Local Labor Markets in Canada and the United States*

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June 15, 2017
PRELIMINARY AND INCOMPLETE – DO NOT CITE

Abstract

This paper examines and compares local labor market in the United States and Canada. Using both households and businesses data, we examine general labor market patterns and use the Bartik instrument as well as examine the China Shock to examine how U.S and Canadian workers respond differently to these industrial shifts. We find that Canada was also hurt by the negative effects of the China Shock.

on most labor market outcomes, such as on employment

Employment varies more in Canada, while wages and skill levels vary less. suggesting weaker agglomeration economies and skill sorting. Majority non-English communities (Francophone and Hispanophone) in each country display distinct wage levels, skills, and inequality. We also examine patterns in labor market institutions and skill prices. Shifts in labor demand have much weaker effects on employment and wages in Canada, although greater effects on unemployment.

JEL classification: J21, J31, J61, R12, N32 *Keywords*: Labor demand, wage structure, regional economies, mobility, China shock, Bartik instrument

*We appreciate helpful feedback from David Card, Brian Kovak, Peter Kuhn, Ethan Lewis, and Lance Lochner, as well as comments from participants at the 2016 NBER conference "Public Policies in Canada and the United States" in Ottawa, the 2016 Canadian Economic Association Meetings, and the 2016 Atlantic Canadian Economic Meetings in Sackville, NB. The Canadian analysis presented in this paper was mainly conducted at the Atlantic Research Data Centre, which is part of the Canadian Research Data Centre Network (CRDCN). The services and activities provided by the Atlantic Research Data Centre are made possible by the financial or in-kind support of the SSHRC, the CIHR, the CFI, Statistics Canada and Dalhousie University. The views expressed in this paper do not necessarily represent the CRDCN or those of its partners. We are also grateful to RDC analyst Heather Hobson for her assistance, as well as Yasmine Amirkhalkhali, Mark Bennett, and Lachlan MacLeod. The U.S. Census data comes from the IPUMS-USA, University of Minnesota, www.ipums.org (Ruggles et al. (2015)). All errors are our own.

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1 Introduction

Canada and the United States share an incredible array of modern, developed cities across the North American continent. There are many reasons to believe that local labor markets in these two countries should operate similarly. Both countries share a common border from sea to sea, a similar history of settlement, and cities that resemble each other in age and in structure. While both countries have vast geographies, their people are interconnected through extensive highways, rail, and air, and mostly share a common language, English. Furthermore, the countries are each other's largest trading partner, are fairly similar in labor market institutions, as well as industrial composition.

Nevertheless, there are some reasons to believe their labor markets may operate differently. Transfers to individuals and to local governments are much larger in Canada, which may insulate their cities from economic disruptions. At one tenth the population, Canadians also have fewer options over where to live and work, although Canada's land area is slightly larger than the U.S. Furthermore, labor protections from laws, as well as unions, tend to be stronger in Canada.

Below, we perform the very first comprehensive analysis of U.S. and Canadian local labor markets in a unified empirical setting. By using similar data, time periods, and methods, we are able to draw clearer conclusions about how the two countries resemble and differ from each other. The first set of questions we consider involve inequality in labor market outcomes both across and within metropolitan areas (the areas which we consider to be local labor markets). For instance, are wage and employment outcomes more spatially differentiated in Canada or in the U.S.? Is income inequality more spatially concentrated? The second set of questions involve how workers are affected by shifts in local labor market demand. For instance, do U.S. wages exhibit greater flexibility in response to changing demand? Do workers exhibit greater mobility? Were U.S. or Canadian manufacturing jobs more devastated by imports from China?

Most of the work on growth and inequality across regions — see Barro et al. (1991), for the U.S., and Coulombe and Lee (1995) for Canada — has focused on differences across large areas using macro data. Analyses using metropolitan areas, and especially using micro data are relatively rare. Long-standing work has examined the urban wage differences, finding wages increase with city size, and fall with amenities — for contemporary approaches examining these issues together with the role of selection and amenities in U.S. data, see Glaeser and Maré (2001), Baum-Snow and Pavan (2013), and Albouy (2016). Recent work by Baum-Snow and Pavan (2012) has highlighted how growing national wage inequality has taken place disproportionately within the largest U.S. cities. Moretti (2013) and Diamond (2016) document rising levels of sorting of university graduates in the United States, which is related to fears of rising spatial polarization along economic as well as political dimensions Bishop and of Like-Minded America is Tearing Us Apart (2008). Work on local labor markets in Canada has been more limited. Albouy et al. (2013) explain cross-sectional wage and housing-cost differences in terms of local amenities and productivity. Fortin and Lemieux (2015) find that resource booms have lifted wages in several regions, and following Lee (1999), argues that regional minimum wages reduced local inequality at the bottom of the income distribution.

In general, the U.S. appears to have slightly more variation in earnings across regions, while Canada has more variation in employment outcomes, although this disparity may be disappearing. We mostly find signs of growing divergence across local labor markets in both the U.S. and Canada. Wage levels have grown more dispersed in patterns largely not explained by observable characteristics, reflecting increases in overall inequality. Canada shows stronger signs of educational divergence than the U.S. when measured by university graduates; the U.S. shows a greater divergence in measures of overall skills.

Examining the urban wage premium, the relationship between city size in wage levels is much weaker in Canada, than in the U.S. Inequality in larger cities is also less prevalent. Yet, Canada does exhibit trends towards becoming more like its southern neighbor: urban inequality is growing at a faster rate in Canada, though starting at a lower base. We also find unique traits for the Spanish and French linguistic enclaves in each country. While both are marked by lower wages, French-Canadian enclaves have low inequality and high skills, while Spanish-American enclaves have high inequality and low skills.

Research on how shifts in labor demand affect local areas has largely been confined to the U.S. The most prominent methodology used is that of Bartik (1991) — first explored by Bradbury et al. (1982) and popularized by Blanchard and Katz (1992). Bartik's method examines the predicted impact of national changes in industry structure on local employment and wages. It has been followed up by works examining differential effects by skill group

(Bound and Holzer, 2000), transfer payments (Autor and Duggan, 2006), and housing costs (Notowidigo, 2011). No similar work for Canada exists. Studies on other countries, e.g. Détang-Dessendre et al. (2016) for France, 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. The second methodology we employ, developed by Autor et al. (2013), considers the effect of import competition from China on local manufacturers. We construct similar measures of import competition to look at whether these imports had impacts on local Canadian employment greater or weaker than in the U.S.

We contribute to the literature on local labor market demand shocks by using two "Bartik" shift-share instruments simultaneous, taking advantage of separate data sets surveying households and businesses. This technique promises more reliable and comparable estimates. In addition, we develop an algorithm to match Canadian cities to their U.S. counterparts, loosely following Abadie et al. (2010). We are able to match improves our ability to discern how U.S. and Canadian workers respond differently to shifts in either country.

Although there is previous U.S. analysis using the Bartik instrument to examine the impact of industrial shifts on local labour markets, as well as the China Shock, our analysis has important scientific value. In addition to replicating previous U.S. analysis with slightly different data and approach, we also complement the U.S. analysis by directly examining another country in tandem. We also control for lagged Bartik measures to control for any momentum in industries in our synthetic control analysis.

We find that U.S. and Canadian local labor markets respond to demand shocks in somewhat similar ways in most instances. However, it appears that most Canadian workers are less mobile than their U.S. counterparts, but benefit from having somewhat more flexible housing markets, leading to fairly similar aggregate outcomes. We also found university-educated labor more mobile, and firm creation more responsive shocks in Canada, while changes in unemployment insurance were less so. In both the U.S. and in Canada we find fairly similar negative effects Chinese imports on most labor market outcomes, such as on employment. Estimated effects on wages and growth appear to be more positive, but not significantly so. Overall, the estimates suggest that Canadian institutions have had little if any moderating effect on local labor market outcomes.

2 Data

2.1 Census Data

2.1.1 U.S. Public Use Data

We draw most 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. for 1980, 1990 and 2000, each of which has 5 % of the population. For 2005 to 2007 (pooled as "2006") and 2009 to 2011 (as "2010"), we pool the American Community Survey data, covering 3 % of the population. Overall, this leaves us with a sample of 276 metro areas, which had a population of over 50,000 in 2000.[1]

2.1.2 Canadian Master File Data

Public use microdata files from the Census for Canada are inadequate for studying most local labor markets, as they identify 13 individual metro areas. The smallest identifiable metro in these samples is Halifax, which had a population of 277 thousand in 1981. We circumvent these problems by using the restricted access Canadian Master File Census data for 1981, 1986, 1991, 1996, 2001 and 2006. These cover 20 % of the population. Thus, while the population of Canada is smaller than the U.S., it is drawn from a sample large enough to be very precise. For 2011 we use master files from the National Household Survey, which we treat somewhat cautiously due to its non-mandatory nature.[2]

To compensate for the smaller number of cities in Canada, we use a lower population threshold than for the U.S. to determine whether a metro area is included in the sample, namely that of 15,000 or more in 1990. This leaves us with 93 Canadian metro areas.[3]

[1] Large metro areas use the Consolidated Metropolitan classification, so that Oakland is joined to San Francisco, and Stamford to New York. In a small number of cases we use a probabilistic matching system based on the overlap between Public Use Microdata Areas (PUMAs) and metropolitan areas. These areas are defined using 1999 Office of Management and Budget definitions. For New England we use New England County Metro Area (NECMAs) definitions to make better use of county-level data. Because PUMAs generally comprise populations of 100,000 or more, this largely precludes analyzing so-called "micropolitan" areas with less than 50,000 populations. Such areas were defined in later OMB publications. Analyzing these metro areas sufficiently requires restricted access U.S. data, which are currently not at our disposal.

[2] Given that the 2011 "Census" was made non-mandatory, to compensate, the sample was increased to 33 % of household instead of 20 % of households in previous Censuses. The response rate was around 68 % in 2011 whereas it was over 95 % in previous Censuses.

[3] Canadian metro areas are formed from municipalities (Census subdivisions). From 2001 definitions, we use 32 "Census Metropolitan Areas" as well as 61 "Census Agglomerations." A small problem with comparing Canadian metro areas to (Consolidated) U.S. ones, is that the latter are somewhat broader in land area as they are formed out of counties, which can be quite large. For example, Oshawa is a CMA separate from

2.1.3 Overlap in Population size

Together, the metro areas in our sample account for about four-fifths of the population in each country. In terms of metro population sizes, our samples have common domains between 50,000 and 3 million: some Canadian metros are below that limit, while the U.S. has metros above it. Toronto is the largest metro area in Canada, with a population of 2.9 million in 1981. If we compare Toronto's population to that of metros in the United States, it would be behind Boston, Detroit, Philadelphia, San Francisco-San Jose, Washington-Baltimore, Chicago, Los Angeles, and New York. Since 1981, Toronto has surpassed Detroit and been surpassed by Dallas; currently, it is tied roughly with Boston.

2.1.4 Timing of Samples

One issue we face with comparing the U.S. and Canada are slight differences in time periods. The U.S. Decennial Census data correspond to April 1, 1980, 1990, and 2000 for outcomes such as employment, and to the previous calendar year for earnings. In Canada, the Census day is around the middle of May, with the previous week being the reference week for employment, and the previous calendar year for earnings.[4] We deflate the Canadian and U.S. 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 U.S. dollars.

In the U.S., the recessions are dated to have started in July 1981, July 1990, March 2001, and December 2007, always after the data collection. In Canada the situation is more delicate, as the February 1980 to June 1980 recession happened during the year previous to the Census reference week but during the earnings reference period, while the April 1990 to April 1992 recession occurred during the both Census employment reference week and earnings reference year. For the American Community Survey, the U.S. data refer to broader

Toronto, even though its Census subdivisions (Clarington, Oshawa, Whitby) are still in the "Greater Toronto Area".

