Local Labor Markets in Canada and the United States

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We examine US and Canadian local labor markets from 1990 to 2011 using comparable household and business data. Wage levels and inequality rise with city population in both countries, albeit less in Canada. Neither country saw wage levels converge despite contrasting migration patterns from/to high-wage areas. Local labor demand shifts raise nominal wages similarly, although in Canada they attract immigrant and highly skilled workers more while raising housing costs less. Chinese import competition had a weaker negative impact on manufacturing employment in Canada. These results are consistent with Canada's more redistributive transfer system and larger, more educated immigrant workforce.

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I. Introduction

The cities of Canada and the United States share much in common, and there are many reasons to believe that local labor markets in the two countries should operate similarly. Both countries have a similar history of settlement, and their cities resemble each other in age and construction. Each country is the other's largest trading partner, and they share the longest land border in the world.

Nevertheless, local labor markets in Canada and the United States may operate differently for several reasons. While both countries share similar labor market institutions, unions and legal protections for workers tend to be stronger in Canada. Transfers to individuals and to local governments are also much larger in Canada. These factors may cause Canadian workers to respond less to local economic conditions. Furthermore, Canada selects immigrants more strongly on economic criteria than the United States, and hence Canadian immigrants may respond more to local economic opportunities.

In this paper, we analyze US and Canadian local labor markets in a unified empirical setting with comparable data.[1] By using similar data, time periods, and methods, we can draw clearer conclusions about how the two countries differ and, in many ways, also resemble each other. In contrast, most other work on growth and inequality across regions—see Barro et al. (1991) for the United States and Coulombe and Lee (1995) for Canada—has focused on differences across large areas using macro data. Analyses using metropolitan areas across countries are quite rare, especially using micro data.

Our analysis begins with a descriptive comparison of wage rates, wage inequality, skill sorting, and economic convergence across metro areas in Can-

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[1] We take metropolitan areas to be "local" labor markets in both countries.

ada and the United States, involving several of the canonical approaches outlined in Moretti (2011). Mirroring previous studies, we find a strong positive association between city size and both wage levels and inequality in the United States.[2] These associations are much weaker in Canada. When we compare cities of the same size, we find that university graduates sort similarly toward larger cities in both countries. However, we find that immigrants sort toward larger cities more in Canada than in the United States.[3] We additionally consider whether wages across cities converge over time. In both countries, wage disparities across cities appear stubbornly persistent. This similarity is remarkable given that in Canada we find that workers moved to higher-wage areas while in the United States they did not (Ganong and Shoag 2018). Overall, these descriptive analyses of the differences between local labor markets across both countries provide a valuable baseline for our ensuing analysis of the effect of local labor demand shifts.

The persistence of wage differences, together with contrasting migration patterns across Canada and the United States, motivates the second part of our analysis. This part considers the causal impact of local labor demand shifts within a standard spatial equilibrium framework. We model these shifts using two key and well-known approaches. First, we consider changes in labor demand predicted by nationwide sectoral shifts, as in Bartik (1991), providing the first such analysis for Canada.[4] Leveraging variation in business and household data for each country, we make novel use of two "Bartik" shift-share instruments.

We find that the Bartik shift-shares predict similar increases in employment and nominal wages in either country, implying similar elasticities of local labor supply to nominal wage levels. However, when we exclude US megacities and reweight Canadian cities to resemble US demographics, US labor supply begins to look more elastic. Furthermore, we find that university graduate and immigrant responses to local labor market demand shocks are relatively higher

[2] See Glaeser and Maré (2001) for wage levels and Baum-Snow and Pavan (2013) for wage inequality.

[3] Moretti (2013) and Diamond (2016) document rising levels of sorting of university graduates in the United States. Lee (1999) argues that regional minimum wages reduced local inequality for lower percentiles. Fortin and Lemieux (2015) find similar results for Canadian provinces and find that resource booms lifted wages and reduced inequality in several provinces.

[4] The Bartik method was popularized by Blanchard and Katz (1992), who argue that wages and worker migration cause unemployment effects of demand shifts to disappear over the long run. Other work examines differential effects by skill group (Bound and Holzer 2000), transfer payments (Autor and Duggan 2003), and housing costs (Notowidigo 2011). Studies of other countries (e.g., for France, Détang-Dessendre, Partridge, and Piguet 2016) are generally not done in tandem with others, except for macro studies, such as Decressin and Fatas (1995), who consider 51 regions within the European Union.

in Canada. We also find that Canadian housing costs responded less to demand changes, meaning that the real wages of Canadians responded more.

We finish by examining how the United States and Canada responded differently to increased import competition from Chinese manufacturing, following Autor, Dorn, and Hanson (2013). Our results indicate that this competition had a weaker effect on manufacturing employment in Canada than in the United States. This result is consistent with the moderate decline of Canadian manufacturing relative to the United States from 1990 to 2007. While our data limit the ability to identify the exact cause of the discrepancy, it may be explained by differences in the demographics of places most affected by Chinese competition.

Overall, the US-Canada differences we observe are consistent with differences in policy on immigration and in personal transfers. Canada's more numerous and educated immigrants appear more oriented toward urban opportunities. Their responsiveness to changes in economic conditions suggest that they may indeed "grease the wheels" of the national labor market even more than their US counterparts (Borjas 2001; Cadena and Kovak 2016). At the same time, there is no more evidence in Canada than in the United States that within-country migration does much to depress persistent wage disparities across cities.

A number of facts also indirectly support the notion that individual and intergovernmental transfers lower geographic mobility. Once we control for differences in Canada-US demographics and exclude America's housing-inelastic megacities, Canadians do appear to be slightly less mobile. This finding is in line with Notowidigo's (2011) hypothesis that greater individual transfers may hinder geographic mobility.[5] The point is arguably reinforced by the fact that Canadian housing costs were less responsive to labor demand shifts than in the United States. Tax-and-transfer programs (both individual and intergovernmental), which redistribute nominal wage differences across cities, should depress demand shifts' effects on housing prices. If instead housing cost changes were orthogonal to demand shifts by accident, then Canadian workers did receive a greater proportion of the benefits and costs of these changes through their real wages. In either case, demand shifts were passed on to local property owners to a greater extent in the United States.

In Section II, we briefly discuss theoretical considerations and key features of the US and Canadian institutions and transfer systems that could affect local labor market outcomes in both countries. In Section III, we out-

[5] We find that local labor demand shocks increase the university-educated share of the population to a greater extent in Canadian cities. This may be the result of higher transfers in Canada discouraging the mobility of those with lower education, as suggested by Notowidigo (2011). Alternatively, this may be due to the influx of university-educated immigrants to Canadian cities during our study period, as documented in Warman and Worswick (2015).

line the census, business, and other data used in the analysis. In Section IV, we examine how cross-sectional labor market patterns vary by metro population. In Section V, we then consider more dynamic changes, with a brief overview of aggregate trends, wage persistence, and labor mobility. In Sections VI and VII, we examine how local labor markets respond to demand shifts. In Section VIII, we conclude by discussing the possible sources of Canada-US differences.

II. Spatial Equilibrium, Fiscal Policy, and Institutions in Local Labor Markets in the United States and Canada

In this section we provide an overview of local labor market theory to guide our empirical analysis. Additionally, we discuss how immigration and government transfer policies in Canada and the United States may affect labor mobility in each country.

A. Theory of Local Labor Market Equilibrium

The standard model of local labor markets assumes that workers move across cities to maximize utility while firms and capital achieve equal returns across cities. It produces differences in wage and employment outcomes in spatial equilibrium mainly due to variation in productivity and quality of life across cities. Using an augmented version of the Rosen (1979)–Roback (1982) model, Albouy (2016) and Albouy, Leibovici, and Warman (2013) argue that level (or persistent) differences in wages across cities in the United States and Canada are largely driven by underlying firm productivity. Productivity differences, key in determining labor demand, are driven by many factors, including urban agglomeration economies, natural advantages, and access to export markets.[6]

Quality-of-life amenities, enjoyed by households, increase the supply of workers for a given wage. In equilibrium, these amenities lower real wages, as workers accept lower consumption levels to enjoy them. These lower real wages, in turn, are manifested primarily through higher costs of living, for example, in housing costs. How the supply of labor to cities responds to (nominal) wages or amenities depends critically on the supply of housing (Moretti 2011). Cities where the supply of housing adjusts little to demand may experience large cost increases but little employment growth. The other main determinant of local labor supply is moving costs, psychic and otherwise. It

[6] In larger metro areas, agglomeration economies potentially benefit workers through reduced search frictions, better matching, and greater human capital accumulation (Baum-Snow and Pavan 2013). Arguably, frictions created by institutions may lower this return while also reducing the inequality they engender. Larger cities also offer a greater variety of consumer products and neighborhood public goods. See Baum-Snow and Pavan (2012) and Baum-Snow, Freedman, and Pavan (2018) for work on causal mechanisms.

is generally assumed that these costs follow an increasing schedule, meaning that, on the margin, workers require higher real wages to expand their supply.[7] Existing (inframarginal) workers in an expanding local labor market are made better off by such real wage increases. Local property owners are made better off when demand shifts raise local land values through increases in housing costs.

This standard model of location and mobility can be amended to handle unemployment outcomes and worker heterogeneity. Kline and Moretti (2013) incorporate a search model and find that higher productivity levels lower equilibrium unemployment and raise employment-population ratios. Modeling heterogeneous workers, Black, Kolesnikova, and Taylor (2009) find that highly educated workers—more common to the United States—sort toward high-wage areas, as they can better afford higher housing costs.

B. Immigration Policy and Local Labor Markets

Canada admitted over twice as many legal immigrants as the United States per capita over our study period.[8] Since Canada admits a higher fraction of immigrants, this should make the Canadian population more mobile on average, ceteris paribus. Canada-US differences in the criteria for selecting immigrants may further strengthen the relative importance of immigrants on issues related to mobility. In the United States, most immigrants enter under family reunification and may locate based on where existing family live. This contrasts with Canadian immigration policy, as more than half of Canadian immigrants are selected on the basis of economic criteria (Warman, Webb, and Worswick 2019). Therefore, immigrants to Canada may be more likely to follow economic incentives when choosing where to live. Canada's immigration policy also favors university-educated immigrants, which may change the level of education in cities.

In general, immigrants appear to be more mobile than the native-born population and more willing to move to places with greater economic opportunities (Borjas 2001; Cadena and Kovak 2016). A more debatable issue is whether immigrants have an important effect on local wage levels. Simple models of local labor markets with fixed factors imply that an influx of workers to a city will lower its wages. In this case, labor mobility can reduce wage differences across cities, as workers move to higher-wage areas (Ganong and Shoag 2018). Thus, higher immigrant numbers could reduce interregional

[7] These costs are often microfounded through smooth variability in preference heterogeneity (e.g., Diamond 2016).

[8] However, this may overestimate the relative fraction of the foreign-born population in our census sample. For example, it will depend on how undocumented migrants, which make up a higher fraction of the US population, are captured in the census data. In addition, differences in out-migration may also impact the relative importance of the foreign-born population. Aydemir and Robinson (2008) estimate very high rates of out-migration in Canada, particularly for young working-age male immigrants.

wage differences if markets are not already in equilibrium. It is worth noting that such theories are at odds with urban agglomeration models that predict wages to rise with the number of workers. Indeed, work by Card (2001) and others has generally found little effect of immigrants on local wages.

Last, immigrants may sort across markets differently from natives. They may have stronger tastes for certain amenities (Albouy, Cho, and Shappo 2018). Or they could be more attracted to high-cost, high-wage areas, as many make remittances and consume relatively little locally (Albert and Monras 2019).

C. Fiscal Policy: Taxes and Transfers to Governments and Individuals

Canada's more redistributive interregional policies should arguably reduce how much Canadians move relative to Americans in the pursuit of higher wages. While federal taxes in both countries reduce incentives to move to high-wage areas (Albouy 2009), Canada provides larger social insurance transfers to individuals and larger local government transfers through equalization payments. This generally benefits lower-wage regions, such as the Atlantic provinces. The United States has no explicit form of equalization outside of a few programs that operate at a smaller scale, such as empowerment zones.[9] Accounting for intergovernmental transfers, the typical dollar earned through worker migration is implicitly taxed by more than 30% in the United States, while in Canada the tax is roughly double that percent (Albouy 2012).

The means testing of individual transfers should further dull incentives, as various clawbacks raise the effective marginal tax rate even further. Although programs differ by location and individual, these disincentives appear to be generally stronger in Canada (Hoynes and Stabile 2017). However, as noted in Milligan and Schirle (2017), the relative generosity of the US disability insurance system could do more to pull US workers out of the labor force.[10]

In analyzing labor markets, unemployment insurance is an especially important transfer. The Canadian insurance program is generally more centrally run. Incomplete experience rating and regional targeting causes areas with higher unemployment rates to effectively receive greater net transfers.[11]

[9] See Busso, Gregory, and Kline (2013). Note that the United States does potentially subsidize low-wage areas by providing them with greater intergovernmental transfer match rates, e.g., federal medical assistance percentages. But since total payments rely on local generosity, these higher match rates rarely lead to greater federal transfers (Chodorow-Reich et al. 2012).

[10] The lack of universal insurance in the United States over our period could lower US mobility rates by reducing turnover through "job lock" (Madrian 1994) or raise mobility through "employment lock" (Garthwaite, Gross, and Notowidigdo 2014), as those without insurance may move to procure it.

[11] Unemployment insurance and unemployment duration have traditionally been higher in Canada than in the United States. This was especially true up until the late 1990s, when Canadian unemployment benefits fell precipitously after a series government cuts. See, e.g., Battle (1998). Furthermore, at the end of our sample period

All in all, one would expect larger transfers to discourage mobility in Canada relative to the United States. This may be especially true for lower-income workers. Furthermore, transfers should dampen the effect of nominal wage increases on local housing costs. While it may appear that Canadians are seeing greater responses in real wages, the effects may be greatly muted through redistribution.

In concluding this section, we note that higher unionization rates and minimum wages might also affect local labor markets, reducing mobility and stiffening wage adjustments.[12]

III. Data and Methods

A. Census Data

1. US Public Use and Canadian Master File Data

We draw much of our analysis from geographically detailed census data. For the United States, public use geographic identifiers are generally adequate for defining metro areas, which have populations above 50,000. Therefore, we use the Integrated Public Use Microdata Series (IPUMS) from Ruggles et al. (2015) using the 1990 and 2000 census 5% samples and the American Community Survey, pooling the years 2005–7 (referred to as 2007) and 2009–11 (referred to as 2011). Overall, this leaves us with a sample of 264 metro areas.[13] We use the terms “cities” and “metros” interchangeably throughout this paper.

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unemployment benefits jumped in the United States, as US policy makers sought to offset the effects of the Great Recession. Generally, the paths of unemployment duration document the stark differences in the severity of the Great Recession across the United States and Canada.

