The Long-Run Labor Market Effects of the Canada-U.S. Free Trade Agreement*

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Abstract

This paper assesses the long-run effects of the 1988 Canada-U.S. Free Trade Agreement (CUSFTA) on the Canadian labor market using matched longitudinal administrative data for the years 1984-2004. We simultaneously examine the labor market effects of increased export expansion and import competition, generally finding adverse effects of Canadian tariff cuts and favorable effects of U.S. cuts, though both effects are small. Workers initially employed in industries that experienced larger Canadian tariff concessions exhibit a heightened probability of layoffs at large firms, but little impact on long-run cumulative earnings. Lower earnings and years worked at the initial employer are offset by gains in other manufacturing industries, construction, and services. Canadian workers quickly transitioned from industries facing import competition, with the majority of industry adjustment occurring among new entrants to the labor market.

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1 Introduction

We know very little about what happens to workers when high-income countries deliberately agree to freer trade with one another. Much of the empirical evidence assessing the relationship between trade and labor markets examines trade liberalizations involving low- or middle-income countries.[1] This is a critical omission; trade between high-income countries accounted for 45 to 63 percent of world trade during 2000-2015, and these countries are actively engaged in debates over trade policy.[2]

This paper aims to fill this gap by studying the effects of the Canada-U.S. Free Trade Agreement (CUSFTA) on Canadian workers. Because Canada and the U.S. have similar factor endowments and production technologies, comparative advantage based models of international trade imply modest labor market effects of trade liberalization between two countries. However, a large body of empirical work documents tremendous effects on plant exit and plant employment in response to this change in trade policy, suggesting the possibility of important effects on workers (Head and Ries, 1999; Trefler, 2004).

We examine the long-term labor market effects of the CUSFTA using high-quality, longitudinal, matched worker-firm administrative data from Statistics Canada for the years 1984-2004. We apply a research design similar to Autor et al. (2014) to the context of bilateral changes in trade policy. Specifically, we compare the career trajectories of otherwise similar workers initially employed in industries that were subsequently subject to different Canadian and United States tariff concessions legislated by the FTA, which began on January 1, 1989. The bilateral nature of this agreement allows us to study the effects of both import competition and export expansion. We examine a large number of individual-level labor market outcomes including displacement, years worked, cumulative

[1] For example, Pierce and Schott (2016) study the effects of the U.S. granting permanent normal trade relations to China, Dix-Carneiro and Kovak (2017) study Brazilian trade liberalization, McCaig and Pavcnik (2018) examine the Vietnam-U.S. Bilateral Trade Agreement, and Utar (2018) considers the effects in Denmark of ending Multi Fibre Arrangement quotas facing China.

[2] Authors' calculations based on BACI trade data developed in Gaulier and Zignago (2010); "high-income" definition based on World Bank income group classification. Recent trade policy changes involving high-income countries include the Canada-European Union Comprehensive Economic and Trade Agreement, the renegotiated Canada-Mexico-United States Agreement, and the United Kingdom's withdrawal from the European Union. Ongoing trade negotiations include potential U.K.-U.S. and Australia-E.U.-New Zealand agreements.

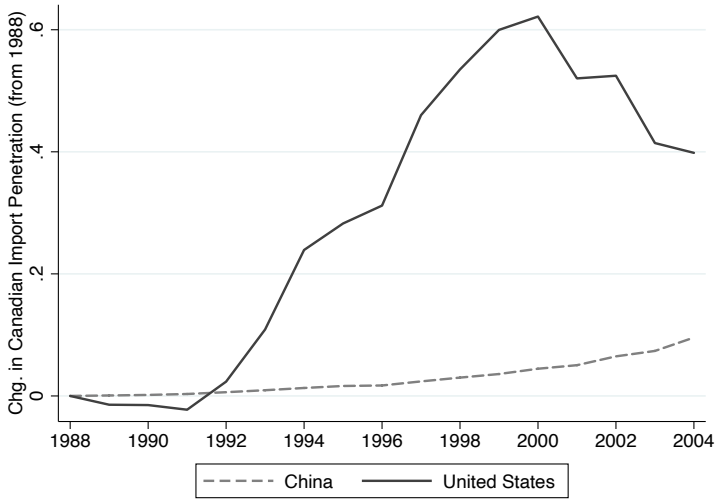
earnings, and transitions into other firms, other industries, or unemployment during the 16 years following the FTA's implementation. Because our sample starts in 1984, we can control for a variety of initial conditions and pre-trends including worker, firm, and industry wage trajectories, firm and industry employment trajectories, and capital intensity.

The CUSFTA provides a nearly ideal setting in which to study the causal effects of changing bilateral trade policy (Trefler, 2004). The Agreement cut tariffs to zero on nearly all non-agricultural trade between Canada and the U.S., with minimal changes to non-tariff barriers or other hard-to-measure aspects of trade policy. The FTA was not part of a larger reform package, nor was it passed in response to a crisis or other macroeconomic shocks. As we will show, the tariff changes were not confounded by pre-existing trends in industry performance. Given the large size of the U.S. economy in comparison to Canada's, the FTA drove substantial increases trade from the Canadian perspective; Figure 1 shows that U.S. import penetration in Canada increased by more than 60 percentage points from 1988 to 2000, while for comparison Chinese import penetration grew by less than 10 percentage points.

We find that workers initially employed in manufacturing industries that subsequently lost tariff protection in Canada experienced an increased probability of a job separation, while those facing U.S. tariff concessions had lower probabilities of separation. For example, an interquartile (25^{th} to 75^{th} percentile) increase in the size of the Canadian tariff cut caused a 3 percentage point higher layoff probability for workers with low labor force attachment initially employed at large firms. For the same group, an interquartile increase in the U.S. tariff concession led to a 1.9 percentage point lower layoff probability. Thus, the adverse effects of increased import competition and the favorable effects of increased access to the U.S. export market partly offset each other.

In spite of these changes in the probability of separating from one's initial employer, we find little effect on total years worked or on cumulative earnings during the 16 years following the FTA's implementation. Consistent with the separation results, larger Canadian tariff cuts did indeed reduce years worked and earnings at the initial employer and at other firms in the initial industry. However, these losses were largely offset by increased earnings from sources in other manufacturing

Figure 1: Import Penetration Ratio for Canadian Imports from China and the U.S.



Notes: The y-axis plots the change in Canadian import penetration accounted for by Chinese or U.S. imports from 1988 to the year on the x-axis. Specifically, it follows Autor et al. (2014) equation (1) by plotting $(\text{imports}_t^c - \text{imports}_{1988}^c)/(\text{absorption}_{1988})$, where $c \in \{\text{China,U.S.}\}$ and absorption is industry output plus imports minus exports. All values deflated to 1988 dollars using the Canadian CPI.

industries, construction, and services. Moreover, the favorable effects of U.S. tariff reductions also offset the losses from Canadian cuts on average, leading to a very small net impact on workers' employment and earnings.

These findings contrast with the large and persistent effects of the China Shock in Autor et al. (2014) or of Brazilian trade liberalization in Dix-Carneiro and Kovak (2017).[3] Instead, our results are more in line with those of Dauth et al. (2014, 2017, 2021), who find offsetting effects of import and export flows with China and Eastern Europe in the German context. Three additional findings help explain the relatively favorable results in Canada. First, Canadian workers quickly moved from industries facing large increases in import competition to industries facing smaller shocks. Second, while increased import penetration from China induced mass layoffs among Canadian firms, the CUSFTA tariff changes did not. Third, total industry-level employment responded to

[3]In ongoing work, Autor, Dorn, and Hanson extend the results of Autor et al. (2013a) forward nine years to 2016. See "On the Persistence of the China Shock," presented at the Fall 2020 NBER International Trade and Investment Program Meeting.

import competition, with employment shifting away from industries facing larger Canadian tariff reductions, but these adjustments occurred primarily among new entrants to the labor market rather than among incumbent workers.

As in the prior empirical work on the CUSFTA, firm size plays an important role (see literature review below). Canonical models of heterogeneous firms and trade, such as Melitz (2003) and its asymmetric-country extension in Demidova and Rodríguez-Clare (2013), predict that larger Canadian firms should benefit most from increased access to the U.S. export market because those more productive firms can bear the fixed costs of exporting. Our results confirm this prediction: workers initially employed at larger firms experience bigger reductions in the probability of separation when facing larger U.S. tariff reductions. However, in contrast to the canonical models, larger firms also exhibit the biggest increases in separations when facing larger Canadian tariff reductions. As discussed below, this surprising result is consistent with the empirical findings of Head and Ries (1999), Autor et al. (2013b), and Pierce et al. (2020), and can be rationalized by the niche-market mechanism formalized by Holmes and Stevens (2014) and the complementary product-cycle arguments of Eriksson et al. (2021). Our heterogeneity analysis also reveals that while the tariff cuts had small effects on average, a relatively small group of workers, those with low labor force attachment initially employed at large firms, have nontrivial effects of both Canadian and U.S. tariff cuts. However, the adverse effects of Canadian tariff reductions and the favorable effects of U.S. cuts have very similar magnitudes for this group of workers, so the net effects of the FTA remain close to zero on average.

This study possesses three virtues relative to the existing literature. First, it examines the effects of a well-defined policy change, so our findings can inform ongoing trade policy debates. In this sense, it is most closely linked to studies analyzing the effect of the NAFTA on various aspects of the American, Canadian, and Mexican economies (see literature review below), the effect of trade liberalization in developing countries (e.g. McCaig (2011) and McCaig and Pavcnik (2018) for Vietnam, Topalova (2007, 2010) for India, and Kovak (2013) and Dix-Carneiro and Kovak (2017) for Brazil), and the end of the Multi Fibre Arrangement (e.g. Harrigan and Barrows (2009) and

Utar (2014, 2018)).[4]

Second, because of the bilateral nature of the CUSFTA, we are able to simultaneously examine the effects of increased access to U.S. export markets and also the effects of increased import competition in Canada. Prior work that examines the joint effects of imports and exports generally studies the effects of changes in trade flows rather than examining explicit trade policy changes.[5] Studies examining unilateral trade liberalizations are often restricted to studying the effects of imports. We contribute an analysis of explicit trade policy change that substantially and simultaneously affects both import competition and access to an important export market.[6]

Third, by relying on longitudinal matched employee-firm data, we are able to examine not just whether workers were displaced by import competition (for example) but also where they went and whether these displacements affected their long-run earnings. In this sense our work is distinct from all the papers we are aware of examining the effects of the CUSFTA on the Canadian economy, which focus on outcomes at the plant or industry level (e.g. Gaston and Trefler (1997), Head and Ries (1999), Beaulieu (2003), Trefler (2004), and Lileeva (2008)), and the vast majority of papers studying other trade liberalization episodes, although Utar (2014, 2018) and Dix-Carneiro and Kovak (2017) are notable exceptions.

Additional Literature

A large body of work documents that the CUSFTA had measurable effects on Canadian plant outcomes. Using industry-level data on the number of manufacturing establishments, total output, and output per establishment, Head and Ries (1999) find increased establishment exit and output per establishment. Trefler (2004) uses plant-level data from the Canadian Annual Survey of Manufactures for 1980-1996 to show that firms most adversely affected by Canadian tariff conces-

[4]Brambilla et al. (2012) also study the effects of U.S. anti-dumping duties imposed on Vietnamese fish exports.

[5]See, for example, Baziki et al. (2021), Biscourp and Kramarz (2007), Costa et al. (2016), Dauth et al. (2014), Dauth et al. (2021), and Hummels et al. (2012). In addition, Feenstra et al. (2019) study the effect of increased exports to China from the U.S.

[6]In this regard, our analysis is most closely related to a robustness test in McCaig and Pavcnik (2018) that considers the effects of tariff changes in the U.S. and Vietnam as part of the U.S.-Vietnam Bilateral Trade Agreement. However, in contrast to this paper, they use repeated cross-sections for four years (2001-2004) rather than longitudinal data.

sions suffered employment losses, and that there was, on average, no effect of U.S. concessions on Canadian plant-level employment. However, this null result for U.S. concessions is a combination of a positive effect for Canadian exporting firms and a negative effect for non-exporting firms.[7] Beaulieu (2003) documents job losses concentrated among lower-paid production workers rather than higher-paid managers. In contrast to this study, neither Beaulieu (2003) nor Trefler (2004) observes whether these contractions in industry-level employment were accompanied by reallocations to other sectors, whether these reflect transitions into prolonged unemployment, or whether there were cumulative long-run effects on worker incomes.[8]

A number of papers also examine how NAFTA affected Mexican and U.S. workers, but these papers do not follow long-term outcomes. Chiquiar (2008) finds that regions in Mexico that were more exposed to NAFTA exhibited increased wage levels, but decreased inequality, relative to other parts of the country. Hanson (2003) engages in a more general discussion of the effect of NAFTA on Mexico's wage structure and finds that wage gains were largest in regions most exposed to globalization. Hakobyan and McLaren (2016) use a local labor markets analysis for the United States, but only focus on industries' vulnerability to Mexican imports and localities' dependence on these industries. They find evidence of lower wage growth for blue-collar workers in the most affected industries and localities.[9]

Canonical models of firm heterogeneity such as Melitz (2003) also motivate our exploration of

[7]While Trefler finds that Canadian industries that lost protection subsequently had relatively *higher* average earnings, this result conditions on workers remaining employed and does not take into account workers whose income disappeared due to being laid off. See Trefler (2004), section IX for more details. Autor et al. (2013a) demonstrate that increased transitions into unemployment are extremely important for understanding the effect of Chinese import competition on U.S. labor markets.

[8]Trefler (2004) only makes use of plants that were in existence in 1980, 1986, 1988, and 1996 and is unable to make corrections for entry and exit due to data limitations. Trefler also notes that many of these panel-based studies (including Gaston and Trefler (1997)) fail to correct for auto-correlation in standard errors. Lileeva (2008) explicitly accounts for entry and exit. Chan (2019) examines how CUSFTA affected self-employment in Canada. He finds that Census Divisions that experienced larger Canadian tariff cuts against US imports experienced higher rates of self-employment while those with larger American tariff cuts against Canadian goods correspondingly experienced lower rates of self-employment. Hsieh et al. (2016) offer a structural assessment of variety creation/destruction due to the agreement. Thompson (1993), Breinlich (2014), and Greenland et al. (2020) use event-study approaches to examine the effects of news regarding the CUSFTA's passage on Canadian or U.S. firms' stock returns.

[9]Unfortunately, such a local labor markets approach is infeasible in Canada because, unlike the United States, Canada's population is concentrated in a few large cities, and these cities are largely close to the U.S. border [see Albouy et al. (2017)]. This means that there is little variation in affected and unaffected regions based on geography.

how the CUSFTA affected firms of different sizes. Demidova and Rodríguez-Clare (2013) extend the Melitz model to the case when countries and trade policies are asymmetric, which is applicable in our context given that the U.S. is roughly ten times the size of Canada and had lower levels of protection prior to the FTA. These models predict that Canadian tariff concessions should increase exit and worker displacement among smaller firms and that U.S. concessions should benefit larger firms. Note, however, that Melitz (2003) and Demidova and Rodríguez-Clare (2013) present single-industry models, while our empirical setting leverages variation across multiple industries. In this context, a multi-industry version of the model would require some degree of input market segmentation to capture differences in outcomes for small firms in industries facing different U.S. tariff cuts.[10]

As mentioned above, both our results and those of the prior literature on the CUSFTA find that Canadian concessions led to larger degrees of exit and job displacement at *larger* firms, rather than at *smaller* firms as predicted by these canonical models. Baldwin and Gu (2004) and Lileeva (2008) argue that this surprising finding reflects contraction at multi-plant firms and increased specialization at the firm level. The effects of U.S. tariff cuts on Canadian firms are more in line with these models. Exporters experienced employment growth, whereas non-exporting firms actually contracted due to within-industry reallocation of workers (Lileeva (2008)).[11] Our empirical results are also consistent with the empirical work of Verhoogen (2008) who finds that large Mexican firms were most able to take advantage of the 1994 Peso devaluation relative to the U.S. Dollar.

By explicitly examining the importance of sectors outside of manufacturing, our paper is also linked to recent work assessing the importance of the service sector in adjustment to import competition. Fort et al. (2018) and Bloom et al. (2019) each emphasize the importance of services in how the United States responded to the China Shock documented in Autor et al. (2013a).[12]

[10]Chaney (2008) shows how to add many countries and asymmetric trade barriers to the Melitz (2003) framework but relies on an outside good to pin down factor prices. This precludes the possibility that lower tariffs abroad cause non-exporting firms to contract as we find here. Melitz and Redding (2014) derive results for many symmetric countries without an outside good. Egger and Kreickemeier (2009) and Felbermayr et al. (2011) introduce fair wages and search-based unemployment, respectively, into heterogeneous firms models but both rely on symmetric countries. Helpman et al. (2010) introduce search and matching frictions into a Melitz model with costly screening to show how trade can affect wage inequality within sectors and within groups of ex-ante identical workers.

[11]Like Trefler (2004), Lileeva (2008) uses the Canadian Annual Survey of Manufactures.

[12]More generally, Harrison (2017) argues that understanding the role played by service sectors in globalization is extremely important for understanding how trade affects labor markets.

The paper is organized as follows. Section 2 discusses the Agreement in more detail. Section 3 describes our data. Section 4 discusses our empirical approach. Section 5 presents results. Section 6 examines heterogeneous effects across firms and within-industry worker reallocations. Section 7 offers concluding comments.

2 The Canada-U.S. Free Trade Agreement

The Canada-US Free Trade Agreement was signed on January 2, 1988 by Canadian Prime Minister Brian Mulroney and U.S. President Ronald Reagan, culminating more than 100 years of proposals and negotiations seeking free trade between the two neighbors.[13] The Agreement went into effect on January 1, 1989, eliminating tariffs for nearly all non-agricultural goods traded between Canada and the U.S. In addition to tariff cuts, the agreement liberalized foreign investment in Canada, required nondiscrimination in new regulations applying to the service sector and to foreign investment, and created an appeals mechanism to ensure appropriate application of treaty commitments, along with a variety of other minor provisions (Copeland, 1989).

The tariff cuts were phased in from 1989 to 1998. Figure A1 in the Appendix presents the evolution of Canadian tariffs on U.S. manufacturing exports and U.S. tariffs on Canadian manufacturing exports between 1988 and 1998.[14] For simplicity, we refer to Canadian tariffs on U.S. exports as "Canadian tariffs" and U.S. tariffs on Canadian exports as "U.S. tariffs" except where explicitly stated. In 1988, Canadian tariffs varied greatly, with those in the 95th percentile seeing protection of more than 20 percent, while the least protected industries were protected by rates of less than 5 percent. Average Canadian tariffs declined from approximately 10 percent in 1988 to zero in nearly

[13]Under the Elgin-Marcy Treaty of 1854, the two countries engaged in duty-free trade in a variety of primary products from 1854 to 1866, with failed attempts at subsequent agreements in the 1870s, 1910s, and 1940s (Morici, 1990). Canadian passage of the FTA was far from certain. The Canadian Senate rejected the bill after it passed the House of Commons, something that had not happened in the preceding 40 years (Forsey, 2020). The FTA dominated the ensuing November 1988 election, in which the Conservatives won enough seats for a majority (although they lost the popular vote), which led the Senate to pass the FTA (Lileeva and Trefler, 2010; Sears, 2012). Because of this uncertainty and prior failures at passing free trade agreements, we do not expect to observe anticipatory effects, although we control for extensive pre-trends in our analysis.

[14]Tariffs on the majority of Canadian imports experienced linear tariff reductions during a 10-year period (schedule C tariff lines), with the remainder phased in linearly over a 5-year period (schedule B), implemented immediately in January 1989 (schedule A), or having no cut due to pre-existing free trade (schedule D) (Head and Ries, 1999).

all product categories in 1998. Figure A1 also graphs the corresponding U.S. tariff cuts. While U.S. tariffs were initially much lower (≈ 3 percent), their mean and variance fell similarly.