[4]Construction of weekly and hourly wage series are hampered by differences in how weekly hours are reported in Canada, which apply only to a reference week, while the U.S. asks for typical hours. The annual earnings and weeks worked are reported for the reference calender year. We calculate weekly earnings for people employed in the reference year so that the hourly earning calculations are more comparable for the two countries and the wage better match the timing of the industry of employment information. For that reason, we generally focus on comparisons of weekly wages, except for when we consider differences in the hourly minimum wage. There are also some challenges in classifying education. While the U.S. has a standardized four years of high school and university each, Canada has a system that varies more by province. We group education into five groups based on the highest level of education of achieved: less than high school, high school, a post secondary degree below a bachelor's degree, a bachelor's degree, and a graduate degree.

periods of 3 years, but 2005-2007 and 2009-2011 are largely outside of recessions.

2.2 Wage and Skill Indices

Using a standard log-linear framework, we decompose wages differences across metropolitan areas according to what is explained by observed (location-invariant) worker characteristics, and what is explained by location. Using the logarithm of weekly wages w_{ijt}^k for worker i in city j in year t in country k, we fit a Mincerian regression of the form for each country-year of

$$w_{ijt}^k = X_{ijt}^k \beta_t^k + \mu_{jt}^k + \varepsilon_{ijt}^k \tag{1}$$

where X_{it}^k are location invariant characteristics of the worker, whose returns β_t^k can vary by country and year. The "fixed effects" μ_{jt}^k are coefficients on indicator variables for each city in each time period. With an orthogonal error term ε_{ijt}^k, the μ_{jt}^k represent the average effect of location j on the wages of a typical worker.[5] Taking the expectation of wages by year and metro area allows us to express the average of log wages at the metro level as the sum of a skill index and a location index

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

where $\bar{X}_{jt} = E_i[X_{ijt}]$ denotes the average characteristics, and $E_i[\varepsilon_{ijt}^k] = 0$. Overall wage changes by metro area across time may then also be decomposed as changes in the skill index versus changes in the location index.

In addition we consider measures related to educational attainments based on University (Bachelor's Only) and High School (12 years in the U.S. and 11 to 13 in Canada) equivalents.[6] Following Katz and Murphy (1992) the measure adds workers with less than a high-school degree to high school, those with more than a Bachelors to University, and divides those

[5] We later consider how the coefficient may differ across worker types, indicating a measure of comparative advantage across locations. Despite the tremendous potential for confounding unobservables, the overall pattern of wages across U.S. and Canadian cities appear consistent with one of spatial equilibrium. On the whole, 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 et al. (2013), Albouy (2016)).

[6] In Québec, secondary school ends at grade 11 and then students can continue on with Collège d'Enseignement Général et Professionnel (CEGEP), while in Ontario, until 1987, they had grade 13, while after, for students not planning on attending university, they 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.

in-between with 2/3 to high school and 1/3 to university.[7]

2.2.1 Housing Costs

We calculate housing costs by using Census data on monthly rents, or imputed rents for owned units. Following a similar methodology, we control for housing characteristics – namely on number of rooms, and age of structure – to construct an index based only on the location.

2.3 Other Data Sets

2.3.1 County and Canadian Business Patterns

We also obtain employment data from the U.S. County Business Patterns and the Canada Business Patterns from the U.S. Census and Statistics Canada. For brevity we jointly refer to these datasets using the "CBP" moniker. Both CBP datasets for the U.S. and Canada report the number of firms within employment ranges at the SIC/NAICS industry-level. We first convert all industry codes to the SIC 1987 4-digit level of aggregation and then impute actual employment within each industry following Autor et al. (2013). The U.S. data is at the county level, while the Canadian data is collected for cities (CMAs). Thus, we convert the U.S. data to the metro level, matching the foregoing datasets.

2.3.2 UN Comtrade Database

Our trade data come from the UN Comtrade database. From this dataset, we retain exports from China to the U.S., Canada, and other developed countries at the 6-digit Harmonized System product level. Following Autor et al. (2013), we aggregate all trade data to 4-digit SIC 1987 level in 2007 U.S. Dollars.

2.3.3 Transfer Data

The Canadian Employment Insurance (formerly Unemployment Insurance) data comes from the T1 Family File (T1FF), created from the administrative income tax and the Canada Child Tax Benefit records.[8] The contains city level total Employment Insurance (EI) as well as number of taxfilers collecting EI so we are able to create a EI per person. Our first time observation for the EI data in Canada is 1991.

[7] Auxiliary regressions based on cross-sectional wage structures suggest that this is relatively correct, although the in-between "some-college' group may in fact be closer to high-school for Canadians.

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

2.4 Union Data

For the U.S., rates extrapolate from Hirsch and Macpherson (2004) from the 1986 city rates to 1980 using state unionization rates. For Canada we calculate the city level unionization rates from the Masterfile Labour Force Survey (LFS). Unfortunately, questions about unionization were only added starting in 1997, and while for 2001, 2006 and 2011 we can directly calculate the rates, for earlier years we extrapolate backwards. We use two year averages when calculating the city average union rates (include the previous year) to ensure that we have accurate measures for the smaller cities. As well, not all cities are identifiable in the LFS and so we are able to obtain unionization rates for XXX cities. We extrapolate from 1997-1998 to 1981 and 1991 using provincial unionization rates.[9]

3 Features of U.S and Canadian Labor Markets

Several features of U.S. and Canadian labor markets help to explain why they may resemble and differ from each other. First, one must consider how industries are concentrated geographically in each area, and how they have changed in importance over time. Second, there is the importance of local labor market institutions, such as unions and minimum wages. Third, is the role of federal transfers and insurance. Last, we consider the role of linguistic enclaves, as a "sub-country" within each country.

3.1 Industry Sector Shifts

Over the period covered by our study, there have been major industrial shifts that have shaped the national economy and had strong divergent regional effects. We begin by outlining the North American trends and Canadian and U.S. relative differences to get a sense of how the economies have transformed since the 1980s to put the subsequent local labor market analysis into context. Figure 1 outlines the changes in employment and mean hourly wages for four key industries: manufacturing, construction, natural resources and information technology. The top two plots outline the employment and mean hourly wages (relative to the average) for North America overall, while the bottom two plots show these variables for Canada relative to the U.S.

As seen in the figure, manufacturing comprises the bulk of North American employment from these sectors, but from 1978 to 2010 manufacturing employment declined nearly 40 per-

[9] We obtain the provincial unionization rates from Morissette et al. (2005). They use the Survey of Work History for the 1981 rates, and the Labour Market Activity Survey for the 1986 and 1989.

cent. Manufacturing wages have similarly fallen and by around 2008 dipped below the North American average wage. Before 1995, Canadian manufacturing employment was consistently one-tenth of that in the U.S. (bottom-left plot) before rising slightly in the late 1990s and leveling in the 2000s. Manufacturing wages in Canada, relative to the U.S., have followed a similar pattern, rising from the early 1990s to the mid-2000s and then falling during the great recession. What cannot be seen from these figures is the important regional concentration of manufacturing. Both countries share a "manufacturing belt," which according to Krugman (1991) this belt corresponds 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 Québec. These areas are predicted to have suffered with the decline in manufacturing, most apparent in the early 1980s, and much of the 2000s.

Construction did not see a decline like manufacturing (Hurst et al., 2016). The bottom-left plot shows that relative construction employment between the Canada and the U.S. remained relatively steady until the Great Recession, when U.S. housing crashed while Canadian housing suffered only a minor temporary setback. Construction wages are notably higher than those in manufacturing, and reverted back slightly to the North American average over the period. Although construction is often a leading indicator of macroeconomic growth, it must be interpreted cautiously as an economic indicator, since it may respond to other demand shifts, rather than drive it. Nevertheless, while construction tends to be less geographcially concentrated than manufacturing, it does vary in relative importance across North America. For example, areas along the coasts and nicer climates have generally seen what appears to be amenity-driven migration and has led to a relative increase in construction (Rappaport, 2007). Furthermore, foreign investment in real estate, particular in the larger cities may be an important stimulus.

Figure 1 also shows natural resource employment. It is small for North America overall, but is highly concentrated in Canada relative to other sectors. Indeed, at the peak of oil prices in the mid-2000s, nearly half of all natural resource workers were in Canada. The top-right plot in the figure shows that wages are substantially higher in natural resource and were nearly 40 percent higher than the North American average in 2015. The bottom-right plot shows that natural resource wages in Canada exploded, relative to the U.S., in the 1990s and remained at these elevated levels through the end of the sample. Natural resources are particularly concentrated in certain regions. Oil is concentrated east of the Rockies, particularly in Alberta, as well along the Gulf Coast, Appalachia, northwestern Texas and Oklahoma. Fishing and related industries are a major employer in the Canadian Atlantic provinces, while in the U.S., it is concentrated in New England and Alaska.

In addition to natural resources being very regionally concentrated, the economics of particular resources are driven often by idiosyncratic factors and timing. For example, fishing saw a major decline in the early 1990s due to depleted fish stocks. International oil demand caused oil employment to rapidly expand in the 1970s and early 1980s, then collapse in the mid 1980s and rapidly expand again in the early 2000s only to drop again in the late 2000s. Forestry is largely procyclical as lumber needs depend heavily on new construction.

The fourth industry plotted in figure 1 is professional and technical service employment, including high tech and computer programming. This sector grew sizable in the 1990s when the tech boom fueled the U.S. economy, in centers such as Austin and San Francisco. The already high wages in this sector grew rapidly relative to the North American average. While employment in this industry is smaller in Canada, it matters enormously for cities like Kitchener-Waterloo and Ottawa-Gatineau.

3.2 Labor Market Institutions at the Local Level

In light of the previous work on U.S. Card and Riddell (1993), e expect many U.S. differences to depend on their institutions. Unionization fell precipitously between 1980 and 2007 in the U.S.. Canadian unionization only saw more recent, smaller losses. [10]

In the early 1980s, minimum wages pushed up the lower part of the wage distribution in the U.S., while in Canada the effect was is much weaker (DiNardo and Lemieux, 1997). These roles reversed at the end of the 1980s when the Canadian minimum wage grew, while the

[10]Starting in the 1960s, union membership fell in the U.S. as the labor market shifted towards women and college graduates who are less likely to be union members — Levy and Temin (2011), Osterman (2014), and Hirsch and Macpherson (2004). Researchers have estimated that this decline in unionization has accounted for about a third of the increase in the spread of the U.S. income distribution and for 20 percent of the increase in the variance of log wages. See Card (1992), Freeman (1993), and DiNardo et al. (1996). Lemieux (2008) provides an overview. In marked contrast, unionization rates in Canada ticked upwards in the 1970s before leveling off in the 1980s and dropping off in the 1990s. This divergence in union density has been studied by DiNardo and Lemieux (1997) and Freeman (1990), among others. While the U.S. and Canada are closely integrated economies with similar views on unionization — Freeman (1990), Riddell (1993), Card and Freeman (1993), and DiNardo and Lemieux (1997) — small differences in labor laws are credited for cross-country differences in firms' pursuit of anti-union strategies. Indeed, Canadian labor laws limit firms' ability to fight unions by certifying unions after card checks, whereas so-called "union-prevention" technologies (e.g. union avoidance consultants) have flourished in the U.S. where labor laws are more conducive to anti-union strategies (Logan, 2006). Freeman (1990) aptly summarizes these differences, noting that "...the same firms that go all out to defeat unions in the U.S. accept unionization of their Canadian plants."

U.S. minimum was gradually eroded by inflation. Since that time, minimum wage rates have seen a few large increases in the U.S., but were generally out-paced by Canadian increases. Because of differences in wage levels locally, their impact on local wage structures could vary considerably. Note that the minimum wage is determined provincially in Canada; in the U.S. a common floor is set federally, while some states choose a higher minimum wage.