[12] See Card and Riddell (1993) for an early Canada-US comparison. Union coverage rates have declined in both countries but remain more than 10 percentage points higher in Canada (see panel G of table A1). In fact, few US metros have unionization rates as high as those found in the least unionized Canadian metros. This makes it difficult to compare. Nevertheless, unions are thought to increase employment stability and reward seniority, thereby reducing geographic mobility and making wage structures more rigid (Zimmerman 2008). The minimum wage is determined provincially in Canada; in the United States, the federal government provides a wage floor, which some states top up. Recent work on local labor markets by Monras (2019) argues that minimum wages raise local wages but drive workers away. Such effects would likely play a larger role in Canada, where real minimum wages rose over this period, than in the United States, where they fell. See DiNardo and Lemieux (1997) for an earlier analysis.

[13] Large metro areas use the consolidated metropolitan classification, so that Oakland is joined to San Francisco and Stamford to New York. These areas are defined using 1999 Office of Management and Budget definitions. For New England, we use New England county metro area definitions to make better use of county-level data. In a small number of cases, we use a probabilistic matching system based on the overlap between public use micro-data areas (PUMAs) and metropolitan areas. Because

Public use micro data files from the census for Canada are generally inadequate for studying most local labor markets, since they identify few metro areas. We circumvent these problems by using the restricted access 20% Canadian Master File census data for 1991, 2001, and 2006 (referred to as 1990, 2000, and 2007, respectively, in our tables and figures to remain consistent with the reference years for our US data).[14] Thus, while the population of Canada is smaller than that of the United States, it is drawn from a sample large enough to be very precise. We also use the restricted-access 2011 National Household Survey data.[15] To compensate for the smaller number of cities in Canada, we consider a lower population threshold than for the United States to determine whether an area is included in the sample, namely, that of a working-age population of 15,000 or more in 1990. This leaves us with 82 Canadian metro areas.[16]

2. *Overlap in Population Size*

Together, the metro areas in our sample account for about four-fifths of the population in each country. However, nine US metros are bigger than the largest Canadian metro (Toronto). These US megacities appear to have difficulty growing (Rappaport 2018), which may have something to do with tighter housing supply.[17] Twenty-eight Canadian agglomerations are smaller than our smallest US metro (Enid). Given this, we examine how sensitive our results are to excluding the smallest Canadian and largest US cities, with the lower and upper bounds given by Enid and Toronto. The cities that are dropped on the basis of this exclusion account for 37% of workers in the United States and less than 5% of workers in Canada.

PUMAs generally comprise populations of 100,000 or more, this largely precludes analyzing areas with populations less than 50,000. Analyzing them would require restricted access US data, which are not currently at our disposal.

[14] We also provide Bartik estimates in app. A using the 1980 US census and 1981 Canadian census data. However, our main analysis does not include these data in order to remain consistent with the available years of Canadian Business Pattern data.

[15] These data should be treated cautiously due to their nonmandatory nature. The response rate was around 68% in 2011, whereas it was more than 95% in previous censuses. The sample was increased to 33% of households instead of 20% of households in previous censuses.

[16] Canadian metro areas are formed from municipalities (census subdivisions). From 2001 definitions, we use 32 "census metropolitan areas" (CMAs) as well as 50 "census agglomerations." A small problem with comparing Canadian metro areas to (consolidated) US ones is that the latter are somewhat broader in land area because they are formed out of counties, which can be quite large. For example, Oshawa is a CMA separate from Toronto, even though its census subdivisions are still in the "greater Toronto area."

[17] According to numbers from Saiz (2010), the elasticity of housing supply in these cities is on average half that of other US cities.

3. Timing of Samples and Macroeconomic Conditions

One issue we face with comparing the United States and Canada is slight differences in time periods. The US decennial census data correspond to April 1, 1990 and 2000, for outcomes such as employment and to the previous calendar year for earnings. In Canada, the census day is in mid-May, with the previous week being the reference week for employment and the previous calendar year being the reference year for earnings.[18]

In the United States, the recessions are dated to have started in July 1990, March 2001, and December 2007, always after the data collection. In Canada, both the census employment reference week and earnings reference year occurred during the 1990–92 recession. Therefore, all variables for this census were recorded amid the early 1990s recession in Canada. For the American Community Survey, the US data refer to broader periods of 3 years, but 2005–7 and 2009–11 are largely outside of recessions. We deflate the monetary values into 2010 dollars using each countries' respective consumer price index and then use the 2010 purchasing power parity to deflate the Canadian dollars into US dollars. We use an Organization for Economic Cooperation and Development (OECD) purchasing power parity for 2010 of 1.220 Canadian dollars per US dollar.[19]

4. Location and Skill Indices

We decompose wage differences across metro areas according to what is explained by location and what is explained by observed worker characteristics. Using the logarithm of weekly wages, w^k_{ijt}, for worker i in city j in year t in country k, we fit regressions for each country-year of

$$w^k_{ijt} = X^k_{it}\beta^k_t + \mu^k_{jt} + \varepsilon^k_{ijt}, \tag{1}$$

where X^k_{it} are location-invariant worker characteristics whose returns β^k_t can vary by country and year. The "fixed effects" μ^k_{jt} are coefficients on indicator variables for each city in each time period. With an orthogonal error term ε^k_{ijt}, the μ^k_{jt} represent the average effect of location j on the wages of a

[18] Construction of weekly and hourly wage series is hampered by differences in how weekly hours are reported in Canada, which apply only to a reference week, while the United States asks for typical hours. The annual earnings and weeks worked are reported for the reference calendar year. We calculate weekly earnings for people employed in the reference year so that the earnings calculations are more comparable for the two countries and the wages better match the timing of the industry of employment information. For that reason, we generally focus on comparisons of weekly wages.

[19] This purchasing power parity is quite stable during our sample period, with a mean value of 1.218 and a coefficient of variation of 1.2% for the years 1990–2011. Our OECD purchasing power parity is sourced from Canadian Socioeconomic Information Management System (CANSIM) table 36-10-0100-01.

typical worker.[20] Taking the expectation of wages by year and metro area, the average metro-level wage is given by the sum of the skill and location index:

$$E_i[w_{ijt}^k] = \underbrace{\bar{w}_{jt}^k}_{\text{metro wage}} = \underbrace{\bar{X}_{jt}^k \beta_t^k}_{\text{skill index}} + \underbrace{\mu_{jt}^k}_{\text{location index}}, \qquad (2)$$

where $\bar{X}_{jt} = E_i[X_{ijt}]$ denotes the average characteristics and $E_i[\varepsilon_{ijt}^k] = 0$.

For a simpler measure of skill, we consider the log of the university-educated share of the population (see app. sec. B1). This measure is only weakly correlated with the skill index, as the skill index is based on a finer measurement of education and includes variables for minority status, immigrant background, and other characteristics.

For wage dispersion within cities, we use two measures. The first is the log ratio of the wages of university graduates to high school graduates; the second is the log ratio of the wage at the 90th percentile to that at the 10th. The first is more a measure of the local return to education; the second is a measure of overall local inequality.

B. Business Data

We obtain employment data from US County Business Patterns from the US Census Bureau and Canadian Business Patterns from Statistics Canada; for brevity, we jointly refer to these data sets using the CBP moniker. Both CBP data sets for the United States and Canada report the number of firms within employment ranges at the Standard Industrial Classification (SIC)/North American Industry Classification System (NAICS) industry level. For the US CBP data, we first convert all industry codes to the SIC 1987 three-digit level of aggregation and then impute actual employment within each industry following Autor, Dorn, and Hanson (2013).

A major limitation of the CBP is that the data are top coded and somewhat coarse, especially in Canada. We enhance the Canadian CBP data with the micro data from the Annual Survey of Manufacturing (ASM). We access plant-level ASM data at the Canadian Centre for Data Development and Economic Research (CDER) using an updated version of the data from Baldwin and Li (2017). To align with our other data, we use the ASM employment counts for 1991, 2001, 2007, and 2011 (referred to as 1990, 2000, 2007, and 2011, respectively, in our tables and figures to remain consistent with the ref-

[20] Despite the tremendous potential for confounding unobservables, the overall pattern of wages across US and Canadian cities appears to be consistent with one of spatial equilibrium. In general, wage levels—controlling for differences in observed worker characteristics—appear to compensate workers, by and large, for differences in amenities as well as costs of living (Albouy, Leibovici, and Warman 2013; Albouy 2016).

erence years for our US data). The ASM covers employment in all manufacturing establishments with revenue above a low threshold.[21]

We also use administrative micro data from CDER to create a crosswalk from SIC-E 1980 to NAICS 1997. The ASM micro data has NAICS industry classification for all our periods. However, the Canadian CBP data for the 1990s uses the SIC-E 1980 industrial classification, requiring a crosswalk to convert them to NAICS 1997.[22] The details of our SIC-E 1980 to NAICS 1997 crosswalk are described in appendix B (sec. B4).

C. Other Data

We also use additional data, which we discuss in appendix B. See section B3.1 for the United Nations (UN) Comtrade database, section B3.2 for transfer data, section B3.3 for union data, and section B3.4 for World KLEMS data.

D. Propensity-Score Reweighting

To examine the importance of the demographic and institutional differences between the two countries, we reweight the Canadian sample to resemble the US sample in terms of available start period demographic, industry, and institutional characteristics. We use the standard propensity score reweighting methodology, popularized by DiNardo, Fortin, and Lemieux (1996).[23] The first set uses the share of the population with a university degree and the share who are foreign born. The second set adds the share of employment in manufacturing and in oil as well as an institutional variable, namely, minimum wages.[24]

[21] For much of the observation period, the minimum annual threshold is $30,000, although there is some variation in this cutoff across industries and over time. The updates to the Baldwin and Li (2017) ASM micro data set reflect efforts to address a change in survey population that was in effect during the period 2004–6. Administrative data were used to add back in the employment counts for plants that were excluded from the ASM sample after 2004 due to the changes in the survey population during the 2004–6 period. We thank Jiang Li at CDER for her effort in updating the ASM micro data set for this project.

[22] SIC-E 1980 is an Canadian industrial classification and differs substantially from the US SIC 1987 industrial classification. Therefore, the NAICS 1997 to SIC 1987 crosswalk from Autor, Dorn, and Hanson (2013) cannot be used to crosswalk the Canadian CBP data.

[23] We adjust the weight by multiplying the 1990 population weight by $W = \mathrm{US} + (1 - \mathrm{US}) \times [(p|X)/(1 - (p|X))]$. US is 1 if the city is in the United States and 0 if it is in Canada; $(p|X)$ is the conditional probability that the city equals 1. Table A2 shows the probit estimates used for reweighting for both the first set and the second set in cols. 1 and 2, respectively. In table A3, we show the predicted probabilities for a select set of cities for both specifications. We top code the top five odd ratios and bottom code the bottom five odds ratios.

[24] Given the lack of common support for unionization rates in Canada and the United States, we were not able to include unionization rates in this analysis.

IV. Local Labor Market Patterns by Metro Area

A. Relationships with Metro Size

In this section we consider how wage levels, inequality, and worker sorting vary across metro areas according to their size. These relate to important agglomeration issues discussed earlier and the overall labor markets of cities.

Table 1 presents a succession of descriptive regressions showing the relationship between these outcomes and the standard regressor for city size, the logarithm of population. We interact this regressor with a Canadian indicator to highlight differences between the United States and Canada.[25] Panel B uses our common city sample. These cities are shown in figure 1, which plots wages relative to metro population in 1990. Panels C and D of table 1 consider the role of aggregate city characteristics by reweighting the Canadian sample to resemble the US sample, as discussed in Section III.D.

Column 1 of table 1 displays how wages differ across metropolitan areas. Across years in panel A, the wage-population elasticity is 0.065 in the United States. In Canada, the gradient is only half that size. The interaction becomes weaker in panel B, as the gradient in the United States is quite steep for its larger cities, as seen in figure 1. Panel C shows that putting more weight on Canadian cities that resemble US cities in terms of their demographic characteristics further reduces the gap in the gradient. In panel D, we find that reweighting by start period demographic, industrial, and institutional characteristics pushes the gap up slightly.

This relationship from column 1 largely persists in column 2, which uses the wage location index from equation (2), controlling for observable worker skills. The gap in the gradient is slightly weaker as the skill index, seen in column 3, falls slightly but insignificantly with city size in Canada. This difference becomes more pronounced once we control for common city sizes in panel B.

Columns 4 and 5 address issues of skill and immigrant sorting. Here we see that university graduates sort into larger cities in both countries, where there is no difference in the sorting patterns of university graduates once we account for common city sizes. At the same time, as we see in column 5, immigrants are much more likely to sort into larger cities as well. Since immigrants earn less than comparable natives, this sorting lowers the "skill index" or predicted wages workers command on the basis of their observable characteristics. Immigrant sorting to larger metros is even stronger in Canada than in the United States, where in panel B, when we drop the largest metros from the United States and the smallest from Canada, the difference becomes

[25] In addition, the model includes indicators and interactions with population for Quebec and Hispanophone communities. We also include decadal indicators interacted with a country indicator in each regression.

Table 1
Urban Population Gradients for Local Labor Market Outcomes in the United States and Canada: 1990–2011 Pooled

	Dependent Variable							
	Log Weekly Wage (1)	Wage Location Index (2)	Wage Skill Index (3)	Log Univ/Pop (4)	Log Foreign/Pop (5)	Log Univ/HS Wage (6)	Log 90/10 Wage (7)	Local Housing Costs (8)
	A. Full Sample							
Log population	.065***	.067***	−.003	.057***	.417***	.038***	.046***	.170***
	(.007)	(.003)	(.005)	(.010)	(.026)	(.004)	(.005)	(.012)
Log population × Canada	−.037***	−.028***	−.009	.026**	.082	−.016**	−.039***	−.045***
	(.008)	(.008)	(.006)	(.013)	(.075)	(.006)	(.007)	(.017)
Observations	1,384	1,384	1,384	1,384	1,384	1,384	1,384	1,384
	B. Common City Sizes (Prime Age from 24 Thousand to 2 Million)							
Log population	.057***	.057***	.0004	.073***	.365***	.032***	.028***	.121***
	(.006)	(.003)	(.005)	(.012)	(.037)	(.007)	(.007)	(.015)
Log population × Canada	−.029***	−.013**	−.016**	.003	.139*	−.008	−.017*	.009
	(.007)	(.007)	(.006)	(.016)	(.083)	(.010)	(.010)	(.019)
Observations	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236

	C. Common City Sizes, Reweighted Using Demographic Characteristics							
Log population × Canada	−.015	−.006	−.008	−.010	.218***	−.015	−.015	.002
	(.012)	(.012)	(.006)	(.018)	(.070)	(.009)	(.011)	(.021)
Observations	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236
	D. Common City Sizes, Reweighted Using Demographics, Industries, and Institutions							
Log population × Canada	−.021**	−.012	−.009	−.008	.201**	−.011	−.014	−.004
	(.010)	(.011)	(.006)	(.017)	(.088)	(.009)	(.011)	(.021)
Observations	1,236	1,236	1,236	1,236	1,236	1,236	1,236	1,236

Note.—Panel A corresponds to the full sample data, observed in 1990, 2000, 2007, and 2011 with 264 metros in the United States and 82 in Canada. In panel A, Canadian metro areas are those with a population greater than 15,000 in 1990; US metro areas have a population greater than 50,000 in 1999. Panel B uses common city size support where cities are chosen so that 1990 aged 24–59 metro population size across countries has a common support. Specifically, the minimum city size within each country is equal to the minimum city size in the United States and the maximum city size within each country is equal to the maximum city size in Canada based on start-of-sample population. This yields 255 metros in the United States and 54 in Canada. See table A2 for the reweighting model specifications. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

