing regional tariff reductions of 2.5 percent or more. Panel (b) shows the population-weighted inter-quartile range of regional tariff reductions. See text for discussion of the apparent differences across Canada and the US.

## C.12 Evolution of Tariff-Cut Exposure

Figure A15: Evolution of Canadian Tariff-Cut Exposure: High Attachment Workers

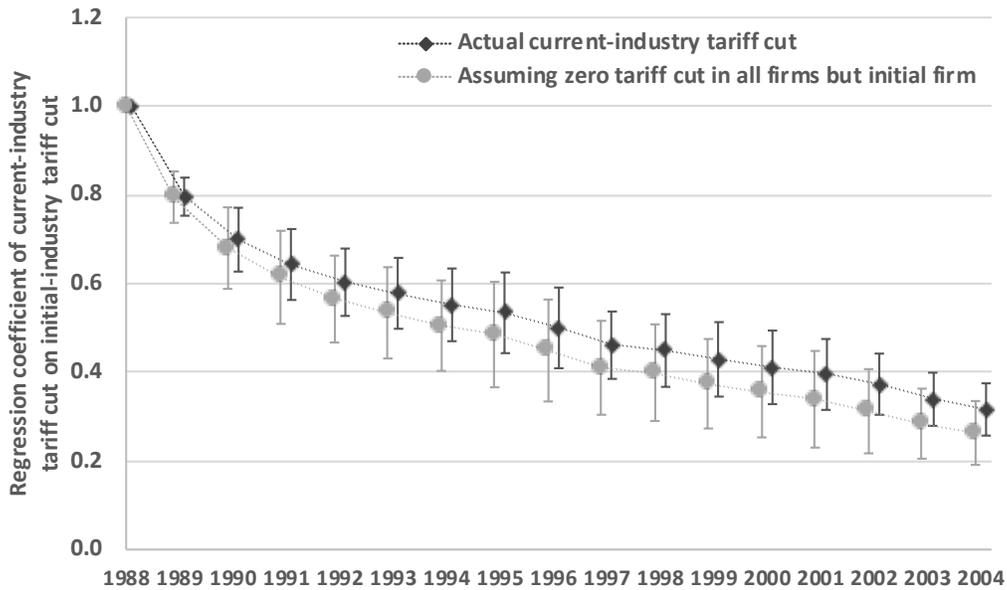


*Notes:* We divide manufacturing industries into terciles based on the size of the industry's Canadian tariff cut and assign workers to each tercile based on their initial industry of employment. For each initial-tariff-cut tercile, we plot the average Canadian tariff cut faced by workers in their current industry of employment during the year listed on the x-axis. Non-employed individuals in a given year are omitted from that year's average, and we assign zero tariff cut to non-tradable industries. Declining profiles imply that, on average, workers transition into industries that faced smaller Canadian tariff cuts than their initial industry.

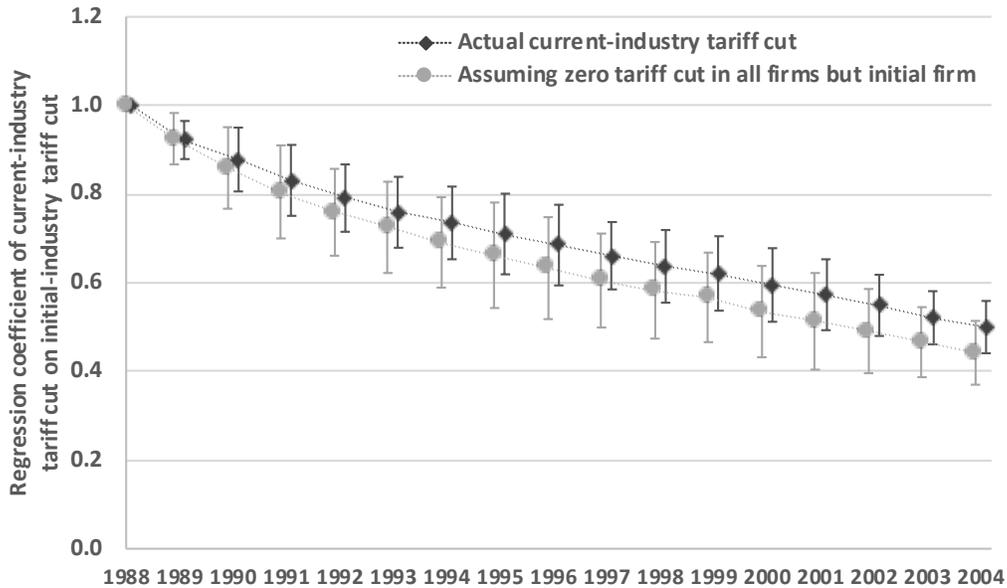
Figure IV in Autor et al. (2014) plots regression coefficients and 90% confidence intervals obtained from 32 regressions that relate the 1991-2007 trade exposure of a workers industry to the 1991-2007 trade exposure of the workers initial 1991 industry. In their graph, the counterfactual data series sets trade exposure to 0 for all firms except the workers initial employer. We perform an identical exercise here for low attachment workers (Figure A16a) and high attachment workers (Figure A16b).