3.3 Transfers to Individuals and Local Governments

The U.S. and Canada have distinct approaches to fiscal federalism. In most regards, Canada devolves more power to the provinces, while providing large transfers to provinces with low "fiscal capacity" through its equalization system. The U.S. has no explicit form of equalization outside of a few programs that operate at a smaller scale such as Empowerment Zones (see Busso et al. (2013)) It does provide transfers through higher matching rates to states with lower incomes in several programs, most importantly Medicaid. In both countries, the uniform federal tax code implicitly penalizes workers for moving to high-wage areas. In the U.S., federal transfers only mildly reinforce this bias against high-wage areas, particularly in large metros Albouy (2009). In Canada, the representative tax system used in for equalization program, works much more strongly with the federal tax system to move dollars from high-wage areas to low-wage areas. The typical dollar earned through migration is implicitly taxed at an average rate of over 60 percent Albouy (2012). The Atlantic and Prairie provinces generally benefit the most through this system.

It is not possible for us to provide a detailed comparison of transfers here. For the sake of examining local labor markets, we do consider effects on unemployment insurance (known as "employment" insurance in Canada). These programs are more centrally run in Canada than the U.S. We also consider transfers paid to retirees through the CPP/QPP and social security. [11]

3.4 Francophone and "Hispanophone" Enclaves

Both countries have a substantial non-English population that outnumber English speakers in several non-metro areas. 20 percent of Canadian workers report using French as their primary

[11] Unemployment insurance and unemployment duration have traditionally been higher in Canada than in the U.S. This was especially true up until the late 1990s when Canadian unemployment benefits fell precipitously after a series government cuts. See for example Battle (1998). Further, at the end of the end of the sample unemployment benefits jumped in the U.S. as American 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 U.S. and Canada.

language of work, with a similar percentage using French at home. These Francophones live primarily in the province of Québec (Canada, 2013). The linguistic divide between Francophone and Anglophone spheres could slow the mobility of workers across these areas.[12]

The United States has roughly the same number of native Spanish speakers, 42 million, as Spain (Cervantes, 2016). The American Community Survey finds 13 percent of those over 5 use Spanish at home, although over half of these people claim proficiency in English, too. These populations are less geographically concentrated, but do outnumber English speakers in several metro areas, such as Laredo, McAllen, and El Paso , all along the Mexican border.[13] Yet, Hispanophones in the U.S. have far less political and economic power than Francophones in Canada. While those who speak Spanish at home make up 27 percent of California, New Mexico, and Texas, no states contain a majority.

To examine the idiosyncrasies of metro areas with non-English majorities, we construct variables to indicate those in Québec or in "Hispanophone" communities. These are defined as metro areas where the number of French or Spanish speakers exceeds the number of English speakers.[14] These linguistic enclaves offer an additional layer, within each country, for considering small differences that may matter. While Canada has one tenth of the population shared with the U.S. (34.9 out of 349 million in 2012) Québec has just under a quarter of Canadians. The metro areas we label Hispanophone contain just over 1% of the U.S., but these areas may expand economically and politically as the Hispanic population grows as a share of the population.

4 Cross-Metro Differences and Changes in Labor Market Outcomes

4.1 Differences across Regions vs. across Countries

Table 1 presents labor market statistics by country and four different regions within each country. Here we see that in many instances, differences across regions are often as large as those across the two countries. While the U.S. generally has lower unemployment figures,

[12] Albouy (2008a) provides an important analysis comparing the changing labor market fortunes of Anglophones and Francophones in Québec relative to the rest of Canada since 1970, arguing that Québec has transitioned to a largely Francophone economy by the year 2000.

[13] There do not seem to be data sources on the language of work in the United States.

[14] Our Francophone communities consists of Montréal, Québec, Sherbrooke, Chicoutimi-Jonquiére and Trois-Riviéres. While New Brunswick has a large concentration of Franchohones, they make up less than a third of Moncton's population and only slightly more of Non-CMA New Brunswick's population, so we do not classify them as Francophone communities. Our Hispanophone communities are El Paso, McAllen-Edinburg-Mission, Brownsville-Harlingen-San Benito, Laredo, TX; Salinas, Visalia-Tulare-Porterville, CA; Las Cruces, NM; Yuma, AZ.

For instance, in 1980 (81 in Canada), the unemployment rate in the U.S. East North Central region (6.2%) was higher than in Canada (5.8%), while the unemployment rates in Texas and Alberta were equal at the low rate of 2.8%. Unemployment differences between the U.S. and Canada are at their largest in 1990, reflecting the "unemployment gap" studied by Card and Riddell (1993). Yet, by 2011, the gap was actually reversed, with Canada below.[15]

The within country differences are even more pronounced when it comes to sectoral composition. For example, over time, Québec has manufacturing rates more similar to the United States than to the rest of Canada.

We compare differences in weekly wages by converting Canadian dollars into U.S. ones using a Purchasing Power Parity (PPP) adjustment of 1.221 for the year 2010. With this benchmark in place, wages are then deflated through each country's Consumer Price Index. At the beginning of the period, the average weekly wage in Canada and the U.S. are almost identical, at a little less than 800 dollars U.S. While over the next two decades, the average weekly wage grew much faster in the U.S., after the Great Recession, weekly earnings in Canada were higher, driven mainly by the oil boom in Alberta.

Table 1 also shows the Unemployment Insurance (UI) per person. What is clear is that the level in Canada is much more generous, which may have important implications for not only the national economy, but also the local economies through discouraging labor mobility. In 1991, the first year we have data for both countries, the average EI person was over five times the value of the U.S. While there was a major recession in Canada, the UI was still much higher in 2001. Regardless of the business cycle, the UI per person was usually much higher in the Atlantic Provinces and was lower in Alberta than any other region in Canada. However, prior to the Great Recession, even in Alberta, the UI per person was higher than any of the presented regions in the U.S. After the Great Recession, and resulting expansions of unemployment benefits, the UI per person in the U.S. approached that of Canada.

4.2 Across-metro Variation and Trends in Growth and Divergence

Figure 2 plots metro-by-metro variation in three different outcomes: log weekly wages, unemployment, and the employment-population ratio. Outcomes for the years 2011 are plotted against those in years 1980/81 to help make sense of divergence, discussed below. To help

[15]Note that Census measures of unemployment differ from those found in the U.S. Current Population Survey and the Canadian Labour Force Survey.

distinguish areas, the markers shapes distinguish linguistic enclaves with a square, and areas of states not part of metros with a triangle. The size of the marker is proportional to the population. In all of the outcomes, the variation across metro areas that is substantially larger than even in the regions shown in table 1 in both countries. Moreover, some of these differences appear to have persisted over the entire sample period of 30 years.

To examine the extent to which which local labor markets diverge or converge in greater depth, we employ standard metrics known as "σ" and "β" convergence. The first considers changes in overall dispersion, say as measured by the standard deviation. Areas are converging (diverging) if overall dispersion across areas falls (rises).

$$\frac{\sigma_t^k}{\sigma_0^k} < 1. \tag{3}$$

for standard deviations, σ_t^k in the current period, and a base period $t = 0$. This concept is referred to as σ-convergence.

The second depends on whether areas that are ahead are likely to see their advantage shrink (or mean revert), which is known as β convergence. This latter concept is more related to concepts around labor mobility. Rather than apply it to growth rates, we simply consider whether for a given outcome, with drift ξ_t,

$$x_t^k = \zeta_t^k + \beta_t^k x_0, \tag{4}$$

The case of $\beta_t^k < 1$ refers to β-convergence, and $\beta_t^k > 1$, β-divergence. It is possible for overall dispersion to increase, i.e., σ diverge, even while areas grow together, i.e., β converge. Statistics relevant to these two forms of convergence are given in table 2 for numerous outcomes.

While there is much talk of a "great divergence" in U.S. labor markets, we find only mixed evidence of this in trends since 1980. Trends in Canada are not particularly clear as well.

In the U.S., we see no particular trend in unemployment or employment-population ratios diverging over time. The East North Central Region, with its rust-belt cities like Detroit and Benton Harbor, experienced the high levels of unemployment in both 1980 and 2010 (although in some interim years they did better). Many Southwestern metros, often

Hispanophone communities, suffered disproportionately from unemployment as well. Interestingly, both areas did worse than in the traditional depressed areas of Appalaicha.[16] University cities, such as Columbia, Charlottesville, and Iowa City have rates that are persistently low.

In Canada, we see greater patterns of dispersion over space in employment outcomes, and while some are quite persistent, many differences appear to be shrinking. The highest levels of unemployment seen, in the Atlantic areas outside of Halifax, do appear to be persistent, but still show some signs of moderating. These areas also seen of their low employment-population rates rising by the end of the sample. Table 2 shows that over the entire period, unemployment dispersion grew in the U.S. from 1.64 to 1.80, while it shrank in Canada from 3.03 to 2.22. This may have something to do with the fact that Canada experienced a much milder recession than the U.S. over the latter period. These patterns are largely mirrored in the employment-population ratio, which also show an upward trend from women's growing employment.

In terms of population, table 2 suggests that there has been fairly little convergence or divergence in either country, in support of Gibrat's Law.

The dynamics of the changing local wage structure are seen in the first three rows of table 2. As far as our data can show, the wage varies a little more in the United States then Canada. Both countries exhibit signs of σ divergence, as these numbers were once smaller at 0.11 and 0.10 in 1980, respectively.[17] In terms of β convergence, the countries exhibit slightly different patterns, as seen in the last row of table 2. Figure 2 shows that in 1980, wages in the U.S were high in cities like Detroit, Peoria, Chicago, San Francisco, Washington and Seattle. In Canada, they were high in Calgary, Edmonton and Vancouver had high week, as well as in smaller manufacturing and resource-oriented cities in Québec and British Columbia. While places like Washington, San Francisco and Seattle had large wage growth in the U.S. and Calgary and Edmonton continued to outpace the national average, places like Detroit, which were more heavily reliant on manufacturing saw relative declines in wages. The numbers on the local index reveal that this growing divergence may have much to do with growing skill disparities in the U.S., which shows signs of β-divergence. In Canada, the opposite may be occurring, as variation in the wage index, controlling for skill, has grown more than overall

[16] See Kline and Moretti (2014).

[17] The differences in the U.S. are greater after controlling for observable characteristics.

wages.

A different pattern arises when we consider skills defined by university degrees. While the U.S. has a larger log standard deviation in terms of the university high school ratio, there was only very slight increase in the σ divergence in the U.S., while there evidence of β convergence using our (Katz-Murphy) supply definition. Conversely, in Canada, while there was a modest β divergence, the σ divergence was very large. These patterns run opposite to the patterns seen in the skill index. What appears to help drive this is the large increase in the fraction of immigrants who had a university degree in Canada, who tend to move to a few large cities.[18]

Dispersion patterns in the university-high school wage premium follows a different pattern. Canada saw no change in the dispersion in this number. Meanwhile the variation in the wage premium paid to university graduates grew considerably in the U.S. This might be explained compositionally by the lower quality of university degree of immigrant workers, who may cluster in areas where the return to an education is otherwise high.[19]

While it may seem surprising to those following recent housing trends in Vancouver, the U.S. saw much greater divergence in how housing costs vary across cities. While standard deviation of log housing costs increased from 0.21 to 0.31 between 1980 and 2000, the housing boom and bust appears to have exacerbated these differences. The degree of β divergence is remarkably strong. Canada, on the other hand, sees less of a clear trend over this period.

4.3 Local Labor Market Patterns by Population and Linguistic Plurality

In this section, we consider how wage rates, skills, and inequality vary across metro areas according to city characteristics, namely their size, and the language spoken at home by the plurality of the population. These results from these descriptive regressions are shown in table 3.

Through population, we may consider varying how U.S. and Canadian workers may reap different benefits from agglomeration economies. Indeed, larger metro areas potentially benefit workers through reduced search frictions, better matching, and greater human capital accumulation (Baum-Snow and Pavan, 2013). Amenity-wise they typically offer a greater

[18] Warman and Worswick (2015) show that the percent of new immigrants to Canada with a university degree increased rapidly starting in the early 1990s from around 25 % to well over 50 %.