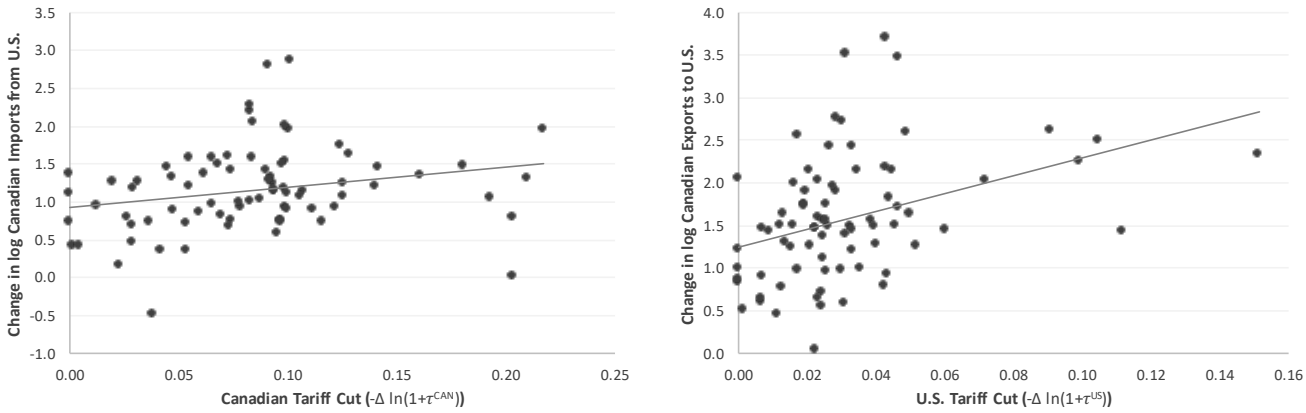
Because of the linear phase-in of the tariff cuts, there is minimal variation in the timing of cuts across industries. All of our analyses therefore rely on cross-industry variation in tariff cuts between 1988 and 1998 to examine the effects of the CUSFTA on the Canadian labor market. In order to interpret our results as the causal effect of the tariff changes, it must be the case that i) the observed tariff cuts were unrelated to counterfactual industry performance and ii) the tariff cuts were uncorrelated with other aspects of the FTA that might have affected industry outcomes. We address the former requirement in Section 5.1, showing that the tariff cuts were unrelated to pre-FTA industry performance. On the latter point, the CUSFTA is nearly ideal relative to other large liberalization episodes (Trefler, 2004). While most large-scale trade liberalizations, particularly those in lower-income countries, involved significant reductions in non-tariff barriers and other reforms, the non-tariff provisions of the FTA primarily focused on limiting new non-tariff barriers and prohibiting new discriminatory regulations (Copeland, 1989). The CUSFTA tariff cuts were also incorporated into the subsequent NAFTA agreement, so they were relevant throughout our study period, which extends through 2004.[15]

Figure 2 shows that the tariff cuts expanded bilateral trade as expected. The left panel shows that industries with larger Canadian tariff cuts saw increased imports from the U.S., while the right panel shows that larger U.S. tariff cuts drove increased Canadian exports to the U.S. Although this is not a gravity equation, and the estimated coefficient cannot be interpreted as a trade elasticity, estimated coefficients are consistent with the literature.[16]

[15]NAFTA accelerated the tariff cuts prescribed by the CUSFTA for some products, but this accounted for a relatively small share of trade (Besedes et al., 2020).

[16]For Canadian imports, the estimated slope is 2.66 and, for U.S. imports, the estimated slope is 10.48. The first is significant at the 5 percent level and the second is significant at the 1 percent level. Results are stronger if we control for the change in MFN tariffs. Using a more formal CES framwork, Romalis (2007) finds an elasticity of substitution between 6 and 9 for U.S. imports and between 2 and 5 for Canadian imports in response to the CUSFTA tariff cuts.

Figure 2: Tariff Cuts and Bilateral Trade: Canada (left) and United States (right)



Notes: Each figure plots the change in log bilateral trade against the tariff cut in the importing country from 1988 to 1998 for each of 78 4-digit NAICS manufacturing industries. The left panel plots the change in log imports into Canada from the U.S. against negative one times the change in log one plus the Canadian tariff; the associated regression line has a slope of 2.66 (s.e. 1.33, p=0.05). The right panel plots the change in log exports from Canada to the U.S. against negative one times the change in log one plus the U.S. tariff from 1988-1989; the associated regression line has a slope 10.48 (s.e. 2.44, p<0.01).

3 Data

Our main research design compares labor market outcomes for Canadian workers whose initial industries faced different tariff cuts in Canada or the U.S. as a result of the FTA. We observe individual workers' labor market outcomes over time using Statistics Canada's matched T2-LEAP-LWF data set which covers 1984-2004. The heart of this database is the Longitudinal Worker File (LWF), which assembles individual T4 tax records providing demographics and longitudinal employment and earnings information.[17] The LWF represents a 10 percent random sample of Canadian workers appearing in the underlying tax records during 1984-2004, and we observe complete labor market histories for the workers in our sample.[18] As discussed below, we restrict attention to workers initially employed in manufacturing, but we are able to follow them even if they move into other

[17]All references to "income" and "earnings" refer to wage income reported on tax form T4. This is the Canadian equivalent of the W2 form that U.S. workers receive from each employer.

[18]The 10 percent random sample is taken over unique Social Insurance Numbers for workers appearing in the data at any point. If a worker's SIN number is in the 10 percent sample, they are included in *all* years in which they received T4 income.

sectors, including agriculture, mining, and services.

The LWF contains yearly data on each worker's employer(s), wage income, basic demographic information, province of employment, and industry affiliation at the 4-digit NAICS level. There are 328 of these industries, of which 86 are within manufacturing. As discussed below, we drop 2 industries that do not map onto our tariff data and 6 additional industries subject to quantitative trade restrictions.[19] This provides us with 78 manufacturing industries in our sample. The LWF also includes a unique field based on Records of Employment (ROE), which Canadian employers must submit whenever a worker experiences an interruption in earnings.[20] The ROE classifies each separation as either temporary (returned to the firm in the year of separation or the following year) or permanent (otherwise) and provides a reason for the separation, including firing, returning to school, ending seasonal work, quit, or work shortage (equivalent to layoff). This information allows us to focus our main analysis on permanent separations, which avoids diluting effects by inadvertently including temporary or voluntary separations (Flaaen et al., 2019).

Statistics Canada merges the longitudinal worker-level information in the LWF with firm-level data for their employers. T2 Corporate Income Tax Returns report interest, sales, gross profits, equity, assets, etc. for all incorporated firms in Canada and the Longitudinal Employment Analysis Program (LEAP) database reports firms' total employment over time. Unlike Trefler (2004) who uses the Canadian Annual Survey of Manufactures, we possess data on firms (tax entities) rather than plants. Consequently, changes in continuing firm employment can be due to either plant entry and exit or changes in employment within continuing plants. In addition, a firm disappears from our sample if all of its workers *in our sample* experience separations despite it continuing to employ workers not in our sample. This limits our ability to undertake firm-level analyses and further motivates our focus on worker-level outcomes.

While the LWF data are very rich, particularly in their ability to track workers across employ-

[19]The two industries that do not map onto HS product codes are 3151 ("Clothing Knitting Mills") and 3328 ("Coating, Engraving, Heat Treating and Allied Activities").

[20]The Canadian Employment Insurance Act requires every employer to issue an ROE when an employee working in insurable employment has an interruption in earnings. The ROE information is used to determine eligibility for Employment Insurance (EI) benefits, the benefit rate, and the claim duration, and the ROE must be issued even if the employee does not intend to file a claim. Morissette et al. (2013) describe ROEs in detail.

ment status and different jobs over time, they have a few important limitations. First, we have relatively coarse geographic information at the province level, precluding us from implementing local labor markets analyses by commuting zone. Second, we cannot observe non-labor income except Employment Insurance payments and have no information on occupation or education. To account for heterogeneity in worker skill in our empirical analysis, we normalize workers' earnings by their pre-FTA earnings and control for the share of workers in the industry earning less than the national median income. We also stratify our samples in some analyses by labor force attachment or by initial earnings.

We calculate tariff changes in each worker's initial industry primarily using data provided by Global Affairs Canada. Legislated tariffs from 1988 through 1998, including tariffs facing Canadian exports to the U.S., U.S. exports to Canada, and Canadian Most Favored Nation (MFN) tariffs facing other exporters are taken directly from the CUSFTA agreement.[21] U.S. MFN Tariffs are derived from Feenstra (1997).[22] In both cases, we aggregate tariffs to the 4-digit NAICS industry level using concordances from Pierce and Schott (2012) and the U.S. Census Bureau.[23] We set the initial tariff in Auto Pact sectors to zero.[24] We drop from our sample six 4-digit NAICS industries that were subject to quantitative restrictions, as described in Lester et al. (1988), because legislated tariff changes do not accurately capture changes in protection in these industries.[25]

[21]We are extremely grateful to Emily Yu at Global Affairs Canada for providing us with digitized data that describes the phase-in schedule for the CUSFTA tariff cuts between 1988-1998.

[22]To proxy U.S. MFN tariffs, we divide total duties paid by total customs imports in 1989 from Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, and the U.K.

[23]When calculating average tariffs at the 4-digit NAICS level, we weight 8-digit HS codes by 1988 imports to the relevant country. See the Data Appendix for details.

[24]Sectors 3361, 3362, and 3363. While there were strictly positive tariffs in these sectors, waivers were easily obtained, leading to free trade in practice. See Trefler (2004) for more details.

[25]The relevant industries are Meat Products, Poultry Products, Dairy Products, Flour and Breakfast Cereals, Sugar, Distilleries and Breweries, Wineries, Tobacco and Tobacco Products (Lester et al., 1988), which we concord to 3112 ("Grain and Oilseed Milling"), 3113 ("Sugar and Confectionery Product Manufacturing"), 3115 ("Dairy Product Manufacturing"), 3116 ("Meat Product Manufacturing"), 3121 ("Beverage Manufacturing), 3122 ("Tobacco Manufacturing").

4 Empirical Approach

Our empirical analysis compares labor market outcomes of otherwise similar Canadian workers who were initially employed in industries facing different Canadian or U.S. tariff cuts. We measure the tariff cuts as negative one times the change in log one plus the tariff rate from 1988 to 1998: $-\Delta \ln(1+\tau_j^c)$, where $c \in \{\text{CAN}, \text{US}\}$ is the country imposing the tariff in industry j. Because tariffs went to zero in all industries, this measure is equivalent to the initial value of $\ln(1+\tau_j^c)$.

We relate these tariff changes to labor market outcome Y_{ifjk} for worker i initially employed in firm f in manufacturing industry j using the following worker-level specification.

$$Y_{ifjk} = \beta_0 - \beta_1 \Delta \ln(1+\tau_j^{\text{CAN}}) - \beta_2 \Delta \ln(1+\tau_j^{\text{US}}) + \mathbf{X}_i'\beta_3 + \mathbf{X}_f'\beta_4 + \mathbf{X}_j'\beta_5 + \epsilon_{ifjk}. \tag{1}$$

The subscript k represents time windows over which we calculate the worker's post-FTA outcomes: 1989-1993, 1989-1998, or (most frequently) 1989-2004. The first time span covers the initial phase-in of tariff cuts until the year before NAFTA came into force, the second covers the full phase-in of the CUSFTA tariff cuts, and the third extends to the final year of the sample. Because we multiply the tariff changes by negative one, a positive estimate of β_1 implies that workers whose initial industry faced larger Canadian tariff cuts experienced more positive values of the outcome Y. The vectors $\mathbf{X}_i'$, $\mathbf{X}_f'$, and $\mathbf{X}_j'$ are worker, initial firm, and initial industry level controls, described below. ϵ_{ifjk} is an error term, clustered by the worker's initial four-digit NAICS industry.

Tariff cuts are assigned to workers based on their *initial* industry of employment, so even if a worker switches industries after 1988, the same initial-industry tariff cuts remain associated with that worker, analogous to Autor et al. (2014) and Utar (2018). To assign an initial firm and industry, we define the worker's base year as the final year in 1986-1988 in which the worker had strictly positive earnings and a valid industry code. We then define the initial industry as the industry of employment in that base year. The initial firm and initial province are defined analogously.

Our sample consists of workers initially employed in manufacturing who were born between 1940 and 1964, ensuring they were of working age (22-64) during 1986-2004. We require that workers

had positive earnings in at least one year during 1986-1988 to assign an initial firm and industry of employment. We drop workers initially employed in the Canadian Territories.[26] Following Autor et al. (2014), we examine both high and low labor force attachment workers. High attachment workers are defined as those who earned at least the equivalent of 1,600 annual hours of work at the nominal provincial minimum wage in *every* year between 1985 and 1988 (inclusive). Low attachment workers are the remainder of workers meeting other sample requirements. Section 5 discusses the characteristics of these workers in more depth, and Appendix B describes the sample and variable construction in detail.

We include extensive controls in equation (1) to ensure that we are comparing outcomes for otherwise similar workers facing different tariff cuts. $\mathbf{X}_i'$ is a vector of worker level controls including the worker's gender, birth year indicators, log real average earnings during 1986-1988, the change in log real earnings from 1986 to 1988, indicators for labor market experience and tenure in the worker's initial firm, and the initial province of employment. All nominal earnings are converted into real 2002 dollars using the Canadian CPI. A worker is defined as having "low" labor market experience if they had positive earnings in two or fewer years in the period 1984-1988, "medium" if they had positive earnings in three or four years, and "high" if they had positive earnings in all years in the period 1984-1988. Tenure is distinct from experience in that it refers to the worker's tenure in a given firm whereas the labor market experience measures employment regardless of employer. A worker is defined as "low" tenure if they have fewer than two years of experience at their initial firm, "medium" if they have two or three years, and "high" if they have four or more years as of their base year. In addition, we interact the worker's age with their log real average earnings during 1986-1988.

Initial-firm controls, $\mathbf{X}_f'$, include indicators for firm size. Following Autor et al. (2014), "small" firms are defined as those with 99 or fewer workers, "medium" sized firms have 100 to 999 workers (inclusive), and "large" firms are those with 1000 or more workers.[27] We also include average log

[26] We omit workers in the Territories (Yukon, Northwest Territories, and Nunavut) to avoid disclosure concerns due to their very small populations, totaling 0.33 percent or less of Canada's overall population during our sample period.

[27] This measure is based on the Statistics Canada national average labour units (nalus) measure.

real earnings per worker in 1988 within the firm as well as the average of the change in log worker real income within the firm between 1986 and 1988.

We also include extensive initial-industry controls, $\mathbf{X}'_j$. These include the log share of workers earning less than the aggregate median income in 1988, average log earnings per worker in 1988, the log industry capital-labor ratio in 1988, the change in the log of the share of aggregate employment accounted for by the industry between 1986 and 1988, and the mean change in log income for those employed in the industry between 1986 and 1988. While our data cannot directly distinguish between skilled and unskilled workers, the share of workers below the median income proxies for the industry's unskilled labor intensity. The change in the log of the industry's share of aggregate employment captures whether certain industries were already shedding or gaining employment for reasons unrelated to the CUSFTA. We also control for a measure of industry responsiveness to the business cycle to avoid confounding the changes in bilateral trade policy with the early-1990s Canadian recession.[28] We control for the 1988 to 1998 change in log one plus the MFN tariff facing non-FTA countries in Canada and the U.S. to account for substitution between potential trading partners. When considering heterogeneous results by initial firm size, we interact both the CUSFTA and MFN tariff changes with firm size indicators. In all of our specifications, we include industry-level pre-trends in the dependent variable and its interactions with initial firm size indicators and indicators for the worker's tenure at their initial firm.[29] We also address the rise of China by controlling for the change in Chinese import penetration in Canada in the worker's initial industry, following Acemoglu et al. (2016).[30] Finally, we include 2-digit NAICS fixed effects, so we compare outcomes for workers initially in different 4-digit industries within the same 2-digit manufacturing industry.

[28]One of the major objects of interest in Gaston and Trefler (1997), Beaulieu (2003), and Trefler (2004) was to estimate the independent effects of the CUSFTA on Canadian employment relative to recession. Using the NBER manufacturing database for 1958-1989, we regress log industry employment on log GDP and a linear time trend, and use the coefficient on GDP as our measure of cyclicality. Ex-ante, it is not obvious that more sensitive industries would have worse employment outcomes, as our study also covers the late 1990s expansion.

[29]For example, when we examine the determinants of the probability of a work-shortage related separation between 1989 and 2003, we control for the unconditional probability of a separation in the same industry in the years 1984 through 1988.

[30]Specifically, we control for the change in real imports into Canada from China between 1989 and 2004, divided by 1988 industry absorption (output plus imports minus exports) in Canada.

Our empirical analyses examine workers' labor market outcomes. We first examine an indicator for whether a worker experienced a permanent work-shortage related separation from their initial employer during the relevant time period. This dependent variable allows us to measure how Canadian and U.S. tariff cuts in the worker's initial industry affected their probability of a layoff by their initial firm. We also examine cumulative years worked T_{ifjk} as well as years worked in the initial firm, initial industry outside the initial firm, and inside/outside manufacturing.[31]

We also study the FTA's effects on workers' cumulative earnings, $\tilde{E}_{ifjk}$, where

$$\tilde{E}_{ifjk} \equiv \frac{\left[\sum_{t=1989}^{2004} \sum_{j'} \sum_{f'} E_{if'j't}\right]}{\overline{E}_{i,88-86}}. \tag{2}$$

The numerator is worker i's cumulative real earnings from 1989 to 2004 from employment in any firm f' and in any industry i', including those other than the worker's initial firm and industry.[32] To account for unobserved worker heterogeneity, we normalize these cumulative earnings by the worker's pre-FTA yearly earnings, $\overline{E}_{i,88-86}$, calculated as average yearly real earnings in 1986-1988 (averaging over years with strictly positive earnings). Given this normalization, $\tilde{E}_{ifjk} = 16$ means that the worker on average earned their real pre-period income in each of the 16 years spanning 1989-2004. Because the numerator of (2) decomposes additively into earnings from different firms, industries, and sectors, we additionally investigate how the sources of workers' earnings adjusted in response to the FTA tariff changes.

In some specifications, we consider heterogeneous effects by the size of the worker's initial employer, interacting the tariff cut variables with indicators for small (1-99 employees), medium (100-999), and large ($\geq$ 1000) initial firms. This analysis is motivated by the findings of Head and Ries (1999), Lileeva (2008), and Autor et al. (2013b) who emphasize the firm reallocation effects that trade can induce. We also examine workers' labor market transitions by observing their employment

[31]The maximum number of years worked between 1989 and 2004 inclusive is 16. When decomposing years worked into industries, each year's employment is assigned to the industry of primary employment (that with the most earnings).

[32]Because many workers earn labor income from multiple employers in a given year, we follow Autor et al. (2014) and define the worker's primary employer as the one from whom a worker earns the most income in a given year.

status in the year following a permanent separation. For the purposes of this transition analysis, and because our earnings information is reported at the yearly level, we define a worker as being unemployed if their yearly earnings fall below the equivalent of 1600 hours worked at the relevant provincial minimum wage.[33] For employed workers, we then observe whether they are working for a different firm in the same industry, a different industry within manufacturing, or in a different sector in the year following separation. Because the indicators for each of these post-separation conditions sum to the overall separation indicator, we perform an additive decomposition revealing how workers transitioned following a permanent separation.

Finally, to provide context for the results that follow, we ask the question "who are high and low attachment workers?" Overall, the majority of our sample is high-attachment: our sample contains 63,128 high-attachment workers and 20,577 low-attachment workers. Columns (1)-(3) of Appendix Table A1 examine the features of high-attachment status, regressing an indicator for high labor force attachment on the worker, firm, and industry controls just discussed. We omit the experience and tenure indicators, which are mechanically correlated with the high-attachment indicator. Columns (1) and (2) show that women and younger workers are unconditionally less likely to be high attachment. Column (3) adds the full set of controls. Workers with higher average initial wage income and lower pre-FTA wage income growth are more likely to have high attachment status. Workers at large firms are *less* likely to be high attachment, as are workers at firms with stronger pre-FTA wage growth. Workers in industries with lower average wages and lower average wage growth are more likely to be high attachment.

5 Results

We present six sets of results in this section. Section 5.1 rules out the possibility that Canadian tariff cuts were substantially related to observable industry characteristics or pre-existing trends. Section 5.2 asks whether workers initially employed in industries that subsequently experienced

[33]Note the distinction between this unemployment measure and those in surveys such as the U.S. Current Population Survey and the Canadian labor Force Survey, which ask about employment and job search activity within a specified reference period.

different Canadian and American tariff concessions experienced different probabilities of separating from their initial employer. Sections 5.3 and 5.4 present results for years worked and cumulative earnings, respectively. Section 5.5 investigates the implications for inequality by stratifying the results by workers' initial income levels. Section 5.6 discusses possible explanations for these results and links their magnitudes to the widely-studied China shock.

5.1 Exogeneity of Trade Policy

The main threat to interpreting our results as the causal effects of the FTA is that the tariff changes may have been correlated with unobserved factors affecting workers' outcomes. Since all of the tariffs fell to zero (Appendix Figure A1), the relevant question is whether the initial tariff levels were correlated with counterfactual industry performance. To assess the importance of this concern, we estimate the following specification examining the correlates of the initial tariffs at the four-digit NAICS industry level:

$$\ln\left(1+\tau^{c}_{j,1988}\right) = \beta_0 + \beta_1 \ln\left(1+\tau^{-c}_{j,1988}\right) + \mathbf{X}'_j\beta_2 + \epsilon_j \tag{3}$$

where $c, -c \in \{\text{CAN}, \text{US}\}$, $\mathbf{X}_j$ is the vector of industry level controls discussed in Section 4, and we present specifications with and without controlling for the other country's $(-c)$ initial tariff.

The results in columns (2) and (4) of Appendix Table A2 show that the strongest correlate of a country's initial tariff is the other country's initial tariff; other factors are far less important.[34] To assess whether industries facing larger tariff cuts were on similar trajectories prior to the FTA, we examine how the initial tariff level related to growth in the industry's share of employment from 1984 to 1988 ($\Delta_{1984-1988} \ln(emp_j/\sum_{j'} emp_{j'})$) and the growth in the industry's average earnings from 1986 to 1988 ($\Delta_{1986-1988}$ Mean log earnings$_j$). For Canadian tariffs (columns (1) and (2)), the associated coefficients on pre-FTA growth are statistically indistinguishable from zero and are

[34] Although the initial Canadian and U.S. tariff levels are closely related, there are far from perfectly collinear, making it possible for us to separately identify their effects. The R^2 from an industry-level bivariate regression of initial Canadian tariffs on initial U.S. tariffs is 0.35, although this rises to 0.61 when weighted by the number of workers in each industry.

economically small.[35] For U.S. tariffs (columns (3) and (4)), we find a statistically significant negative relationship between growth in the industry's share of employment and the initial tariff level, implying that industries with larger U.S. concessions had relatively declining shares of employment prior to the FTA. However, the relationship is again economically small. While these estimates rule out the presence of substantial confounding pre-trends, our analyses nonetheless control for pre-FTA firm- and industry-level pre-trend measures to allay remaining endogeneity concerns, as discussed in Section 4.