For each figure, black diamonds correspond to coefficients from a regression of  $\Delta \ln(1 + \tau_{j(i)}^{\text{CAN}})$  on  $\Delta \ln(1 + \tau_{j(i)t}^{\text{CAN}})$  where  $\Delta \ln(1 + \tau_{j(i)}^{\text{CAN}})$  is the tariff cut in worker  $i$ 's initial industry of employment  $j$  and  $\Delta \ln(1 + \tau_{j(i)t}^{\text{CAN}})$  is the tariff cut in the industry in which the worker is employed in year  $t$ . There are 2x17 of these regressions each corresponding to a year in 1988-2004 with the coefficient for 1988 equal to one by construction. Confidence intervals are at the 95 percent level. Non-employed individuals in a given year are omitted from the regression in that year, and we assign zero tariff cut to non-tradable industries. Following Autor et al. (2014). The gray circles reflect an otherwise similar exercise in which we assign  $\Delta \ln(1 + \tau_{j(i)t}^{\text{CAN}}) = 0$  for employment at all firms other than the worker's initial firm when running this regression. The similarity of the black and gray diamonds indicate that Canadian workers quickly moved into industries facing dramatically less import competition as a result of Canadian tariff cuts.

Figure A16: Persistence of Tariff-Cut Exposure



(a) Low Attachment Workers



(b) High Attachment Workers

*Notes:* These figures replicate Figure IV of Autor et al. (2014). Black diamonds represents regression coefficients from regressing each worker's current industry's tariff cut in the relevant year on their initial-industry's tariff cut. Error bars are the associated 95 percent confidence intervals. Non-employed individuals in a given year are omitted from the regression in that year, and we assign zero tariff cut to non-tradable industries. The gray circles reflect an otherwise similar exercise in which all firms other than the worker's initial firm are assigned zero tariff cut. The similarity of the black and gray series indicate that Canadian workers quickly moved into industries facing less import competition as a result of Canadian tariff cuts.