[19] It is worth noting, however, that increases in the distribution of skills has no discernible correlation with changes in the wage differentials across cities.

variety of consumer produces and neighborhood public goods as well. However, reaping the benefits of agglomeration requires paying higher costs in terms of housing or commuting. To explore these issues, the time-independent regression results in Panel A takes the United States as the base case. It includes the logarithm of population, a standard regressor, which is interacted with a Canadian dummy.

In addition, the model includes indicators for Québec and Hispanophone communities, to see if labor markets in the two enclaves behave any differently. Based on cultural proclivities of these regions, one might suspect Québec to exhibit more European qualities, such as moderate incomes and low inequality. Meanwhile, Hispanophone communities may betray more Latin American characteristics, generally lower incomes and high inequality.

In Panel B, we consider variation over time, by interacting the variables with a time trend, expressed in decades

$$O_{jt}^{k} = \alpha_c + \left(\alpha_p^0 + \alpha_p^T \frac{t}{10}\right) \ln pop_{jt}^{k} + \sum_{R \in \{Q,H\}} \left[\alpha_R^0 + \alpha_R^T \frac{t}{10}\right] I\left[j \in R\right] + \varepsilon_{jt}^{k} \tag{5}$$

where t measures the number of years from the base year. The coefficient α_p^0 is the population gradient, while α_Q^0 and α_H^0 are indicators for Québec and Hispanophone metros. In panel A, the time-interaction coefficients $\alpha_p^T, \alpha_Q^T, \alpha_H^T$ are set to zero. In all cases, the sample is limited to metro areas only.

Column 1 of table 3 displays how wages differ across metropolitan area. Across years in Panel A, the wage-population elasticity is 0.060 in the United States. In Canada, the gradient is only half the size. Thus, it appears that agglomeration benefits in Canada may be only half as large as those in the U.S. This effect persists, in column 2, after controlling for observable skills in the local wage index (2). In fact, as we see in column 3, high-skilled Canadians, as measured by our index, favor large cities less than Americans. In the U.S. the skill level remains roughly constant over time, although there is some hint that urban skills may be declining relatively over time.

The results for linguistic enclaves suggest a negative penalty for workers in either Francophone or Hispanophone metros. Looking at Panel B, the penalty to being an enclave is growing over time. Yet, contrasting forces at work in each case. As seen in column 3, Québec has skills levels that are gaining over time. At the same time, the wage index for Quebec dropped, as Montréal lost its prominence to Toronto. Hispaonophone metros began with a deficit in skills that is getting wider over time. The small negative penalty in the wage index, however, appears insignificant.

Evidence for skill sorting looks rather different when we consider the ratio of university to high-school labor. Here we see a pronounced positive gradient with population. Interestingly this gradient is growing over time in Canada, from below the U.S. in 1980, to above it in 2011.

The inequality and wage differences are greater not just across workers in the U.S., but also across local labor markets. In general, the return to skills appears to be larger in the U.S., which would generally make it advantageous for the skilled to emigrate from and the less skilled to immigrate to Canada (Card, 2003). This would suggest that comparative advantage of moving across cities is larger for the unskilled in Canada than for the skilled labor.

Important signs of urban wage inequality are seen in the population gradients for the university/high school wage premium in column 5, and the 90-10 differential, in column 6. As seen in panel B, these relationships did not exist in 1980, but have come to be a remarkable feature of large cities(Baum-Snow and Pavan, 2012). The patterns of urban wage inequality in Canada are decidedly weaker. In fact, it appears that the university urban wage premium is growing at half the rate in Canada as it is in the U.S. Meanwhile the urban 90-10 differential is growing in large Canadian cities at a faster rate than in the U.S., even though it was once smaller in large Canadian metro areas than in tinier ones.

In addition we also find lower levels of inequality in Francophone Québec. This finding mirrors previous studies, based on Census data Albouy (2008a) and tax records, Saez and Veall (2005). In contrast, Hispanophone communities exhibit higher levels of inequality, with a particularly high observed return to a university degree. The ultimate causes of this disparity — relative supply, differences in educational quality, or ethnic discrimination — could be a fruitful area for further study.

4.4 Housing Costs

Not surprisingly, housing costs rise with city size. Households should be willing to pay more to be in higher-wage areas. However, a 1-percent increase in wages should more than compensate for a 1-percent increase in housing costs, it appears that the real-wage benefit of living in a large city is smaller in Canada than in the U.S. In either country, the real-wage premium might even be negative. However, in an equilibrium framework, (Roback, 1982) (Albouy, 2008b), this might suggest that larger cities have a higher quality of life, than smaller ones.

Housing costs are also substantially lower in Québec. This relationship is becoming more pronounced over time. We see similar signs that Hispanophone metros have also become less expensive.

5 The Impact of Labor Demand Shifts on Local Outcomes

5.1 Omnibus ("Bartik") Sectoral Changes

Below we combine well-known approaches to study local shifts in labor demand, following the standard Bartik (1991) method. This method accounts for these demand shifts by predicting changes in employment at the local level, based on pre-determined industrial composition. The predictions interact this composition with national changes in the number of workers each industry. This omnibus approach benefits in its generality by considering all sectors of the economy. However, it suffers from potential concerns, especially regarding with pre-existing trends.

We contribute to the literature by not only considering two countries in parallel, but also by using two separately constructed Bartik instruments simultaneously. Each of these predicts an aggregate labor demand shift given by

$$\Delta B_j^t = \sum_l \lambda_{jl}^{1980} \left(E_{kl}^t - E_{ik}^{1980} \right) \tag{6}$$

where λ_{jl}^{1980} is the share of employment in city j that is in industry l in the base year of 1980. $\left(E_{kl}^t - E_{ik}^{1980} \right)$ is the change in overall employment in industry l of country k between time t and the base year.

The first-stage of this empirical design is simply to regress actual employment changes on these predicted changes. An impediment to using this instrument is that it relies on industrial classifications, which may be particularly subject to classification errors. These issues motivate our use of two separately constructed instruments: the first based off of Census data, the second from the County Business Patterns in the U.S., and Canadian Business Patterns in Canada. Both Business Patterns data are based off of business registries, and are likely to classify industries more accurately. They do not always provide an exact count of employees by area, although they do give a distribution of firms sizes, which allows this number to be estimated. [20] In appendix figure A3, we demonstrate how these two instruments are positively related in each country. The correlation is well below one, as each instrument conveys different information.

5.1.1 First-Stage Bartik Results

In table 4, we begin by examining each instrument's relationship with metropolitan employment changes, measured with Census data, one at a time. The regressions, set in first differences, include indicators for time periods. The Bartik constructed from the Census exhibits first-stage relationship that is larger in the U.S., but more precisely estimated in Canada. This may be due to the more detailed and greater quantity of data in the Canadian master file data. Ultimately, we cannot reject the hypothesis that the U.S. and Canadian coefficients are in fact equal.

In column 2, we see the effect of the CBP instrument in the U.S., is a more precise predictor of employment changes, even though the latter is measured by the Census. The coefficient is notably smaller. In Canada, the relationship is notably weaker, both numerically, and in precision, although still significant. This may be the result of the lower precision of the Canadian BP data in providing firm sizes at the upper end of the distribution.

When we combine the two instruments, in column 3, we see that each has a particular strength: the CBP instrument works better in the U.S., the Census instrument, in Canada. Yet, as we see from the test statistics, the U.S. and Canadian Census estimates are statistically indistinguishable. The same is true for the U.S. and Canadian CBP estimates. When we test both Bartik instruments together, the of equal coefficients tightens somewhat, with p-value of 7 percent. These number relaxes to 9 percent, when we introduce regional fixed effects for both countries. Overall, these results suggest that Canadian workers are slightly less responsive to shifts in local labor demand.

Nevertheless, the similarity of the estimates across countries, as well as the desire to

[20] From the Canadian and U.S. Census data, we construct 19 industries to calculate the Bartik instrument. The industries include: Agriculture, Forestery/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, Other Services. For County and Canadian Business Patterns we use more detailed matched 3-digit SIC codes, providing 373 industries in the U.S., and XXX industries Canada. The Business Pattern data cover only the private sector.

provide 2SLS estimates easily comparable across countries, motivates us to consider a pooled estimator. This restricted the coefficients across the U.S. and Canada to be equal, while allowing them to differ across the Census and CBP versions. This promises to provide a more efficient use of the data. The results in Panel C, suggest that this may indeed be the case. Both instruments are highly significant in this regression, including the case when both are included. The joint F-test, in the case of our favored regression in column 4, is a 7.2, is passable.

5.1.2 Long Differences in the Reduced Form

Figure 4 illustrates the first stage using only the Census Bartik instrument using long differences over the 1990 to 2011 period. This longer period may produce different estimates because of the long-run nature of the change. In these regressions we also include changes in non-metro employment. This is due to the fact that we lack CBP data for non-metro areas in Canada.

In Canada, the metros with the greatest positive shifts occurred around natural resources, such as Calgary and Fort McMurray (Wood Buffalo), and indeed their populations grew roughly 1.5 times. On the other end are old manufacturing cities, such Sudbury and Sarnia. In the U.S., many western cities, such as Las Vegas and Santa Fe, grew from sectoral expansions - although these were driven more by services. On the other end, we see similar declines in manufacturing cities, like in Hickory and Kokomo.

In the second set of figures for wages in B, we see strong wage responses in the U.S. In Canada the response is weaker, although imprecise. Effects on unemployment are positive, but weak and imprecise. The low unemployment effects are unsurprising given the long period for labor to adjust.

5.1.3 Second-Stage Bartik results

Table 5 presents the 2SLS results for the Bartik specification using the common first stage for changes in log employment. Results using an unrestricted, country-specific first stage are shown in the appendix. The results in the unrestricted model resemble those of the restricted model rather closely in most instances. However, the unrestricted model is harder to compare across countries, as estimates may differ because of either coefficient differences in either the first stage or the reduced-form relationship between the instruments and the outcome variables. The restricted model imposes that differences do stem from the these latter reduced-form relationships.

The general finding across outcomes is that the estimates are fairly similar across the United States and Canada, although sometimes significantly different at common test sizes. Thus, overall it appears that U.S. and Canadian labor markets are not extremely different from each other, although the size of the standard errors cannot rule out some fairly important differences.[21]

A central result, shown in column 1, is that a one percent increase in employment predicts roughly a 0.6 point difference in wages in the U.S, and 0.8 in Canada. This implies an elasticity of local labor supply of about 1.7 in the U.S, and 1.2 in Canada, although this difference is insignificant at the 10 percent level. This same is true in the unrestricted regression in figure B1.

The most significantly different finding, seen in column 2, regards housing costs. While wages in Canada appear to rise slightly more in Canada, albeit not significantly, housing costs respond significantly less. Since housing costs reduce the purchasing power of labor income, this implies is that real wages rise more in Canada than in the U.S. in response to a positive labor demand shock. Therefore, local residents in Canada, particularly renters, stand to gain more from positive demand shocks, and possibly lose more from negative shocks.

The results for population in column 3, are fairly similar, albeit slightly larger for Canada. The net effects on the employment population ratio, seen in column 4 is that the employment-population ratio rises somewhat more in the U.S., than Canada. Unemployment effects (column 5) are not much different however. This implies that labor force participation responds more strongly to demand shifts in the U.S. than in Canada.

In a standard equilibrium setting with heterogeneous moving costs (e.g., Notowidigo (2011)), the result has interesting implications about labor mobility. Namely, Canadians appear to have higher moving costs, as a larger real wage increase is associated with a given increase in local employment. This may seem puzzling, since the implied elasticities of labor supply appear to be roughly equal. The puzzle is easily resolved if housing supply is simply more elastic in Canadian cities than in U.S. ones. In that case, higher mobility costs in

[21]We also tried specifications using only Census data, which allowed us to include changes from 1980 to 1990, as well as the later periods in our sample. In that case, we found weaker wage effects and larger unemployment effects Canada.

Canada are offset by housing in growing being relatively more affordable.