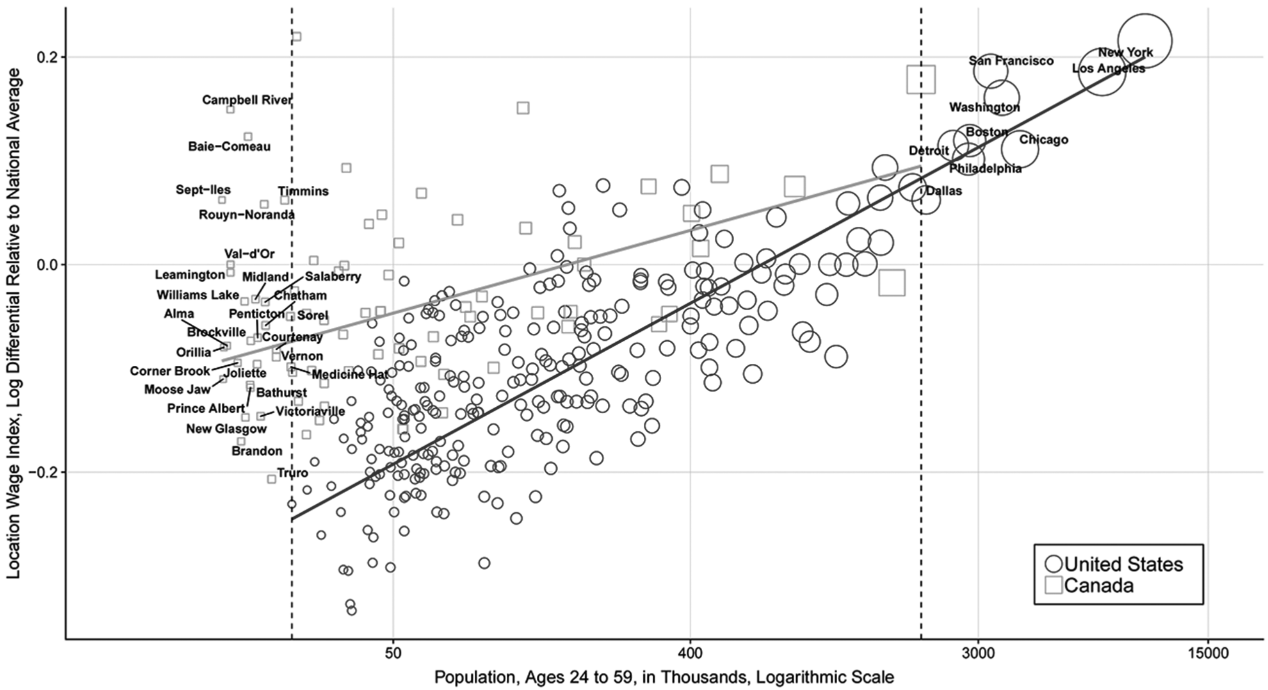

FIG. 1.—Urban weekly wage differences by metro population, aged 24–59, and common city size cutoffs. The points and the regression line are weighted by population aged 24–59. Metros names are printed for metros that are cut off in the common city support sample. See the note to table 1 for details. A color version of this figure is available online.

stronger. Furthermore, when we reweight on start-of-sample demographics, including the (initial) 1990 share of the population who is foreign born, this difference becomes even larger.[26]

It is well documented that wage inequality is greater in the United States than in Canada. The point made here is that this inequality gap grows with metro population, as measured by the university/high school wage premium in column 6 and the 90/10 differential in column 7. Furthermore, the gradient differences become weaker in panel B, since wage inequality is greatest in the largest US metros. The gap in the gradient does remain significant for the 90/10 wage differential. In panel C, when we reweight according to demographic characteristics, the differences between the Canadian and US gradients are no longer statistically significant, although this is partly due to the estimates losing precision.[27] In general, the return to education is larger in the United States than in Canada. This makes it advantageous for the more educated to move to the United States and the less educated to move to Canada (Card 2003). This advantage is magnified if we consider a move from a small Canadian city to a large US one.

Finally, in the last column we note how housing costs increase with population size (see app. B, sec. B2, for a brief discussion on how we construct this variable). While the Canada-US difference is large, it disappears without the largest US cities. However, the fact that wages rise more slowly in Canada than in the United States with population implies that larger Canadian metros are less affordable than US metros of comparable size. In an equilibrium framework, this suggests that larger cities in Canada are relatively more desired for their quality-of-life amenities.

[26] The reason why the Canadian slope coefficient gets larger can be seen by looking at the cities with the largest predicted probabilities in table A3, which determine the magnitude of the DiNardo, Fortin, and Lemieux (1996) weight. Many of the cities with the highest weights (e.g., Rimouski and Chicoutimi) have relatively low population and a small foreign share of the population. Heavily weighting these observations in the left tail of the population distribution has a strong influence, pulling down the left side of the regression line and making it steeper.

[27] These inequality relationships did not exist in 1980 but have come to be a remarkable feature of large cities (Baum-Snow and Pavan 2012). In panel D, when we further add controls for start period industry shares and minimum wage to our reweighting, the difference remains very similar to those in panel C. The patterns of urban wage inequality in Canada are decidedly weaker. In fact, it appears that the urban wage premium for university graduates relative to high school graduates is growing at half the rate in Canada as it is in the United States. The top panel of fig. A1 shows the scatterplots comparing the log university–high school wage ratio for 1990 and 2011 for all of the cities, while the second panel shows the urban 90/10 differential. For both measures, the inequality increased more in the United States than in Canada. While the urban 90/10 differential in Canada in 1990 was typically lower in the larger cities than what was seen in the smaller cities, it grew at a faster rate in the larger cities. Conversely, in the United States the 90/10 differential was generally greater in the larger cities in 1990, and this difference has increased.

In sum, the equilibrium relationship studied here tells us that on the one hand urbanization in Canada is associated with less of a wage premium and less income inequality than in the United States. On the other hand, larger Canadian cities are even more attractive to immigrant workers and suffer more from affordability issues.

V. Changes in Labor Market Outcomes over Time, Sector, and Space

In this section we present descriptive statistics that help link sectoral shifts over time with local impacts on labor markets, setting up our next section on local demand shifts.

A. Aggregate Labor Dynamics by Sector

Figure 2 provides an overview of the annual variation in Canada and the United States over the period 1980–2010.[28] These four plots document the trends in hours worked and hourly labor compensation by sector over this period using the World KLEMS data. It separates the economy into four broad sectors.[29] The top two plots show hours worked and mean hourly labor compensation by sector, combining Canadian aggregates with much larger US numbers. The bottom two panels show values of these variables for Canada relative to the United States.[30]

Figure 2*A* shows the steady growth in hours worked in the services sector and the decline in the manufacturing and resource/utilities sectors from 1980–2010. This recent structural transformation has been a common trend in most advanced economies. While manufacturing remained the largest of the nonservices sectors, its share of hours fell by more than half. Figure 2*B*

[28] Table A1 provides a numerical overview of the aggregate labor markets in Canada and the United States. Panels B–D show that employment and wages were initially higher in the United States in 1990, noting that census measures of unemployment differ from the US Current Population Survey (CPS) and the Canadian Labour Force Survey (LFS). By 2011 these spreads narrowed or even reversed, as Canada experienced a mild recession in the late 2000s while the Great Recession struck the United States. Regarding demographics, US workers began the sample as more educated. This flipped toward the end of the sample. In terms of immigration, Canada initially had a larger foreign-born share of the working-age population, and while this metric grew in both Canada and the United States, it reached nearly 30% in 2011 in Canada.

[29] We use the concordance in Gu (2012) to convert the KLEMS data from International Standard Industrial Classification revision 3 to NAICS two digit. The NAICS two-digit classifications are as follows: resource/utilities, 11–22; construction, 23; manufacturing, 31–33; and services, 41–91.

[30] Hours worked is defined as the total hours worked by persons engaged in the sector. Hourly labor compensation is defined as total labor compensation in the sector divided by hours worked. Canadian labor compensation is converted to US dollars at the average annual Canada-US exchange rate downloaded from FRED, Federal Reserve Bank of St. Louis.

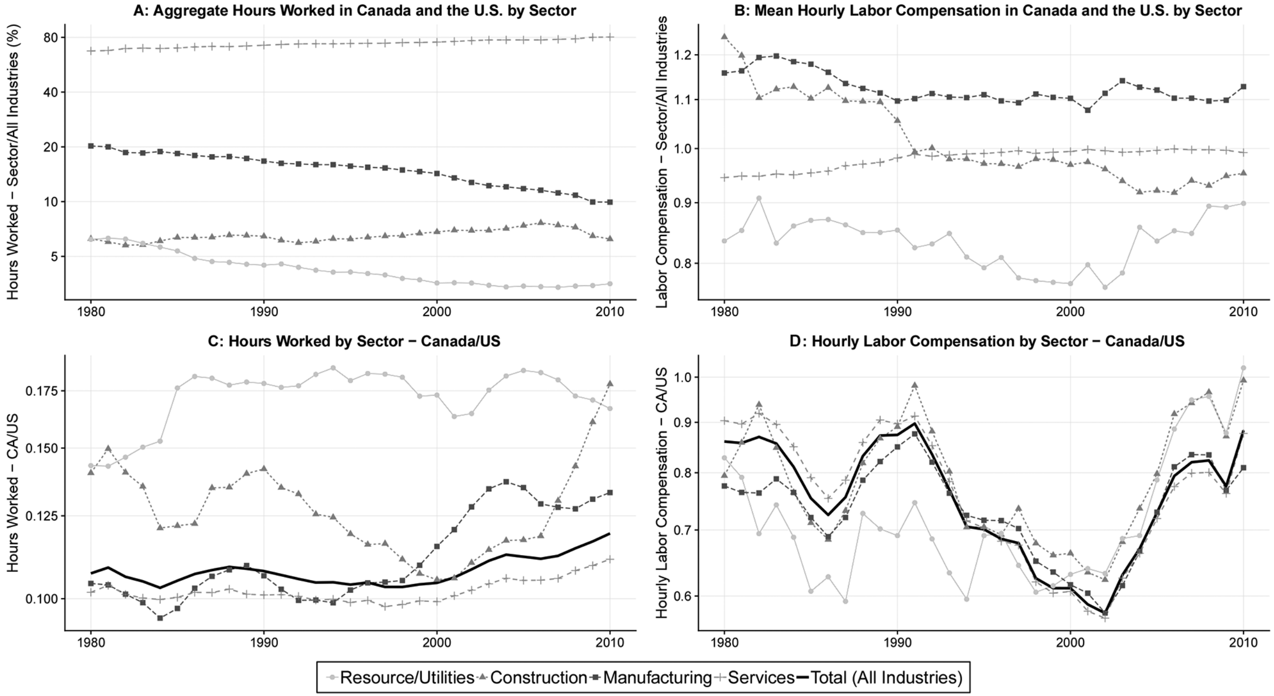

FIG. 2.—Aggregate hours and mean hourly labor compensation by sector in Canada and the United States, 1980–2010. Data are from World KLEMS. Sector labels are defined by North American Industry Classification System two-digit codes as follows: resource/utilities, 11–22; construction, 23; manufacturing, 31–33; and services, 41–91. Hours worked is defined as the total hours worked by persons engaged in the sector. Hourly labor compensation is defined as total labor compensation in the sector divided by hours worked. Canadian labor compensation is converted to US dollars at the average annual Canada-US exchange rate downloaded from FRED, Federal Reserve Bank of St. Louis. A color version of this figure is available online.

shows that hourly labor compensation in manufacturing did on average remain higher than that in the other three sectors over this entire period.

Figure 2*C* indicates that before 1995, Canadian manufacturing hours worked was, like the population, about one-tenth of that in the United States. In the late 1990s, it rose relative to the United States before leveling off in the mid-2000s.

The construction sector's share of total hours worked was higher in Canada than in the United States for almost every year between 1980 and 2010. The Canada-US ratio of construction hours worked was volatile, punctuated by a dramatic rise after the 2007–8 financial crisis. Hours fell precipitously in the United States as the housing marketed crashed, while Canadians suffered only a minor temporary setback.

Figure 2*D* shows that the resource/utilities sector's share of hours worked is much higher in Canada, especially from the mid-1980s onward. Oil and gas trends help explain the labor dynamics of this sector. International demand caused oil employment to expand in the early 1980s, collapse in the mid-1980s before rapidly increasing in the early 2000s, and drop again in the late 2000s.

The aggregated data do not show how concentrated these sectors are regionally. For instance, both countries share a "manufacturing belt," corresponding to a parallelogram from Baltimore, west to St. Louis, north to Green Bay, and east to Maine, with the last border cutting into southern Ontario and Quebec (Krugman 1991). While these areas suffered from manufacturing decline, this was less of the case north of border from the late 1990s onward. Natural resource booms were especially impactful in the less dense areas of Alberta and Saskatchewan as well as in Texas and North Dakota. Meanwhile, construction booms and busts were important in high-growth areas like Las Vegas and Florida in the United States and Toronto and Vancouver in Canada.

B. Cross-Metro Differences and Changes in Labor Market Outcomes

From 1990 to 2011, local labor market outcomes did shift considerably across metro areas. Yet despite the variation in these shifts across sectors, we find that inequalities in wages across areas were remarkably consistent over time. Figure 3 plots variation in three different outcomes for each country separately: weekly wages, the employment-population ratio, and the manufacturing share. Outcomes for the year 2011 are plotted against those in 1990. For completeness, we present outcomes for nonmetro areas, averaged by state or province, represented with a triangle.[31]

[31] For fig. 3, we also include the additional nine Canadian metro areas as well as areas of states/provinces/territories not part of metros. A city's market is proportional to its population. These additional metros and provinces/territories are not available in the CBP/ASM data and so are not included in our main analysis.