## C.13 Worker Transitions by Initial Firm Size Results Tables

Table A18: Worker Transitions, by Labor-Force Attachment and Initial Firm Size (1989-1993)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown	Unemp.
<b>Panel A: Low Attachment (n=20,577)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	-0.378 (0.260)	-0.0419 (0.0330)	-0.0360 (0.0640)	0.000103 (0.0303)	—	—	-0.00242 (0.0630)	—	-0.401** (0.182)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	0.448** (0.180)	0.00199 (0.0284)	0.0319 (0.0717)	-0.00744 (0.0245)	—	—	0.0730 (0.0537)	—	0.181 (0.179)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	-0.204 (0.295)	-0.0167 (0.0327)	0.0763 (0.0521)	0.0153 (0.0225)	—	—	-0.0447 (0.0514)	—	-0.237 (0.198)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	0.516** (0.257)	0.101* (0.0511)	-0.0172 (0.0886)	0.0901* (0.0514)	—	—	-0.00172 (0.0827)	—	0.295 (0.210)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	-0.611** (0.280)	0.0246 (0.0534)	-0.0649 (0.0893)	0.0819 (0.0611)	0.0101 (0.0121)	—	-0.0762 (0.0838)	—	-0.472* (0.248)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	-0.106 (0.314)	0.00217 (0.0421)	-0.0838 (0.102)	0.0711 (0.0455)	—	—	-0.00503 (0.0808)	—	-0.393 (0.338)
R-squared	0.043	0.005	0.006	0.010	0.005	0.005	0.006	0.005	0.047
<b>Panel B: High Attachment (n=63,128)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	-0.142 (0.184)	-0.0465 (0.0455)	0.00610 (0.0610)	-0.00197 (0.0287)	—	—	-0.0586 (0.0536)	—	-0.0297 (0.0954)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	0.104 (0.137)	-0.0192 (0.0245)	0.0167 (0.0446)	0.0157 (0.0196)	—	—	0.00695 (0.0284)	—	0.0647 (0.102)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	0.00199 (0.204)	-0.0250 (0.0363)	0.0535 (0.0585)	0.0293 (0.0202)	—	—	0.0165 (0.0306)	—	-0.0880 (0.116)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	0.231 (0.221)	0.0499 (0.0518)	-0.0176 (0.0730)	0.0884 (0.0667)	—	—	0.0788 (0.0658)	—	0.0437 (0.135)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	-0.159 (0.207)	0.0312 (0.0482)	-0.0567 (0.0670)	0.0415 (0.0370)	—	—	-0.0447 (0.0437)	—	-0.0346 (0.139)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	-0.306 (0.346)	-0.0169 (0.0325)	-0.0788 (0.107)	0.0604 (0.0514)	—	—	-0.0935* (0.0499)	—	-0.162 (0.211)
R-squared	0.025	0.007	0.005	0.006	0.003	0.004	0.005	0.001	0.018

*Notes:* Dependent variable in column (1) is an indicator for experiencing a permanent work-shortage based separation from the worker's initial firm during 1989-1993. The subsequent columns additively decompose this separation indicator based upon the worker's employment status in the year following separation. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry, interacted with initial firm size (small=1-99, medium=100-999, large=1000+). Because the transition indicators in columns (2) through (9) additively decompose the overall separation indicator, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Estimates suppressed due to data confidentiality concerns are shown as —. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A19: Worker Transitions, by Labor-Force Attachment and Initial Firm Size (1989-1998)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown	Unemp.
<b>Panel A: Low Attachment (n=20,577)</b>									
$-\Delta \ln(1 + \tau_j^{CAN}) * \mathbb{1}(\text{small firm})$	-0.513 (0.316)	-0.0394 (0.0453)	-0.0262 (0.0702)	-0.00804 (0.0335)	—	—	0.0253 (0.0607)	—	-0.579** (0.242)
$-\Delta \ln(1 + \tau_j^{CAN}) * \mathbb{1}(\text{medium firm})$	0.304 (0.213)	-0.0218 (0.0391)	0.0349 (0.0798)	0.0135 (0.0289)	—	—	0.0391 (0.0688)	—	0.103 (0.225)
$-\Delta \ln(1 + \tau_j^{CAN}) * \mathbb{1}(\text{large firm})$	0.550** (0.217)	0.0173 (0.0435)	0.131** (0.0629)	0.0991** (0.0463)	—	—	-0.00802 (0.0576)	—	0.369 (0.245)
$-\Delta \ln(1 + \tau_j^{US}) * \mathbb{1}(\text{small firm})$	0.657** (0.299)	0.156** (0.0677)	-0.0366 (0.0914)	0.116* (0.0653)	—	—	-0.00621 (0.0763)	—	0.358 (0.253)
$-\Delta \ln(1 + \tau_j^{US}) * \mathbb{1}(\text{medium firm})$	-0.543* (0.281)	0.130 (0.0853)	-0.0944 (0.0881)	0.0737 (0.0732)	0.0105 (0.0124)	—	-0.0218 (0.111)	—	-0.615* (0.312)
$-\Delta \ln(1 + \tau_j^{US}) * \mathbb{1}(\text{large firm})$	-0.892** (0.361)	-0.0226 (0.0672)	-0.150 (0.125)	-0.00607 (0.0652)	—	—	-0.0255 (0.0897)	—	-1.094** (0.522)
R-squared	0.063	0.008	0.006	0.011	0.005	0.007	0.006	0.005	0.071
<b>Panel B: High Attachment (n=63,128)</b>									
$-\Delta \ln(1 + \tau_j^{CAN}) * \mathbb{1}(\text{small firm})$	-0.197 (0.260)	-0.0996 (0.0602)	-0.0362 (0.0789)	-0.00357 (0.0345)	—	—	-0.0331 (0.0653)	—	-0.0202 (0.125)
$-\Delta \ln(1 + \tau_j^{CAN}) * \mathbb{1}(\text{medium firm})$	0.102 (0.211)	-0.0356 (0.0321)	0.0352 (0.0653)	0.0199 (0.0217)	—	—	0.0216 (0.0411)	—	0.0372 (0.127)
$-\Delta \ln(1 + \tau_j^{CAN}) * \mathbb{1}(\text{large firm})$	0.451* (0.233)	0.00889 (0.0424)	0.169** (0.0732)	0.0931** (0.0446)	—	—	0.0491 (0.0472)	—	0.106 (0.195)
$-\Delta \ln(1 + \tau_j^{US}) * \mathbb{1}(\text{small firm})$	0.394 (0.304)	0.173** (0.0746)	0.0292 (0.0939)	0.127 (0.0882)	—	—	0.0243 (0.0807)	—	0.0648 (0.160)
$-\Delta \ln(1 + \tau_j^{US}) * \mathbb{1}(\text{medium firm})$	-0.145 (0.286)	0.127* (0.0687)	-0.0599 (0.0864)	0.0625 (0.0506)	—	—	-0.0925 (0.0648)	—	-0.0856 (0.178)
$-\Delta \ln(1 + \tau_j^{US}) * \mathbb{1}(\text{large firm})$	-0.738* (0.437)	-0.0690 (0.0593)	-0.162 (0.123)	0.0321 (0.0686)	—	—	-0.111* (0.0643)	—	-0.377 (0.264)
R-squared	0.036	0.015	0.006	0.008	0.002	0.005	0.005	0.001	0.027