In columns 6 and 7 we examine whether labor demand shifts have greater effects on more educated workers. In Canada, the estimates suggest substantially greater effects on employment for university-educated labor, while the opposite in the U.S., high-school labor is more responsive. The wage gains are relatively higher for the university-educed in both countries, although possibly more in the U.S.

An interesting and somewhat puzzling result in column 8 is that firms are much more responsive in Canada. The numbers imply that in the U.S. the number of employees per firm rises, while in Canada they fall. This issue deserves more study.

The last two columns examine the impact of labor demand shocks on social transfers. In column 9, we find a somewhat lower response of unemployment benefits in Canada. In absolute terms, the difference is in fact rather similar, since unemployment insurance benefits are roughly three times higher on average in Canada, as we saw in table 1.

5.2 Import Competition from Chinese Manufactures

The second approach addresses the decline of manufacturing more specifically, singling out the impact of import competition from China following Autor et al. (2013). This approach benefits in its detail, and a more plausible form of exogeneity. However, the smaller nature of the exogenous demand shifts makes them more vulnerable to unlucky violations of exogeneity.

Moving away from the omnibus variation provided by the Bartik instrument, we consider the much more detailed effects of local labor demand shifts in manufacturing due to rising imports from China. Our proxy for local import competition from China follows the change in imports per worker (IPW) measure develedped by Autor et al. (2013). For each for each region i at time t in country u, this is measure is given by:

$$\Delta IPW_{uit} = \sum_{j} \frac{L_{ijt}}{L_{ujt}} \frac{\Delta M_{ucjt}}{L_{it}} \tag{7}$$

where L_{it} is the start of period employment (year t) in region i; ΔM_{ucjt} is the change in national imports from China in industry j between the start and end of the period; L_{ijt} is the region i employment in industry j at time t; L_{ujt} is national employment in industry j at time t; and $\frac{L_{ijt}}{L_{ujt}}$ is the share of region i for industry j relative to all national employment in industry j. We compute ΔIPW_{uit}, the imports per worker in region i, for all available cities using Chinese imports at the national level for the U.S. and Canada respectively. Clearly, ΔIPW_{uit} varies at the local level due to specialization in (1) manufacturing relative non-manufacturing sectors, and (2) local manufacturing industries with greater import exposure risk (e.g. textile versus defense manufacturing). Variation in ΔIPW_{uit} over time is likely to due structural changes as the Chinese economy shifted more towards a market based system and China's ascension to the World Trade Organization (WTO) in 2000.

Import competition from China may be due to local industries faltering on their own or be correlated with nation-wide product demand shifts. In this case, OLS estimates using ΔIPW_{uit} would understate the true impact of imports on local manufacturing employment. This motivates using an instrument for ΔIPW_{uit}. We follow Autor et al. (2013) by using Chinese imports to other Western countries in equation 7:

$$\Delta IPW_{oit} = \sum_{j} \frac{L_{ijt-1}}{L_{ujt-1}} \frac{\Delta M_{ocjt}}{L_{it-1}} \tag{8}$$

where ΔM_{ocjt} are the change in imports for the other Western countries in industry j. Both our U.S. and Canada rely on the same set of other countries.[22] To make the imports from the other Western countries comparable across the U.S. and Canada, we multiply the imports from the other Western countries by the ratio of American and Canadian populations. The aim of this instrument is to isolate the aforementioned supply-side changes in Chinese manufacturing output and exports. We note that all of the import measures are recorded in U.S. dollars.

5.2.1 First Stage Results

Table 6 presents results from the first stage relationships between ΔIPW_{uit} and its instrument ΔIPW_{oit}. We follow Autor et al. (2013) by including a control for log manufacturing share, as well as regional indicators. Unlike their work, our regressions involve only metro areas in the U.S., not commuting zones, meaning that our results need not be identical. Yet, overall we find a similar first stage relationship is quite similar to theirs, in Canada, as well as the United States. In fact, after our population adjustment, the two coefficients for the U.S. and Canada are not significantly different from each other.

[22] These countries are Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland.

5.2.2 Two-Stage Least Squares Estimates

In general, the estimated impact of Chinese import competition appears to produce as negative effects on Canadian manufacturing employment in Canada as it has in the U.S. The precision of the estimates cannot rule out a range of estimates, but the best guess is wholly consistent with costly adjustment patterns. In column 1, we see reductions in manufacturing employment similar to that of Autor et al. (2013), including for Canada. The point estimates are quite similar, although imprecisely estimated for Canada.

Chinese import competition is also associated with lower employment-population ratios. The effect is slightly larger in magnitude, though not statistically significant.

While the Canadian results discussed thus far are largely in line with previous findings for the U.S., some of the other results for Canada are rather surprising, For instance, we see higher population growth rates and increases in housing costs. This suggests one of two alternatives. One possibility is that the exclusion restriction is violated, making the results invalid. A second, is that the manufacturing decline caused by Chinese imports could have led to city growth, possibly because of differences in Canadian policy.

5.3 Synthetic Matching of Canadian Cities to their U.S. Counterparts

Next we match Canadian cities to their comparable U.S. counterparts. Specifically, when examining differences in local American and Canadian labor markets, ideally we want to compare cities that are similar along several dimensions *and* receive the same labor market shock. Our approach combines the Synthetic Control Method (SCM; Abadie et al. (2010)) with standard techniques from the statistical clustering literature (see Izenman (2008) for an overview). For each Canadian city, the so-called weight is chosen to "best" approximate the key characteristics of the given Canadian city along multiple dimensions. This technique then yields a broad-based "Canadian Treatment Effect."

First, in line with clustering, we standardize all variables, within each country, to have zero mean and unit variance. This ensures that we match Canadian cities to their U.S. counterparts along points in their respective distributions and thus nullifies country-level data concerns, for example regarding data collection and measurement. Then we minimize the distance between Canadian and U.S. cities using certain key "structural" local labor market characteristics (to be discussed momentarily below). The importance (weight) of each local labor market characteristic is chosen to minimize the forecast error in subsequent labor market shocks between American and Canadian cities. Crucially, the importance of local labor market characteristics varies completely across cities. For each Canadian city, the end result is a linear combination of weights on American cities that best approximates the most important local labor market characteristics for that given Canadian city. As previously stated, the relative predictive power of the local labor market characteristics, in terms of the subsequent labor market shocks, determines their importance in the matching procedure. Note that our approach here extends the recent literature that employs the SCM to assess policy effects at various geographic aggregates as we minimize the error.[23] While previous work attempts to assess policy interventions using past data, our approach aims to compare economic aggregates by minimizing the distance between future realizations of economic shocks.

Our structural labor market characteristics include manufacturing, construction, petroleum, public administration, and finance/insurance/real estate employment shares; the log of the working age population (24-59); and the log of the university to high school labor ratio. These variables are all measured in 1990/1. Our predictor set also includes the 1980-90 Census Bartik instrument, to control for pre-trends, as their may be subsequent positive momentum in labor market shocks within cities. The labor market shocks to be predicted are the Census Bartik instrument, the CBP Bartik instruments, and the change in imports per worker from China.[24] The changes in these variables are all from 1990/1 to 2011.

5.3.1 Matching results

Table 8 shows the average root mean-squared forecasting errors (RMSFE) across Canadian cities for the both the matching and predicted variables relative to their standard deviations. Clearly, the matching errors are small on average and all less than one-half of one standard deviation. Not surprisingly, the errors on the matched variables in panel B of table 8 are even smaller and all less than one-third of one standard deviation.

We display example of Canadian cities to their U.S. counterparts in table 9 and in figure 6. First, for a select few Canadian cities, table 9 shows the corresponding U.S. matches. For brevity, only U.S. cities with positive weight are listed. In general, the results are

[23] For a recent example, see Gabriel et al. (2016).

[24] As a reference variable, we also include population ages 24-59 in the vector of predictands.

congruent our expectations. For example, Hamilton, an archetype manufacturing city in Canada, matches 52 percent to Detroit, 16 percent to Charlotte, 11 percent to Fayetteville and 9 percent to Pittsburgh. Similarly, Windsor matches to Youngstown and Fayetteville and large Canadian cities are paired with their large American counterparts. The map in Figure 6 colorfully and more fully assigns Canadian cities to the U.S. city with the highest percentage in its match. In the map, the triangles get larger and colors get darker as the size of the largest match increases. Printed cities have a first match of at least 30 percent. In total, the map shows the geographic concordance of Canadian and U.S. cities: Oil rich areas such as Medicine Hat and Red Deer have matches in Texas, high manufacturing areas like Hamilton, Windsor, Kitchener, and Guelph have largest matches located in the upper Midwest and Northeast, and large Canadian cities, including Toronto, Montreal, Vancouver, and Ottawa match to large American cities on the East and West Costs.

5.3.2 Revised Bartik Estimates

With our Synthetic weights in hand, we can re-estimate our main 2SLS Bartik regressions, re-weighting the U.S. data to match Canada using these Synthetic weights. Indeed, above in table 5 we find differences (though often not statistically significant) in the respective responses to changes in local employment. However, the foregoing econometric approach is silent on the nature of these differences in the sense that they could arise due to distributional or data measurement differences across the U.S. and Canada. By re-weighting the U.S. in the regression according to the Synthetic weights, we are directly comparing similar Canadian and U.S. cities within our estimation. Further, as the re-weighted U.S. cities still use U.S. data, we mitigate concerns regarding cross-country data differences. First, the results in Panel A of table 10 mimic those of table 5, except that it is written in terms of a main effect for both the U.S. and Canada, and with an interaction effect for Canada only. The results in panel B, re-weight the U.S. sample to correspond with its matched Canadian cities. In a sense, it is the U.S. sample as if it shared observable Canadian characteristics. While the precision of the estimates tends to decrease somewhat substantially, it is interesting to note the changes. Panel C extends panel B by including institutional variables, such as the minimum wage and union coverage in 1990 as predictors in the Synthetic match.

First in panel B column 1, we see that the wage effects are now virtually identical in the two countries. The housing cost shifts also become much smaller, albeit very imprecise. The

U.S. cities matched to Canada appear to have more flexible housing markets. We see slightly stronger evidence that Bartik shocks have a weaker impact on unemployment status, and perhaps more importantly, the benefits that come with them. Evidence suggesting that the relative number of university graduates and firms increase stays roughly as strong as before.