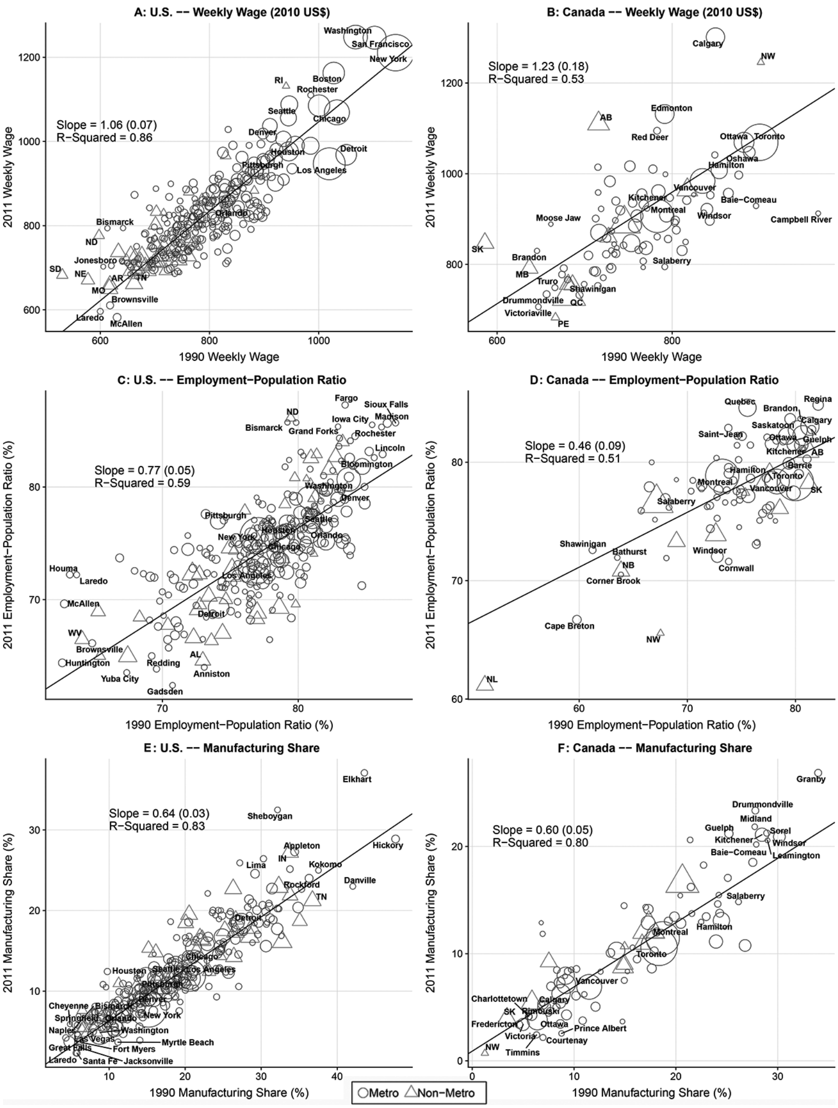

FIG. 3.—Local labor market outcomes in 2011 versus 1990 in the United States and Canada. The points and the regression line are weighted by population aged 24–59. The text within each plot shows the slope of the weighted regression line with its heteroskedasticity-robust standard error in parentheses. A color version of this figure is available online.

Looking first at the plots of the 1990 and 2011 weekly wage by metro (top of fig. 3), in 1990 wages in the United States were high in cities like New York, San Francisco, Washington, and Detroit; in Canada, wages were high in Toronto, Ottawa, and Calgary, as well as in smaller manufacturing and resource-oriented cities in the provinces of Quebec and British Columbia. Wages rose disproportionately in places like San Francisco, Washington, and all over Alberta. Places like Detroit and nonmetro Quebec saw relative declines in wages. In both countries, wage differences across cities appear to have grown between 1990 and 2011. More strikingly, there was generally no wage convergence and, importantly, we still see persistent differences between 1990 and 2011, with most cities close to the regression line.

Unlike with wages, we do see imbalances in the employment-population ratio that mean reverted in both countries, as shown in figure 3*C* and 3*D*. This reversion, even stronger in Canada, is consistent with findings of Blanchard and Katz (1992) for the United States that such imbalances are generally short lived.

Figure 3*E* and 3*F* presents the 2011 and 1990 manufacturing shares. While manufacturing shares fell over the 20-year period, metros with high shares in 1990 still had above-average shares in 2011. For example, in Canada, Granby had the highest manufacturing share in both years. In the United States, the two highest-ranked metros in 1990, Elkhart and Hickory, were still in the top three in 2011. Yet in both Canada and the United States, the slope of the regression line is below 1, thus indicating that local manufacturing shares generally fell from 1990 to 2011, in line with figure 2.

Figure 4 examines whether migration, or the lack thereof, could be affecting wage convergence. Figure 4*A* shows that places with higher wages in 1990 saw *less* growth than lower-wage areas. Ganong and Shoag (2018) argue that this pattern, which they attribute to housing supply, is responsible for the lack of income convergence shown above. But as we see in figure 4*B*, Canada saw a different pattern of higher population growth in places with high initial wages. Nevertheless, wage levels do not appear to have converged any more in Canada. This suggests that barriers to labor mobility may not be the main obstacle to income convergence.[32]

VI. Omnibus (“Bartik”) Sectoral Changes

Below we combine standard approaches to study local shifts in labor demand, following Bartik (1991). This approach accounts for local demand

[32] In fig. A1, we also examine metro-level convergence with regard to the university-population and foreign born–population ratios. Broadly, we see little convergence in Canada and the United States in terms of the university-population ratio. Concerning immigration (fig. A1*G*, A1*H*), we see slight convergence in the foreign born–population ratio for the United States but nearly no convergence in Canada.

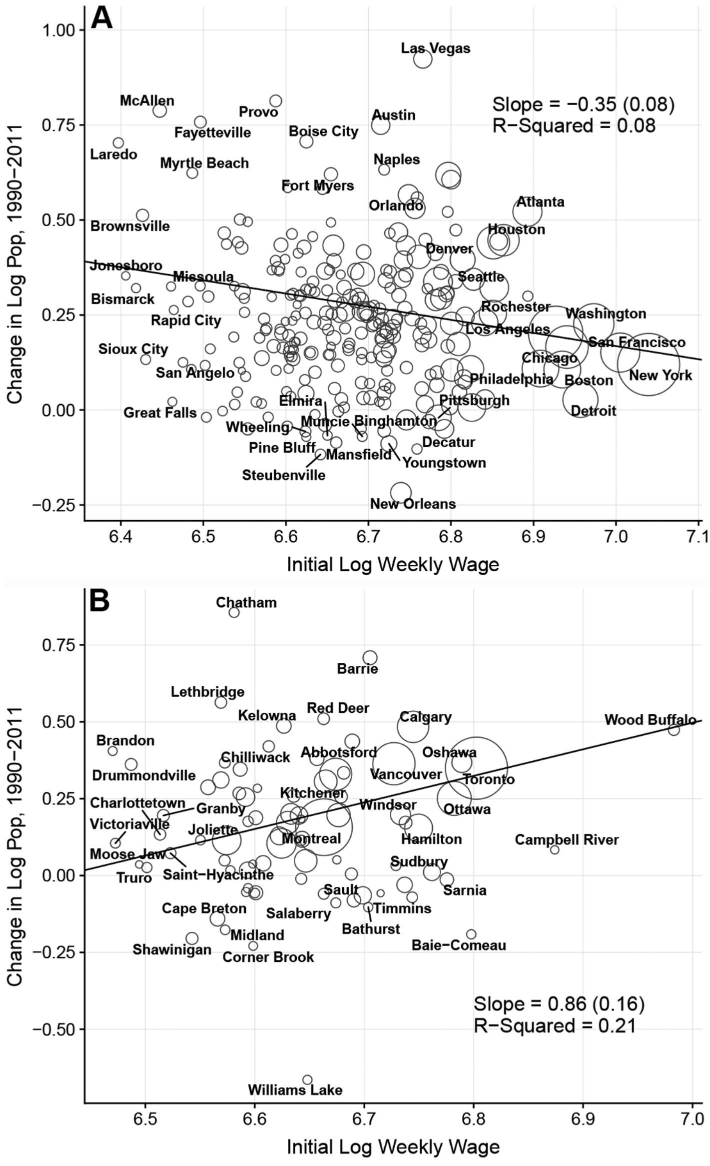

FIG. 4.—Twenty-year population growth rate relative to initial wage in 1990. The points and the regression line are weighted by population aged 24–59. The text within each plot shows the slope of the weighted regression line with its heteroskedasticity-robust standard error in parentheses. A color version of this figure is available online.

shifts by predicting changes in employment at the local level with the interaction of predetermined industrial composition and the national growth of workers in each industry. This omnibus approach benefits in its generality by considering all industries with the overarching aim of causally estimating the local impacts of labor demand changes and shocks on wages, mobility, welfare transfers, and other key outcomes. The basis for this analysis extends back to Blanchard and Katz (1992). Our innovation is to examine Canada and the United States in unison and how the so-called Bartik shocks differentially affect local labor markets in the two countries.

We contribute to the literature by considering two separately constructed Bartik instruments simultaneously. Each of these predicts an aggregate labor demand shift given by

$$\Delta B_{jk}^{t} = \sum_{l} \frac{E_{jl}^{1990}}{E_{j}^{1990}} \Delta \ln E_{lk}^{t}, \tag{3}$$

where $E_{jl}^{1990}/E_{j}^{1990}$ is the share of employment in city j that is in industry l in the base year and $\Delta \ln E_{lk}^{t}$ is the first-difference change in the log of overall employment in industry l of country k (i.e., Canada or the United States).[33]

For any outcome, Y, the simultaneous equations system takes the form

$$\Delta \ln E_{jk}^{t} = \alpha_k \Delta B_{j}^{t} + \zeta_{k}^{t} + X_k \theta_k + \varepsilon_{j}^{Et}, \tag{4a}$$

$$\Delta \ln Y_{jk}^{t} = \beta_k \Delta \ln E_{j}^{t} + \eta_{k}^{t} + X_k \lambda_k + \varepsilon_{j}^{Yt}. \tag{4b}$$

The first stage (eq. [4a]) simply regresses actual log employment changes, ΔE_{j}^{t}, on projected changes. The coefficients α_k may vary by country, as can time effects, ζ_{k}^{t} , and the coefficients on the controls X_k, which in our benchmark specification include a set of region indicators for each country. The second stage involves a vector of labor results in Y.

As the Bartik instrument relies on industrial classifications, it may be subject to errors. This issue motivates our use of two separately constructed Bartik instruments: one using census data, and the other constructed from the CBP for the United States and the CBP/ASM for Canada. Census industrial classification is inferred from household responses, whereas for the CBP data the classification is administratively determined by each country's business registry. Recognizing that there is error in both household- and business-reported data (Card 1996), our approach of using two instruments

[33] We calculate $\Delta \ln E_{lk}^{t}$ using a leave-one-out approach. That is, $\Delta \ln E_{lk}^{t}$ is city j specific and is computed as the first-difference change in the log of aggregate employment in industry l of country k, excluding the change in employment in city j. We use this leave-one-out approach to mitigate concerns that preexisting trends at the city level may compromise the exogeneity of our Bartik instruments. To match the year of the census-derived outcome variables for each country, the base year is 1990 for the United States and 1991 for Canada. To standardize our notation across both countries, we use the superscript 1990 to denote the base year in each country.

leverages the strengths of each data source. Indeed, the CBP data, for example, do not always provide an exact count of employees by area, although they do provide the firm size distribution. For both CBP data sets we impute employment counts, but for Canadian manufacturing data we use exact employment counts from the ASM (in lieu of the CBP) to improve accuracy.[34]

A. Long Differences in the Reduced Form

To better see the relationship between the Bartik projection and observed outcomes, figure 5 illustrates reduced-form outcomes using long differences between 1990 and 2011. This long period may produce different estimates than higher-frequency ones because of the long-run nature of the change. For brevity, we present only the census Bartik projection relative to employment and wages. In this simpler case, the indirect least-squares (or instrumental variable) estimate of the elasticity of the wage with respect to employment equals the ratio of two slopes: that of the wage to that of employment. Since Bartik shocks are predictors of demand growth, this elasticity is equal to the inverse elasticity of demand.

In the United States, cities with the lowest predicted growth, such as Hickory, Elkhart, and Danville, saw major declines in their textile mills and other manufacturing. Conversely, cities such as Las Vegas and Santa Fe grew from expansions in service industries. In Canada, the metros with the greatest positive shifts occurred around natural resources, such as Calgary and Wood Buffalo (which contains Fort McMurray): employment levels there grew by more than 50%. On the other end are cities with relative declines, such as Campbell River, with a struggling natural resource sector, and manufacturing cities, such as Sarnia. In general, we see that the Bartik instrument does on average predict employment in almost equal amounts in both the United States and Canada, with a 10% increase in projected employment predicting a 17% and 18% increase, respectfully. However, the fit was closer for Canada, as evinced by the larger R^2. The wage response in Canada was also slightly stronger. Thus, a 10% increase in projected employment is associated with an 8.6% and 11.3% increase in wages.

[34] From the Canadian and US census data, we construct 19 industries to calculate the Bartik instrument. The industries include agriculture, forestry/logging, fish, coal, mining, petroleum, manufacturing, construction, transportation, communication/utilities, wholesale, retail, finance/insurance/real estate, business services, public administration, education, health/social service/professional, accommodations, and other services. For the Canadian CBP/ASM data, we use the NAICS 1997 four-digit classification, which has 321 industry groups. Our US CBP data have the three-digit SIC classification, providing 373 industries in the United States. We exclude NAICS four-digit industries that we are unable to concord over NAICS vintages 1997–2007 or because of zero employment counts in any NAICS or SIC industry. The CBP data cover only the private sector. Our algorithm for CBP imputation is from Autor, Dorn, and Hanson (2013).

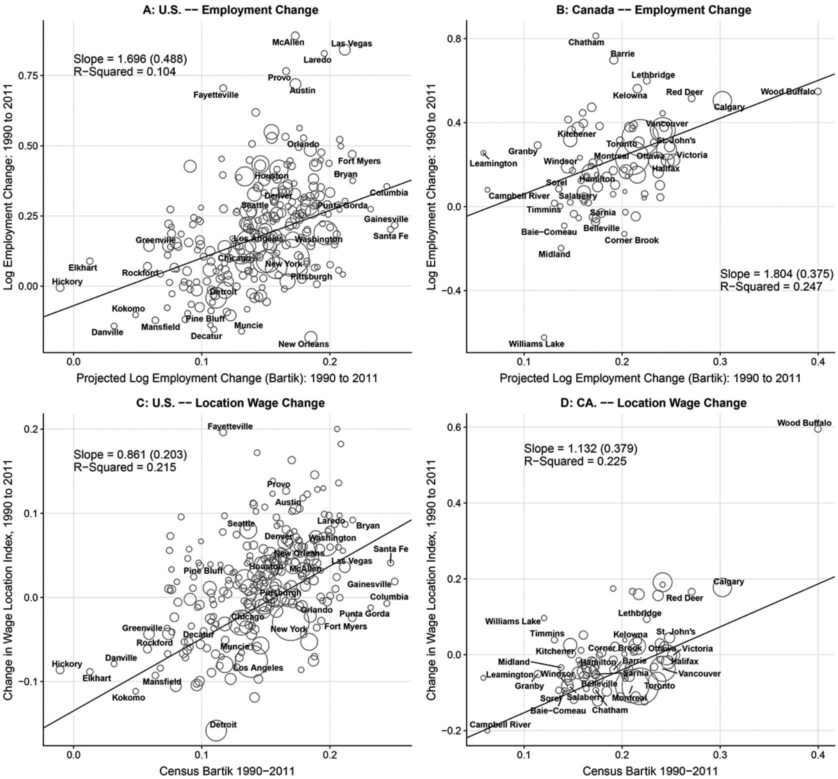

FIG. 5.—Reduced-form relationships between realized employment and wage changes and projected employment change. The points and the regression line are weighted by population aged 24–59. The text within each plot shows the slope of the weighted regression line with its heteroskedasticity-robust standard error in parentheses. A color version of this figure is available online.

Taking the ratio of the employment change in the first stage to the wage change in the reduced form provides an estimate of the elasticity of local labor supply to (nominal) wages. In the United States this elasticity is 2.0, while in Canada it is 1.6. Thus, this simple evidence suggests that the elasticity of local labor supply is somewhat elastic in both countries, albeit slightly more in the United States.