5.2 Permanent Work-Shortage Related Separations

We start by examining whether bilateral tariff cuts affected the likelihood of a permanent layoff. We estimate equation (1), setting $Y_{ifjk} = 1$ if worker i was initially employed at firm f in industry j, and had a permanent work-shortage related separation from initial employer f between 1989 and 2003 (inclusive), and zero otherwise.[36] We do this separately for low attachment and high attachment workers, with results in Table 1.

Columns (1) and (3) estimate homogenous effects and find the expected signs for both low and high attachment workers: increased import competition due to a Canadian tariff cut raises the probability of a permanent layoff, while increased access to the U.S. export market due to a U.S. tariff cut lowers the probability. However, neither of these effects can be statistically distinguished from zero and (as discussed below) they are very small. A possible explanation is that trade liberalization affected large and small firms differently, as predicted by standard models of firm heterogeneity and trade. For example, Melitz (2003) and Demidova and Rodríguez-Clare (2013) predict that trade liberalization reduces employment at smaller and less productive domestic firms

[35] Very large changes in the industry's share of employment or average wage are associated with small tariff changes. Even a 25 percent increase in an industry's employment share (say from 1 to 1.25 percent) is associated with less than a one percentage point difference in tariff.

[36] For separations alone, we stop our analysis in 2003 for two reasons. First, we cannot tell if separations in the final year of our data set (2004) are temporary or permanent. Second, we cannot see where separated workers go in the subsequent year. We do not consider permanent separations from a firm that was not their initial employer. For example, if they quit their initial employer and then had a permanent separation from a second employer, $Y_{ifjk} = 0$ for this worker. We do not consider temporary separations, as suggested by Statistics Canada. We thank René Morissette for this guidance.

Table 1: Probability of Separation from Initial Firm (1989-2003)

	Low Attachment		High Attachment	
	(1)	(2)	(3)	(4)
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	0.0731		0.124	
	(0.159)		(0.180)	
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)		-0.480		-0.263
		(0.337)		(0.289)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)		0.225		-0.0300
		(0.195)		(0.219)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)		0.475**		0.382
		(0.205)		(0.271)
$-\Delta \ln(1+\tau_j^{\text{US}})$	-0.155		-0.0297	
	(0.194)		(0.284)	
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)		0.633**		0.481
		(0.318)		(0.337)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)		-0.472*		0.0970
		(0.271)		(0.337)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)		-0.796**		-0.651
		(0.353)		(0.445)
Observations	20,577	20,577	63,128	63,128
R-Squared	0.067	0.068	0.037	0.037

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 ($-\Delta \ln(1+\tau_j^{CAN})$) 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.

while increasing employment at larger and more productive exporting firms. These opposite-signed effects for different size firms may therefore partly offset, potentially leading to small and statistically insignificant average effects.

With these theoretical predictions in mind, columns (2) and (4) of Table 1 interact the tariff changes with an exhaustive set of initial firm size indicators. The effects of U.S. tariff concessions on low attachment workers (column (2)) are statistically significant and consistent with standard firm heterogeneity models. Workers initially at large firms are less likely to be laid off when their industry gains freer access to the U.S. market, but workers at small firms in the same industry are more likely to be laid off. The effects for high attachment workers (column (4)) are similar, but have smaller magnitudes and larger standard errors leading to insignificant estimates. These results are

consistent with the empirical findings of Trefler (2004) and Lileeva (2008) who find positive effects of U.S. tariff concessions for Canadian exporters but negative effects for Canadian non-exporters.[37]

Turning to Canadian tariff cuts, we find displacement effects that are concentrated among workers initially employed at large firms, with statistically significant increases in separations for low attachment workers (column (2)). This pattern of heterogeneity runs counter to standard models of heterogeneous firms, which predict employment reductions at small firms when facing increased import competition. Yet, our finding parallels similar results in prior empirical work on the effects of the CUSFTA in Canada (Head and Ries, 1999; Baldwin et al., 2001; Baldwin and Gu, 2004; Lileeva, 2008) and more recently on the effects of Chinese import competition in the U.S. (Autor et al., 2013b; Holmes and Stevens, 2014; Pierce et al., 2020), each of which finds larger effects of import competition at large firms.[38]

We now assess the magnitudes of these results by comparing the predicted layoff probabilities for workers whose initial industries faced tariff cuts at the 75^{th} percentile vs. the 25^{th} percentile of the tariff cut distribution. This interquartile range is 6.4 log points for Canadian tariff cuts and 2.4 log points for U.S. tariff cuts.[39] We focus on the effects for workers at large firms, as these generally have the largest magnitudes. The estimates in column (2) suggest that low attachment workers at large firms facing larger Canadian tariff cuts had a 3 percentage point higher probability of separation than otherwise similar workers in less affected industries. This difference is an 18 percent increase over the unconditional mean separation rate of 17 percent during 1989-2003.[40] Low attachment workers initially at large firms who faced larger U.S. concessions had a 1.9 percentage point (11 percent) lower probability of separation. The effects for high attachment workers at large firms are

[37] See Trefler (2004) pg. 858. The Canadian *Annual Survey of Manufactures* contains plant-level export data while the matched T2-LEAP-LWF data set used here does not.

[38] Lileeva (2008) finds that Canadian concessions tend to decrease the number of plants at multi-plant firms, especially those that produce goods outside the core competency of the firm. Baldwin and Gu (2004) document plant closure at multi-plant firms, while Baldwin et al. (2001) document a substantial increase in the degree of specialization of multi-plant firms across four-digit (SIC) manufacturing industries after the signing of the CUSFTA. See Lileeva (2008), especially pg. 378-379, for additional detail.

[39] These cuts differ slightly from those in Figure A1 because these correspond to percentiles in our worker sample. To avoid disclosure concerns, the reported interquartile ranges reflect the difference in mean tariff cut in narrow windows around the 75^{th} and 25^{th} percentiles.

[40] $\frac{0.064 * 0.475}{0.17} = 0.179$

smaller than those for low attachment workers and are statistically insignificant. The interquartile difference in Canadian tariff cuts increased the separation probability by 2.4 percentage points relative to a mean separation probability of 11.5 percent. The stabilizing effect of U.S. concessions is more comparable to that of low attachment workers at approximately 1.6 percentage points.[41]

While the effects of the change in bilateral policy on separations for workers initially at large firms are nontrivial, the homogenous effects in columns (1) and (3) of Table 1 are much smaller. Our subsequent results will reinforce the conclusion that the bilateral tariff cuts had relatively small overall labor market effects.[42] The remainder of this section presents homogenous effects of the tariff cuts on additional outcomes, while Section 6 returns to the topic of heterogeneous worker responses across firm sizes and within-industry reallocations.

5.3 Years Worked

Did these bilateral cuts and their ensuing changes in worker separations affect the total number of years affected individuals worked? To answer this question, we estimate equation (1) in which the dependent variable is the number of years in 1989-2004 with strictly positive earnings. Table 2 presents results for low attachment workers in Panel A and for high attachment workers in Panel B. In column (1) we estimate the effect on total years worked, while in columns (2)-(9) we additively decompose this overall effect into years at the initial firm of employment, at other firms in the same 4-digit NAICS industry, in other manufacturing industries, in construction, mining, agriculture, services, and in firms with missing industry codes, respectively.[43]

Again we find small overall effects: the bilateral cuts did not lead to substantial effects on years worked for either type of worker (column 1). However, these small overall effects reflect offsetting

[41]For completeness, an interquartile comparison of Canadian tariff concessions increases the mean probability of separation by 0.5 percentage point (2.8 percent) and 0.8 percentage point (6.9 percent) for low and high attachment workers, respectively, while the same comparison for U.S. concessions reduces the mean probability of separation by 0.3 percentage points (2.2 percent) and 0.1 percentage point (0.6 percent) for the same groups, respectively.

[42]Appendix Table A3 further reinforces a causal interpretation of the findings in Table 1 by showing qualitatively different results for non-layoff separations (firing, quits, etc.), ruling out various potential sources of spurious correlations between the tariff cuts and labor supply. In Appendix Tables A9-A11, we also present results for separations, years worked, and cumulative earnings controlling for the tariff cuts facing Mexican imports to Canada under NAFTA, yielding similar conclusions to our main results.

[43]See the Table 2 notes for details on the firm/industry category definitions.

Table 2: Years Worked (1989-2004)

	(1) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	-1.013	-6.477**	-2.661	2.598	1.635**	0.467	-0.657	4.014**	0.0686
	(1.284)	(2.701)	(1.712)	(1.766)	(0.766)	(0.358)	(0.549)	(1.567)	(0.0445)
$-\Delta \ln(1+\tau_j^{\text{US}})$	-3.030	4.551	6.807**	-9.483***	0.841	-0.181	-0.0663	-5.425*	-0.0728
	(2.319)	(3.884)	(3.064)	(2.844)	(1.731)	(0.576)	(0.993)	(2.955)	(0.0689)
R-squared	0.096	0.132	0.048	0.048	0.046	0.022	0.027	0.062	0.008
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	2.338*	-1.602	-2.899*	4.907	0.955	0.460	-0.588*	1.054	0.0521
	(1.206)	(4.364)	(1.724)	(3.254)	(0.737)	(0.427)	(0.325)	(1.410)	(0.0368)
$-\Delta \ln(1+\tau_j^{\text{US}})$	-3.071	8.532	5.095	-9.907*	0.385	-0.292	-0.734	-6.132**	-0.0186
	(1.890)	(7.705)	(4.677)	(5.376)	(1.499)	(0.479)	(0.522)	(2.525)	(0.0616)
R-squared	0.058	0.102	0.035	0.042	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,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.

effects on time spent in different employment situations. Low attachment workers facing larger Canadian tariff cuts spent less time employed at their initial firm (column 2) and at other firms in their initial industry (column 3). This lost time was largely made up for with more time in other manufacturing industries (column 4), construction (column 5), and services (column 8). Low attachment workers facing larger U.S. tariff cuts spent more time employed at their initial firm and at other firms in the same industry, but this was offset by reductions in time spent employed in other manufacturing industries and in services. Results for high attachment workers are qualitatively similar except that the effect of Canadian tariff cuts on years worked at the initial firm is muted, and the effects of U.S. concessions are less precisely estimated in most cases. These findings provide direct evidence that Canadian workers offset gains or losses in employment in the initial firm or industry by moving across firms, industries, and sectors in response to the tariff changes.

Figure 3 presents the magnitude interpretation for the effects in Table 2 and also shows how

the effects evolved over time. We explain the layout of Panel (a) in detail, as other panels and subsequent figures are interpreted similarly. The black bars correspond to the results in Table 2, examining years worked during 1989-2004. The height of each bar represents the predicted change in the outcome for an interquartile difference in tariff cuts, expressed as a share of the unconditional mean outcome for the relevant group. For example, the interquartile difference in Canadian tariff cut reduced low attachment workers' years worked at the initial firm by 0.41 years ($= -6.477 \cdot 0.064$). Since the unconditional mean of years worked is 11.6 for low attachment workers, the interquartile gap in tariff cuts drove a 3.6 percent reduction in years worked, which is shown on the figure. The light and medium gray bars show parallel results for the 1989-1993 and 1989-1998 periods, respectively.[44] To make the results for these shorter time windows comparable to the 16-year window 1989-2004, we multiply the predicted values by 16 over the window length to predict the effect magnitude that would have been observed if it had persisted for 16 years.[45] Stars represent whether the associated regression estimate is statistically different from zero at the 1 (***), 5 (**), or 10 (*) percent level.

The results in Figure 3 suggest that the effects of the FTA gradually grew over time.[46] Examining the Initial Firm bars in Panel (a), an interquartile difference in Canadian tariff cut induces a 2.3 percent reduction in years worked at the initial firm between 1989 and 1993, and a 3.6 percent reduction between 1989 and 2004. Because these are scaled to 16-year equivalents, this difference is not driven by the longer time window for 2004. Yet, as with the separation results, the magnitudes are small: an interquartile difference in Canadian tariff concessions induces only 5 fewer months employed at the initial firm over 16 years. Offsetting this small effect are more years spent in other manufacturing industries, construction, and services. Because it takes time for workers to shift into these other industries, the magnitude of the overall reduction in years worked in Panel (a) falls by more than half from 1993 to 2004 (from -1.4 to -0.6 percent).

Panel (b) presents the effect of U.S. concessions. As expected, most signs are reversed relative

[44]The associated regression results for these shorter time periods appear in Appendix Tables A4 and A5.

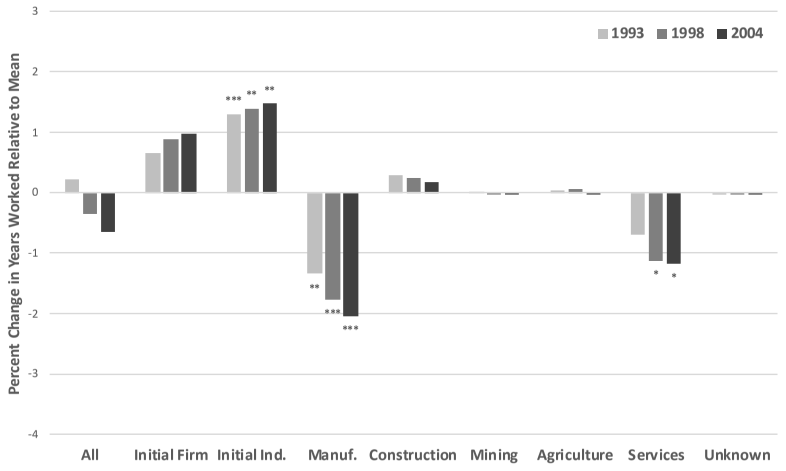
[45]Specifically, we multiply the 1989-1993 values by 16/5, and the 1989-1998 by 16/10.

[46]This is consistent with the results of Besedes et al. (2020) who find gradual increases in trade in response to the CUSFTA, even in industries in which tariffs immediately went to zero.

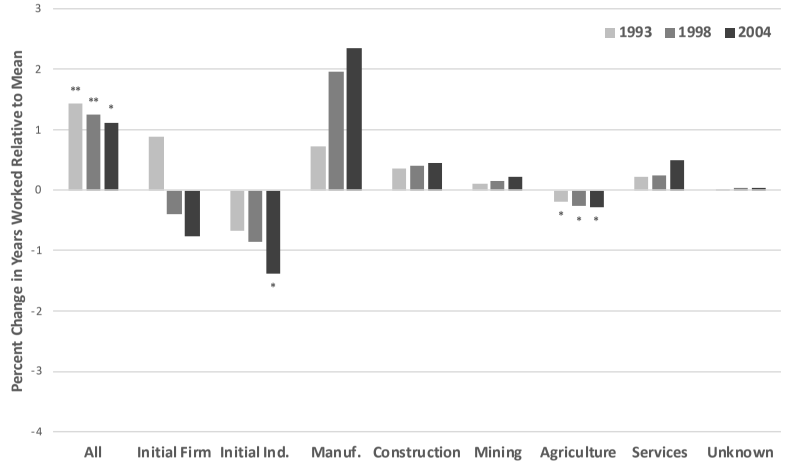
Figure 3: Evolution of Effects on Years Worked



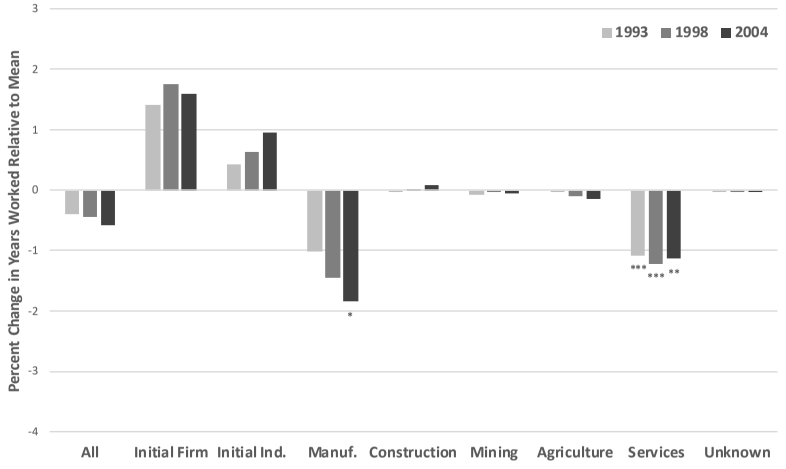
(a) Effect of Canadian Tariff Cuts - Low Attachment Workers



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



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



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

Notes: The figures present scaled estimates from regressions in Table 2 and in the Appendix as Tables A4 and A5. The bars show predicted differences in years worked when facing tariff changes that differ by the interquartile range, expressed as a percent of the group's mean years worked. The interquartile range for Canadian tariff cuts is 0.064 and for U.S. tariff cuts is 0.024. The unconditional mean of years worked for low attachment workers is 11.6 and for high attachment workers is 13.4. 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 2 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.

to Panel (a): a worker more exposed to larger U.S. concessions worked more years at the initial firm and in the initial industry, and fewer years in other sectors. Panels (c) and (d) present results for high attachment workers. As with separations, the estimates for high attachment workers are generally somewhat smaller than for low attachment workers, particularly for years worked at the initial firm and industry, and many are indistinguishable from zero.

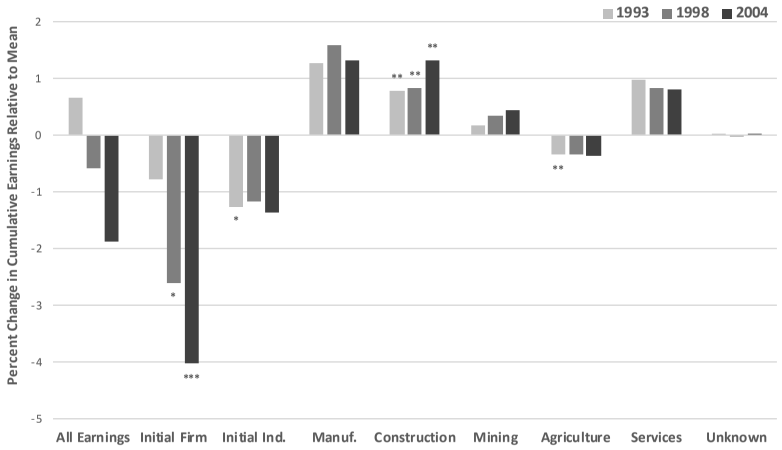
5.4 Cumulative Earnings

We now examine the effects of the bilateral CUSFTA tariff cuts on cumulative earnings of Canadian workers. Recall that the cumulative normalized earnings measure is defined in equation (2) as total earnings during the relevant period divided by the worker's average yearly earnings in the pre-FTA period. The mean cumulative normalized earnings during 1989-2004 is 21.01 for low attachment workers and 14.64 for high attachment workers. This means that low attachment workers earned 21 times their initial yearly earnings during 1989-2004, while high attachment workers earned 14.6 times their initial yearly earnings. This difference partially reflects the fact that low attachment workers tended to be younger in 1988 and hence were on a steeper portion of their lifecycle earnings profile (Mincer, 1974; Lemieux, 2006). We estimate equation (1) with cumulative normalized earnings as the dependent variable, and present regression results in Appendix Tables A6-A8 and associated magnitudes in Figure 4.

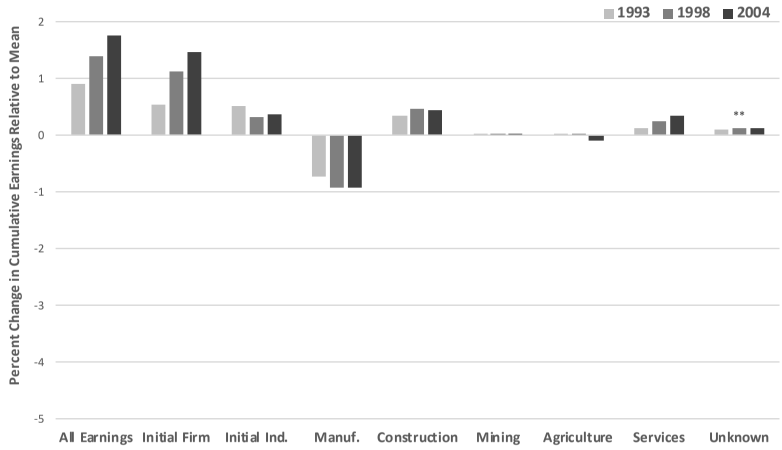
Figure 4 is constructed in the same way as Figure 3, showing differences in predicted cumulative normalized earnings for workers facing interquartile differences in tariff changes as a proportion of the unconditional average outcome, scaled to make the different timeframes comparable. As with years worked, we find earnings adjustments that intensify over time but with small and statistically insignificant effects on long run earnings for both worker types.[47] Significant earnings losses at low attachment workers' initial firms in response to Canadian tariff cuts (Panel a) are consistent with a heightened probability of separation from the initial firm in Table 1 and reductions in years

[47]To map our regression results to this figure, consider the black bar for "All Earnings" in Panel (a) of Figure 4. The associated regression coefficient in Appendix Table A8 is -6.142. Multiplying by the interquartile Canadian tariff cut of 0.064 and dividing by low attachment workers' mean cumulative normalized earnings of 21.04 yields -1.86 percent, shown in the figure.