5.3.3 Heterogeneous Results City by City

6 Conclusion

References

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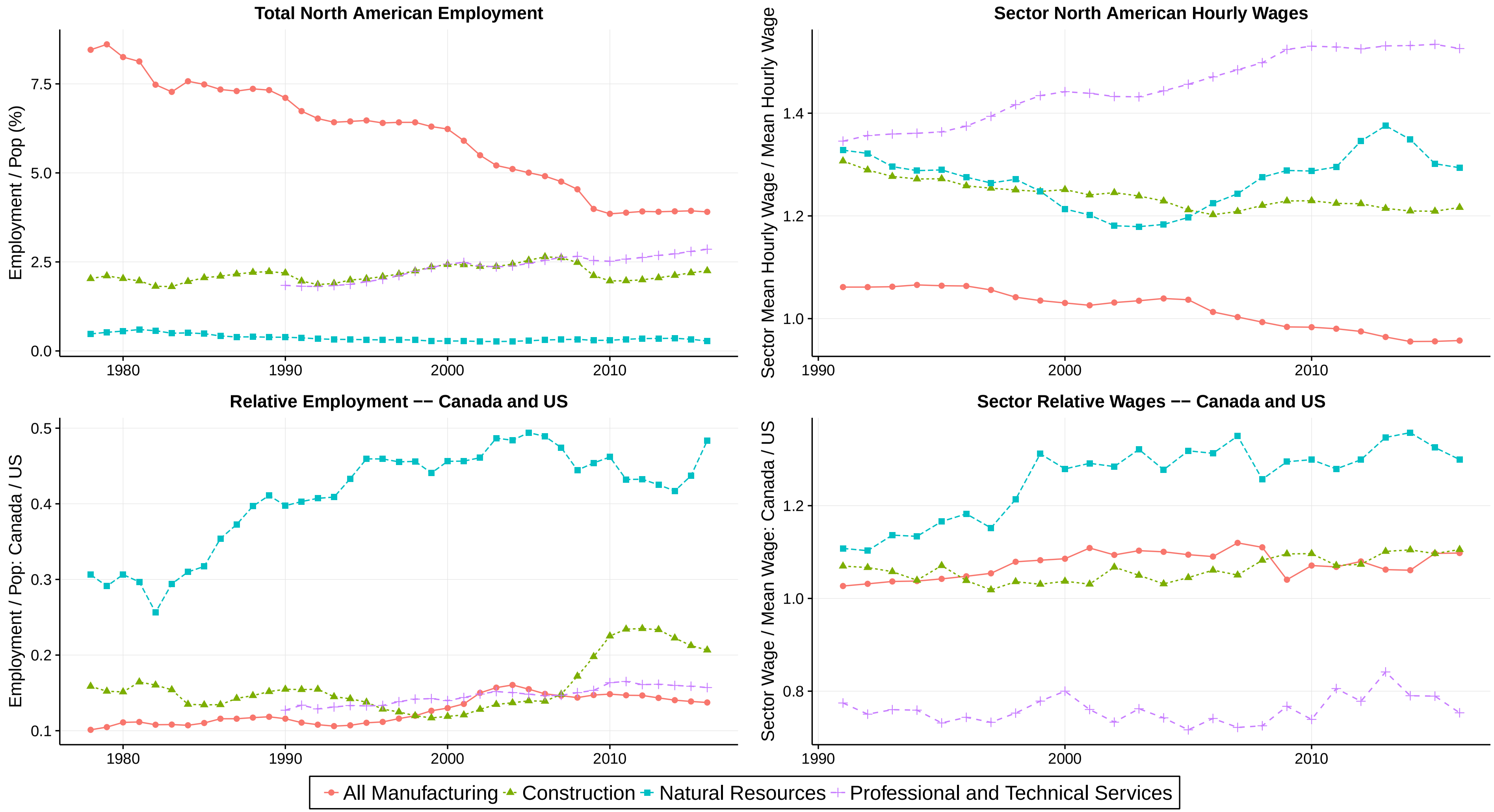
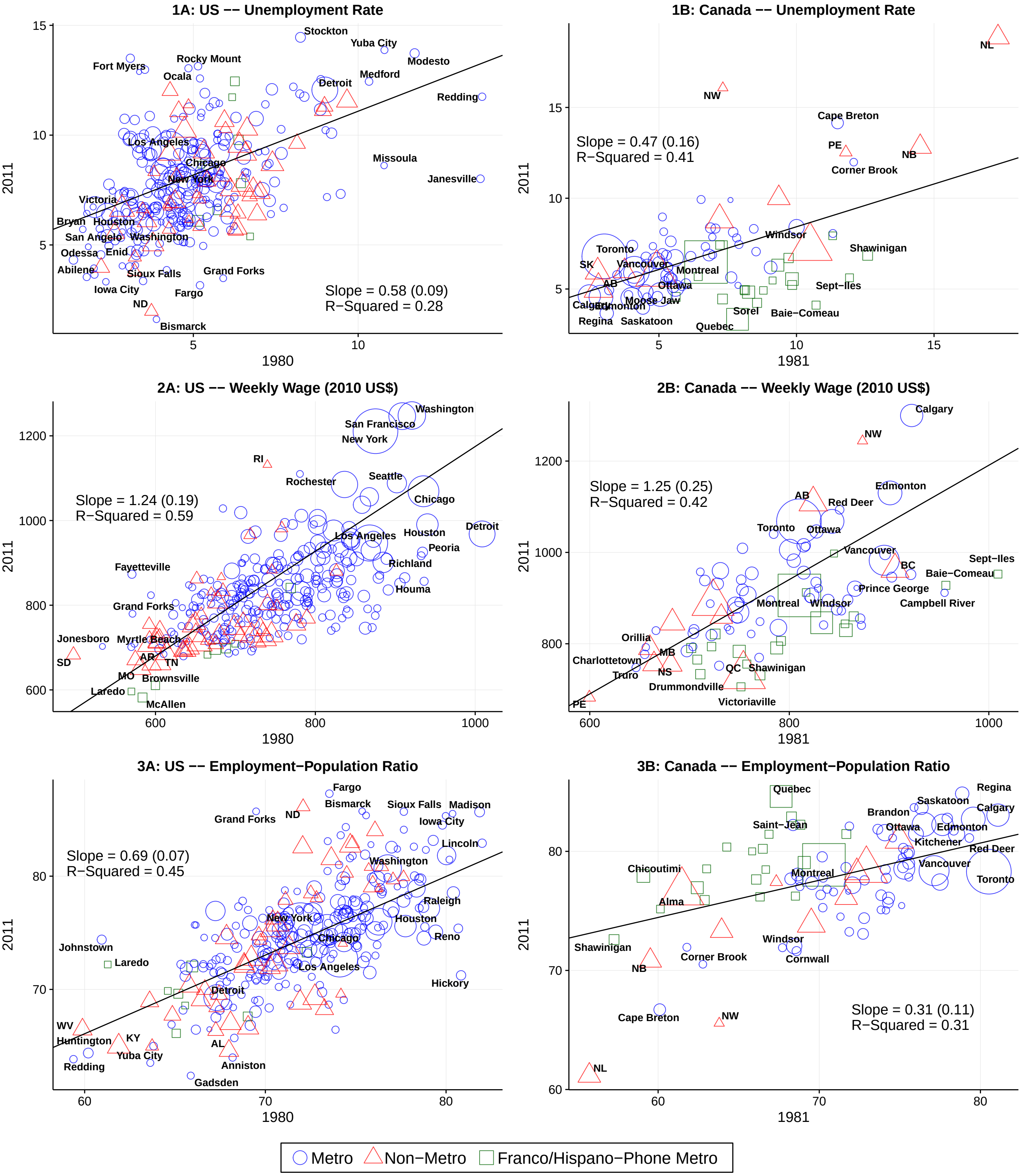
7 Figures

Figure 1: Manufacturing, Construction, Natural Resources, and Professional Services Employment



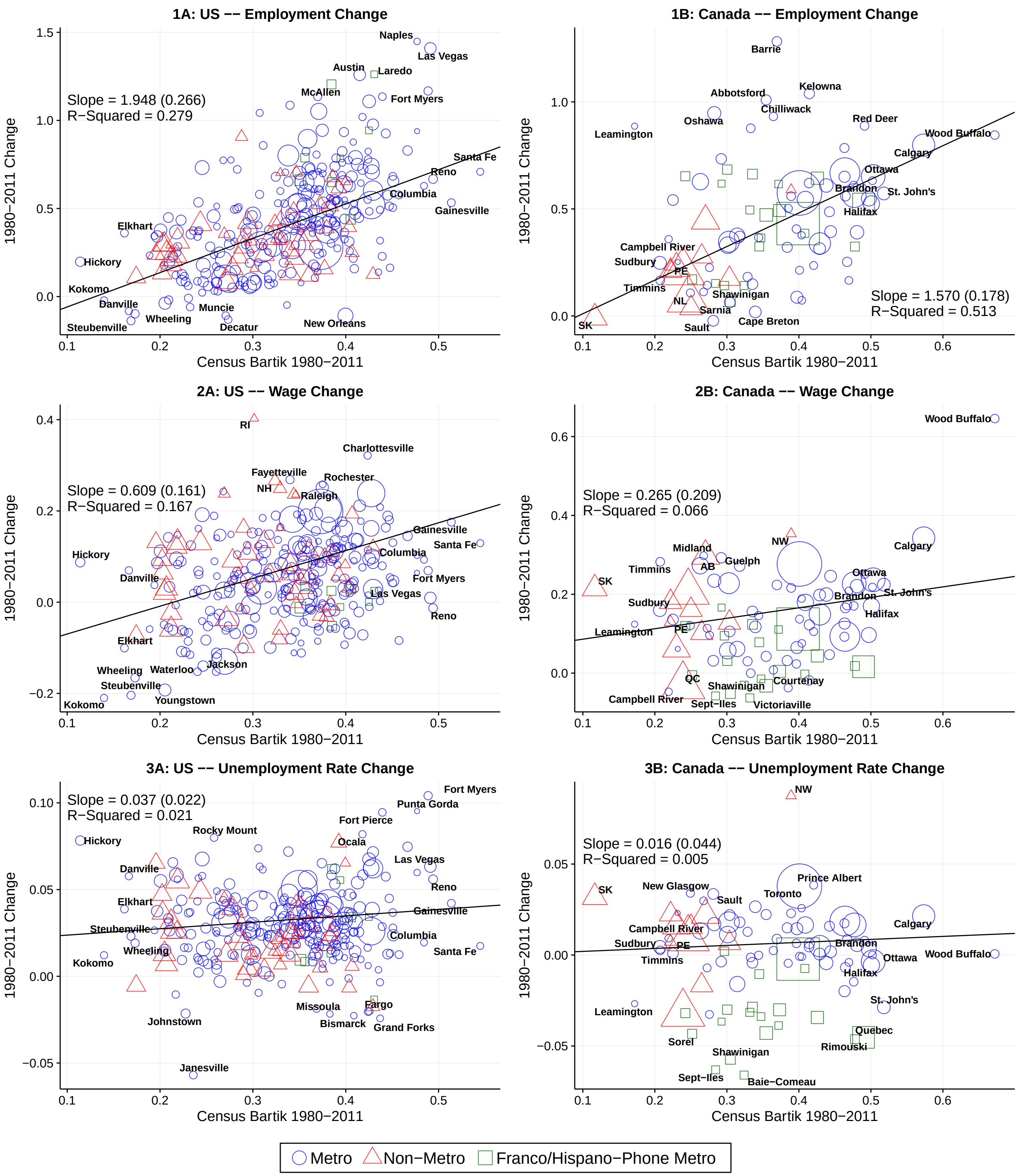
Notes: Data from Datastream. U.S. Datastream Employment Codes: USEMPMANO (All Manufacturing), USEM23..O (Construction), USEMIU..O (Natural Resources), USEM54..O (Professional and Technical Services). U.S. Datastream Wage Codes: USWRIP..B (U.S. Average), USWAGMANA (All Manufacturing), USWR23..A (Construction), USWRIU..B (Natural Resources), and USWR54..A (Professional and Technical Services). Canada Datastream Employment Codes: CN968122 (All Manufacturing), CN968121 (Employed Construction), CN968119 (Natural Resources), and CN968127 (Professional and Technical Services). Canada Datastream Wage Codes: CNWAGES.A (Canada Average), CNWAGMANA (All Manufacturing), CN181928 (Construction), CN181921 (Natural Resources), and CN182109 (Professional and Technical Services). North American mean hourly wages are weighted by country-level population.