B. First-Stage Bartik Results

Table 2 examines each instrument's first-stage relationship with metropolitan changes in log employment using differenced data spanning 1990–2000, 2000–2007, and 2007–11. The analysis here examines the predictive power of the Bartik instrument along three dimensions: across household (census) and business (CBP/ASM) surveys, in Canada relative to the United

States, and for our benchmark sample (cols. 1–3) versus one with a common city size support (cols. 4–6). The regressions are weighted by start-of-sample population, and robust standard errors are clustered at the state/province level.[35]

In column 1, the elasticity of employment with respect to the census Bartik instrument is 1.2 and 1.1 for the United States and Canada, respectively; however, this coefficient is more precisely estimated in Canada. This may be due to the more detailed and greater quantity of data in the Canadian Master File. Panel C pools data across the United States and Canada.[36] The resulting coefficient on the Bartik averages both countries and thus skews toward the United States given population weighting. The bottom of the table also lists the p-value associated with the null that the coefficients are equal across the United States and Canada. We cannot reject the hypothesis that coefficients are the same. Thus, the census instruments are correlated similarly to actual employment changes across both countries.

Column 2 uses only the CBP/ASM instrument, and the estimated elasticities are 0.6 and 0.5 for the United States and Canada, respectively. Relative to column 1, the first-stage F-statistic increases for the United States, but in both columns the instrument is stronger for Canada.[37] Again, we cannot reject the hypothesis that the coefficients on the CBP/ASM Bartiks are equal across countries.

In column 3 we use both the census and the CBP/ASM Bartik instruments in tandem. For Canada, both instruments have predictive power; however, the census Bartik is stronger in both magnitude and significance. Only the CBP Bartik remains statistically significant for the United States. Not surprisingly, the same holds true in the pooled sample.

In columns 4–6 of table 2, we repeat these estimates for the common city size sample to show the effect from forcing a common city size support. Comparing columns 1–3 with 4–6 in panel A shows that the US F-statistics increase across each of the specifications when we use common city sizes: oddly, the

[35] The regressions, set in first differences, include indicators for time periods and regions. Table A5 presents estimates for the 1980s separately, since only the census instrument is available for that period. Employment is measured with census data and includes both public and private sector employment. For the United States, we use census divisions to define our region indicators. For Canada, we define five Canadian regions as follows: Atlantic (Newfoundland and Labrador, New Brunswick, Nova Scotia, and Prince Edward Island), Quebec, Ontario, Prairies (Alberta, Manitoba, and Saskatchewan), and British Columbia.

[36] For these estimates, we interact decadal indicators with a country indicator.

[37] We found that using only the Canadian CBP data, without the ASM data, resulted in a much weaker first-stage relationship between the instrument and employment. The coarseness of the Canadian CBP employment data, particularly for larger firms, motivated our use of the ASM data. Our CBP/ASM Bartik estimates use confidential Statistics Canada micro data. Although these micro data are not publicly available, our Canadian CMA-level CBP/ASM Bartik estimates have been vetted and are available on request for future research.

Table 2
First-Stage Estimates—Changes in Local Employment and Sectoral Shifts Predicted at the National Level (Bartik): 1990–2011

	Dependent Variable: Difference in Log Census Employment					
	(1)	(2)	(3)	(4)	(5)	(6)
	A. United States					
Census Bartik	1.246***		.317	1.786***		1.133**
	(.467)		(.550)	(.398)		(.516)
CBP/ASM Bartik		.621***	.541***		.642***	.377**
		(.175)	(.199)		(.126)	(.155)
R^2	.507	.520	.520	.567	.565	.574
First-stage F-statistic	7.128	12.548	6.240	20.109	26.138	14.965
Regression sample	Full sample	Full sample	Full sample	Common city size	Common city size	Common city size
	B. Canada					
Census Bartik	1.146***		.776***	.968***		.670**
	(.175)		(.283)	(.195)		(.303)
CBP/ASM Bartik		.520***	.334*		.448***	.286
		(.115)	(.174)		(.163)	(.222)
R^2	.480	.476	.504	.564	.559	.582
First-stage F-statistic	42.938	20.323	25.871	24.776	7.535	10.260
Regression sample	Full sample	Full sample	Full sample	Common city size	Common city size	Common city size

	C. United States and Canada					
Census Bartik	1.212***		.491	1.502***		.945***
	(.323)		(.350)	(.304)		(.354)
CBP/ASM Bartik		.595***	.473***		.596***	.374***
		(.134)	(.144)		(.100)	(.122)
R^2	.509	.520	.522	.566	.566	.575
First-stage F-statistic	14.053	19.653	9.782	24.340	35.448	20.499
Regression sample	Full sample	Full sample	Full sample	Common city size	Common city size	Common city size
US Bartik = CA Bartik						
p-value	.840	.628	.683	.840	.628	.683

Note.—The census and CBP/ASM Bartik instruments are calculated using census data and County (US) Business Patterns data or Canadian (CA) Business Patterns along with Annual Survey of Manufacturing (ASM) data, respectively. All regressions include decadal and region fixed effects; panel C interacts decadal fixed effects by country. For the full sample (cols. 1–3), Canadian metro areas have a population greater than 15,000 in 1990; US metro areas have a population greater than 50,000 in 1999. In the common city size sample (cols. 4–6), cities are chosen so that 1990 aged 24–59 city population size has a common support. Specifically, the minimum city size within each country is equal to the minimum city size in the United States and the maximum city size within each country is equal to the maximum city size in Canada based on start-of-sample population. Metros are observed in 1990, 2000, 2007, and 2011. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

first stage is stronger without US megacities.[38] For Canada in panel B, dropping the smallest cities lowers the coefficients and, not surprisingly, the first-stage *F*-statistics as the number of observations falls. Yet congruent with columns 1–3, the census Bartik outperforms the CBP/ASM Bartik in Canada for the common city size sample. The pooled regression in panel C again reflects a weighted average across Canada and the United States.

In summary, the CBP/ASM Bartik instrument is the stronger of the two instruments for the United States, while the census Bartik instrument performs better in Canada. We therefore use the first-stage specifications with both instruments (cols. 3–6) in our two-stage least-squares (2SLS) analysis in Section VI.C, since each instrument has its relative strengths in each country. However, our second-stage results do not differ much if we use only the CBP/ASM or the census Bartik instrument in the first stage, as shown in tables A7 and A8, respectively.[39]

C. Second-Stage Bartik Results

Table 3 presents the results of 2SLS regressions for several outcomes of interest on the change in log employment. These outcomes correspond to a number of issues studied above. They include controls for decadal and regional fixed effects (see n. 35). Our table 3 estimates can be interpreted as elasticities of the outcome with respect to employment, as all of the outcomes are expressed in logarithms.

For wages, the US and Canada estimates are similar: as measured by the location index in column 1, a 10% increase in employment predicts a wage increase of slightly more than 5% in either country. This estimate—which controls for the composition of workers—provides the inverse elasticity of labor supply with respect to (nominal) wages. Thus, the elasticity of labor supply with respect to wages is just below 2 in either country. This value is similar to what is seen in the literature cited earlier, although it differs slightly from the long difference estimates in Section VI.A, where Canada's supply elasticity was slightly smaller.

In column 2, the results for the population elasticity are below 1 in both the United States and Canada, meaning that the population growth in response to a local employment demand shock is less than one for one in either country. The elasticity is significantly higher for Canada relative to the United States. Column 7 provides evidence that immigrant population growth in response to local labor demand shocks may explain the relatively higher population elasticity in Canada. For Canada, a 10% increase in employment predicts a 15% increase in the fraction of the population that is foreign born.

[38] Changing tastes for city amenities (Davidoff 2016) or inelastic housing supply may dull employment effects in these cities.

[39] In table A5, we show that the census Bartiks also perform well in the 1980s, with large first-stage *F*-statistics in both countries. Note that the Canadian CBP/ASM data were unavailable for this earlier period.

Table 3
Two-Stage Least-Squares Estimates—Local Labor Market Effects of Sectoral Shifts Predicted at the National Level (Bartik), 1990–2011

	Dependent Variable: Difference In										
	Wage Location Index (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Log Unemp Rate (4)	Log Unemp Insurance (5)	Wage Skill Index (6)	Log Foreign/Pop (7)	Log Univ/Pop (8)	Log Univ/HS Wage (9)	Log 90/10 Wage (10)	Log Housing Cost (11)
Δ log employment											
× United States	.533***	.581***	.419***	−3.285***	−3.782**	−.258***	−.634	.005	.131	.359	1.653***
	(.118)	(.090)	(.090)	(.755)	(1.542)	(.052)	(.796)	(.032)	(.104)	(.240)	(.352)
Δ log employment											
× Canada	.561***	.816***	.184***	−2.191***	−1.703**	−.227***	1.545***	.171***	.178	.163	.097
	(.063)	(.066)	(.066)	(.370)	(.723)	(.034)	(.253)	(.031)	(.163)	(.146)	(.324)
Observations	1,038	1,038	1,038	1,038	966	1,038	1,038	1,038	1,038	1,038	1,038
US = CA p-value	.831	.035	.035	.193	.223	.625	.009	.000	.809	.487	.001

Note.—See the note to table 1. The sample consists of 264 metro areas in the United States and 82 in Canada observed in 1990, 2000, 2007, and 2011. Not all dependent variables are available for all metro areas. The CBP/ASM Bartik instrument is calculated using County (US) Business Patterns or Canadian (CA) Business Patterns along with the Annual Survey of Manufacturing (ASM) data, respectively. The Bartik instruments are calculated using start of sample as the base year. Within each panel, controls include decadal and census division/region fixed effects. The p-value in the bottom row is associated with the null hypothesis of equality on the coefficients (Δ log employment) across the United States and Canada. See the note to table A1 for data sources and definitions. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

For the United States, this elasticity is negative and insignificant, while the Canada-US difference in the estimates is highly significant. The higher population elasticity for Canada also explains the results in column 3. Because the population rises more with employment in Canada, the elasticity of the employment-population ratio, seen in column 3, is more modest.

The effects on the unemployment rate, seen in column 4, are similar in both countries. While the magnitude of the effect is slightly smaller in logarithms in Canada, the effect on the unemployment rate in percentage points is more similar, since Canada has on average a higher unemployment rate. In column 5 we find that unemployment benefits, which are much higher in Canada, have a relatively larger elasticity for the United States. However, for the unemployment rate and unemployment benefits, the difference in elasticities across the two countries is too imprecise to be statistically distinguishable.

In column 6 we investigate the response of the composition of worker skills to employment shocks. The wage skill index in both countries falls by roughly 2.5 percentage points for a 10-point increase in employment. In other words, the labor demand shifts predicted by the Bartik shocks on average appear to attract a less skilled workforce. Thus, observed unadjusted weekly wages rise by less than what the wage location index would imply. Not accounting for these composition changes would thus bias the labor supply elasticity upward.

In columns 7 and 8, we see significant differences between the United States and Canada with respect to the elasticities for the fraction of the population that is foreign born and the fraction that is university educated. For Canada the elasticity for the fraction with a university education is positive and highly significant, while for the United States the elasticity is close to zero and insignificant. As previously discussed, the elasticity for the fraction that is foreign born is positive and highly significant for Canada but not for the United States.

Warman and Worswick (2015) show that the percentage of new immigrants to Canada with a university degree increased in the early 1990s from around 25% to more than 50%. This influx may help explain why the fraction of university educated and foreign born reacted so much in Canada. At the same time, the greater responsiveness of university graduates in Canada implies a lower responsiveness of nongraduates. This implication appears consistent with Canada's more generous income transfer programs, which can especially dull incentives for lower-skilled workers to move (Notowidigo 2011).

Columns 9 and 10 show the employment elasticity of two measures of pay inequality: the wage difference between university- and high school–educated workers and the difference in pay between the 90th and 10th percentiles. The results are rather imprecise, showing positive point estimates for the elasticities of both inequality measures in both countries, although none of the estimates are significantly different from zero at conventional sizes.

Finally, in column 11 we estimate the elasticity of housing costs to local labor demand shocks. Here we see a strong and positive effect of an employment demand shock on housing costs in the United States but not in Canada. Because employment and housing demand track each other rather well, this implies that housing supply was much more elastic in the Canadian cities that saw demand shifts predicted by the instrument.[40]

Since housing costs reduce the purchasing power of labor income, this result implies that (pre-tax-and-transfer) real wages rise more in Canada than in the United States in response to a positive labor demand shock. Therefore, residents in Canada, particularly renters, stand to gain more from positive demand shocks and possibly lose more from negative shocks. At the same time, the lower elasticity of housing costs in Canada may be the result of greater individual and intergovernmental transfers that act as insurance across regions. Places hit with negative shocks receive greater transfers, helping to prop up falling prices. Those hit with positive shocks see fewer of those gains realized locally, raising prices by less.

The results in table 4 focus on the Canada-US differences in the elasticity estimates under several alternative specifications.[41] Panel A replicates the differences from table 3 to provide a benchmark for comparison. Panel B shows the Canada-US differences when the elasticities are estimated using the common city size sample.[42] Here we see that the wage elasticity difference grows to 0.231, although this difference is not statistically significant at the 10% level. At the same time, the Canada-US difference in the population and employment-to-population responses are smaller and no longer significant, as population growth tracks employment growth more closely in the United States outside its largest metros. Most of the other differences remain the same, although the housing cost estimate shrinks somewhat.

Panel C of table 4 shows the Canada-US differences when we use the common city size sample and the DiNardo, Fortin, and Lemieux (1996) method

[40] The three subplots in fig. A2 show the Canadian Bartik instrument plotted against the difference in the log of housing prices for the periods 1990–2000, 2000–2007, and 2007–11. The slope coefficient is negative and significant for the 1990–2000 period and positive for the latter two periods. This suggests that the lack of responsiveness in Canadian housing costs to local labor demand shocks is largely driven by the data from the 1990–2000 period. Consistent with this explanation, in our sensitivity analysis we found that the Canadian housing cost elasticity is much closer to that of the United States when the sample is restricted to exclude the 1990–2000 data. These results are available on request. Using data on housing prices in Canadian cities, Allen et al. (2009) also find that housing prices responded inconsistently across Canadian cities to labor force changes during the period 1985–2005. Explaining why the elasticity of housing costs in Canada becomes more similar to that of the United States after 2000 is an important topic for future research.

[41] See table A6 for the corresponding estimates for the 1980–90 period.

[42] A complete set of 2SLS results for the common city size specification is provided in table A4.