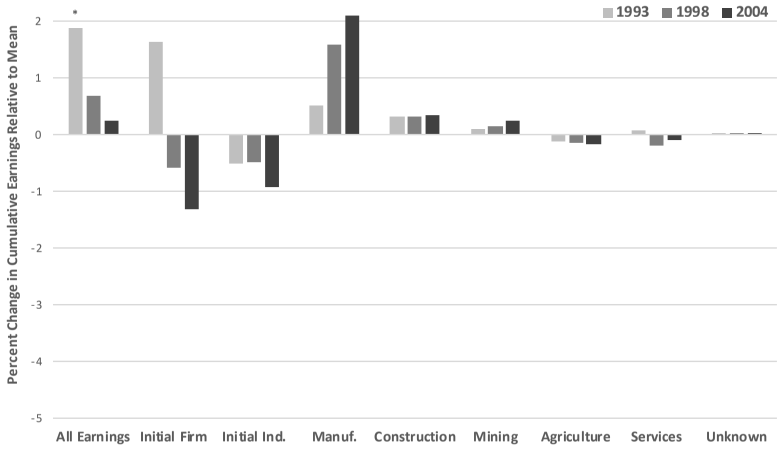
Figure 4: Evolution of Effects on Cumulative Normalized Earnings



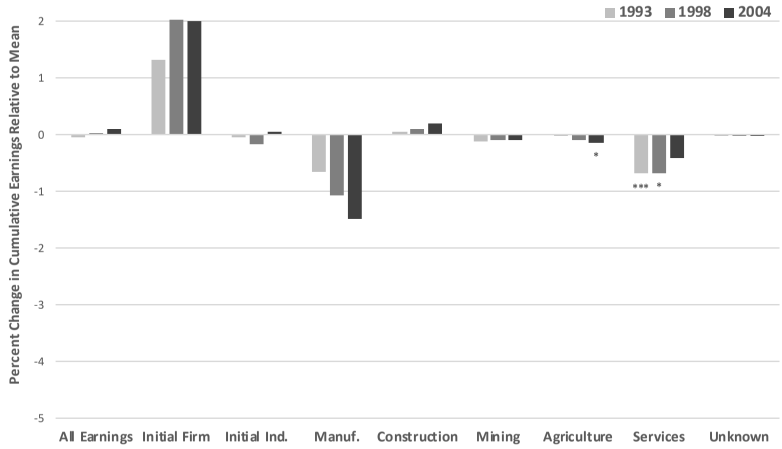
(a) Effect of Canadian Tariff Cuts - Low Attachment Workers



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



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



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

Notes: The figures present scaled estimates obtained from regressions appearing in the Appendix as Tables A6-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. The interquartile range for Canadian tariff cuts is 0.064 and for U.S. tariff cuts is 0.024. The unconditional mean of cumulative normalized earnings for low attachment workers is 21.01 and for high attachment workers is 14.64. 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. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

worked at the initial firm in Figure 3. This negative effect of Canadian concessions on initial firm income is substantially offset by higher earnings in other manufacturing industries, construction, and services, consistent with workers successfully transitioning across industries and sectors to make up for earnings losses at the initial firm. Comparing the overall effects in Panel (a) of Figures 3 and 4, we see that although low attachment workers facing larger Canadian tariff cuts steadily recover over time in terms of years worked as they transition across industries and sectors, their relative earnings effects fall over time, showing that transitions do not fully offset the lost earnings in the initial firm. That said, the overall earnings effects remain quite small at all time horizons. Estimates for the effect of U.S. concessions are small and often indistinguishable from zero. For high attachment workers (Panels c and d), we find little overall effect on long run earnings, although the effects on initial firm earnings have the expected signs.

5.5 Low Income and High Income Workers

In this section, we examine years worked and cumulative earnings separately by workers' initial income rather than by labor force attachment. This alternative split allows us to directly examine the effects of the CUSFTA on earnings inequality among initial manufacturing workers. We split workers into terciles based on their pre-FTA average yearly income ($\overline{E}_{i,88-86}$ in (2)) and run separate regressions for workers in the top and bottom terciles.[48] The regression results appear in Appendix Tables A12-A17 and the magnitude figures for years worked and cumulative earnings are in Appendix Figures A2 and A3, respectively.

Comparing the effects on years worked in Figures A2 and 3, we find nearly identical impacts for low income and low attachment workers, while the effects are qualitatively similar but somewhat larger in magnitude for high income workers than for high attachment workers. Low income workers are employed for fewer years overall in response to Canadian concessions; this overall effect is driven by fewer years worked in the initial firm and industry, which are only partially offset by more years working in services. For high income workers, fewer years worked in the initial industry are more

[48] Results for the middle tercile are roughly a mixture of results for the top and bottom terciles.

than offset elsewhere elsewhere in manufacturing. U.S. tariff concessions lead low income workers to spend more years in their initial firm and industry, with this effect almost exactly offset by fewer years in manufacturing and services. For high income workers, more years at the initial firm are offset by fewer years in the initial industry, elsewhere in manufacturing, and in services.

Comparisons of the cumulative earnings effects in A3 and 4 again yield very similar conclusions. Low attachment and low income workers have very similar patterns and magnitudes of effects. High income workers and high attachment workers also have similar patterns of effects, but high income workers often exhibit larger magnitudes, particularly in terms of increased earnings from other manufacturing industries when facing larger Canadian tariff cuts and increased earnings from the initial firm when facing larger U.S. tariff cuts.

These results emphasize the close link between workers' initial income and their degree of labor market attachment and reinforce our earlier findings that stratified by labor force attachment. They also make explicit the effects of the FTA tariff cuts on earnings inequality. Based on the long-run point estimates for total earnings, Canadian tariff cuts exacerbated earnings inequality by slightly reducing low income workers' long-run earnings and slightly raising them for high income workers, while U.S. tariff cuts reduced earnings inequality by raising low income workers' earnings more than those of high income workers. Yet, none of these point estimates is statistically significantly different form zero, and all are quantitatively small (less than 3 percent), so the FTA likely had minimal effects on manufacturing workers' earnings inequality.

5.6 Understanding Our Results

In the preceding subsections, we find small and offsetting effects of Canadian and U.S. tariff cuts on the probability of permanent layoff from the worker's initial firm, on total years worked, and on cumulative earnings of low and high attachment workers. Although low attachment and low income workers facing larger Canadian tariff cuts experienced meaningful reductions in time employed at their initial firm and had reduced earnings from that firm, these losses were largely offset by higher levels of income in other sectors, suggesting relatively smooth transitions between firms and

industries facing negative vs. positive effects of the CUSFTA.

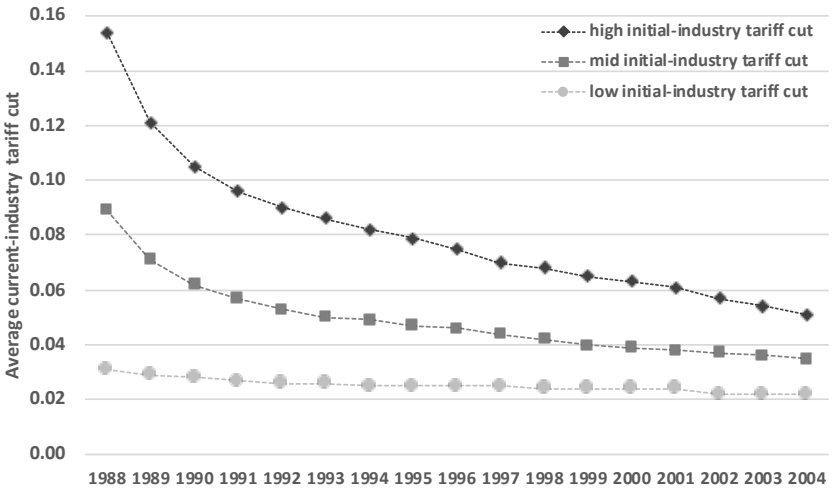
These modest effects and apparently smooth sectoral transitions stand in contrast to a large literature finding substantial and persistent consequences of job displacement, including pioneering work on mass layoffs by Jacobson et al. (1993). Our findings also contrast with more recent research on the effects of trade on workers' labor market outcomes, including Autor et al. (2014) who study the effects of the China Shock in the U.S. and Dix-Carneiro and Kovak (2017) who study Brazilian trade liberalization. Both papers find large and growing effects of import competition over long periods of time, suggesting slow and costly worker transitions into more favorable employment situations. Our findings are more in line with a series of papers on the German labor market's response to increased trade with China and Eastern Europe, finding offsetting effects of import competition and export opportunities and relatively smooth transitions between sectors (Dauth et al., 2014, 2017, 2021).

To help understand the sources of these contrasting results, this subsection presents three additional findings. First, we show that Canadian workers quickly moved from industries facing large increases in competition to industries facing smaller shocks. Second, while the China Shock in Canada induced mass layoffs, the CUSFTA tariff changes did not. Third, we show that industry employment in Canada primarily adjusted to import competition by reducing the number of new hires rather than through separations of existing workers.

As we saw in the years-worked and earnings results in Sections 5.3 and 5.4, Canadian workers whose initial industries faced larger increases in import competition shifted into other industries and sectors. Figure 5 shows that these transitions occurred quickly and that workers not only left industries facing the largest tariff reductions, but also systematically shifted into industries facing smaller increases in import competition. The figure divides low attachment workers into terciles based on the size of their *initial* industry's tariff cut and plots the average tariff cut for each group of workers in their *current* industry in each subsequent year.[49] When calculating this average, we omit workers who are not employed in the relevant year and assign nontradable industries a

[49]The results for high attachment workers are similar and appear in Appendix Figure A4.

Figure 5: Evolution of Canadian Tariff-Cut Exposure: Low 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.

tariff cut of zero.[50] The declining profiles indicate that workers systematically transitioned from relatively high-tariff industries to relatively low-tariff industries. For example, prior to the FTA in 1988, workers initially in the high tariff-cut tercile worked in industries facing an average Canadian tariff cut of 15.4 percentage points. By 1996, the same group of individuals worked in jobs facing an average Canadian tariff cut of 7.5 percentage points, less than half of their initial industries' average tariff cut.

Autor et al. (2014) present a related analysis showing that although U.S. workers were likely to switch firms and industries in response to increased Chinese import competition, many workers moved into jobs facing similar import competition. We replicate their analysis in Appendix Figure A5 and confirm the conclusions of Figure 5: Canadian workers facing import competition due to the FTA quickly transitioned into industries facing substantially less import competition. In addition, their movements were close to what one might expect if workers moved exclusively into

[50]While the ideal approach would take into account local equilibrium spillovers from tradable to nontradable industries as in Kovak (2013), our lack of detailed geographic information precludes such an analysis.

industries that saw no direct increase in import competition. In contrast to the U.S. experience, these relatively fast transitions help explain Canadian workers' ability to quickly recover from employment and earnings losses when their initial firms faced large Canadian tariff cuts.

Mass layoffs lead to substantial and persistently negative labor market outcomes for affected workers (Jacobson et al., 1993; Couch and Placzek, 2010; Lachowska et al., 2020).[51] In Table 3, we examine whether the CUSFTA tariff cuts altered the probability of a mass layoff at affected firms. Following Jacobson et al. (1993) we create a sample of firms meeting three criteria: i) employed at least fifty workers in 1988, ii), employed workers in our sample in each year between 1984 and 1988 (inclusive), and iii) in manufacturing.[52] We then calculate each firm's maximum employment during 1984-1988 and define a firm as having a mass layoff if its employment fell below 70 percent of its pre-FTA peak in any year between 1989 and 2004.[53] We then run a firm-level regression of the mass-layoff indicator on Canadian and U.S. tariff changes, their interactions with the initial firm size, and the full sets of firm and industry level controls described in Section 4. For comparison, we report the coefficient on the industry's change in Chinese import penetration, which we control for in all of our analyses.

Column (1) of Table 3 shows that larger Canadian tariff cuts did not increase the probability of a mass layoff, nor did larger U.S. tariff cuts reduce that probability. The point estimates have the opposite sign of what one would expect, are statistically indistinguishable from zero, and have small magnitudes. For example, firms whose Canadian tariff cuts differed by the industry-level interquartile range of 0.043 have predicted mass layoff probabilities that differ by 1.3 percentage points.[54] In contrast, increased Chinese import penetration drove a statistically significant increase in the probability of a mass layoff for firms in affected industries. The interquartile range for Chinese import penetration is 0.140, implying a 2.7 percentage point larger mass layoff probability for firms facing larger China shocks. Column (2) shows that these results continue to hold when we allow

[51] Although not focusing on mass layoffs, Morissette et al. (2013) and Stepner (2019) also find substantial income losses following general layoffs in the Canadian context.

[52] Again, we use the nalus definition of total firm employment.

[53] We find similar results using definitions based on firm exit or year-to-year employment declines.

[54] This interquartile range weights industries equally, in contrast to the earlier values, which implicitly weight by employment in the worker sample.

Table 3: Mass Layoffs (1989-2004)

	(1)	(2)
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	-0.309	
	(0.447)	
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)		-0.523
		(0.688)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)		-0.165
		(0.493)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)		-0.381
		(1.432)
$-\Delta \ln(1+\tau_j^{\text{US}})$	0.0722	
	(0.652)	
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)		0.876
		(1.025)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)		-0.239
		(0.619)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)		-4.221
		(2.692)
$\Delta IPR_j^{\text{CHN}}$	0.193**	0.191**
	(0.0825)	(0.0859)
R-squared	0.028	0.035

Notes: These firm-level regressions examine the effects of Canadian and U.S. tariff cuts and increased Chinese import penetration on mass layoffs across 4,206 firms. The dependent variable is an indicator for having a mass layoff, defined as having at least one year in 1989-2004 in which employment falls below 70 percent of the firm's 1984-1988 peak employment (results robust to definitions based on year-to-year employment changes or firm exit). Column (1) examines overall effects, while column (2) presents the results of tariff cuts separately by firm size in 1988 (small=1-99, medium=100-999, large=1000+). All specifications include the full set of firm-level and industry-level controls described in Section 4. Standard errors clustered by 4-digit NAICS industry. *** p<0.01, ** p<0.05, * p<0.1.

the tariff-cut effects to vary by firm size. These findings suggest that the CUSFTA tariff changes were much less likely to produce mass layoffs than was the China Shock. Given how disruptive mass layoffs are to workers' employment outcomes, the lack of mass layoffs in response to the FTA helps explain its lack of substantial long-run effects.

Our main analysis focused only on workers initially employed in manufacturing, but the Canadian labor market may have adjusted to the CUSFTA through changes in employment patterns among other workers as well. To examine that possibility, Table 4 studies the change in total industry employment and its components. The dependent variable in column (1) is the proportional change in industry employment from 1988 to 2004, including all workers irrespective of their pre-FTA employment status. We then regress this employment growth on Canadian and U.S. tariff cuts and the full set of industry controls described in Section 4. For comparison, we report the

Table 4: Aggregate Industry Employment Growth (1988-2004)

	(1)	(2)	(3)	(4)	(5)
	Industry	Employment Growth Components			
	Employment Growth	Manufacturing Workers	Non-Manuf. Workers	Previously Unemployed	New Entrants
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	-3.816*	-0.565	-0.726	-0.285*	-2.241**
	(2.131)	(0.580)	(0.589)	(0.153)	(1.112)
$-\Delta \ln(1+\tau_j^{\text{US}})$	-0.460	-0.392	0.0271	-0.0729	-0.0225
	(3.460)	(0.941)	(0.956)	(0.248)	(1.805)
$\Delta IPR_j^{\text{CHN}}$	-0.700**	-0.214**	-0.118	-0.0437*	-0.325*
	(0.333)	(0.0906)	(0.0921)	(0.0239)	(0.174)
R-Squared	0.404	0.403	0.299	0.384	0.469

Notes: These industry-level regressions examine the effects of Canadian and U.S. tariff cuts and increased Chinese import penetration on the proportional change in aggregate industry employment from 1989-2004, across 78 manufacturing industries (not restricting to workers initially in manufacturing as in earlier analyses). Column (1) examines overall industry employment growth, while columns (2)-(5) study the portion of industry employment growth accounted for by its additively separable components: (2): workers employed in manufacturing in 1988; (3): those employed outside manufacturing in 1988; (4): those employed between 1984 and 1987, but not in 1988 ("unemployed"); and (5) those not employed between 1984 and 1988 ("new entrants"). All specifications include the dependent variable pre-trend, calculated for 1984-1987 (results are similar without this pre-trend control), and the full set of industry-level controls described in Section 4. Standard errors clustered by 4-digit NAICS industry which is equivalent to heteroskedasticity-robust for these industry-level regressions. *** p<0.01, ** p<0.05, * p<0.1.

coefficient on the industry's change in Chinese import penetration as well. Column (1) of Table 4 shows that both Canadian tariff cuts and increased import penetration from China substantially reduced industry-level employment growth. An interquartile increase in the Canadian tariff cut reduced employment growth by 16.4 percentage points, while an interquartile difference in Chinese import penetration reduced employment growth by 9.8 percentage points.

The remaining columns additively decompose overall industry growth into the portion accounted for by workers who were already employed in manufacturing in 1988 (column 2), those who were employed outside manufacturing in 1988 (column 3), those who were not employed in 1988 but who were observed working in previous years (column 4), and those who are observed working for the first time after 1988 (column 5). The results are striking: while the China shock affected employment growth across various margins, the effect of Canadian tariff cuts is strongly concentrated among new entrants. Since our worker-level analysis focuses on individuals initially employed in manufacturing, this adjustment among new entrants does not affect the workers in our main analysis. This helps explain why we find small effects for initial manufacturing workers and is consistent

with the differences we have found between workers with high vs. low labor force attachment. The negative effects of import competition resulting from Canadian tariff cuts are minimal among those with strong labor force attachment, larger among low attachment workers already employed in manufacturing prior to the FTA, and largest in terms of aggregate industry adjustment among those newly entering the labor market after the FTA came into force.

Each of these supplementary results helps explain the small effects of the CUSFTA that we document for manufacturing workers in Canada. Unlike other trade shocks, Canadian tariff cuts did not lead to highly disruptive mass layoffs, with their attendant sharp declines in employment outcomes. Workers that were adversely affected by import competition transitioned out of industries facing the largest tariff cuts and quickly moved into industries facing much lower average increases in import competition, which allowed workers to recover earnings and employment losses from their initial firms. Although Canadian tariff cuts did drive substantial cross-industry reallocation, with large relative declines in employment in industries facing larger tariff reductions, this adjustment occurred primarily among new entrants, insulating incumbent manufacturing workers.

6 Firm Heterogeneity

This section returns to the issues of firm heterogeneity raised in Section 5.2 by examining heterogeneous effects of the CUSFTA tariff cuts by initial firm size. We find evidence for within-industry reallocation of workers from small to large firms in industries with expanding export opportunities, consistent with the Melitz (2003) model and its asymmetric-country extension in Demidova and Rodríguez-Clare (2013). In contrast to the predictions of standard firm-heterogeneity models of trade, increased import competition drove separations primarily among workers initially at large firms, consistent with Head and Ries (1999) and Holmes and Stevens (2014). We also find that although the overall effects of the tariff cuts discussed in Section 5 are modest, one relatively small group of workers does experience substantial effects on cumulative earnings: low labor-force attachment workers initially employed at large firms. However, even for this group the adverse effects of

Canadian tariff cuts and favorable effects of U.S. cuts largely offset, leading to very small net effects on average.

6.1 Transitions

Table 1 showed that bilateral tariff cuts affected the probability of a worker experiencing a permanent work-shorted related separation from their initial firm. Here, we additively decompose those separation results based on the worker's subsequent employment situation. We categorize workers based on their primary job in the year following displacement, so each separated worker falls in precisely one employment transition category or unemployment.[55] The results of this decomposition appear in Figures 6 and 7. We present magnitude calculations comparing interquartile differences in tariff cuts, following the same procedure used in Figure 3, and the associated regression results appear in Appendix Tables A18 - A20. The first set of bars ("Total") is simply the scaled change in layoff probability due to an interquartile comparison, while the remaining bars present the decomposition.[56] Estimates suppressed by Statistics Canada due to confidentiality concerns appear with an "x".

Figure 6 shows the effects of Canadian tariff cuts. Results for workers initially at large firms (top panels) and those initially at small firms (bottom panels) tend to be mirror opposites. Canadian tariff concessions induce a higher separation probability at large firms, but a smaller probability at small firms. Separated workers at large firms did not stay in the same industry, but moved elsewhere in manufacturing or into construction, consistent with movement into industries insulated from import competition, as documented in Figure 5. Low attachment workers at small firms (Panel c) benefit from Canadian tariff cuts through lower layoff probabilities and fewer transitions into unemployment, with similar though muted effects for high attachment workers (Panel d).

As mentioned in Section 5.2, displacement effects of import competition concentrated at large firms runs counter to standard firm heterogeneity models such as Melitz (2003) and Demidova and

[55]Because we observe yearly earnings, we define unemployment as earning less than 1600 hours at the provincial minimum wage in the year following separation.

[56]The "Total" bars for 2004 correspond to the magnitude calculations for the regression estimates in Table 1. Results for workers at medium-sized firms appear in Appendix Tables A18 - A20.