Figure 2: U.S. and Canada – Employment, Unemployment, and Wages by Metro Area



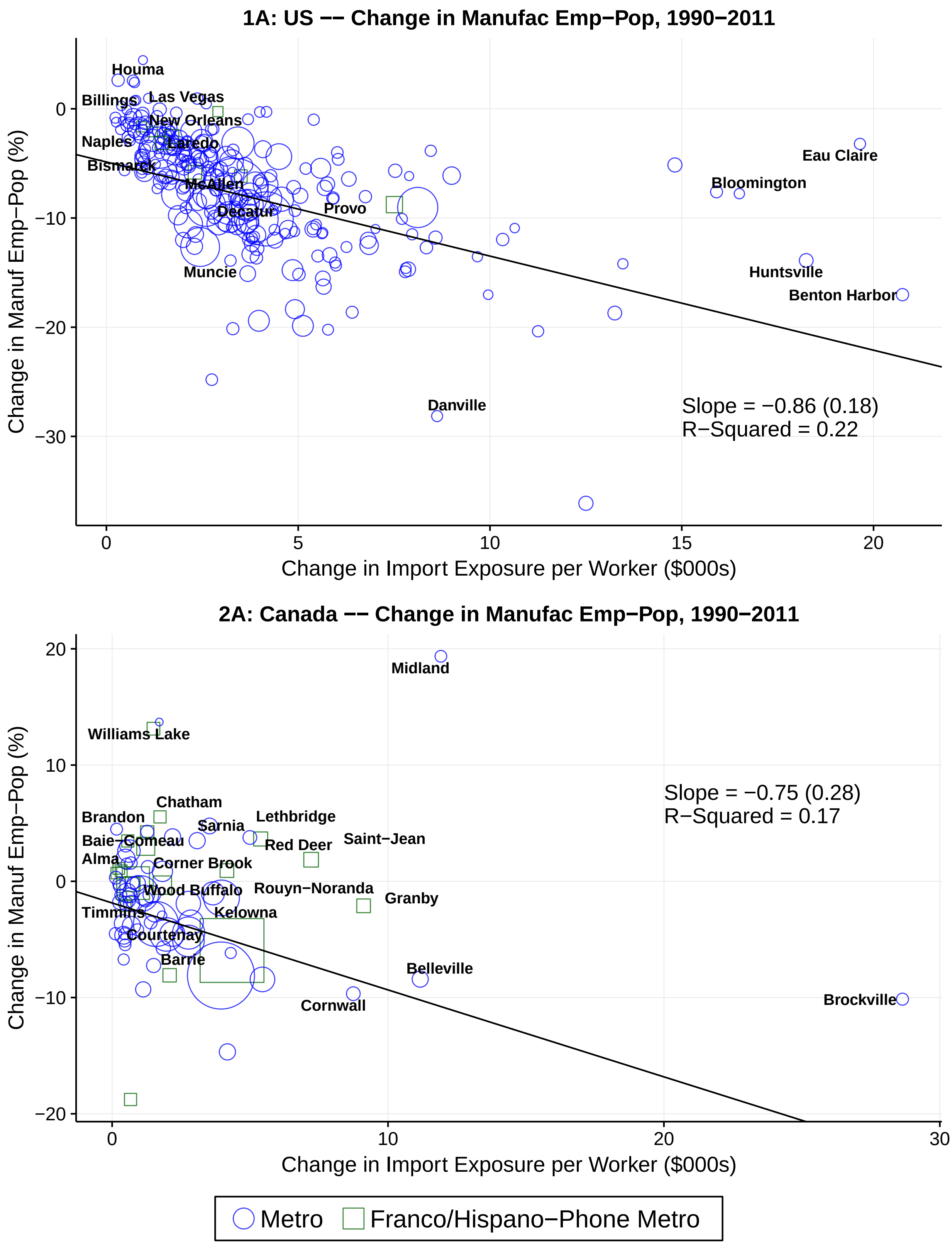
Notes: The unemployment rate, weekly wage, and the employment population ratio in the U.S. and Canada. In each panel, the points and regression line are weighted using population 24-59 in 1980. Text within each plot shows the slope of the weighted regression line with its heteroskedasticity robust standard error in parentheses.

Figure 3: Reduced Form Census Bartik Estimates



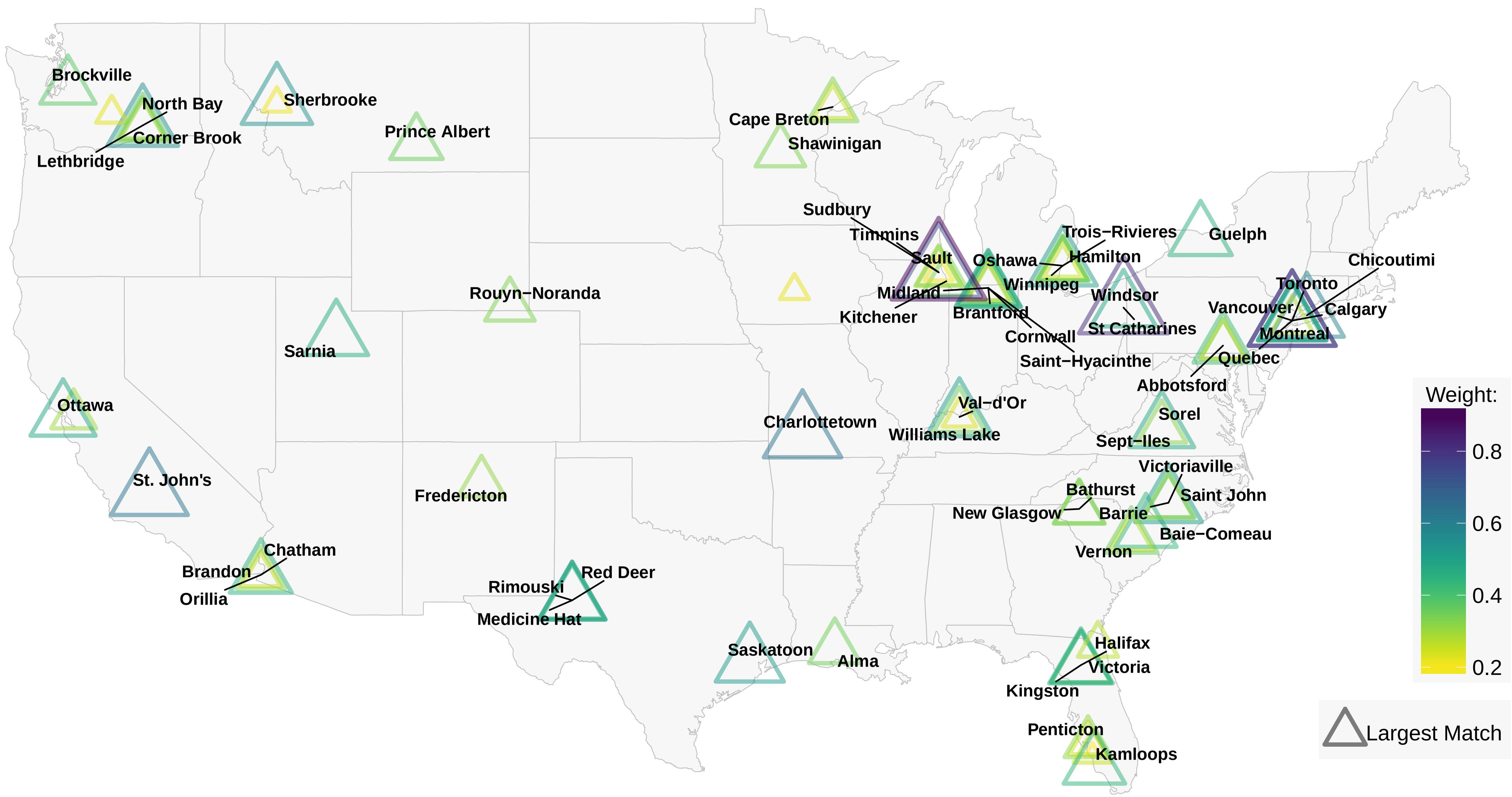
Notes: Points and regression line are weighted by population ages 24 - 59 in 1980. Text within each plot shows the slope of the weighted regression line with its heteroskedasticity robust standard error in parentheses.

Figure 4: Reduced Form Imports per Worker Estimates



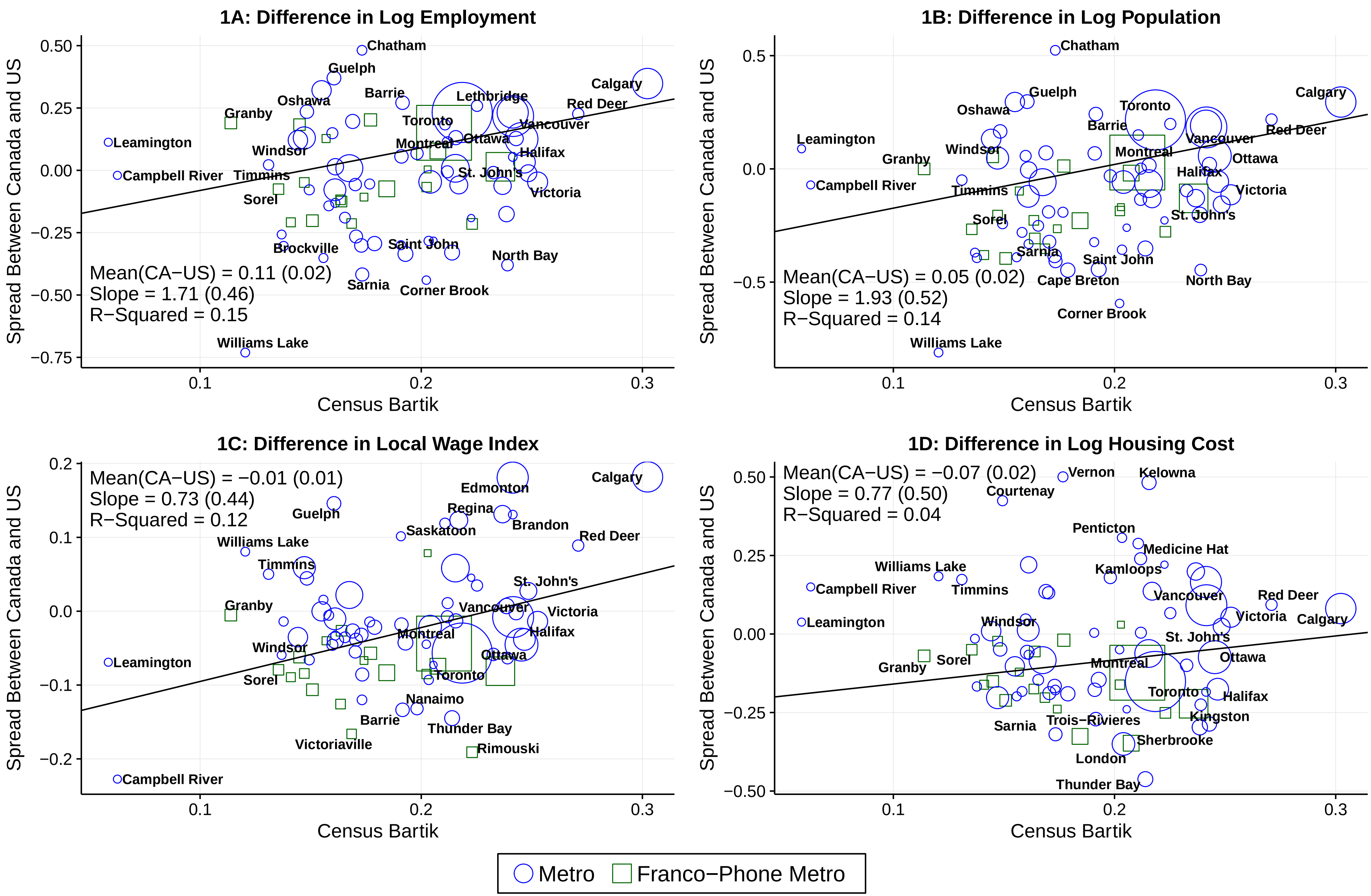
Notes: Points and regression line are weighted by population ages 24 - 59 in 1990. Text within each plot shows the slope of the weighted regression line with its heteroskedasticity robust standard error in parentheses.

Figure 5: Largest Canadian Matches in U.S.



Notes: The largest US Synthetic Control match for each Canadian city. Printed cities have a first match of at least 30 percent. The triangles get larger and colors get darker as the size of the largest match increases.

Figure 6: Spread Between Canada and U.S. Local Labor Market Matches



Notes: Points and regression line are weighted by population ages 24 - 59 in 1990.