Table 4
Differences between the United States and Canada in Local Labor Market Outcomes due to Changes in Employment (Two Bartik Instrument Estimates), 1990–2011

	Dependent Variable: Difference In										
	Wage Location Index (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Log Unemp Rate (4)	Log Unemp Insurance (5)	Wage Skill Index (6)	Log Foreign/Pop (7)	Log Univ/Pop (8)	Log Univ/HS Wage (9)	Log 90/10 Wage (10)	Log Housing Cost (11)
	A. Original Estimates										
Δ log employment (CA − US)	.029	.235**	−.235**	1.094	2.079	.031	2.180***	.167***	.047	−.195	−1.556***
	(.134)	(.111)	(.111)	(.840)	(1.703)	(.062)	(.835)	(.044)	(.194)	(.281)	(.478)
Observations	1,038	1,038	1,038	1,038	966	1,038	1,038	1,038	1,038	1,038	1,038
	B. Common City Sizes (Prime Age from 24 Thousand to 2 Million)										
Δ log employment (CA − US)	.231	.121	−.121	.198	.344	−.096	2.109***	.184***	.315	.120	−1.361***
	(.149)	(.121)	(.121)	(.858)	(.982)	(.066)	(.766)	(.043)	(.258)	(.229)	(.521)
Observations	927	927	927	927	883	927	927	927	927	927	927

	C. Common City Sizes, Reweighted Using Demographic Characteristics										
Δ log employment (CA − US)	.355**	−.039	.039	−.897	1.228	−.016	2.172**	.160***	.337*	−.414	−1.383***
	(.174)	(.148)	(.148)	(.963)	(1.314)	(.094)	(.987)	(.055)	(.172)	(.261)	(.491)
Observations	927	927	927	927	883	927	927	927	927	927	927
	D. Common City Sizes, Reweighted Using Demographics, Industries, and Institutions										
Δ log employment (CA − US)	.325*	−.017	.017	−1.206	.257	−.011	2.053**	.188***	.352	−.304	−1.236**
	(.176)	(.131)	(.131)	(1.282)	(1.136)	(.091)	(1.030)	(.058)	(.282)	(.246)	(.485)
Observations	927	927	927	927	883	927	927	927	927	927	927

NOTE.—See the note to table 1. Data are two-stage least-squares Bartik estimates. Panel A corresponds to our original, full sample data. Panel B uses common city size support. See table A2 for the reweighting model specifications. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

to reweight Canadian cities to resemble US cities in terms of their demographic characteristics, which we discuss in Section III.D. Under this specification the difference in the wage elasticities grows from panel B and is statistically significant at the 5% level. This provides evidence that labor supply is more elastic in the United States than in Canada when we compare cities that are similar in population and demographics. As in panel B, there is no statistically significant difference in the elasticities for population and the employment-population ratio in the reweighted specification. Interestingly, the Canada-US difference in the elasticity of the university to high school wage ratio is positive and becomes statistically significant at the 10% level, as the magnitude of the difference increases only slightly and the standard errors shrink. In all other respects the elasticity estimates in panel C are similar to those in panels A and B.

Finally, in panel D we further reweight the Canadian sample with additional controls for the minimum wage and the start-of-sample shares of employment in manufacturing and in oil. Generally, the coefficients are analogous to those in panel C, with a few minor exceptions.

The takeaway from this section is that most local labor market responses to demand shifts respond similarly in Canada and the United States. However, the differing results on housing costs suggest the labor supply elasticity in terms of real wages is much lower in Canada. This could be the result of transfer programs or because of higher unobserved moving costs. Comparing cities similar in characteristics, it also appears that the supply elasticity in terms of nominal wages is lower in Canada, possibly from similar factors. The greater responsiveness of university-educated and immigrant populations could also be due to transfer or immigration policy or to institutional factors we did not account for.[43]

VII. Import Competition from Chinese Manufacturing

Our second approach to studying the local labor market responses to economic shocks focuses on import competition from China, following Autor, Dorn, and Hanson (2013). Relative to the Bartik analysis, this approach is more specific in its focus on the effect of Chinese import competition on manufacturing industries in Canada and the United States. It also has a more plausible form of exogeneity, since it depends on the rise in Chinese exports seen worldwide, not just sectoral shifts in the United States and Canada, which

[43] We note that our elasticity estimates are qualitatively different for the 1980–90 period, as seen in table A5. For instance, the wage response was much smaller in Canada. We suspect that this may have had something to do with stronger unions. We see a relatively small and nonsignificant Canada-US difference for the elasticity of the fraction of university educated. The fraction of foreign born are more responsive to employment changes in both countries, possibly more so in Canada, but not significantly.

shift for unobserved reasons. However, these "China shocks" are smaller than the Bartik shocks, which makes it harder to identify their effects on broad local labor market outcomes. Indeed, the goal here is to determine how Chinese import competition impacted local manufacturing through very specific manufacturing subsectors, whose local intensity varied considerably.

In line with previous work, our proxy for local import competition from China is given by imports per worker (IPW) for each city j, in year t, in country k:

$$\Delta \mathrm{IPW}_{jk}^{t} = \sum_{l} \frac{E_{jl}^{t}}{E_{j}^{t}} \frac{\Delta M_{lk}^{t}}{E_{lk}^{t}}, \tag{5}$$

where E_{jl}^{t}/E_{j}^{t} is the ratio of city j employment in industry l relative to the total employment, E_{j}^{t}, in city j in year t; ΔM_{lk}^{t} is the first-difference change in imports from China in industry l for country k; and E_{lk}^{t} is total employment in industry l in country k.[44] Our data are set in differences and cover two periods, 1990–2000 and 2000–2007, congruent with Autor, Dorn, and Hanson (2013).

The change in IPW varies at the local level due to specialization in (1) manufacturing relative to nonmanufacturing sectors and (2) local manufacturing industries with greater import exposure risk, e.g., exposed textile versus nonexposed defense manufacturing. The empirical structure rests on the claim that variation in IPW over time is due to structural changes as China shifted more toward a market-based economy and acceded to the World Trade Organization in 2001.

Import competition from China could have increased because domestic demand shifted to products supplied by the Chinese or because domestic industries faltered. If so, ordinary least squares estimates of the effect of changes in IPW on local outcomes will be biased. We thus follow Autor, Dorn, and Hanson (2013) by constructing an instrument using Chinese imports to other Western countries.[45] By using other Western countries' Chinese imports, this instrument is intended to isolate the influence of growth in Chinese exports on the Canadian and US manufacturing sectors as distinct from contemporaneous domestic factors. To make the first-stage estimates more comparable across the United States and Canada, we normalize the instrument for Canada by multiplying by the ratio of the US to Canadian manufacturing employment in 1990.

[44] Autor, Dorn, and Hanson (2013) use a 10-year lag of manufacturing sector employment in the construction of their instrument. Here we use contemporaneous employment since our NAICS 1997–classified manufacturing employment data for Canada begins in 1990. Note that all of the import measures are recorded in US dollars.

[45] For both Canada and the United States we use a common set of other Western countries in constructing our instrument, namely, Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland.

A. First-Stage Results

Table 5 presents results from the first-stage relationships between IPW and its instrument. We follow Autor, Dorn, and Hanson (2013) by including a control start-of-sample (census-based) manufacturing share as well as regional indicators. Due to slight differences in geography, our results are not identical to Autor, Dorn, and Hanson (2013), yet we find a highly similar first-stage relationship for the United States.

For Canada, the coefficient on the IPW instrument is smaller, by an amount that is statistically significant. Without the normalization, the effect would be smaller still, although we note that our second-stage 2SLS results are independent of instrument normalization. Indeed, it is the strength of the first-stage relationship that is of primary importance. In this respect, the IPW instrument performs well for Canada, as the first-stage F-statistic is 43.30. As Canada is an archetypal small open economy, it is not surprising that our instrument, which uses other Western countries' Chinese imports, is strongly predictive of Canadian IPW.

In panel B of table 5, we show the same first-stage regressions but using the common city size sample. This amounts to removing the largest cities in the United States and the smallest cities in Canada (see Sec. III.A.2). The magnitude of the coefficient estimates on the instrument change little when we estimate the first-stage IPW regressions using a common city sample. However, the first-stage F-statistics decline considerably, particularly for Canada, due to the large sample size reduction.

B. 2SLS Estimates

Table 6 presents the 2SLS results for the core labor market outcomes. In panel A, column 1, our estimate for manufacturing employment for US metro areas of −4.4 log points differs by only 0.2 log points from the estimate of −4.2 for US commuting zones, as reported by Autor, Dorn, and Hanson (2013). Our level of precision is also quite similar. For Canada, the decline in manufacturing employment in response to imports from China is smaller than that in the United States. The column 1 point estimate is −1.3 log points for Canada, and the precision of this estimate is very similar to the United States, with the standard error in either country being near 1 log point. The Canada-US difference in the point estimates is statistically significant, with a p-value of .04; yet the Canadian point estimate is not statistically significant.

We see similar results for the employment-population ratio.[46] The point estimate for Canada is half that of the United States but no less precise. There is evidence that increased IPW from China decreased the employment-population ratio in Canada, but the magnitude and statistical significance of

[46] Employment includes manufacturing as well as nonmanufacturing employment.

Table 5
First-Stage "China Syndrome" Estimates: Change in Local Imports Predicted by Foreign Changes

	Dependent Variable: Δ Imports from China per Worker	
	US (1)	Canada (2)
	A. Full Sample	
Δ imports from China to other countries:		
Per US worker	.770***	
	(.144)	
Per Canadian worker		.283***
		(.043)
Start-of-period manufacturing share	.028***	.059***
	(.007)	(.010)
Observations	528	164
R^2	.559	.805
First-stage F-statistic	28.67	43.30
p-value:		
Δ IPW from China to other: US = Canada	.001	
Start-of-period manufacturing share: US = Canada	.009	
	B. Common City Sizes	
Δ imports from China to other countries:		
Per US worker	.802***	
	(.175)	
Per Canadian worker		.283***
		(.084)
Start-of-period manufacturing share	.025***	.060***
	(.009)	(.011)
Observations	510	108
R^2	.495	.820
First-stage F-statistic	21.08	11.44
p-value:		
Δ IPW from China to other: US = CA	.007	
Start-of-period manufacturing share: US = Canada	.011	

NOTE.—See the note to table 1. Panel A uses the full sample. In panel B, metros are chosen so that 1990 aged 24–59 metro population size has a common support. Specifically, the minimum metro size within each country is equal to the minimum metro size in the United States and the maximum metro size within each country is equal to the maximum metro size in Canada using start-of-sample population. Metros are observed in 1990, 2000, and 2007. In both columns, controls include decadal fixed effects and census division (col. 1, United States) or region (col. 2, Canada) fixed effects. Predicted imports per workers are constructed using imports from Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland ("other countries"). Imports from China to other countries for Canada are adjusted using the 1990 relative manufacturing employment between the United States and Canada of 0.1064. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses. IPW = imports per worker.

*** Significant at the 1% level.

Table 6
Instrumental Variable Estimates of the Impact of Import Competition on Local Labor Markets in the United States and Canada, 1990–2007

	Dependent Variable: Decadal Change In				
	Log Manuf Emp (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Manuf Location Wage (4)	Log Unemp Rate (5)
	A. United States				
Δ imports from China to US per worker	−.044***	.001	−.010***	−.004	.057**
	(.011)	(.010)	(.004)	(.004)	(.026)
Start-of-period manufacturing share	.002	−.001	−.0002	−.002**	.003
	(.002)	(.001)	(.0003)	(.001)	(.003)
Observations	528	528	528	528	528
	B. Canada				
Δ imports from China to Canada per worker	−.013	.010	−.005**	−.006	.005
	(.010)	(.013)	(.003)	(.005)	(.030)
Start-of-period manufacturing share	−.002	−.0001	.001***	.002***	−.002
	(.003)	(.001)	(.0002)	(.001)	(.005)
Observations	164	164	164	164	164
Δ IPW US = Canada *p*-value	.040	.577	.250	.751	.179

NOTE.—See the note to table 1. The sample consists of 264 metro areas in the United States and 82 in Canada observed in 1990, 2000, and 2007. Not all dependent variables are available for all metro areas. See the note to table 5 for descriptions of the imports per worker variables. Controls include census division/region and decadal fixed effects. See the note to table A1 for data sources and definitions. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses. IPW = imports per worker.
** Significant at the 5% level.
*** Significant at the 1% level.

this effect is much stronger in the United States. Thus, it appears that import competition from China had a smaller effect on manufacturing employment in Canada than in the United States. This is consistent with the aggregate trends outlined in figure 2, which show that the decline in Canadian manufacturing over the period 1990–2007 was moderate in comparison to the United States.

Our point estimates hint that the increase in Chinese imports may have lowered manufacturing wages, but the estimates are insignificant in both countries. For Canada, we find little evidence that Chinese imports had any effect on the unemployment rate. For the United States, we find a positive and statistically significant effect on the unemployment rate, as in Autor, Dorn, and Hanson (2013).

Table 7 presents differences in the Canada-US estimates under several alternative specifications. For the common city size specification, panel B shows that the Canada-US difference for the manufacturing employment point esti-

Table 7
Differences between the United States and Canada in Local Labor Market Outcomes due to Import Competition from China, 1990–2007

	Dependent Variable: Difference In				
	Log Manuf Emp (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Manuf Location Wage (4)	Log Unemp Rate (5)
	A. Original Estimates				
Δ imports from China per worker (CA − US)	.031**	.009	.005	−.002	−.052
	(.015)	(.016)	(.004)	(.006)	(.038)
Observations	692	692	692	692	692
	B. Common City Sizes (Prime Age from 24 Thousand to 2 Million)				
Δ imports from China per worker (CA − US)	.022	.006	.002	−.004	−.029
	(.019)	(.009)	(.004)	(.006)	(.037)
Observations	618	618	618	618	618
	C. Common City Sizes, Reweighted Using Demographic Characteristics				
Δ imports from China per worker (CA − US)	−.012	.017**	.003	−.020	−.053
	(.067)	(.007)	(.004)	(.022)	(.040)
Observations	618	618	618	618	618
	D. Common City Sizes, Reweighted Using Demographics, Industries, and Institutions				
Δ imports from China per worker (CA − US)	.021	.012	.004	−.007	−.060*
	(.035)	(.007)	(.003)	(.009)	(.035)
Observations	618	618	618	618	618

NOTE.—See the note to table 1. Data are two-stage least-squares import per worker estimates. Panel A corresponds to our original, full sample data from table 6. Panel B uses common city size support as in table A9. See table A2 for the reweighting model specifications. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.

mate falls from 0.31 to 0.22 and is now insignificant.[47] In panel C, we reweight on the basis of the start-of-sample share of the population with a university degree and the share of foreign born. In this specification, we find the Canada-US difference in manufacturing employment shrinks and switches signs, although it becomes very imprecise, pointing to limits in the reweighting strategy. In panel D, when we reweight further using start-of-sample manufacturing and

[47] The 2SLS estimates for the common city size specification are reported in table A9.

oil shares as well as minimum wage, the Canada-US difference in manufacturing employment goes back up to 0.21 but remains imprecise.

In sum, it appears that Chinese import competition had a milder effect on manufacturing sector employment in Canada relative to the United States. We also saw milder effects on unemployment and the employment-population ratio, although the difference was not significant. However, when comparing similar-looking cities, we found that the differences became less distinct; unfortunately, the instrument gets much weaker when we eliminate the smaller, harder-to-compare Canadian cities.

It is worth contrasting these China shock results to the Bartik analysis. While the Bartik instrument captures omnibus (typically positive) demand shocks, the China shock is more specific in its focus on the (negative) employment effects of Chinese import competition. We would expect to see similarities in the Canada-US differences in the response to each of the two shocks. In the first-stage Bartik results (panels A and B of table 2), we saw that the coefficient on the Bartiks for the United States are nearly all larger than for Canada, although the difference is statistically significant only in column 4. With the China shock we also saw a stronger negative response to manufacturing employment for the United States relative to Canada. Therefore, both sets of results suggest that local labor markets in the United States are slightly more responsive to external demand shocks.