Rodríguez-Clare (2013), which predict employment losses at smaller firms. Our findings are more in line with empirical studies of the effects of increased import competition that find larger effects at large firms, perhaps justified by the niche market argument proposed by Head and Ries (1999) and formalized by Holmes and Stevens (2014) or the complementary product-cycle arguments of Eriksson et al. (2021).[57] Yet, in spite of this increased probability of separation from their initial employers, workers at large firms reallocated relatively smoothly into other industries and did not see statistically significant increases in unemployment at the short one-year time horizon following separation.

Figure 7 examines reallocations in response to U.S. concessions. U.S. tariff cuts for low attachment workers at large Canadian firms reduced separations largely by reducing transitions into unemployment (Panel a). The opposite occurs for workers initially at small firms: there is a heightened probability of separation and transition to another firm in the same industry, into construction, or into unemployment (Panel c). This pattern is consistent with results in Trefler (2004) and Lileeva (2008) in which U.S. tariff cuts increase employment at exporters (large firms) but reduce it for non-exporters (small firms). Results for high attachment workers are similar but less precisely estimated: increased job stability at large firms is mirrored by increased transitions to other firms within the same industry for those initially employed at small firms (Panels b and d). The effects of U.S. tariff cuts therefore conform with the predictions of models of firm heterogeneity: increased access to export markets benefits larger firms able to bear the fixed costs of exporting while potentially heightening factor market competition that harms smaller non-exporting firms (Demidova and Rodríguez-Clare, 2013).

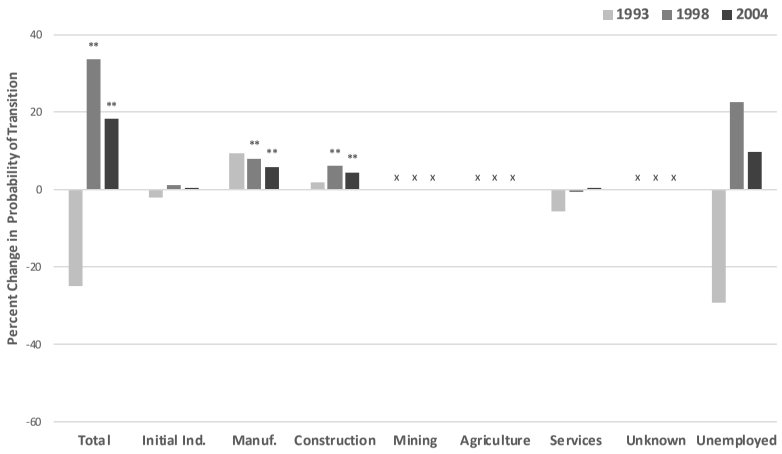
6.2 Earnings

Figures 8 and 9 examine effects on cumulative earnings for workers initially employed at large or small firms, using the same organization as Figures 6 and 7.[58] Up to this point, we have emphasized

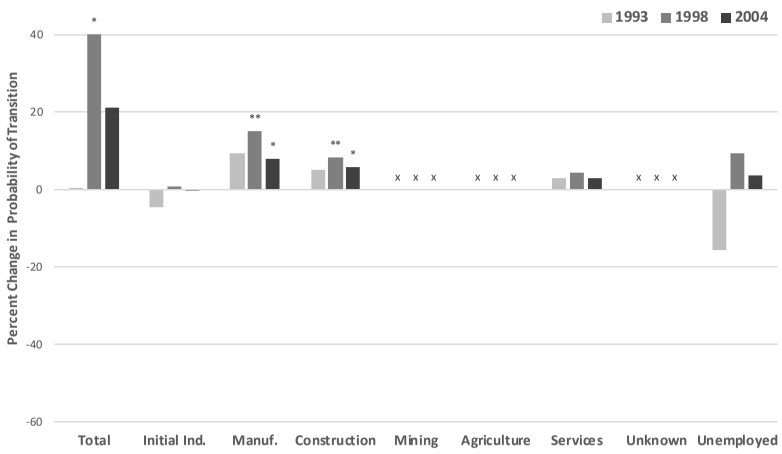
[57]Examples of empirical papers finding larger effects of import competition at large firms include Head and Ries (1999), Baldwin et al. (2001), Baldwin and Gu (2004), and Lileeva (2008), for empirical analyses of the CUSFTA in Canada and Autor et al. (2013b) and Pierce et al. (2020) on Chinese import competition in the U.S.

[58]Regression tables corresponding to these figures appear in the Appendix Tables A21-A23.

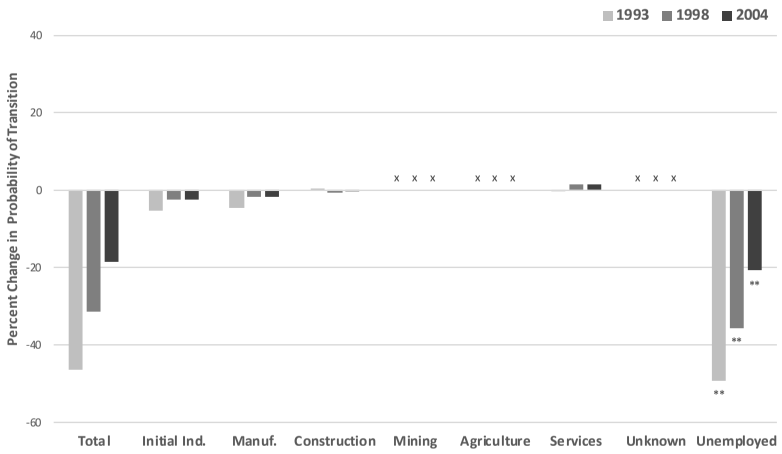
Figure 6: Effects of Canadian Tariff Cuts on Worker Transitions, by Labor-Force Attachment and Initial Firm Size



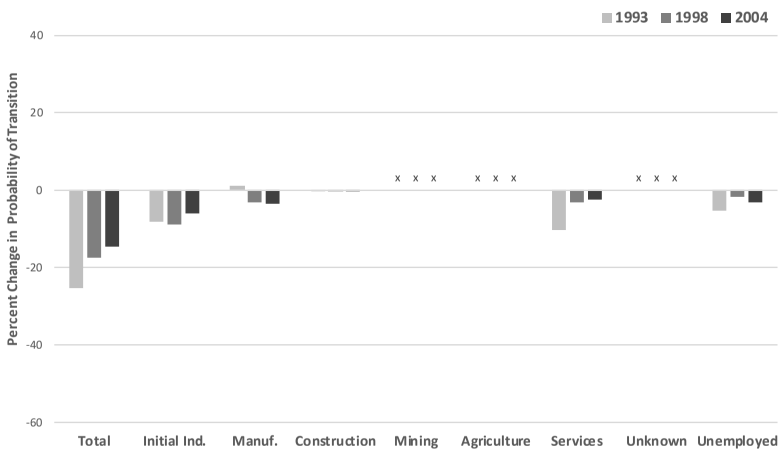
(a) Low Attachment Workers, Large Firm



(b) High Attachment Workers, Large Firm



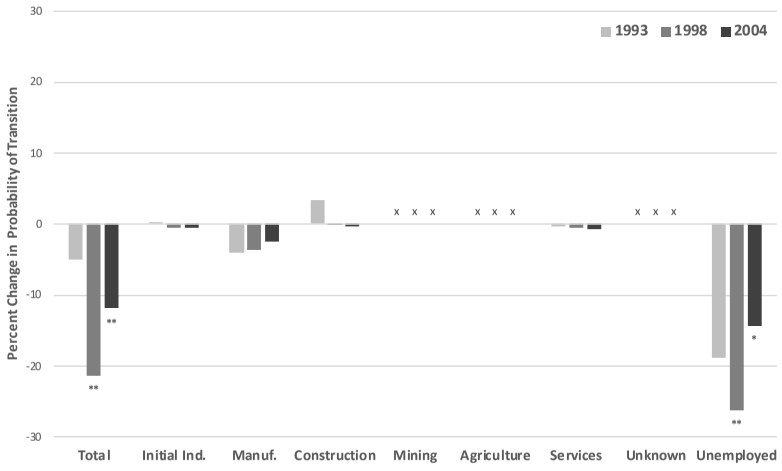
(c) Low Attachment Workers, Small Firm



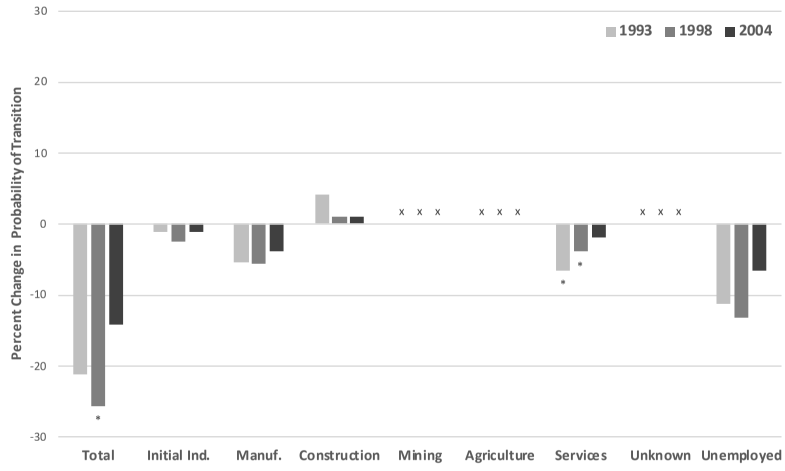
(d) High Attachment Workers, Small Firm

Notes: The figures present scaled estimates from regressions paralleling those in Table 1. The bars labeled "Total" show predicted differences in the probability of a work-shortage related separation from the worker's initial firm from 1989 to the year associated with each bar when facing tariff changes that differ by the interquartile range, expressed as a percent of the group's mean separation probability. Subsequent bars decompose the separations based on the worker's status in the year following separation. The interquartile range for Canadian tariff cuts is 0.064. The unconditional probability of a work-shortage related separation is 0.167 for low attachment workers and 0.115 for high attachment workers. 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.

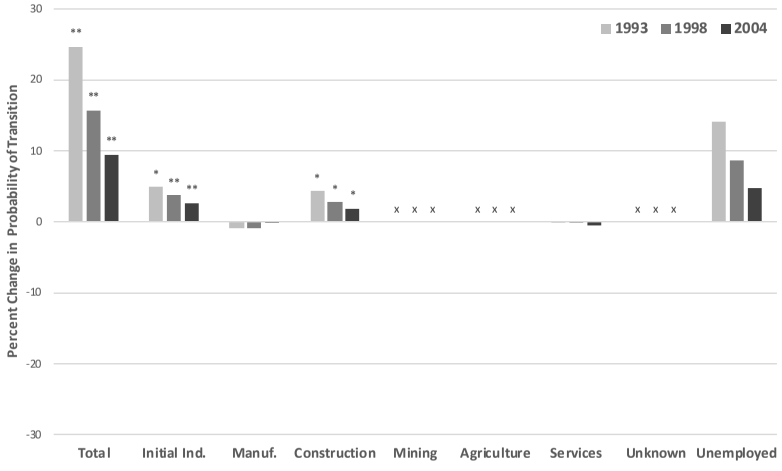
Figure 7: Effects of U.S. Tariff Cuts on Worker Transitions, by Labor-Force Attachment and Initial Firm Size



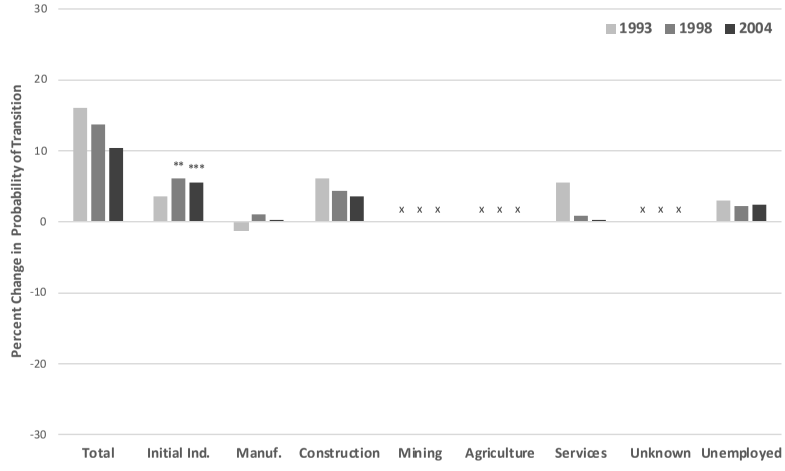
(a) Low Attachment Workers, Large Firm



(b) High Attachment Workers, Large Firm



(c) Low Attachment Workers, Small Firm



(d) High Attachment Workers, Small Firm

Notes: The figures present scaled estimates from regressions paralleling those in Table 1. The bars labeled "Total" show predicted differences in the probability of a work-shortage related separation from the worker's initial firm from 1989 to the year associated with each bar when facing tariff changes that differ by the interquartile range, expressed as a percent of the group's mean separation probability. Subsequent bars decompose the separations based on the worker's status in the year following separation. The interquartile range for U.S. tariff cuts is 0.024. The unconditional probability of a work-shortage related separation is 0.167 for low attachment workers and 0.115 for high attachment workers. 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.

the quantitatively small effects of the CUSFTA on worker outcomes. However, in Figures 8 and 9, we find meaningful effects of both Canadian and U.S. tariff cuts on the earnings of low attachment workers initially employed in large firms. Effects for these workers are substantial and grow over time in their intensity. However, income losses due to Canadian tariff cuts are still offset by gains due to U.S. tariff cuts, so the predicted net effects depend importantly upon the particular set of tariff cuts facing workers in each industry.

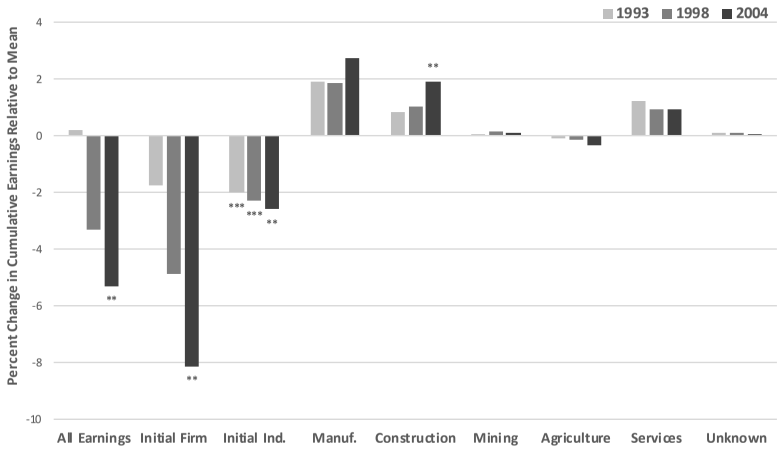
Figure 8, Panel (a) finds that an interquartile comparison of Canadian tariff concessions reduces long-run cumulative earnings by 5.3 percent. This effect is accounted for by earnings losses of 10.7 percent in the worker's initial firm and initial industry (combined), with 5.6 percent recovered through increased earnings in manufacturing, construction, and services. For low attachment workers at small firms and for high attachment workers (regardless of firm size), we find little long run effect of Canadian concessions on cumulative earnings.

Turning to the effect of U.S. concessions in Figure 9, there are larger gains (5.1 percent) for low attachment workers at large firms (Panel A), with the majority (3.3 percent) coming from increased initial firm earnings. For high attachment workers at large firms (Panel b), we see higher initial-firm earnings offset by lower earnings at other firms in the industry.[59] For workers at small firms (Panels c and d), we find little effect, irrespective of labor force attachment.

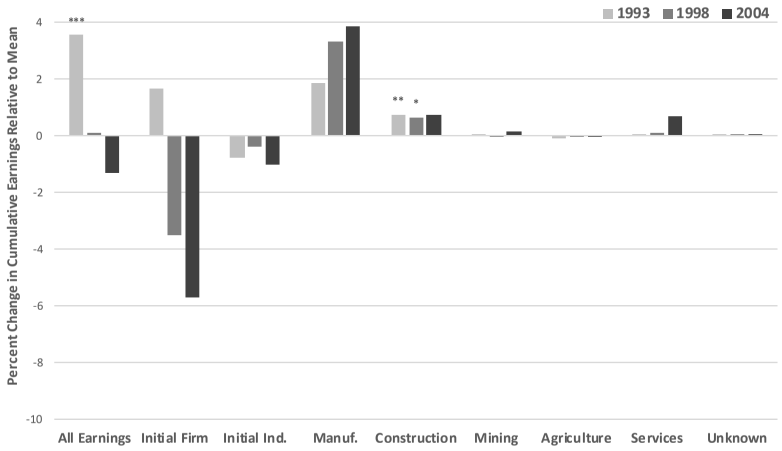
The overall earnings analysis in Figure 4 showed that, on average, Canadian workers with high and low labor force attachment experienced relatively small effects of the CUSFTA tariff changes. The firm-size heterogenetiy analysis in Figures 8 and 9 confirms that this finding also holds for low attachment workers at small firms and for the roughly 75 percent of our sample with high labor force attachment. However, this subsection finds substantial earnings effects for the minority of our sample consisting of low attachment workers initially employed at large firms. While this nontrivial effect poses an important qualifier to our baseline analysis in Section 5, it is important to keep in mind that the effects of Canadian and U.S. tariff cuts offset each other, even for low

[59] These initial-firm earnings increases for workers at large firms gaining freer access to the U.S. market are consistent with Verhoogen's (2008) finding that more productive Mexican plants exhibited higher wage increases after an exchange rate devaluation.

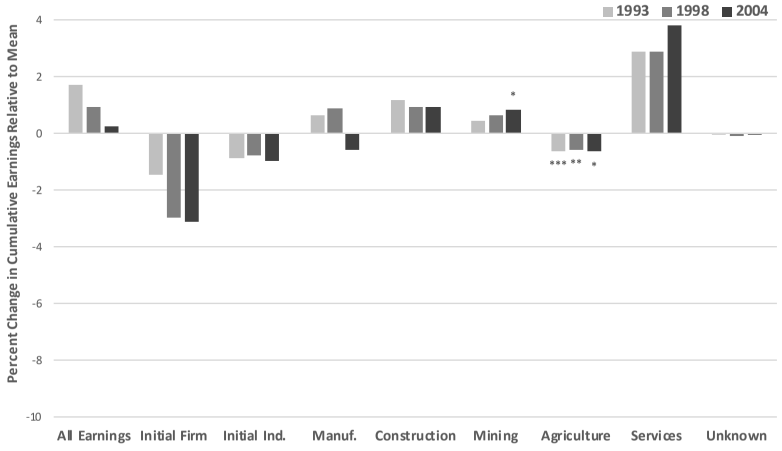
Figure 8: Effects of Canadian Tariff Cuts on Cumulative Normalized Earnings, by Labor-Force Attachment and Initial Firm Size



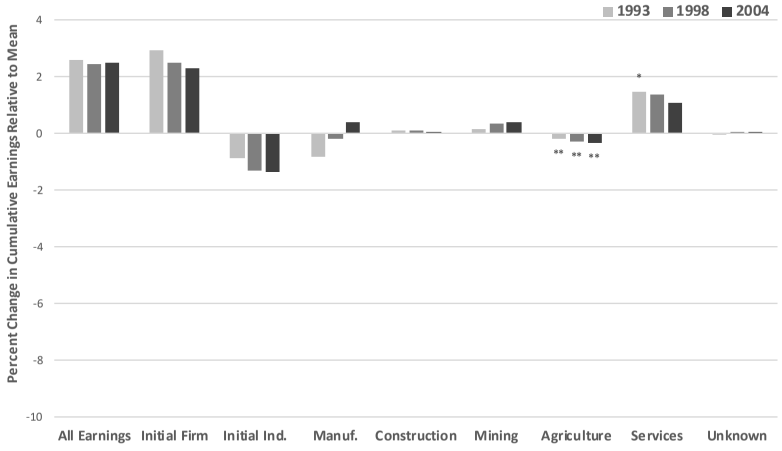
(a) Low Attachment Workers, Large Firm



(b) High Attachment Workers, Large Firm



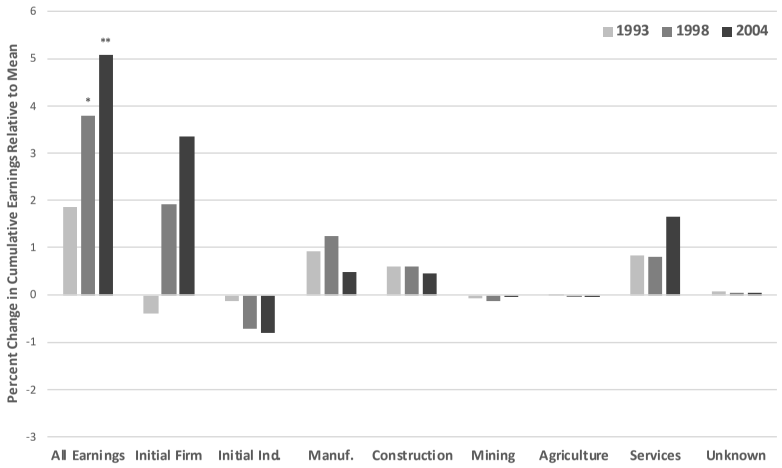
(c) Low Attachment Workers, Small Firm



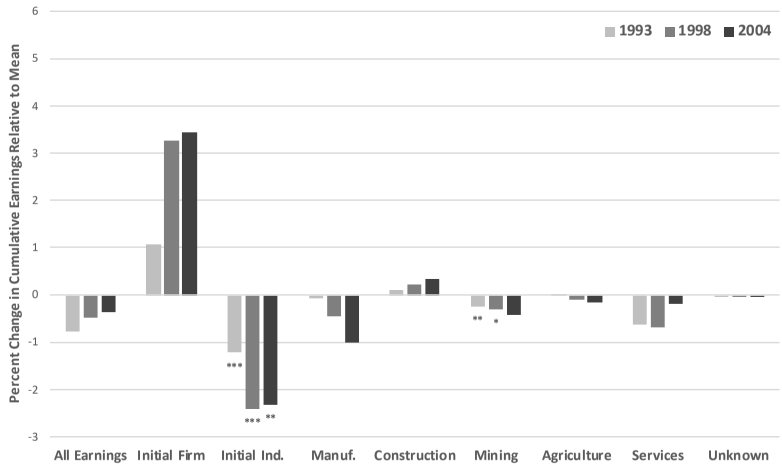
(d) High Attachment Workers, Small Firm

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. The interquartile range for Canadian tariff cuts is 0.064. The unconditional mean of cumulative normalized earnings for low attachment workers is 21.01 and for high attachment workers is 14.64. 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.