*Notes:* Dependent variable in column (1) is an indicator for experiencing a permanent work-shortage based separation from the worker's initial firm during 1989-1998. The subsequent columns additively decompose this separation indicator based upon the worker's employment status in the year following separation. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{CAN})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{US})$ ) in the worker's initial industry, interacted with initial firm size (small=1-99, medium=100-999, large=1000+). Because the transition indicators in columns (2) through (9) additively decompose the overall separation indicator, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Estimates suppressed due to data confidentiality concerns are shown as —. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A20: Worker Transitions, by Labor-Force Attachment and Initial Firm Size (1989-2003)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown	Unemp.
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	-0.480 (0.337)	-0.0640 (0.0495)	-0.0438 (0.0773)	-0.000651 (0.0331)	—	—	0.0366 (0.0562)	—	-0.542** (0.257)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	0.225 (0.195)	-0.0328 (0.0411)	0.00232 (0.0780)	0.00304 (0.0336)	—	—	0.0429 (0.0732)	—	0.0505 (0.221)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	0.475** (0.205)	0.00904 (0.0427)	0.154** (0.0622)	0.119** (0.0543)	—	—	0.00572 (0.0691)	—	0.254 (0.228)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	0.633** (0.318)	0.174** (0.0731)	-0.00310 (0.101)	0.125* (0.0710)	—	—	-0.0357 (0.0732)	—	0.318 (0.261)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	-0.472* (0.271)	0.146* (0.0863)	-0.0502 (0.0947)	0.111 (0.0941)	0.0120 (0.0129)	—	-0.0555 (0.117)	—	-0.579* (0.321)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	-0.796** (0.353)	-0.0360 (0.0658)	-0.164 (0.128)	-0.0214 (0.0787)	—	—	-0.0471 (0.118)	—	-0.959* (0.483)
R-squared	0.068	0.009	0.007	0.012	0.005	0.007	0.007	0.005	0.076
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	-0.263 (0.289)	-0.106 (0.0666)	-0.0614 (0.0872)	-0.00588 (0.0394)	—	—	-0.0459 (0.0758)	—	-0.0577 (0.140)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	-0.0300 (0.219)	-0.0662* (0.0370)	-0.0174 (0.0627)	0.0140 (0.0254)	—	—	0.0131 (0.0417)	—	-0.00396 (0.130)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	0.382 (0.271)	-0.00223 (0.0441)	0.141* (0.0743)	0.103* (0.0542)	—	—	0.0541 (0.0585)	—	0.0671 (0.231)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	0.481 (0.337)	0.258*** (0.0865)	0.00679 (0.0998)	0.164 (0.110)	—	—	0.000381 (0.0890)	—	0.112 (0.179)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	0.0970 (0.337)	0.178** (0.0751)	-0.0287 (0.102)	0.102 (0.0785)	—	—	-0.0453 (0.0714)	—	-0.00326 (0.200)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	-0.651 (0.445)	-0.0551 (0.0608)	-0.173 (0.123)	0.0458 (0.0876)	—	—	-0.0912 (0.0828)	—	-0.303 (0.279)
R-squared	0.037	0.015	0.006	0.009	0.003	0.005	0.006	0.001	0.029