VIII. Conclusion

Our analysis provides a novel examination of labor market dynamics across two major economies, the United States and Canada. While both countries have experienced similar structural transformations—such as declines in their manufacturing sectors and increased import competition from China—they differ moderately in institutions, transfer generosity, and immigration policy. Building on other studies that examined the United States in isolation, we provide a unique synthesis and careful side-by-side comparison with Canada. Studying the United States and Canada in tandem also provides a unique opportunity to examine the external validity of prior research on the United States while learning more about local Canadian labor markets.

In both countries, we see greater concentrations of income and inequality in larger cities, but in the United States this association is considerably stronger. We also see more pronounced patterns of urban sorting in Canada among its larger and more educated foreign-born population. In both countries, we observe persistent differences in earnings across cities. This is true despite the fact that Canadians have moved more toward high-wage areas while Americans have not.

We also find much in common across both countries when we examine the causal responses to changes in local labor market conditions. In reaction to omnibus local labor demand shifts, it appears that cities in the United States and Canada face similar upward-sloping supply curves in terms of nominal wage changes. When we compare Canadian and US cities that have similar features, the US supply curve looks slightly more elastic. The US supply curve also looks more elastic in terms of real wages, as housing-cost increases eroded nominal wage gains more than in Canada. At the same time, Canadian cities saw immigrants react more proportionally to demand shifts, even while they represent a heavier share of workers. Relative to the United States, university graduates in Canada were also more responsive than nongraduates. We also saw hints that US employment rates were slightly more sensitive to shifts in demand. This difference between the United States and Canada is more pronounced when we examine how Chinese import competition reduced manufacturing employment.

The reasons for Canada-US differences in local labor markets remain open questions: They could be due to institutional or structural reasons our methods could not isolate. However, our results do suggest potential paths for future research. That immigrants in Canada were more heavily urban and responsive to labor demand shifts may be due to Canada's more skill-oriented immigration policy. Because the emphasis on family reunification is weaker, it would be interesting to see if immigrant enclaves in Canada predict population growth less in Canada. More skilled immigrants may also provide greater positive spillovers by providing skill complementarities that raise the wages of lower-skilled workers or by establishing more firms.

In Canada, the greater responsiveness to demand of nominal wages and university graduates and the lower responsiveness of housing costs are consistent with the country's more generous transfer policies. The link is still tenuous, and so it would be useful for future researchers to collect transfer data at the individual level to assess how important these policies are in affecting employment and migration decisions. Indeed, many Americans want to know whether more generous transfers would protect US communities from future economic changes, while Canadians may want to know whether market-oriented reforms may encourage greater mobility to high-growth labor markets.

Appendix A

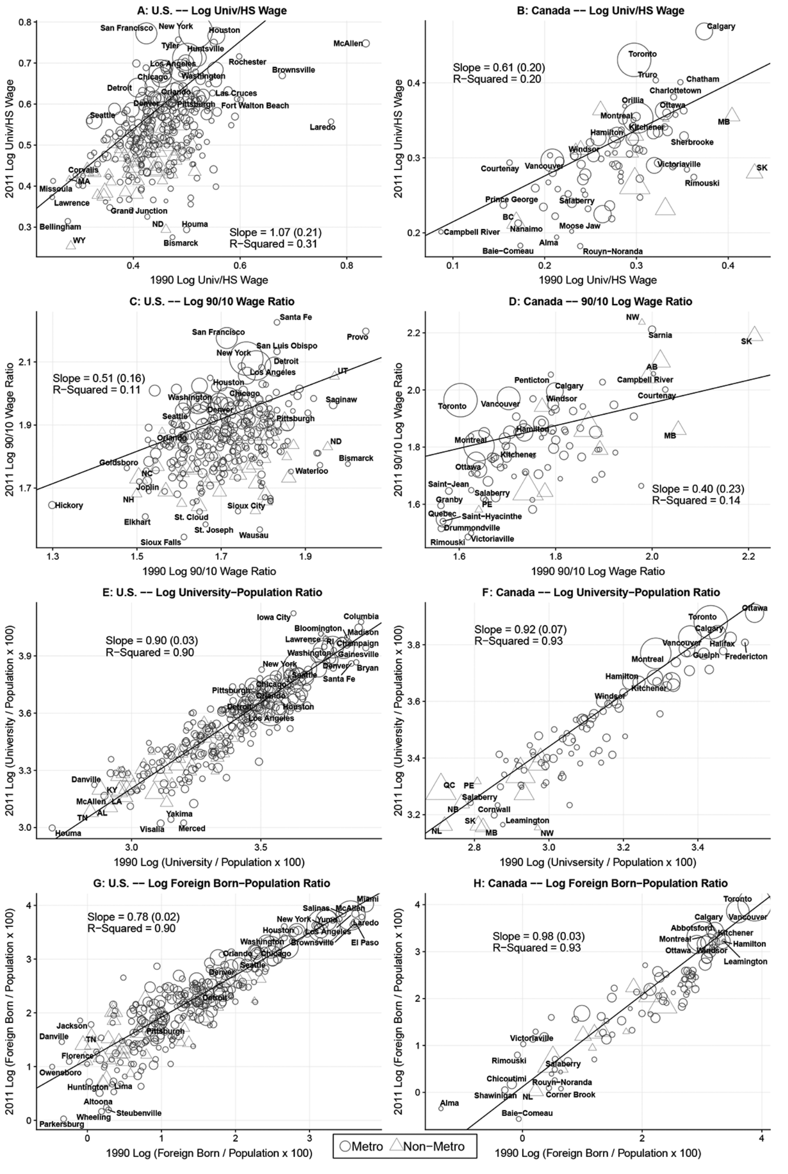

Fig. A1.—University–high school wage, 90/10 wage, university-population, and foreign born–population ratios. The points, means, standard deviations, and regression line are weighted by population aged 24–59. The text within each plot shows the slope of the weighted regression line with its heteroskedasticity-robust standard error in parentheses. A color version of this figure is available online.

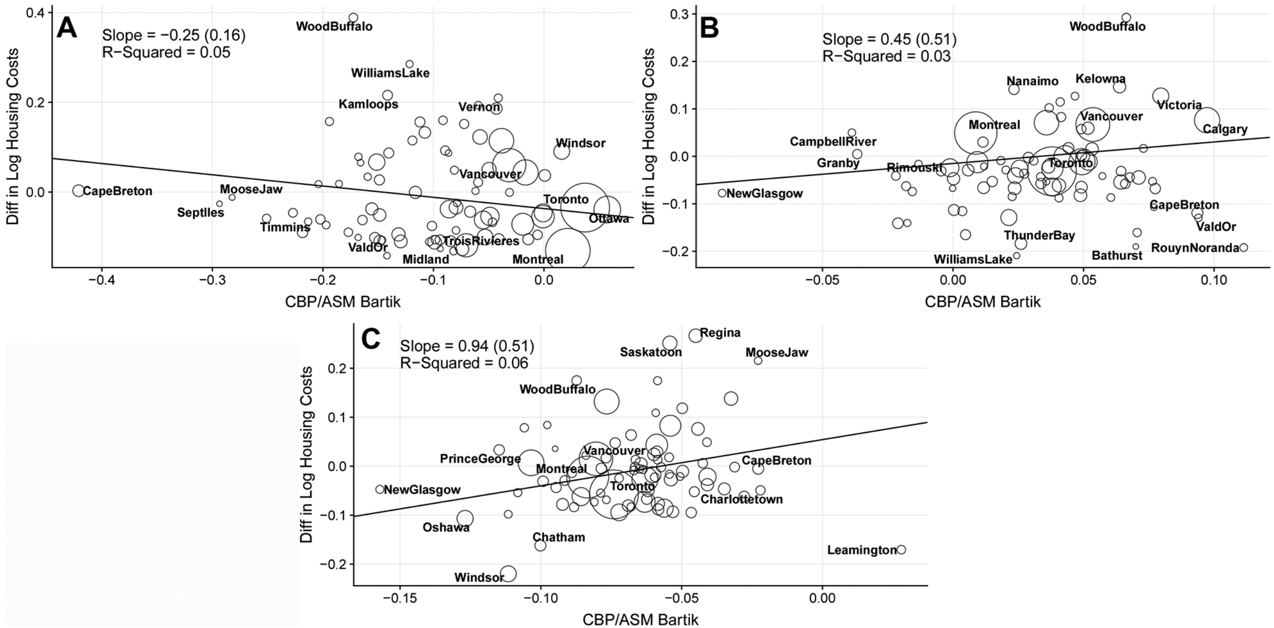

FIG. A2.—Canadian Bartik shocks and the growth in housing costs. The points and the regression line are weighted by population aged 24–59. The text within each plot shows the slope of the weighted regression line with its heteroskedasticity-robust standard error in parentheses. ASM = Annual Survey of Manufacturing; CBP = Canadian Business Patterns.

Table A1
Local Labor Market Outcomes for the United States and Canada for Prime-Age Population (24–59), 1990–2011

	United States				Canada			
	1990 (1)	2000 (2)	2007 (3)	2011 (4)	1990 (5)	2000 (6)	2007 (7)	2011 (8)
	A. Working-Age Population (Thousands)							
Mean	2,617	2,880	2,974	2,988	844	1,018	1,095	1,167
SD	(3,051)	(3,310)	(3,376)	(3,379)	(783)	(937)	(1,011)	(1,075)
	B. Employment-Population Ratio (%)							
Mean	78.6	76.3	77.1	75.3	77.1	78.9	80.0	79.5
SD	(3.4)	(4.0)	(2.7)	(3.2)	(3.8)	(3.2)	(2.6)	(2.6)
	C. Weekly Wage (USD 2010)							
Mean	936	1,070	1,055	972	814	858	901	989
SD	(123)	(154)	(156)	(148)	(65)	(87)	(115)	(133)
	D. Unemployment Rate (%)							
Mean	4.54	3.77	4.88	8.13	8.61	5.67	5.01	5.96
SD	(1.02)	(1.05)	(.94)	(1.71)	(1.86)	(1.64)	(1.20)	(1.22)

	E. University-Population Ratio (%; Katz-Murphy Measure)							
Mean	31.3	32.1	33.9	35.7	25.3	30.7	34.5	37.5
SD	(5.2)	(5.7)	(5.9)	(6.2)	(3.8)	(4.6)	(5.1)	(5.3)
	F. Foreign Born–Population Ratio (%)							
Mean	12.8	18.1	21.1	22.2	24.5	26.9	28.3	29.5
SD	(10.8)	(13.3)	(13.7)	(13.6)	(14.6)	(16.9)	(17.6)	(17.5)
	G. Union Coverage (%)							
Mean	19.2	15.1	13.6	13.1	32.0	27.8	27.2	26.6
SD	(8.4)	(6.9)	(6.8)	(6.4)	(6.5)	(6.7)	(6.5)	(7.0)
	H. Unemployment Insurance (USD per Capita)							
Mean	254	190	224	724	1,376	622	601	720
SD	(125)	(85)	(102)	(260)	(246)	(220)	(215)	(220)

NOTE.—The sample consists of 264 metro areas in the United States and 82 in Canada observed in 1990, 2000, 2007, and 2011. All variables (excluding unemployment insurance) are measured for the 24–59 working-age population. Weekly wages and unemployment insurance are in 2010 US dollars, and weekly wages and manufacturing share are compiled using year $t - 1$ data. The unemployment insurance is annual dollars per person, and unemployment insurance is not available for all metros in all time periods. Canadian metro areas are those with a population greater than 15,000 in 1990; US metro areas have a population greater than 50,000 in 1999. Averages and standard deviations are weighted by start-of-period population. Data definitions are in Sec. III.

Table A2
Probit Models Predicting a US Indicator—United States and Canada

	Dependent Variable: US Dummy	
	(1)	(2)
Foreign born/population	−6.023***	−5.727***
	(.789)	(.837)
University/population	9.909***	11.295***
	(2.409)	(2.714)
Manufacturing		.030*
Share		(.018)
Oil share		.325
		(.244)
Minimum wage		.302
		(.273)
Constant	−.802	−3.600**
	(.644)	(1.827)
Observations	309	309
Log likelihood	−67.213	−65.604
Akaike information criterion	140.427	143.209

NOTE.—Data are probit estimates where the left-hand side variable is a US dummy.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table A3

Predicted Probabilities for Select Metros

Bottom 10		Top 10	
Metro	Probability	Metro	Probability
A. Using Population Demographics			
Toronto	.19	Chicoutimi	.90
Abbotsford	.34	Ottawa	.90
Vancouver	.35	Saskatoon	.90
Chilliwack	.39	Sherbrooke	.91
Hamilton	.40	Charlottetown	.94
Windsor	.42	St. John’s	.94
St Catharines	.43	Halifax	.95
Oshawa	.45	Rimouski	.95
Kitchener	.47	Quebec	.95
Brantford	.49	Fredericton	.97
B. Using Population, Industry, and Institutions			
Chilliwack	.23	Granby	.84
Toronto	.24	Drummondville	.86
Abbotsford	.26	Ottawa	.86
Vancouver	.30	Halifax	.88
Nanaimo	.41	Trois-Rivieres	.89
Kelowna	.44	Rimouski	.90
Wood Buffalo	.46	Chicoutimi	.90
Kamloops	.46	Sherbrooke	.90
Prince George	.47	Fredericton	.91
St Catharines	.48	Quebec	.92

NOTE.—Data are predicted probabilities of a US dummy from probit specifications. See table A2 for model specifications.

Table A4
Two-Stage Least-Squares Common City Size Estimates of Changes in Local Labor Market Outcomes due to Changes in Employment (Two Bartik Instrument Estimates): 1990–2011

	Dependent Variable: Difference In										
	Wage Location Index (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Log Unemp Rate (4)	Log Unemp Insurance (5)	Wage Skill Index (6)	Log Foreign/ Pop (7)	Log Univ/Pop (8)	Log Univ/HS Wage (9)	Log 90/10 Wage (10)	Log Housing Cost (11)
Δ log employment ×											
United States	.447***	.634***	.366***	−2.799***	−2.277***	−.198***	−.574	−.006	−.061	.008	1.501***
	(.085)	(.058)	(.058)	(.486)	(.613)	(.037)	(.672)	(.022)	(.054)	(.126)	(.347)
Δ log employment ×											
Canada	.679***	.756***	.244**	−2.601***	−1.932**	−.294***	1.535***	.177***	.254	.128	.140
	(.123)	(.106)	(.106)	(.708)	(.767)	(.055)	(.367)	(.036)	(.252)	(.191)	(.388)
Observations	927	927	927	927	883	927	927	927	927	927	927
US = CA p-value	.121	.316	.316	.818	.726	.145	.006	.000	.223	.600	.009

Note.—See the note to table 1. The sample consists of 255 metro areas in the United States and 54 in Canada observed in 1990, 2000, 2007, and 2011. Not all dependent variables are available for all metro areas. The CBP/ASM Bartik instrument is calculated using County (US) Business Patterns or Canadian (CA) Business Patterns along with the Annual Survey of Manufacturing (ASM) data, respectively. The Bartik instruments are calculated using start of sample as the base year. Within each panel, controls include decadal and census division/region fixed effects. Cities are chosen so that 1990 aged 24–59 city population size has a common support. The p-value in the bottom row is associated with the null hypothesis of equality on the coefficients (Δ log employment) across the United States and Canada. See the note to table A1 for data sources and definitions. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses.