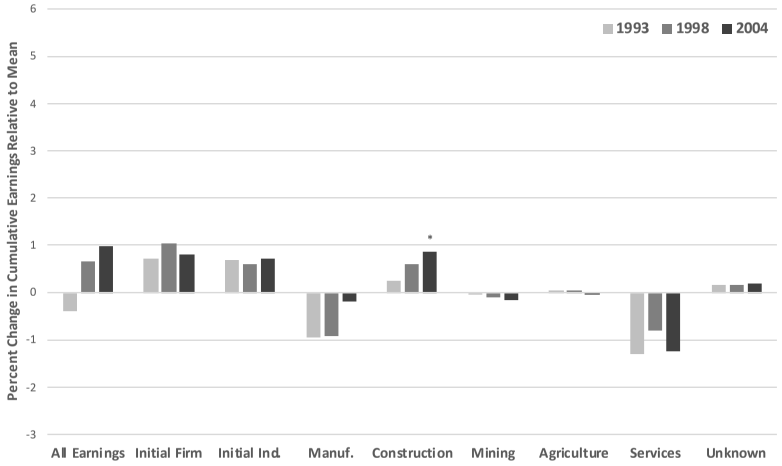
Figure 9: Effects of U.S. Tariff Cuts on Cumulative Normalized Earnings, by Labor-Force Attachment and Initial Firm Size



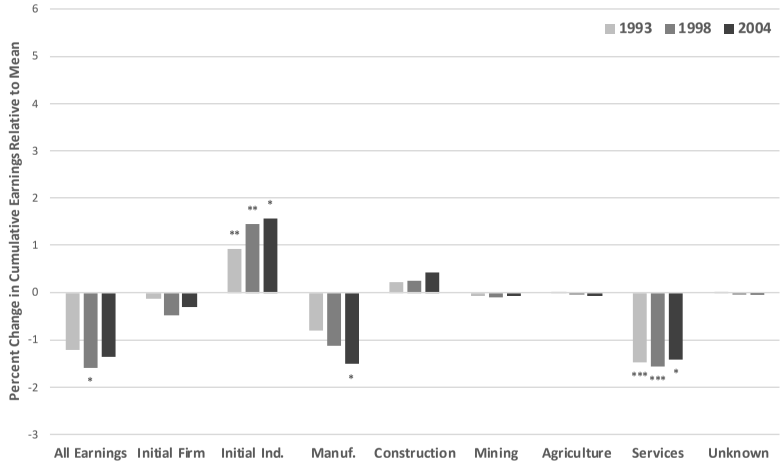
(a) Low Attachment Workers, Large Firm



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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. The interquartile range for U.S. tariff cuts is 0.024. The unconditional mean of cumulative normalized earnings for low attachment workers is 21.01 and for high attachment workers is 14.64. 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.

attachment workers at large firms. When this group faces interquartile differences in Canadian and U.S. tariff cuts, the predicted difference in net cumulative earnings is very close to zero: -0.2 percent $(= 5.1 - 5.3)$.[60]

7 Conclusion

What happens to workers when high-income countries deliberately agree to freer trade with one another? This question has received minimal attention despite clear evidence such events can have large effects on industries, firms, and plants (Head and Ries, 1999; Trefler, 2004). This paper fills that gap by examining how the bilateral tariff reductions legislated by the Canada-U.S. Free Trade Agreement affected Canadian workers for the years 1989-2004.

The bilateral tariff cuts had muted effects on worker outcomes. Substantial adverse effects of Canadian tariff concessions on employment and earnings at workers' initial firm of employment were generally offset by opposing effects elsewhere in the labor market, as workers transitioned into other manufacturing industries, construction and services. Because Canadian and U.S. tariff reductions generally had opposite signs, the net effects had even smaller magnitudes. For example, although low attachment workers initially employed at large firms had larger magnitude effects of each country's tariff change than did other worker groups, the net effects of the FTA were still very small.

These relatively optimistic findings contrast strikingly with the prolonged effects of import competition and mass layoffs documented in Jacobson et al. (1993), Autor et al. (2014), and Dix-Carneiro and Kovak (2017). To help reconcile this difference, we show that Canadian workers left affected industries quickly and that U.S. import competition did not induce mass layoffs. In addition, even though the Canadian tariff reductions and the China shock of Autor et al. (2014) in

[60]Because different industries face different tariff cuts imposed by Canada and the U.S., the predicted net effect of the two cuts differs by industry. Consider low attachment workers initially at large firms, as this group generally has the largest point estimates for each individual tariff change. For the separation probability and for cumulative earnings, we can only reject the null of zero net effect for 3 out of 78 industries, and the effects are generally small. However, for the net effect of tariff cuts on earnings at the worker's *initial* firm, we can reject the null of zero for 25 industries, all of which have negative point estimates. See Appendix Figures A6-A8.

the Canadian context led to similar magnitude reductions in overall industry employment (Table 4), the tariff cuts primarily reduced the number of new hires in affected industries and had little effect on incumbent workers.

This collection of results allows us to reject certain explanations for the small effects of the CUSFTA. Figures 1 and 2 rule out the possibility that CUSFTA was simply too small to matter; if anything, it was larger than the China shock in Canada. We also reject the possibility that Canadian labor markets simply respond more flexibly to all trade shocks. Tables 3 and 4 suggest this is not the case, as the China shock led to substantial labor market disruptions. Instead, our findings show that different trade shocks of similar magnitude can lead to quite distinct labor market outcomes, even within the same institutional context.

Why Canadian workers left affected industries so quickly, why the FTA did not cause mass layoffs, and how incumbent workers were shielded from layoffs remain open questions. One highly speculative possibility is that the change in policy was well-understood by workers, who responded by quickly leaving more affected industries. This type of forward looking behavior is the focus of important work integrating labor market dynamics and international trade including Artuç et al. (2010), Dix-Carneiro (2014), Caliendo et al. (2019), and Traiberman (2019). However, without credible measures of worker expectations in the Canadian context, this will remain a hypothesis.

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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 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.[61] 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

[61] 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_uiearn.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).[62] We define a "high attachment" worker as one who earned more than this cutoff for *each* of the years 1985-1988.

[62]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 (multipled 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 $LWF_T2LEAP_w_uiearn.dta$, 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_uiearn.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

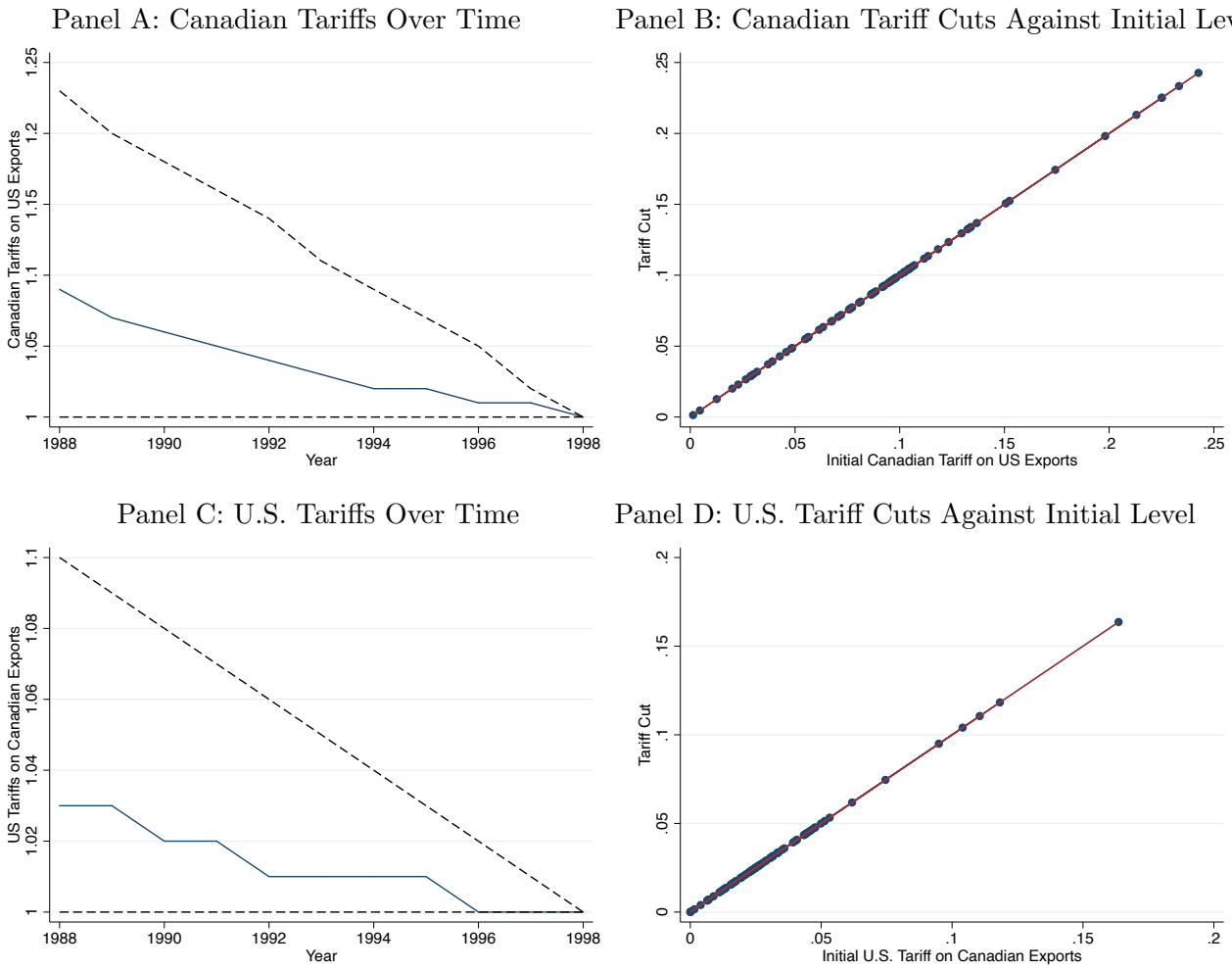
We now describe industry variables that we use as controls. To measure the average worker wages in the initial industry in 1988, we starting with the raw data set *LWF_T2LEAP_w_uiearn.dta*, and keep observations for 1988. We then take the log of real t4 earnings in the industry in 1988 and take the mean 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_uiearn.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_uiearn.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 cyclicality 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^{th} and 95^{th} 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 Correlates of High Attachment Status

Table A1: Correlates of High Attachment Status

	(1)	(2)	(3)
Worker Characteristics			
Female_i	-0.189***		0.0637***
	(0.0209)		(0.00596)
Age_i		0.0775***	0.0607***
		(0.00489)	(0.00751)
Age_i^2		-0.000920***	-4.20e-05
		(6.56e-05)	(3.63e-05)
$\text{Age}_i \times \ln(\text{income}_{i,1986-1988})$			-0.00558***
			(0.000822)
$\ln(\text{income}_{i,1986-1988})$			0.636***
			(0.0286)
$\Delta_{1986-1988} \ln(\text{income}_i)$			-0.0753***
			(0.00502)
Firm Characteristics			
$\ln(\text{income}_{f,1986-1988})$			0.0197***
			(0.00360)
$\Delta_{1986-1988} \ln(\text{income}_f)$			-0.0230***
			(0.00550)
$\mathbb{1}$(medium firm)			0.00336
			(0.00590)
$\mathbb{1}$(large firm)			-0.0198**
			(0.00813)
Industry Characteristics			
$\ln(1+\tau_{j,1988}^{\text{CAN}})$			-0.0699
			(0.117)
$\ln(1+\tau_{j,1988}^{\text{US}})$			-0.151
			(0.141)
$\Delta_{1988-1998} \ln(1+\tau_j^{\text{CAN,MFN}})$			0.243*
			(0.123)
$\Delta_{1988-1998} \ln(1+\tau_j^{\text{US,MFN}})$			0.0436
			(0.159)
$\Delta_{1998-2004} IPR_j^{\text{CHN}}$			-0.0108
			(0.0270)
Cyclicality_j			8.10e-05
			(0.00237)
$\text{Share below median income}_{j,1988}$			-0.0227
			(0.0279)
$\text{Mean log earnings}_{j,1988}$			-0.0529*
			(0.0296)
$\text{Log capital-labor ratio}_{j,1988}$			-0.00618**
			(0.00257)
$\Delta_{1984-1988} \ln\left(\frac{emp_j}{\sum_{j'} emp_{j'}}\right)$			-0.0257
			(0.0249)
$\Delta_{1986-1988}$ Mean log earnings$_j$			-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.

C.3 Exogeneity of Trade Policy

Table A2: Exogeneity of Trade Policy

Dependent variable:	$\ln(1+\tau^{\text{CAN}}_{j,1988})$		$\ln(1+\tau^{\text{US}}_{j,1988})$	
	(1)	(2)	(3)	(4)
$\ln(1+\tau^{\text{US}}_{j,1988})$		0.965***		
		(0.166)		
$\ln(1+\tau^{\text{CAN}}_{j,1988})$				0.351***
				(0.060)
$\Delta_{1988-1998}\ln(1+\tau^{\text{CAN,MFN}}_{j})$		0.644***		-0.186**
		(0.010)		(0.073)
$\Delta_{1988-1998}\ln(1+\tau^{\text{US,MFN}}_{j})$		0.007		-0.028
		(0.202)		(0.122)
$\Delta_{1998-2004}IPR^{\text{CHN}}_{j}$	0.015	0.040**	-0.012	-0.022*
	(0.029)	(0.020)	(0.014)	(0.012)
Separation prob.$_{1985-1988,j}$	-0.143	0.042	-0.054	-0.042
	(0.200)	(0.137)	(0.098)	(0.082)
Cyclicality$_j$	0.008*	-0.003	0.008***	0.006***
	(0.004)	(0.003)	(0.002)	(0.002)
Share below median income$_{j,1988}$	-0.043	-0.006	-0.014	-0.006
	(0.057)	(0.039)	(0.028)	(0.023)
Mean log earnings$_{j,1988}$	-0.075	-0.023	-0.036	-0.015
	(0.047)	(0.032)	(0.023)	(0.020)
Log capital-labor ratio$_{j,1988}$	-0.005	0.002	-0.003	-0.003
	(0.005)	(0.004)	(0.003)	(0.002)
$\Delta_{1984-1988}\ln\left(\frac{emp_j}{\sum_{j'} emp_{j'}}\right)$	-0.012	0.033	-0.053***	-0.048***
	(0.037)	(0.027)	(0.018)	(0.015)
$\Delta_{1986-1988}$ Mean log earnings$_j$	-0.186	-0.137	-0.114	-0.029
	(0.147)	(0.103)	(0.072)	(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. Both columns estimate versions of equation (3). All variables are as described in the text. Estimation is OLS.

C.4 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		0.0262	
	(0.163)		(0.171)	
$-\Delta_k \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)		0.207		-0.0546
		(0.200)		(0.226)
$-\Delta_k \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)		0.0402		0.189
		(0.221)		(0.250)
$-\Delta_k \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)		-0.181		0.0312
		(0.249)		(0.231)
$-\Delta_k \ln(1+\tau_j^{\text{US}})$	0.331		0.864***	
	(0.302)		(0.304)	
$-\Delta_k \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)		0.230		0.452
		(0.349)		(0.324)
$-\Delta_k \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)		0.388		0.527
		(0.362)		(0.365)
$-\Delta_k \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)		0.245		1.595***
		(0.439)		(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.5 Years Worked Results Tables

Table A4: Years Worked (1989-1993)

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

Table A6: Cumulative Normalized Earnings (1989-1993)

	(1) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	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
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	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≥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) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	-1.198	-5.336*	-2.418	3.229	1.688**	0.679	-0.706	1.710	-0.0436
	(3.309)	(2.780)	(2.040)	(2.973)	(0.815)	(0.578)	(0.497)	(2.308)	(0.111)
$-\Delta \ln(1+\tau_j^{\text{US}})$	7.251	5.960	1.616	-4.862	2.479	0.0354	0.0979	1.318	0.606**
	(5.808)	(4.770)	(3.199)	(5.378)	(1.590)	(1.028)	(0.908)	(5.314)	(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	-0.821	-0.688	2.283	0.467	0.200	-0.206	-0.270	0.0260
	(2.009)	(2.926)	(1.196)	(1.964)	(0.396)	(0.243)	(0.176)	(0.968)	(0.0350)
$-\Delta \ln(1+\tau_j^{\text{US}})$	0.00475	7.419	-0.659	-3.909	0.325	-0.343	-0.328	-2.461*	-0.0379
	(2.446)	(5.236)	(2.832)	(3.263)	(0.856)	(0.390)	(0.259)	(1.302)	(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) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) 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.7 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		0.129	
	(0.206)		(0.221)	
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)		-0.729		-0.369
		(0.477)		(0.401)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)		0.228		-0.184
		(0.254)		(0.249)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)		0.693***		0.503**
		(0.230)		(0.247)
$-\Delta \ln(1+\tau_j^{\text{US}})$	-0.159		-0.0219	
	(0.196)		(0.291)	
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)		0.394		0.402
		(0.343)		(0.336)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)		-0.430		-0.0764
		(0.329)		(0.387)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)		-0.400		-0.389
		(0.415)		(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) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	-0.263	-6.908**	-4.721***	4.122**	1.365*	0.303	-0.522	5.967***	0.131***
	(1.402)	(3.028)	(1.636)	(1.831)	(0.782)	(0.345)	(0.551)	(1.845)	(0.0413)
$-\Delta \ln(1+\tau_j^{\text{US}})$	-2.161	4.053	4.424	-7.721***	0.528	-0.370	0.0903	-3.166	-0.000191
	(2.554)	(4.242)	(3.072)	(2.842)	(1.835)	(0.600)	(1.076)	(3.059)	(0.0892)
R-squared	0.096	0.132	0.050	0.048	0.046	0.023	0.027	0.062	0.008
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	2.794*	-2.773	-4.490**	7.632**	1.060	0.241	-0.582*	1.680	0.0257
	(1.548)	(4.755)	(1.739)	(2.957)	(0.760)	(0.406)	(0.313)	(1.570)	(0.0366)
$-\Delta \ln(1+\tau_j^{\text{US}})$	-2.398	6.800	2.743	-5.878	0.540	-0.615	-0.725	-5.205**	-0.0577
	(2.037)	(8.017)	(4.392)	(5.347)	(1.589)	(0.520)	(0.581)	(2.303)	(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.