*Notes:* Dependent variable in column (1) is an indicator for experiencing a permanent work-shortage based separation from the worker's initial firm during 1989-2004. The subsequent columns additively decompose this separation indicator based upon the worker's employment status in the year following separation. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry, interacted with initial firm size (small=1-99, medium=100-999, large=1000+). Because the transition indicators in columns (2) through (9) additively decompose the overall separation indicator, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Estimates suppressed due to data confidentiality concerns are shown as —. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## C.14 Cumulative Normalized Earnings by Initial Firm Size Results Tables

Table A21: Cumulative Normalized Earnings, by Labor-Force Attachment and Initial Firm Size (1989-1993)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	1.735 (3.023)	-1.498 (2.635)	-0.913 (0.983)	0.651 (1.667)	1.217 (0.903)	0.449 (0.334)	-0.627*** (0.213)	2.961 (1.940)	-0.0569 (0.270)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	-0.858 (3.274)	-1.305 (3.304)	-0.912 (1.031)	1.541 (1.344)	0.576 (0.685)	0.0297 (0.174)	-0.337* (0.191)	-0.423 (1.832)	0.00250 (0.0809)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	0.207 (2.414)	-1.781 (3.840)	-2.051*** (0.690)	1.961 (1.998)	0.840 (0.653)	0.0556 (0.369)	-0.122 (0.268)	1.269 (1.233)	0.0917 (0.0925)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	-1.038 (3.752)	1.873 (3.382)	1.845 (1.345)	-2.474 (2.191)	0.654 (1.019)	-0.0159 (0.507)	0.102 (0.326)	-3.445 (2.860)	0.408 (0.484)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	3.302 (4.203)	-0.231 (4.160)	1.374 (1.532)	-3.721 (2.467)	1.326 (1.295)	0.366 (0.292)	0.210 (0.275)	4.167* (2.329)	0.177 (0.138)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	4.918 (5.724)	-1.031 (7.077)	-0.376 (1.024)	2.389 (3.222)	1.564 (1.104)	-0.185 (0.455)	0.00729 (0.642)	2.186 (2.659)	0.178 (0.151)
R-squared	0.111	0.066	0.014	0.036	0.025	0.011	0.020	0.088	0.013
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	1.839 (1.345)	2.103 (1.400)	-0.629 (0.554)	-0.590 (0.821)	0.0876 (0.305)	0.114 (0.142)	-0.155** (0.0721)	1.061* (0.600)	-0.0383 (0.0584)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	-0.484 (1.090)	0.357 (1.680)	-0.533 (0.438)	0.199 (0.753)	0.0697 (0.166)	0.00857 (0.0995)	-0.0416 (0.0629)	-0.515 (0.669)	-0.0200 (0.0257)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	2.534*** (0.890)	1.190 (2.183)	-0.548 (0.480)	1.323 (1.393)	0.531** (0.237)	0.0467 (0.0970)	-0.0557 (0.0944)	0.0513 (0.636)	0.0423 (0.0427)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	-2.242 (1.447)	-0.245 (1.776)	1.706** (0.777)	-1.461 (1.077)	0.403 (0.623)	-0.143 (0.185)	0.0164 (0.121)	-2.680*** (0.843)	0.0175 (0.0665)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	2.020 (1.409)	2.431 (2.115)	0.923 (0.694)	-1.861 (1.174)	0.415 (0.326)	-0.108 (0.129)	-0.0584 (0.0871)	0.142 (0.818)	0.0277 (0.0368)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	-1.427 (1.866)	1.977 (4.652)	-2.225*** (0.766)	-0.129 (2.699)	0.180 (0.341)	-0.436** (0.212)	0.00286 (0.191)	-1.144 (0.741)	-0.0878 (0.0707)
R-squared	0.077	0.078	0.020	0.041	0.020	0.009	0.008	0.055	0.005