** Significant at the 5% level.

*** Significant at the 1% level.

Table A5
Two-Stage Least-Squares Estimates—Local Labor Market Effects of Sectoral Shifts Predicted at the National Level (Bartik), 1980–90

	Dependent Variable: Difference In									
	Wage Location Index (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Log Unemp Rate (4)	Wage Skill Index (5)	Log Foreign/Pop (6)	Log Univ/Pop (7)	Log Univ/HS Wage (8)	Log 90/10 Wage (9)	Log Housing Cost (10)
Δ log employment ×										
United States	.775**	.996***	.004	1.242*	−.014	1.381**	.128*	−.012	−.341*	1.611**
	(.351)	(.077)	(.077)	(.694)	(.058)	(.681)	(.065)	(.089)	(.195)	(.755)
Δ log employment ×										
Canada	.143	.955***	.045	−.355	−.011	2.617***	.162***	−.221***	−.431	−.215
	(.153)	(.135)	(.135)	(.665)	(.050)	(.532)	(.049)	(.060)	(.315)	(.201)
Observations	346	346	346	346	346	346	346	346	346	346
US First-stage F	22.36	22.36	22.36	22.36	22.36	22.36	22.36	22.36	22.36	22.36
CA First-stage F	46.38	46.38	46.38	46.38	46.38	46.38	46.38	46.38	46.38	46.38
US = CA p-value	.100	.795	.795	.098	.978	.154	.678	.053	.808	.020

NOTE.—See the note to table 1. The sample consists of 264 metro areas in the United States and 82 in Canada observed in 1980. Controls include census division/region fixed effects. The p-value in the bottom row is associated with the null hypothesis of equality on the coefficients (Δ log employment) across the United States and Canada. See the note to table A1 for data sources and definitions. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table A6
Two-Stage Least-Squares Bartik Estimates—Difference between the United States and Canada in the 1980s

	Dependent Variable: Difference In									
	Wage Location Index (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Log Unemp Rate (4)	Wage Skill Index (5)	Log Foreign/Pop (6)	Log Univ/Pop (7)	Log Univ/HS Wage (8)	Log 90/10 Wage (9)	Log Housing Cost (10)
	A. Original Estimates									
Δ log employment (CA − US)	−.632*	−.040	.040	−1.596*	.002	1.236	.034	−.209*	−.090	−1.826**
	(.383)	(.155)	(.155)	(.961)	(.076)	(.864)	(.082)	(.108)	(.370)	(.781)
Observations	346	346	346	346	346	346	346	346	346	346
	B. Common City Sizes (Prime Age from 24 Thousand to 2 Million)									
Δ log employment (CA − US)	−.242	.049	−.049	−1.066	.039	1.423**	.046	−.291***	.108	−1.032***
	(.200)	(.147)	(.147)	(.898)	(.073)	(.581)	(.051)	(.078)	(.276)	(.302)
Observations	309	309	309	309	309	309	309	309	309	309

Table A6 (*Continued*)

	Dependent Variable: Difference In									
	Wage Location Index (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Log Unemp Rate (4)	Wage Skill Index (5)	Log Foreign/Pop (6)	Log Univ/Pop (7)	Log Univ/HS Wage (8)	Log 90/10 Wage (9)	Log Housing Cost (10)
	C. Common City Sizes, Reweighted Using Demographic Characteristics									
Δ log employment (CA − US)	−.457***	−.159	.159	−2.843**	.100	1.143**	.019	−.384***	−.242	−1.159***
	(.166)	(.182)	(.182)	(1.108)	(.074)	(.441)	(.061)	(.086)	(.435)	(.314)
Observations	309	309	309	309	309	309	309	309	309	309
	D. Common City Sizes, Reweighted Using Demographics, Industries, and Institutions									
Δ log employment (CA − US)	−.463**	−.145	.145	−2.829***	.112	1.351**	.028	−.367***	−.169	−1.250***
	(.183)	(.172)	(.172)	(1.075)	(.075)	(.538)	(.065)	(.066)	(.427)	(.299)
Observations	309	309	309	309	309	309	309	309	309	309

NOTE.—See the note to table 1. Panel A corresponds to the full sample data in the 1980s. Panel B uses common city size support. See table A2 for the reweighting model specifications. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Table A7
Using Only CBP Bartiks: Two-Stage Least-Squares Estimates—Local Labor Market Effects of Sectoral Shifts Predicted at the National Level (Bartik), 1990–2011

	Dependent Variable: Difference In										
	Wage Location Index (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Log Unemp Rate (4)	Log Unemp Insurance (5)	Wage Skill Index (6)	Log Foreign/Pop (7)	Log Univ/Pop (8)	Log Univ/HS Wage (9)	Log 90/10 Wage (10)	Log Housing Cost (11)
Δ log employment ×											
United States	.518***	.580***	.420***	−3.211***	−3.643**	−.260***	−.481	−.006	.113	.302	1.696***
	(.113)	(.090)	(.090)	(.747)	(1.551)	(.054)	(.752)	(.034)	(.094)	(.228)	(.329)
Δ log employment ×											
Canada	.453***	.834***	.166*	−2.399***	−1.404	−.219***	1.722***	.192***	.351**	.416*	−.120
	(.069)	(.091)	(.091)	(.738)	(1.832)	(.053)	(.409)	(.044)	(.138)	(.253)	(.394)
Observations	1,038	1,038	1,038	1,038	966	1,038	1,038	1,038	1,038	1,038	1,038
US = CA p-value	.623	.047	.047	.439	.351	.585	.010	.000	.155	.737	.000

NOTE.—See the note to table 1. The sample consists of 264 metro areas in the United States and 82 in Canada observed in 1990, 2000, 2007, and 2011. Not all dependent variables are available for all metro areas. The CBP/ASM Bartik instrument is calculated using County (US) Business Patterns or Canadian (CA) Business Patterns along with the Annual Survey of Manufacturing (ASM) data, respectively. The Bartik instruments are calculated using start of sample as the base year. Within each panel, controls include decadal and census division/region fixed effects. The p-value in the bottom row is associated with the null hypothesis of equality on the coefficients (Δ log employment) across the United States and Canada.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table A8
Using Only Census Bartiks: Two-Stage Least-Squares Estimates—Local Labor Market Effects of Sectoral Shifts Predicted at the National Level (Bartik), 1990–2011

	Dependent Variable: Difference In										
	Wage Location Index (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Log Unemp Rate (4)	Log Unemp Insurance (5)	Wage Skill Index (6)	Log Foreign/ Pop (7)	Log Univ/ Pop (8)	Log Univ/HS Wage (9)	Log 90/10 Wage (10)	Log Housing Cost (11)
Δ log employment ×											
United States	.616***	.589***	.411***	−3.709***	−4.594**	−.245***	−1.519	.066*	.237	.688	1.405**
	(.194)	(.131)	(.131)	(1.131)	(1.981)	(.066)	(1.194)	(.036)	(.209)	(.535)	(.630)
Δ log employment ×											
Canada	.659***	.799***	.201**	−2.004***	−1.781	−.235***	1.386***	.152***	.022	−.065	.293
	(.058)	(.089)	(.089)	(.483)	(1.131)	(.027)	(.162)	(.024)	(.214)	(.105)	(.275)
Observations	1,038	1,038	1,038	1,038	966	1,038	1,038	1,038	1,038	1,038	1,038
US = CA p-value	.832	.184	.184	.166	.218	.889	.016	.048	.474	.168	.106

Note.—See the note to table 1. The sample consists of 264 metro areas in the United States and 82 in Canada observed in 1990, 2000, 2007, and 2011. Not all dependent variables are available for all metro areas. The CBP/ASM Bartik instrument is calculated using County (US) Business Patterns or Canadian (CA) Business Patterns along with the Annual Survey of Manufacturing (ASM) data, respectively. The Bartik instruments are calculated using the start of sample as the base year. Within each panel, controls include decadal and census division/region fixed effects. The p-value in the bottom row is associated with the null hypothesis of equality on the coefficients (Δ log employment) across the United States and Canada.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table A9
Common City Size Two-Stage Least-Squares Estimates—the Impact of Import Competition on Local Labor Markets in the United States and Canada, 1990–2007

	Dependent Variable: Decadal Change In				
	Log Manuf Emp (1)	Log Population (2)	Log Emp/Pop Ratio (3)	Manuf Location Wage (4)	Log Unemp Rate (5)
	A. United States				
Δ imports from China to US per worker	−.033***	.009	−.008***	−.001	.030*
	(.009)	(.007)	(.003)	(.003)	(.016)
Start of period	.001	−.002*	−.0002	−.001***	.004*
Manufacturing share	(.001)	(.001)	(.0003)	(.0004)	(.003)
Observations	510	510	510	510	510
	B. Canada				
Δ imports from China to Canada per worker	−.012	.015**	−.006**	−.005	.002
	(.017)	(.006)	(.003)	(.005)	(.036)
Start of period	−.002	−.0001	.001***	.002***	−.002
Manufacturing share	(.004)	(.001)	(.0003)	(.001)	(.005)
Observations	108	108	108	108	108
Δ IPW US = Canada p-value	.241	.494	.546	.543	.441

Note.—See the note to tables 1 and 5. The sample consists of 255 metro areas in the United States and 54 in Canada observed in 1990, 2000, and 2007. Not all dependent variables are available for all metro areas. Controls include census division/region and decadal fixed effects. Metros are chosen so that 1990 aged 24–59 metro population size has a common support. See the note to table A1 for data sources and definitions. Regressions are weighted by start-of-period population aged 24–59. Heteroskedasticity-robust standard errors clustered at the state/province level are in parentheses.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Appendix B

Data Appendix

B1. University Variable

We follow Katz and Murphy (1992), who create university (bachelor's only) and high school (12 years in the United States and 11–13 in Canada) equivalents. The measure adds workers with less than a high school diploma to high school and those with more than a bachelor's to university. Those in between are divided with two-thirds to high school and one-third to university. Auxiliary regressions based on cross-sectional wage structures suggest that this is roughly correct, although the some-college group may in fact be closer to high school for Canadians. There are some additional challenges in classifying education. While the United States has a standardized 4 years of high school and university, Canada has a system that varies more by province. In Quebec, secondary school ends at grade 11, and then students can continue on with Collège d'Enseignement Général et Professionnel. In Ontario, they had grade 13 until 1987. Subsequently, students not planning on attending university ended high school at grade 12, while students planning to go on to university took an additional year (Ontario Academic Credit [OAC]). After 2003, grade 12 is the last grade of high school for all students after the OAC was phased out. We group education into five groups based on the highest level of education achieved: less than high school, high school, a postsecondary degree below a bachelor's degree, a bachelor's degree, and a graduate degree prior to defining our university equivalent.

B2. Housing Costs

We calculate housing costs from census data on gross monthly rents or by imputing rents from owned units, similar to Albouy, Leibovici, and Warman (2013). We control for housing characteristics—namely, the number of rooms and the age of the structure—to construct a housing index based only on location.

B3. Other Data

B3.1. UN Comtrade Database

Our trade data comes from the UN Comtrade database. From this data set, we retain exports from China to the United States, Canada, and other developed countries at the six-digit harmonized system product level. We aggregate the US trade data to the SIC 1987 three-digit level in 2007 US dollars. The Canadian trade data are aggregated to the NAICS 1997 four-digit level in 2007 US dollars to align with the industry classification of our Canadian CBP/ASM data.

B3.2. Transfer Data

The Canadian unemployment insurance[48] data come from the T1 Family File.[49] This contains city-level total unemployment insurance as well as the number of tax filers collecting unemployment insurance, so we are able to create measures of unemployment insurance per person. Similarly, we obtain unemployment insurance data from the Bureau of Economic Analysis at the county level. We then convert these data to the metro-area level of aggregation.

B3.3. Union Data

For Canada, we calculate the city-level unionization rates from the Master File LFS. Unfortunately, questions about unionization were added only in 1997; therefore, for 1991 we extrapolate backward.[50] We use 2-year averages when calculating the city average union rates (including the previous year) to ensure that we have accurate measures for the smaller cities. For the United States, we obtain unionization rates from http://www.unionstats.com/, which are calculated from the CPS.[51]

B3.4. World KLEMS Data

We use World KLEMS data for Canada and the United States to provide an aggregate perspective on labor dynamics in both countries during our study period.[52] The KLEMS initiative uses a harmonized growth accounting framework, which ensures that our Canada-US comparisons use variables that are measured using a common methodology.

B4. SIC-E 1980 to NAICS 1997 Crosswalk

We structure our crosswalk using Statistics Canada's concordance table between SIC-E 1980 and NAICS 1997.[53] This concordance table provides a

[48] In 1996, unemployment insurance was renamed employment insurance in Canada. Given that "unemployment insurance" is the term used in the United States, we use it throughout the paper to avoid confusion.

[49] For 2011 we downloaded the data directly from CANSIM, while for the preceding years we purchased tables from Statistics Canada.

[50] We extrapolate from 1997–98 to 1991 using provincial unionization rates, which we obtained from the 1990 Labour Market Activity Survey with our 1997–98 LFS city rates and 1997–98 LFS provincial rates.

[51] The LFS and CPS do not identify union rates for all of the cities we require. For Canada, we have union rates for 71 of the 82 cities in 1990, 2001, and 2011 and 60 in 2007. For the United States, of the 264 cities we have union rates for 174 in 1990, 182 in 2011, and 194 in 2007 and 2011. We impute the union rates for the remaining cities.

[52] The Canada and US data were downloaded from the World KLEMS website. Documentation for the Canada and US KLEMS data sets are provided in Gu (2012) and in Ho, Jorgenson, and Samuels (2012), respectively.

[53] Statistics Canada's industrial concordance tables are available at https://www.statcan.gc.ca/eng/concepts/concordances-classifications.

one-to-many mapping between SIC-E 1980 four-digit and NAICS 1997 six-digit codes. Unfortunately, there are no weights for the one-to-many mappings, so the Statistics Canada concordance table cannot be directly used to crosswalk the data.

We create the crosswalk weights using micro data from CDER's T2-Longitudinal Employment Analysis Program (T2-LEAP). A limitation of the T2-LEAP data is that the NAICS classification is limited to four digits. Accordingly, we collapse the original Statistics Canada's concordance table to a SIC-E 1980 three-digit to NAICS 1997 four-digit concordance table. We leverage the fact that in the crossover year of 1997, T2-LEAP has both SIC-E 1980 and NAICS 1997 industrial classification for many enterprises in the data. Using these data, we calculate our weights as the share of SIC-E–classified T2-LEAP employment in each NAICS cell for all one-to-many mappings in the SIC-E 1980 three-digit to NAICS 1997 four-digit concordance table. One-to-one mappings in the concordance table are assigned a crosswalk weight of 1.

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