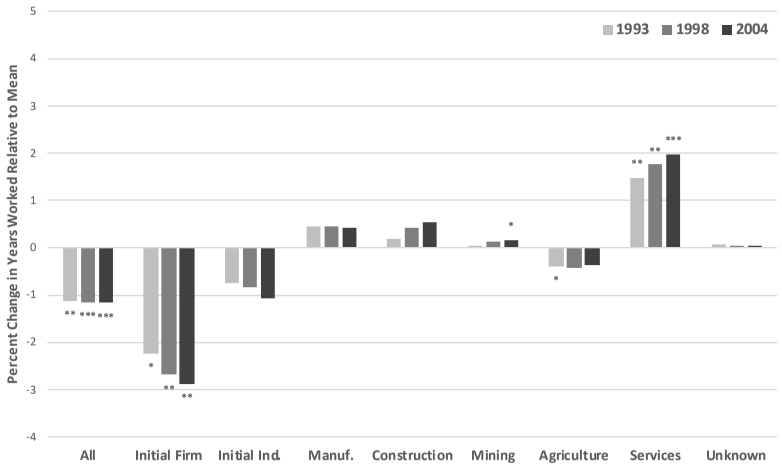
Table A11: Cumulative Normalized Earnings (1989-2004), Controlling for NAFTA Tariff Cuts Facing Imports from Mexico

	(1) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	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)
$-\Delta \ln(1+\tau_j^{\text{US}})$	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
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	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)
$-\Delta \ln(1+\tau_j^{\text{US}})$	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

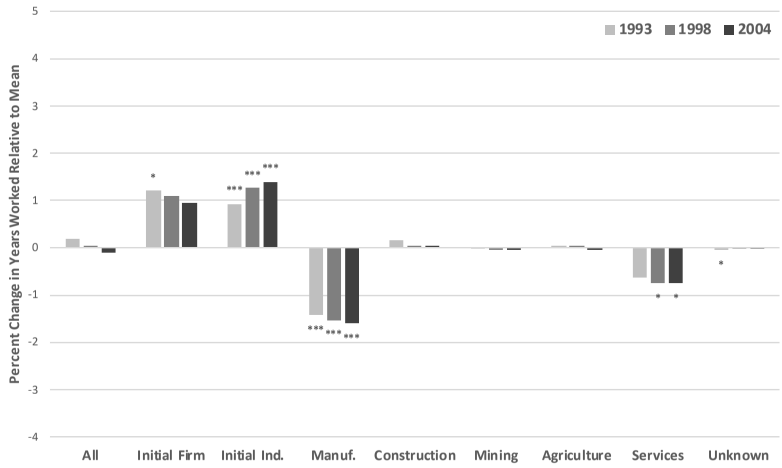
Notes: Dependent variable is the sum of a worker's earnings during 1989-2004, divided by the worker's average yearly earnings in 1986-1988 (omitting years with zero earnings), defined in equation (2). The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ($-\Delta \ln(1+\tau_j^{\text{CAN}})$) 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, 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.8 Effects by Income Level

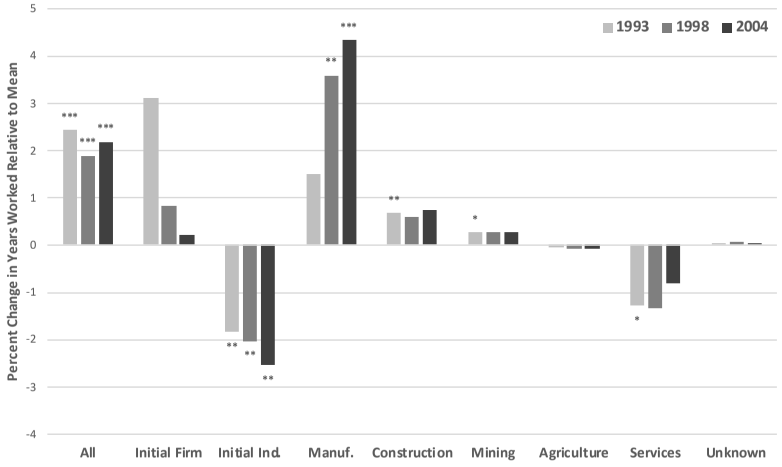
Figure A2: Evolution of Effects on Years Worked by Income



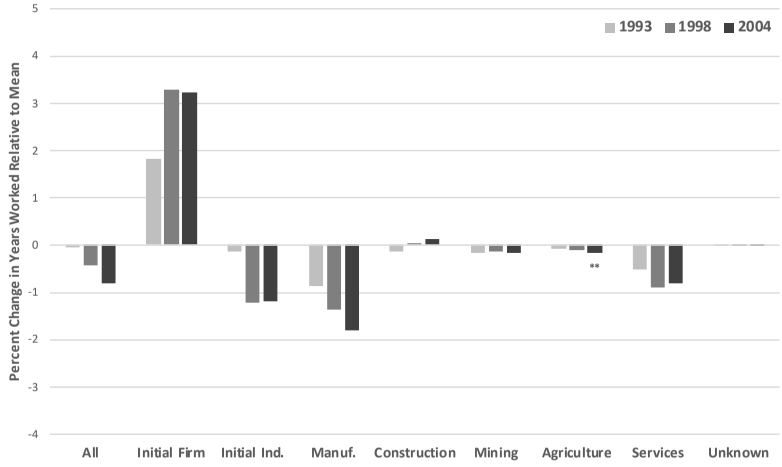
(a) Effect of Canadian Tariff Cuts - Low Income Workers



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

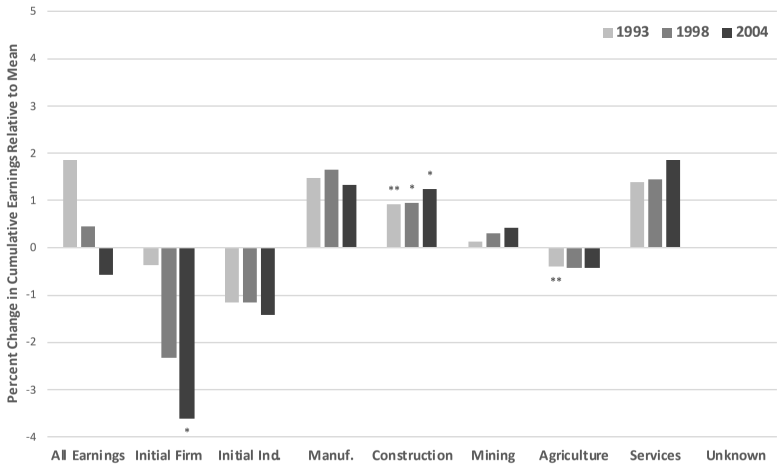
Notes: Dependent variable is the number of years worked (with nonzero earnings) during 1989-1998. The independent variables of interest are the 1988-1998 tariff cuts facing U.S. exports to Canada ($-\Delta \ln(1+\tau_j^{\text{CAN}})$) or facing Canadian exports to the U.S. ($-\Delta \ln(1+\tau_j^{\text{US}})$) 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≥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)

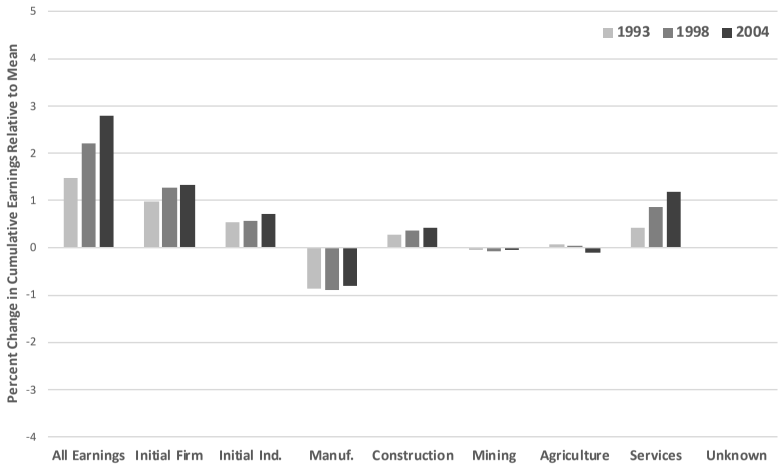
	(1) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) Unknown
Panel A: Low Income (n=27,902)									
$-\Delta \ln(1+\tau_j^{\text{CAN}})$	-2.351***	-5.834**	-2.182	0.866	1.110	0.345*	-0.734	4.015***	0.0641
	(0.803)	(2.808)	(1.508)	(2.109)	(0.698)	(0.202)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

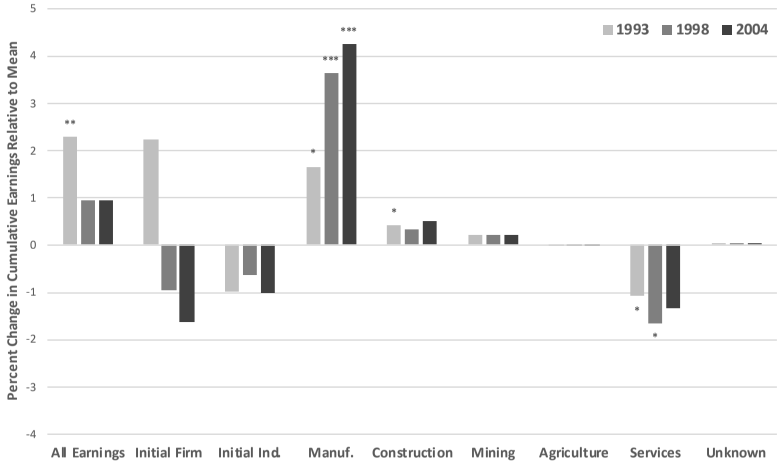
Figure A3: Evolution of Effects on Cumulative Normalized Earnings by Income



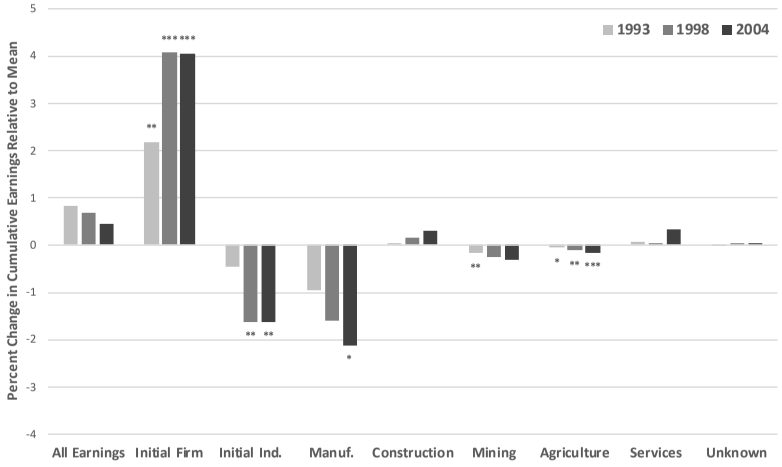
(a) Effect of Canadian Tariff Cuts - Low Income Workers



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

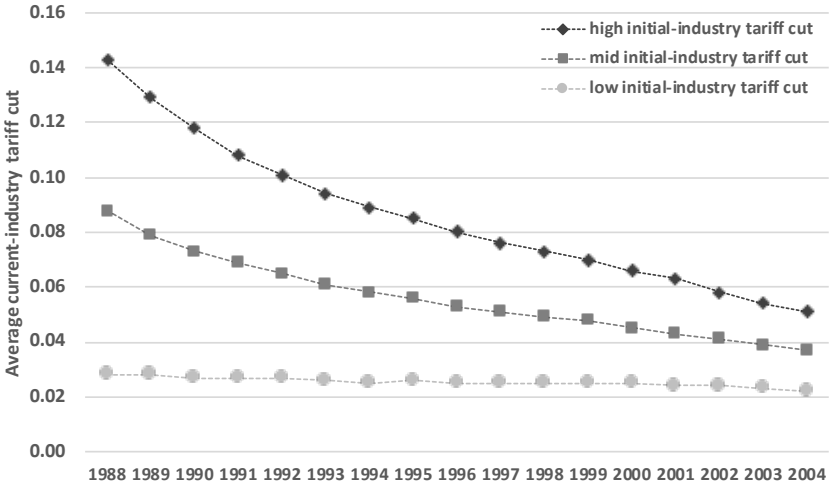
Table A17: Cumulative Normalized Earnings, by Income Group (1989-2004)

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

Figure A4: Evolution of Canadian Tariff-Cut Exposure: High Attachment Workers

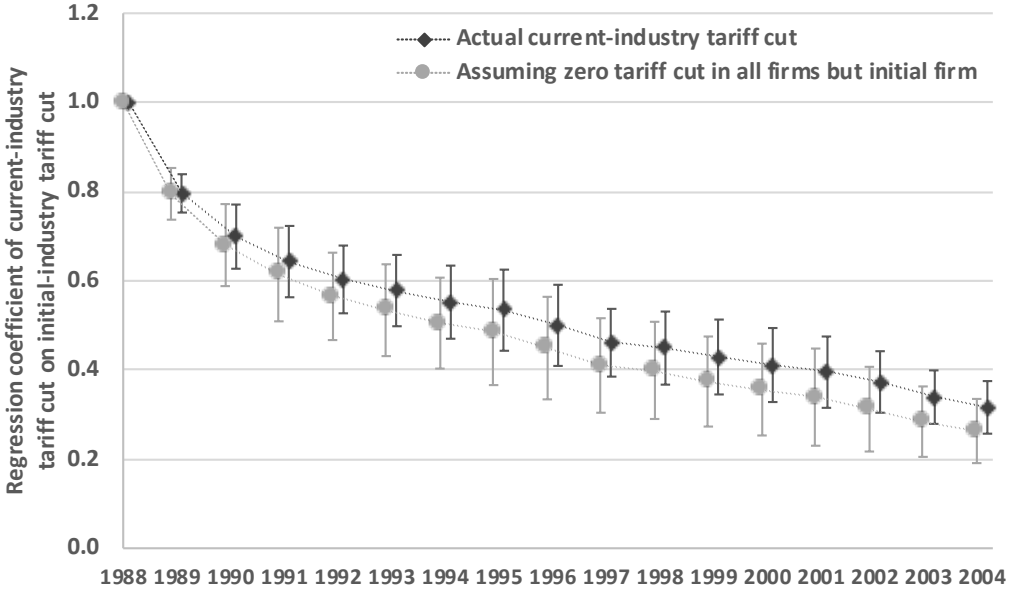


Notes: We divide manufacturing industries into terciles based on the size of the industry's Canadian tariff cut and assign workers to each tercile based on their initial industry of employment. For each initial-tariff-cut tercile, we plot the average Canadian tariff cut faced by workers in their current 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.

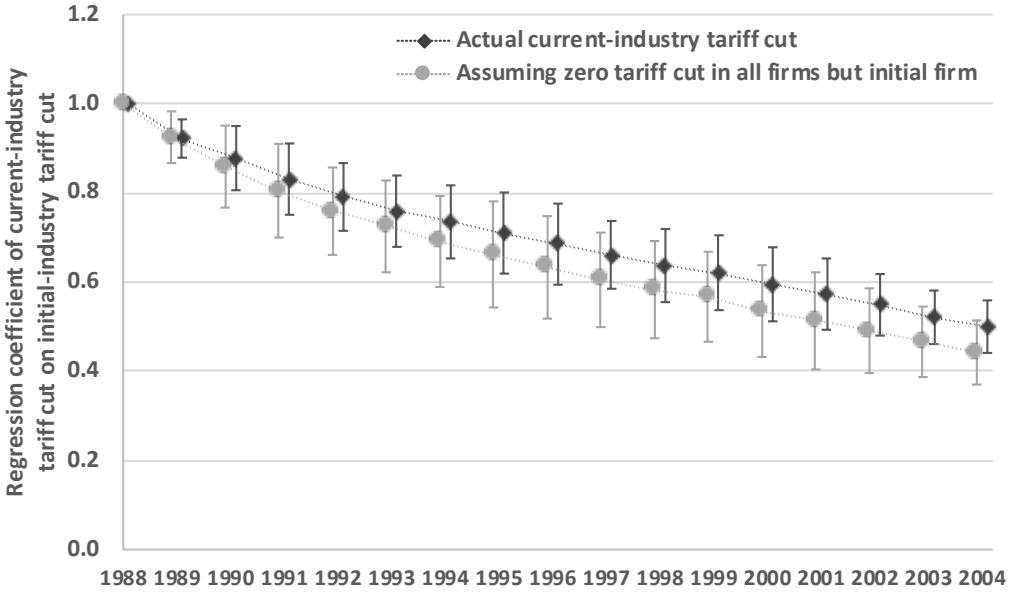
Figure IV in Autor et al. (2014) plots regression coefficients and 90% confidence intervals obtained from 32 regressions that relate the 1991-2007 trade exposure of a workers industry to the 1991-2007 trade exposure of the workers initial 1991 industry. In their graph, the counterfactual data series sets trade exposure to 0 for all firms except the workers initial employer. We perform an identical exercise here for low attachment workers (Figure A5a) and high attachment workers (Figure A5b).

For each figure, black diamonds correspond to coefficients from a regression of $\Delta \ln(1+\tau^{\text{CAN}}_{j(i)})$ on $\Delta \ln(1+\tau^{\text{CAN}}_{j(i)t})$ where $\Delta \ln(1+\tau^{\text{CAN}}_{j(i)})$ is the tariff cut in worker $i's$ initial industry of employment j and $\Delta \ln(1+\tau^{\text{CAN}}_{j(i)t})$ 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 $\Delta \ln(1+\tau^{\text{CAN}}_{j(i)t}) = 0$ 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 A5: 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.10 Worker Transitions by Initial Firm Size Results Tables

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

	(1) Total	(2) Initial Ind.	(3) Manuf.	(4) Constr.	(5) Mining	(6) Agric.	(7) Services	(8) Unknown	(9) Unemp.
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)	-0.378	-0.0419	-0.0360	0.000103	–	–	-0.00242	–	-0.401**
	(0.260)	(0.0330)	(0.0640)	(0.0303)			(0.0630)		(0.182)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)	0.448**	0.00199	0.0319	-0.00744	–	–	0.0730	–	0.181
	(0.180)	(0.0284)	(0.0717)	(0.0245)			(0.0537)		(0.179)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)	-0.204	-0.0167	0.0763	0.0153	–	–	-0.0447	–	-0.237
	(0.295)	(0.0327)	(0.0521)	(0.0225)			(0.0514)		(0.198)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)	0.516**	0.101*	-0.0172	0.0901*	–	–	-0.00172	–	0.295
	(0.257)	(0.0511)	(0.0886)	(0.0514)			(0.0827)		(0.210)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)	-0.611**	0.0246	-0.0649	0.0819	0.0101	–	-0.0762	–	-0.472*
	(0.280)	(0.0534)	(0.0893)	(0.0611)	(0.0121)		(0.0838)		(0.248)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)	-0.106	0.00217	-0.0838	0.0711	–	–	-0.00503	–	-0.393
	(0.314)	(0.0421)	(0.102)	(0.0455)			(0.0808)		(0.338)
R-squared	0.043	0.005	0.006	0.010	0.005	0.005	0.006	0.005	0.047
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)	-0.142	-0.0465	0.00610	-0.00197	–	–	-0.0586	–	-0.0297
	(0.184)	(0.0455)	(0.0610)	(0.0287)			(0.0536)		(0.0954)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)	0.104	-0.0192	0.0167	0.0157	–	–	0.00695	–	0.0647
	(0.137)	(0.0245)	(0.0446)	(0.0196)			(0.0284)		(0.102)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)	0.00199	-0.0250	0.0535	0.0293	–	–	0.0165	–	-0.0880
	(0.204)	(0.0363)	(0.0585)	(0.0202)			(0.0306)		(0.116)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)	0.231	0.0499	-0.0176	0.0884	–	–	0.0788	–	0.0437
	(0.221)	(0.0518)	(0.0730)	(0.0667)			(0.0658)		(0.135)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)	-0.159	0.0312	-0.0567	0.0415	–	–	-0.0447	–	-0.0346
	(0.207)	(0.0482)	(0.0670)	(0.0370)			(0.0437)		(0.139)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)	-0.306	-0.0169	-0.0788	0.0604	–	–	-0.0935*	–	-0.162
	(0.346)	(0.0325)	(0.107)	(0.0514)			(0.0499)		(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) Total	(2) Initial Ind.	(3) Manuf.	(4) Constr.	(5) Mining	(6) Agric.	(7) Services	(8) Unknown	(9) Unemp.
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)	-0.513	-0.0394	-0.0262	-0.00804	–	–	0.0253	–	-0.579**
	(0.316)	(0.0453)	(0.0702)	(0.0335)			(0.0607)		(0.242)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)	0.304	-0.0218	0.0349	0.0135	–	–	0.0391	–	0.103
	(0.213)	(0.0391)	(0.0798)	(0.0289)			(0.0688)		(0.225)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)	0.550**	0.0173	0.131**	0.0991**	–	–	-0.00802	–	0.369
	(0.217)	(0.0435)	(0.0629)	(0.0463)			(0.0576)		(0.245)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)	0.657**	0.156**	-0.0366	0.116*	–	–	-0.00621	–	0.358
	(0.299)	(0.0677)	(0.0914)	(0.0653)			(0.0763)		(0.253)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)	-0.543*	0.130	-0.0944	0.0737	0.0105	–	-0.0218	–	-0.615*
	(0.281)	(0.0853)	(0.0881)	(0.0732)	(0.0124)		(0.111)		(0.312)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)	-0.892**	-0.0226	-0.150	-0.00607	–	–	-0.0255	–	-1.094**
	(0.361)	(0.0672)	(0.125)	(0.0652)			(0.0897)		(0.522)
R-squared	0.063	0.008	0.006	0.011	0.005	0.007	0.006	0.005	0.071
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)	-0.197	-0.0996	-0.0362	-0.00357	–	–	-0.0331	–	-0.0202
	(0.260)	(0.0602)	(0.0789)	(0.0345)			(0.0653)		(0.125)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)	0.102	-0.0356	0.0352	0.0199	–	–	0.0216	–	0.0372
	(0.211)	(0.0321)	(0.0653)	(0.0217)			(0.0411)		(0.127)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)	0.451*	0.00889	0.169**	0.0931**	–	–	0.0491	–	0.106
	(0.233)	(0.0424)	(0.0732)	(0.0446)			(0.0472)		(0.195)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)	0.394	0.173**	0.0292	0.127	–	–	0.0243	–	0.0648
	(0.304)	(0.0746)	(0.0939)	(0.0882)			(0.0807)		(0.160)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)	-0.145	0.127*	-0.0599	0.0625	–	–	-0.0925	–	-0.0856
	(0.286)	(0.0687)	(0.0864)	(0.0506)			(0.0648)		(0.178)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)	-0.738*	-0.0690	-0.162	0.0321	–	–	-0.111*	–	-0.377
	(0.437)	(0.0593)	(0.123)	(0.0686)			(0.0643)		(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 ($-\Delta \ln(1+\tau_j^{\text{CAN}})$) 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 A20: Worker Transitions, by Labor-Force Attachment and Initial Firm Size (1989-2004)