*Notes:* Dependent variable is the sum of a worker's earnings during 1989-1993, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry, interacted with initial firm size (small=1-99, medium=100-999, large=1000+). Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A22: Cumulative Normalized Earnings, by Labor-Force Attachment and Initial Firm Size (1989-1998)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Attachment (n=20,577)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	1.888 (6.437)	-6.067 (4.579)	-1.647 (2.543)	1.840 (4.666)	1.932 (1.592)	1.259 (0.807)	-1.181** (0.574)	5.945 (4.468)	-0.193 (0.275)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	1.631 (7.735)	-3.967 (6.273)	-0.816 (2.322)	5.886 (3.568)	1.395 (1.439)	0.291 (0.450)	-0.697 (0.473)	-0.328 (5.019)	-0.133 (0.222)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	-6.834 (4.404)	-9.988 (7.487)	-4.716*** (1.755)	3.756 (4.349)	2.120 (1.459)	0.276 (0.908)	-0.345 (0.780)	1.902 (3.180)	0.162 (0.131)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	3.492 (8.730)	5.542 (6.743)	3.198 (3.319)	-4.808 (5.699)	3.144 (2.108)	-0.511 (1.216)	0.272 (0.838)	-4.229 (7.103)	0.885 (0.552)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	1.666 (10.63)	-1.917 (7.328)	1.497 (3.702)	-10.28 (6.434)	2.673 (2.691)	0.628 (0.666)	0.174 (0.650)	8.247 (7.157)	0.648** (0.314)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	19.98* (11.52)	10.01 (15.63)	-3.701 (2.691)	6.582 (7.476)	3.219 (2.559)	-0.618 (1.413)	-0.0258 (1.920)	4.302 (6.867)	0.211 (0.192)
R-squared	0.116	0.060	0.016	0.031	0.025	0.017	0.019	0.106	0.010
<b>Panel B: High Attachment (n=63,128)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	3.519 (2.883)	3.536 (3.814)	-1.879 (1.750)	-0.259 (2.238)	0.113 (0.655)	0.456 (0.320)	-0.429** (0.202)	1.973 (1.644)	0.00709 (0.104)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	-0.462 (2.431)	1.003 (4.488)	-1.523 (1.141)	1.813 (2.070)	0.446 (0.389)	0.0295 (0.238)	-0.186 (0.169)	-2.050 (1.980)	0.00384 (0.0258)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	0.149 (2.187)	-5.052 (4.960)	-0.567 (1.244)	4.722 (3.255)	0.922* (0.502)	-0.0136 (0.390)	-0.0608 (0.267)	0.148 (1.825)	0.0514 (0.0479)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	-5.820* (3.412)	-1.758 (4.781)	5.330** (2.453)	-4.090 (2.761)	0.925 (1.398)	-0.372 (0.467)	-0.116 (0.308)	-5.724*** (2.075)	-0.0142 (0.123)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	1.994 (3.550)	2.012 (5.790)	3.829* (2.157)	-5.614* (3.111)	0.624 (0.846)	-0.0460 (0.356)	-0.196 (0.264)	1.364 (2.396)	0.0221 (0.0399)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	-1.794 (4.200)	11.97 (12.20)	-8.812*** (3.221)	-1.681 (6.527)	0.775 (0.800)	-1.091* (0.642)	-0.320 (0.517)	-2.548 (1.981)	-0.0890 (0.0741)
R-squared	0.088	0.074	0.035	0.048	0.021	0.016	0.012	0.066	0.004

*Notes:* Dependent variable is the sum of a worker's earnings during 1989-1998, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry, interacted with initial firm size (small=1-99, medium=100-999, large=1000+). Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS≥4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table A23: Cumulative Normalized Earnings, by Labor-Force Attachment and Initial Firm Size (1989-2004)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	Initial Firm	Initial Ind.	Manuf.	Constr.	Mining	Agric.	Services	Unknown
<b>Panel A: Low Attachment (n=20,577)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	0.811 (11.69)	-10.20 (7.118)	-3.205 (4.919)	-1.891 (9.292)	3.092 (3.159)	2.749* (1.444)	-2.123* (1.123)	12.48 (9.047)	-0.0871 (0.604)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	1.093 (13.71)	-7.228 (9.890)	-1.719 (4.529)	8.224 (6.848)	3.962** (1.893)	0.676 (0.880)	-0.584 (0.933)	-2.191 (10.26)	-0.0467 (0.319)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	-17.40** (7.922)	-26.71** (10.52)	-8.512** (3.483)	9.028 (7.648)	6.320** (2.548)	0.279 (1.891)	-1.041 (1.296)	3.005 (6.473)	0.231 (0.168)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	8.246 (18.27)	6.866 (11.40)	6.134 (6.228)	-1.591 (13.47)	7.248* (4.106)	-1.248 (2.330)	-0.393 (1.613)	-10.32 (13.81)	1.548 (1.239)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	5.439 (19.63)	-2.648 (11.90)	2.972 (7.313)	-15.81 (12.04)	2.833 (3.675)	1.031 (1.306)	-1.589 (1.120)	17.74 (15.04)	0.913* (0.498)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	42.68** (19.23)	28.08 (23.96)	-6.863 (5.515)	4.014 (13.45)	3.779 (4.963)	-0.451 (3.205)	-0.148 (3.024)	13.88 (13.00)	0.388 (0.332)
R-squared	0.141	0.049	0.019	0.038	0.030	0.021	0.018	0.123	0.005
<b>Panel B: High Attachment (n=63,128)</b>									
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{small firm})$	5.704 (4.692)	5.269 (6.803)	-3.169 (3.459)	0.920 (4.430)	0.00395 (1.264)	0.926 (0.624)	-0.821** (0.358)	2.466 (3.374)	0.110 (0.139)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{medium firm})$	-0.179 (3.869)	2.759 (8.173)	-3.665 (2.286)	3.648 (4.027)	0.681 (0.761)	0.117 (0.415)	-0.378 (0.276)	-3.355 (3.956)	0.0136 (0.0358)
$-\Delta \ln(1 + \tau_j^{\text{CAN}}) * \mathbb{1}(\text{large firm})$	-2.969 (3.715)	-13.00 (8.372)	-2.293 (2.267)	8.858 (5.384)	1.692 (1.122)	0.301 (1.103)	-0.110 (0.460)	1.558 (2.852)	0.0208 (0.0528)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{small firm})$	-8.002 (5.818)	-1.824 (8.409)	9.246* (4.723)	-8.865* (5.177)	2.530 (2.648)	-0.407 (0.954)	-0.336 (0.495)	-8.260* (4.307)	-0.0862 (0.173)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{medium firm})$	2.220 (5.525)	0.983 (10.23)	8.474** (4.247)	-11.36* (5.919)	1.715 (1.709)	0.184 (0.718)	-0.483 (0.420)	2.646 (4.981)	0.0614 (0.0642)
$-\Delta \ln(1 + \tau_j^{\text{US}}) * \mathbb{1}(\text{large firm})$	-2.101 (6.489)	20.08 (20.80)	-13.59** (6.032)	-5.846 (11.22)	1.897 (1.626)	-2.447 (1.480)	-1.013 (0.868)	-1.112 (3.788)	-0.0641 (0.0809)
R-squared	0.121	0.071	0.037	0.054	0.023	0.025	0.014	0.078	0.004

*Notes:* Dependent variable is the sum of a worker's earnings during 1989-2004, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ( $-\Delta \ln(1 + \tau_j^{\text{CAN}})$ ) or facing Canadian exports to the U.S. ( $-\Delta \ln(1 + \tau_j^{\text{US}})$ ) in the worker's initial industry, interacted with initial firm size (small=1-99, medium=100-999, large=1000+). Column (1) examines total earnings from all sources, (2) earnings from the initial firm, (3) from firms other than the initial firm, but in the same initial 4-digit industry, (4) in manufacturing industries (NAICS=3xxx) other than the initial industry, (5) in construction and utilities (NAICS=22xx, 23xx), (6) in mining (NAICS=21xx), (7) in agriculture (NAICS=1xxx), (8) in services (NAICS $\geq$ 4xxx), or (9) from a firm with unknown industry code. Because earnings in columns (2) through (9) additively decompose total earnings, the coefficients in columns (2) through (9) sum to the overall effect in column (1). All specifications include extensive worker, initial firm, and initial industry controls, described in Section 4. Standard errors clustered by 4-digit NAICS industry. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.