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

C.11 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) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{CAN}) * \mathbb{1}$(small firm)	1.735	-1.498	-0.913	0.651	1.217	0.449	-0.627***	2.961	-0.0569
	(3.023)	(2.635)	(0.983)	(1.667)	(0.903)	(0.334)	(0.213)	(1.940)	(0.270)
$-\Delta \ln(1+\tau_j^{CAN}) * \mathbb{1}$(medium firm)	-0.858	-1.305	-0.912	1.541	0.576	0.0297	-0.337*	-0.423	0.00250
	(3.274)	(3.304)	(1.031)	(1.344)	(0.685)	(0.174)	(0.191)	(1.832)	(0.0809)
$-\Delta \ln(1+\tau_j^{CAN}) * \mathbb{1}$(large firm)	0.207	-1.781	-2.051***	1.961	0.840	0.0556	-0.122	1.269	0.0917
	(2.414)	(3.840)	(0.690)	(1.998)	(0.653)	(0.369)	(0.268)	(1.233)	(0.0925)
$-\Delta \ln(1+\tau_j^{US}) * \mathbb{1}$(small firm)	-1.038	1.873	1.845	-2.474	0.654	-0.0159	0.102	-3.445	0.408
	(3.752)	(3.382)	(1.345)	(2.191)	(1.019)	(0.507)	(0.326)	(2.860)	(0.484)
$-\Delta \ln(1+\tau_j^{US}) * \mathbb{1}$(medium firm)	3.302	-0.231	1.374	-3.721	1.326	0.366	0.210	4.167*	0.177
	(4.203)	(4.160)	(1.532)	(2.467)	(1.295)	(0.292)	(0.275)	(2.329)	(0.138)
$-\Delta \ln(1+\tau_j^{US}) * \mathbb{1}$(large firm)	4.918	-1.031	-0.376	2.389	1.564	-0.185	0.00729	2.186	0.178
	(5.724)	(7.077)	(1.024)	(3.222)	(1.104)	(0.455)	(0.642)	(2.659)	(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)									
$-\Delta \ln(1+\tau_j^{CAN}) * \mathbb{1}$(small firm)	1.839	2.103	-0.629	-0.590	0.0876	0.114	-0.155**	1.061*	-0.0383
	(1.345)	(1.400)	(0.554)	(0.821)	(0.305)	(0.142)	(0.0721)	(0.600)	(0.0584)
$-\Delta \ln(1+\tau_j^{CAN}) * \mathbb{1}$(medium firm)	-0.484	0.357	-0.533	0.199	0.0697	0.00857	-0.0416	-0.515	-0.0200
	(1.090)	(1.680)	(0.438)	(0.753)	(0.166)	(0.0995)	(0.0629)	(0.669)	(0.0257)
$-\Delta \ln(1+\tau_j^{CAN}) * \mathbb{1}$(large firm)	2.534***	1.190	-0.548	1.323	0.531**	0.0467	-0.0557	0.0513	0.0423
	(0.890)	(2.183)	(0.480)	(1.393)	(0.237)	(0.0970)	(0.0944)	(0.636)	(0.0427)
$-\Delta \ln(1+\tau_j^{US}) * \mathbb{1}$(small firm)	-2.242	-0.245	1.706**	-1.461	0.403	-0.143	0.0164	-2.680***	0.0175
	(1.447)	(1.776)	(0.777)	(1.077)	(0.623)	(0.185)	(0.121)	(0.843)	(0.0665)
$-\Delta \ln(1+\tau_j^{US}) * \mathbb{1}$(medium firm)	2.020	2.431	0.923	-1.861	0.415	-0.108	-0.0584	0.142	0.0277
	(1.409)	(2.115)	(0.694)	(1.174)	(0.326)	(0.129)	(0.0871)	(0.818)	(0.0368)
$-\Delta \ln(1+\tau_j^{US}) * \mathbb{1}$(large firm)	-1.427	1.977	-2.225***	-0.129	0.180	-0.436**	0.00286	-1.144	-0.0878
	(1.866)	(4.652)	(0.766)	(2.699)	(0.341)	(0.212)	(0.191)	(0.741)	(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 ($-\Delta \ln(1+\tau_j^{CAN})$) 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+). 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 A22: Cumulative Normalized Earnings, by Labor-Force Attachment and Initial Firm Size (1989-1998)

	(1) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)	1.888	-6.067	-1.647	1.840	1.932	1.259	-1.181**	5.945	-0.193
	(6.437)	(4.579)	(2.543)	(4.666)	(1.592)	(0.807)	(0.574)	(4.468)	(0.275)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)	1.631	-3.967	-0.816	5.886	1.395	0.291	-0.697	-0.328	-0.133
	(7.735)	(6.273)	(2.322)	(3.568)	(1.439)	(0.450)	(0.473)	(5.019)	(0.222)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)	-6.834	-9.988	-4.716***	3.756	2.120	0.276	-0.345	1.902	0.162
	(4.404)	(7.487)	(1.755)	(4.349)	(1.459)	(0.908)	(0.780)	(3.180)	(0.131)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)	3.492	5.542	3.198	-4.808	3.144	-0.511	0.272	-4.229	0.885
	(8.730)	(6.743)	(3.319)	(5.699)	(2.108)	(1.216)	(0.838)	(7.103)	(0.552)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)	1.666	-1.917	1.497	-10.28	2.673	0.628	0.174	8.247	0.648**
	(10.63)	(7.328)	(3.702)	(6.434)	(2.691)	(0.666)	(0.650)	(7.157)	(0.314)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)	19.98*	10.01	-3.701	6.582	3.219	-0.618	-0.0258	4.302	0.211
	(11.52)	(15.63)	(2.691)	(7.476)	(2.559)	(1.413)	(1.920)	(6.867)	(0.192)
R-squared	0.116	0.060	0.016	0.031	0.025	0.017	0.019	0.106	0.010
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)	3.519	3.536	-1.879	-0.259	0.113	0.456	-0.429**	1.973	0.00709
	(2.883)	(3.814)	(1.750)	(2.238)	(0.655)	(0.320)	(0.202)	(1.644)	(0.104)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)	-0.462	1.003	-1.523	1.813	0.446	0.0295	-0.186	-2.050	0.00384
	(2.431)	(4.488)	(1.141)	(2.070)	(0.389)	(0.238)	(0.169)	(1.980)	(0.0258)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)	0.149	-5.052	-0.567	4.722	0.922*	-0.0136	-0.0608	0.148	0.0514
	(2.187)	(4.960)	(1.244)	(3.255)	(0.502)	(0.390)	(0.267)	(1.825)	(0.0479)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)	-5.820*	-1.758	5.330**	-4.090	0.925	-0.372	-0.116	-5.724***	-0.0142
	(3.412)	(4.781)	(2.453)	(2.761)	(1.398)	(0.467)	(0.308)	(2.075)	(0.123)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)	1.994	2.012	3.829*	-5.614*	0.624	-0.0460	-0.196	1.364	0.0221
	(3.550)	(5.790)	(2.157)	(3.111)	(0.846)	(0.356)	(0.264)	(2.396)	(0.0399)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)	-1.794	11.97	-8.812***	-1.681	0.775	-1.091*	-0.320	-2.548	-0.0890
	(4.200)	(12.20)	(3.221)	(6.527)	(0.800)	(0.642)	(0.517)	(1.981)	(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) Total	(2) Initial Firm	(3) Initial Ind.	(4) Manuf.	(5) Constr.	(6) Mining	(7) Agric.	(8) Services	(9) Unknown
Panel A: Low Attachment (n=20,577)									
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)	0.811	-10.20	-3.205	-1.891	3.092	2.749*	-2.123*	12.48	-0.0871
	(11.69)	(7.118)	(4.919)	(9.292)	(3.159)	(1.444)	(1.123)	(9.047)	(0.604)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)	1.093	-7.228	-1.719	8.224	3.962**	0.676	-0.584	-2.191	-0.0467
	(13.71)	(9.890)	(4.529)	(6.848)	(1.893)	(0.880)	(0.933)	(10.26)	(0.319)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)	-17.40**	-26.71**	-8.512**	9.028	6.320**	0.279	-1.041	3.005	0.231
	(7.922)	(10.52)	(3.483)	(7.648)	(2.548)	(1.891)	(1.296)	(6.473)	(0.168)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)	8.246	6.866	6.134	-1.591	7.248*	-1.248	-0.393	-10.32	1.548
	(18.27)	(11.40)	(6.228)	(13.47)	(4.106)	(2.330)	(1.613)	(13.81)	(1.239)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)	5.439	-2.648	2.972	-15.81	2.833	1.031	-1.589	17.74	0.913*
	(19.63)	(11.90)	(7.313)	(12.04)	(3.675)	(1.306)	(1.120)	(15.04)	(0.498)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)	42.68**	28.08	-6.863	4.014	3.779	-0.451	-0.148	13.88	0.388
	(19.23)	(23.96)	(5.515)	(13.45)	(4.963)	(3.205)	(3.024)	(13.00)	(0.332)
R-squared	0.141	0.049	0.019	0.038	0.030	0.021	0.018	0.123	0.005
Panel B: High Attachment (n=63,128)									
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(small firm)	5.704	5.269	-3.169	0.920	0.00395	0.926	-0.821**	2.466	0.110
	(4.692)	(6.803)	(3.459)	(4.430)	(1.264)	(0.624)	(0.358)	(3.374)	(0.139)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(medium firm)	-0.179	2.759	-3.665	3.648	0.681	0.117	-0.378	-3.355	0.0136
	(3.869)	(8.173)	(2.286)	(4.027)	(0.761)	(0.415)	(0.276)	(3.956)	(0.0358)
$-\Delta \ln(1+\tau_j^{\text{CAN}}) * \mathbb{1}$(large firm)	-2.969	-13.00	-2.293	8.858	1.692	0.301	-0.110	1.558	0.0208
	(3.715)	(8.372)	(2.267)	(5.384)	(1.122)	(1.103)	(0.460)	(2.852)	(0.0528)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(small firm)	-8.002	-1.824	9.246*	-8.865*	2.530	-0.407	-0.336	-8.260*	-0.0862
	(5.818)	(8.409)	(4.723)	(5.177)	(2.648)	(0.954)	(0.495)	(4.307)	(0.173)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(medium firm)	2.220	0.983	8.474**	-11.36*	1.715	0.184	-0.483	2.646	0.0614
	(5.525)	(10.23)	(4.247)	(5.919)	(1.709)	(0.718)	(0.420)	(4.981)	(0.0642)
$-\Delta \ln(1+\tau_j^{\text{US}}) * \mathbb{1}$(large firm)	-2.101	20.08	-13.59**	-5.846	1.897	-2.447	-1.013	-1.112	-0.0641
	(6.489)	(20.80)	(6.032)	(11.22)	(1.626)	(1.480)	(0.868)	(3.788)	(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.

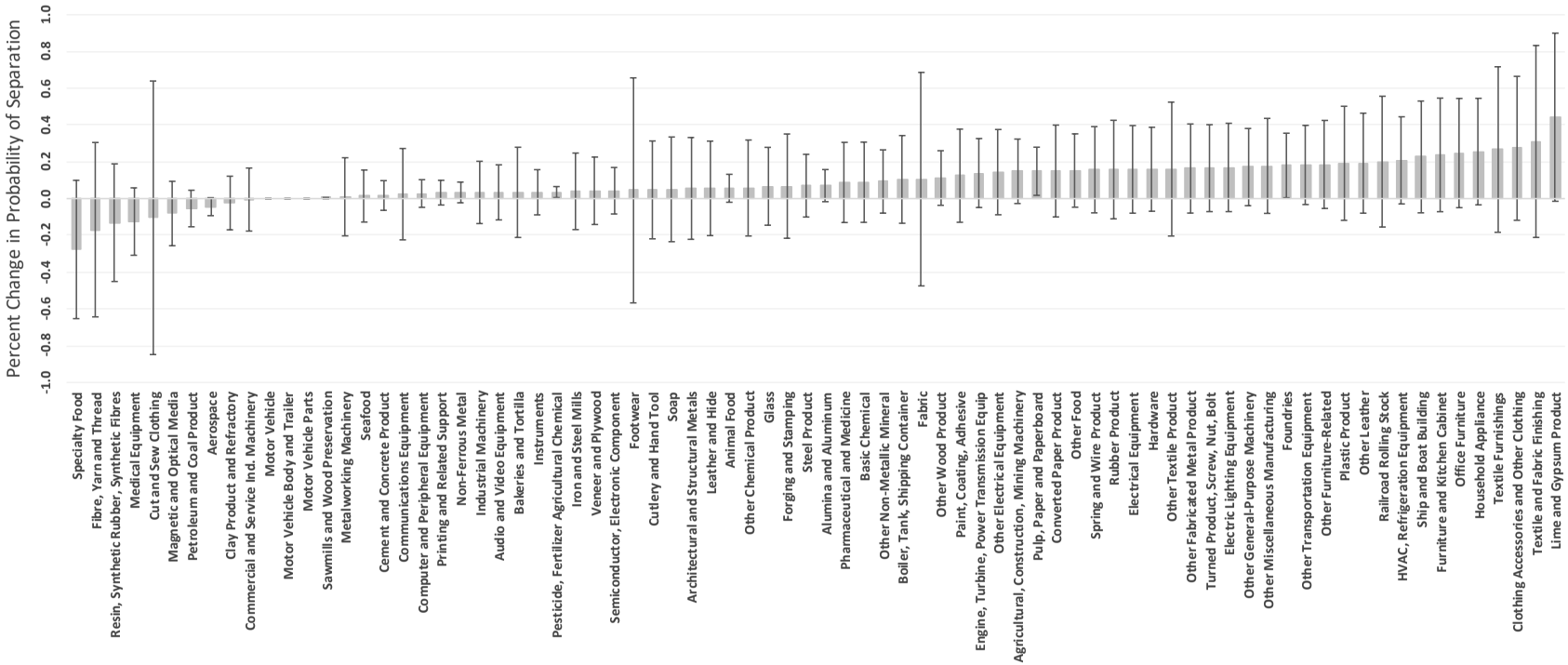
C.12 Net Effects by Industry

In Figures A6-A8, 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 A6 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 A7 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.

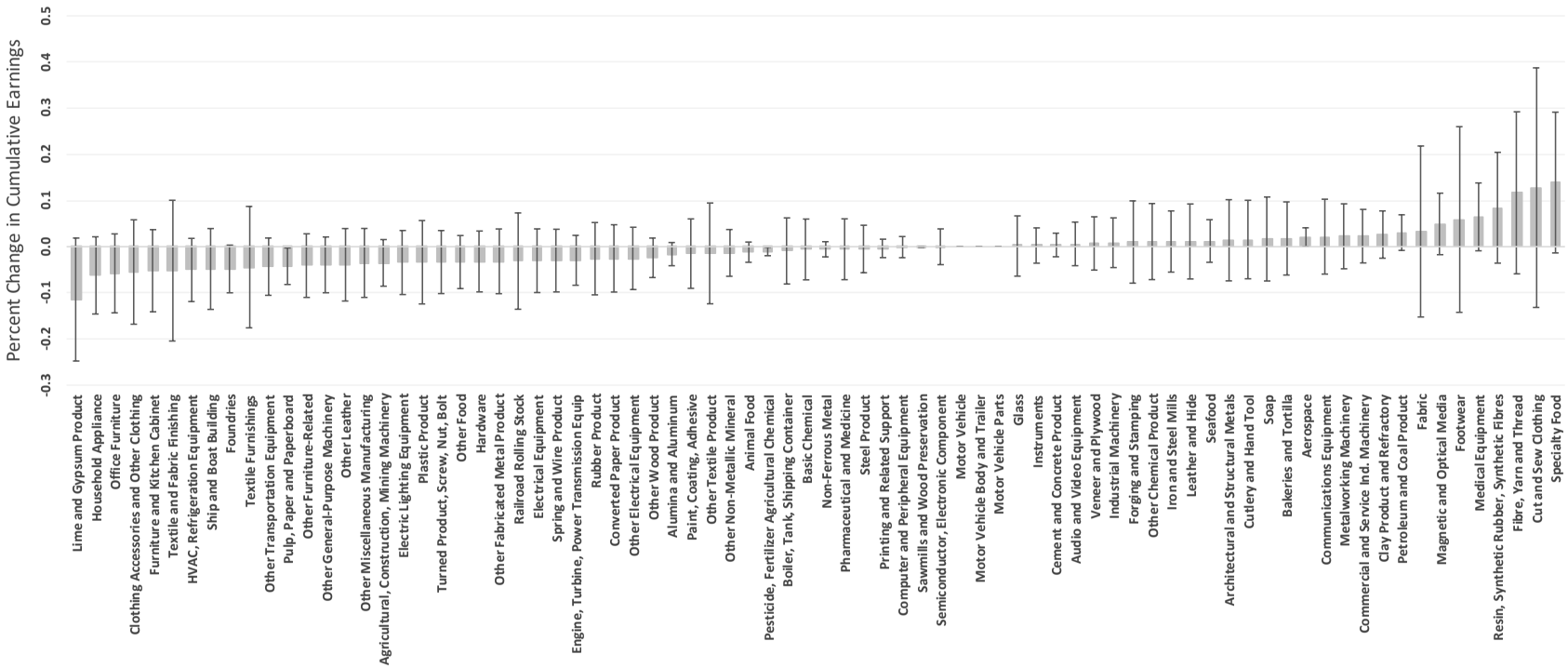
Figure A8 shows the net effects on cumulative earnings from the worker's initial firm. Consistent with the overall estimates shown in the main text, these effects are substantially larger than the overall earnings estimates, reflecting Canadian workers' ability to recover lost earnings at the initial 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 A6: Net Effects of Canadian and U.S. Tariff Cuts on the Probability of Separation for Low Attachment Workers Initially at Large Firms (1989-2003)



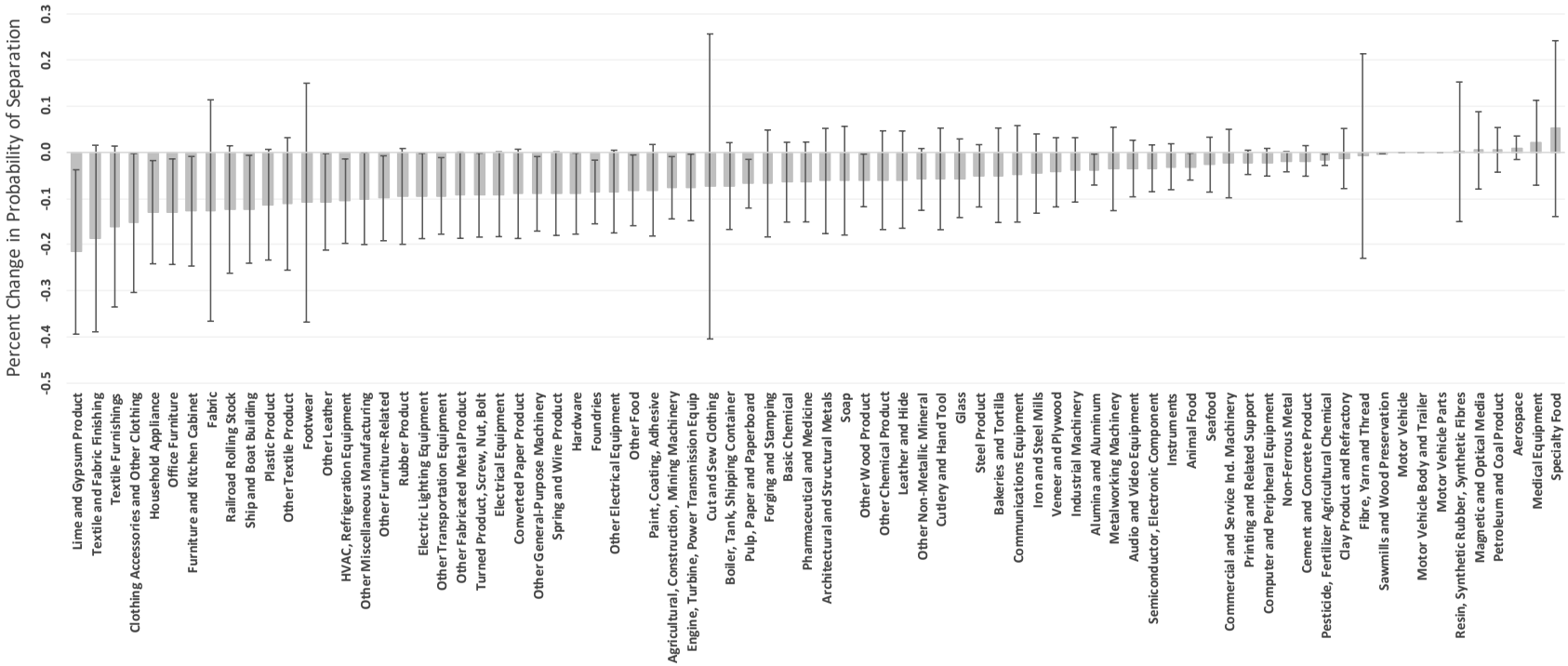
Notes: Each bar represents the predicted net effect of the Canadian and U.S. tariff cuts on the probability of experiencing a work-shortage related separation for low attachment workers initially at large firms in the industry listed on the x-axis. The predicted values are expressed relative to the worker 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 A7: 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 A8: 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.