8 Tables

Table 1: Labor Market Statistics for Regions in the U.S. and Canada – Ages 24 to 59

Panel A: United States

	Unemployment Rate (%)				Manufacturing Share (%)			
	1980	1990	2000	2011	1980	1990	2000	2011
U.S. Overall	4.9	4.6	3.8	8.2	24	19	16	12
U.S. Metro Std Dev	(1.6)	(1.1)	(1.0)	(1.8)	(8)	(7)	(6)	(5)
East North Central	6.2	4.8	3.6	9.0	31	25	22	17
Pacific	5.2	4.8	4.8	9.3	21	18	15	11
Appalaicha	5.8	5.2	3.8	7.6	29	22	19	14
Texas	2.8	5.2	4.0	6.5	19	15	13	10

	Unemp Insurance (USD/person)				Weekly Wage (USD)			
	1980	1990	2000	2011	1980	1990	2000	2011
U.S. Overall	520	251	194	707	796	888	1010	924
U.S. Metro Std Dev	(369)	(118)	(90)	(258)	(106)	(149)	(184)	(164)
East North Central	988	293	217	745	855	902	1026	909
Pacific	448	279	239	979	851	970	1086	980
Appalaicha	709	314	256	767	767	795	872	813
Texas	151	176	142	463	783	838	984	885

Panel B: Canada

	Unemployment Rate (%)				Manufacturing Share (%)			
	1981	1991	2001	2011	1981	1991	2001	2011
Canada Overall	5.8	9.3	6.4	6.3	20	15	15	10
Canada Metro Std Dev	(3.0)	(3.7)	(3.3)	(2.0)	(9)	(6)	(6)	(4)
Ontario	7.2	11.1	8.5	7.3	18	15	14	10
Atlantic Canada	7.7	11.4	8.3	6.7	12	9	8	6
Québec	7.4	10.3	6.8	5.9	23	18	17	12
Alberta	2.8	7.0	4.1	4.7	9	8	9	6

	Unemp Insurance (USD/person)				Weekly Wage (USD)			
	1981	1991	2001	2011	1981	1991	2001	2011
Canada Overall	-	1375	621	719	799	789	828	964
Canada Metro Std Dev	(-)	(261)	(230)	(231)	(69)	(79)	(103)	(146)
Ontario	-	1320	608	627	778	742	766	879
Atlantic Canada	-	1681	1050	1110	731	740	738	866
Québec	-	1650	768	926	809	769	788	877
Alberta	-	1169	450	589	882	788	856	1179

Notes: Sample consists of 310 metro and non-metro areas in the United States – observed in 1980, 1990, 2000, and 2011 – and 93 in Canada – observed in 1981, 1991, 2001, and 2011. Appalaicha defined by whether the main county is covered by the Appalachain Region Commission, excluding Ohio. 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. Canadian metro areas those with population greater than 15,000 in 1990; U.S. metro areas have population greater than 50,000 in 1999.

Table 2: Standard Deviations and Regression Slopes in the U.S. and Canada – Ages 24 to 59

	Std Dev			Slope
	1980	2000	2011	1980-2011
Panel A: United States				
Unemployment Rate	1.64	1.00	1.80	0.58
Emp-Pop Ratio (%)	3.80	4.25	3.92	0.69
Manufac Share (%)	8.30	6.38	4.86	0.48
Log Weekly Wage	0.12	0.15	0.15	0.94
Local Wage Index	0.11	0.14	0.13	0.91
Local Skill Index	0.03	0.05	0.06	1.31
Log Pop	1.43	1.43	1.42	0.98
Log Univ/HS Labor	0.33	0.35	0.34	0.92
Log Univ/HS Wage	0.07	0.09	0.12	0.78
Log 90/10 Wage	0.08	0.13	0.13	0.49
Log Housing Cost	0.21	0.31	0.44	1.82
Panel B: Canada				
Unemployment Rate	3.03	1.84	2.22	0.47
Emp-Pop Ratio (%)	6.46	3.56	3.64	0.31
Manufac Share (%)	8.70	6.24	4.26	0.40
Log Weekly Wage	0.10	0.09	0.11	0.69
Local Wage Index	0.09	0.11	0.13	0.75
Local Skill Index	0.02	0.04	0.04	0.99
Log Pop	1.40	1.61	1.45	1.02
Log Univ/HS Labor	0.28	0.24	0.37	1.22
Log Univ/HS Wage	0.07	0.07	0.07	0.24
Log 90/10 Wage	0.14	0.08	0.14	0.58
Log Housing Cost	0.29	0.26	0.33	1.09

Notes: Sample Consists of 310 metro and non-metro areas in the United States – observed in 1980, 2000, and 2011 – and 93 in Canada – observed in 1981, 2001, and 2011. All variables are measured for the 24-59 working age population. Standard deviations and regressions are weighted by 1980 population ages 24-59. Weekly Wages and Unemployment Insurance are in 2010 dollars in local currency, and weekly wages and manufacturing share are compiled using year $t-1$ data. Canadian metro areas those with population greater than 15,000 in 1990; U.S. metro areas have population greater than 50,000 in 1999.

Table 3: Population Gradients and Linguistic Isolation Effects for Local Labor Markets

	Dependent variable:						
	Log Weekly Wage	Local Wage Index	Local Skill Index	Log Univ/HS Labor	Log Univ/HS Wage	Log 90/10 Wage	Local Housing Cost
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Metros Pooled Across Years							
Log Pop	0.060***	0.063***	−0.003	0.101***	0.039***	0.046***	0.148***
	(0.006)	(0.002)	(0.004)	(0.012)	(0.003)	(0.004)	(0.014)
Log Pop × CA	−0.034***	−0.026***	−0.008*	0.038**	−0.017***	−0.037***	−0.031*
	(0.006)	(0.005)	(0.005)	(0.016)	(0.005)	(0.005)	(0.016)
Québec	−0.091***	−0.131***	0.040***	−0.132*	0.0003	−0.131***	−0.283***
	(0.017)	(0.019)	(0.003)	(0.073)	(0.018)	(0.025)	(0.035)
Hispanic Metro	−0.195***	−0.009	−0.185***	−0.323***	0.144***	0.107***	−0.081
	(0.065)	(0.055)	(0.013)	(0.039)	(0.028)	(0.020)	(0.217)
Panel B: With Time Interactions							
Log Pop	0.056***	0.054***	0.003	0.087***	−0.003	−0.003	0.108***
	(0.005)	(0.006)	(0.002)	(0.013)	(0.006)	(0.005)	(0.020)
Log Pop × Decade	0.001	0.003	−0.002*	0.001	0.012***	0.014***	0.014***
	(0.003)	(0.002)	(0.001)	(0.005)	(0.001)	(0.001)	(0.005)
Log Pop × CA	−0.022***	−0.016**	−0.005**	−0.038**	0.004	−0.056***	−0.006
	(0.007)	(0.008)	(0.002)	(0.015)	(0.006)	(0.007)	(0.022)
Log Pop × Decade × CA	−0.004	−0.003	−0.001	0.020***	−0.006***	0.005**	−0.008
	(0.003)	(0.002)	(0.001)	(0.005)	(0.001)	(0.002)	(0.005)
Québec	−0.019	−0.013	−0.006	−0.143**	0.079***	−0.057***	−0.217***
	(0.024)	(0.029)	(0.007)	(0.056)	(0.019)	(0.020)	(0.044)
Québec × Decade	−0.023***	−0.037***	0.014***	0.015*	−0.024***	−0.019***	−0.022***
	(0.007)	(0.007)	(0.002)	(0.008)	(0.001)	(0.004)	(0.008)
Hispanic Metro	−0.121	−0.028	−0.093**	−0.117	0.149**	0.025	0.186
	(0.077)	(0.039)	(0.039)	(0.129)	(0.063)	(0.027)	(0.135)
Hispanic Metro × Decade	−0.022***	0.006	−0.028***	−0.073**	−0.007	0.020***	−0.084***
	(0.005)	(0.006)	(0.009)	(0.035)	(0.011)	(0.004)	(0.026)
Observations	1,725	1,725	1,725	1,725	1,725	1,725	1,462

Notes: Sample consists of 263 metro areas in the United States – observed in 1980, 1990, 2000, 2007, and 2011 – and 82 in Canada – observed in 1981, 1991, 2001, 2006, and 2011. Controls include indicator variables for each year are interacted with country are included. Canadian metro areas those with population greater than 15,000 in 1990; U.S. metro areas have population greater than 50,000 in 1999. Regressions are weighted by start of period population 24-59. Heteroskedasticity robust standard errors clustered at the state/province level and are in parentheses. *, **, *** indicates statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 4: First Stage Estimates – Changes in Local Employment and Sectoral Shifts Predicted at the National Level (Bartik): 1990 to 2011

	Dependent variable: Difference in Log Census Employment			
	(1)	(2)	(3)	(4)
Panel A: United States				
Census Bartik	1.695**		0.962	0.334
	(0.664)		(0.727)	(0.552)
CBP Bartik		0.740***	0.480**	0.527**
		(0.210)	(0.189)	(0.204)
First Stage F-Statistic	6.5	12.5	6.3	5.7
R^2	0.375	0.378	0.386	0.516
Census Div FE?	No	No	No	Yes
Panel B: Canada				
Census Bartik	1.235***		1.224***	1.130***
	(0.341)		(0.359)	(0.323)
CBP Bartik		0.205**	0.031	0.050
		(0.084)	(0.080)	(0.081)
First Stage F-Statistic	13.1	5.9	16.9	8.0
R^2	0.458	0.364	0.458	0.481
Region FE?	No	No	No	Yes
Panel C: United States & Canada				
Census Bartik	1.563***		1.110**	0.729**
	(0.490)		(0.458)	(0.322)
CBP Bartik		0.658***	0.379**	0.378**
		(0.182)	(0.150)	(0.156)
First Stage F-Statistic	10.2	13.1	6.4	7.2
R^2	0.386	0.378	0.395	0.514
Census Div/Region FE?	No	No	No	Yes
US Bartik = CA Bartik pval	0.446	0.015	0.068	0.090

Notes: Sample consists of 263 metro areas in the United States – observed in 1990, 2000, 2006, and 2011 – and 82 in Canada – observed in 1991, 2001, 2006, and 2011. The Census and CBP Bartik instruments are calculated using census data and County (US) or Canadian (CA) Business Patterns Surveys, respectively. Both the CBP and Bartik instruments are calculated using the start of period as the base year. Controls include a dummy variable for decade; in panel C, decadal fixed effects with an indicator for country. Canadian metro areas those with population greater than 15,000 in 1990; U.S. metro areas have population greater than 50,000 in 1999. Regressions are weighted by start of period population 24-59. Heteroskedasticity robust standard errors clustered at the state/province level and are in parentheses. *, **, *** indicates statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 5: 2SLS Estimates – Local Labor Market Effects of Sectoral Shifts Predicted at the National Level (Bartik): 1990 to 2011

	Dependent variable: Decadal Change in									
	Local Wage Index	Log Housing Cost	Log Pop	Emp-Pop Ratio	Unemp Rate	Log Univ/HS Labor	Log Univ/HS Wage	Log # of Firms	Log Unemp Insur	Log Soc Sec Retire
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δ Log Employment × United States	0.571***	1.704***	0.544***	0.309***	−0.169***	−0.336**	0.153	0.665**	−3.925***	−0.370
	(0.127)	(0.493)	(0.182)	(0.079)	(0.032)	(0.149)	(0.099)	(0.318)	(0.884)	(0.260)
Δ Log Employment × Canada	0.778***	0.461*	0.610	0.145**	−0.138***	0.310	0.042	2.005***	−1.369**	1.447
	(0.135)	(0.245)	(0.434)	(0.065)	(0.032)	(0.249)	(0.159)	(0.548)	(0.693)	(1.441)
Observations	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	963	963
US = CA p-value	0.130	0.013	0.445	0.051	0.238	0.013	0.273	0.016	0.010	0.108

Notes: Sample consists of 263 metro areas in the United States – observed in 1990, 2000, 2006, and 2011 – and 82 in Canada – observed in 1991, 2001, 2006, and 2011. Not all dependent variables are available for all metro areas. The Census and CBP Bartik instruments are calculated using census data and County (US) or Canadian (CA) Business Patterns Surveys, respectively. Both the CBP and Bartik instruments are calculated using the start of period as the base year. Within each panel, controls include decadal and census division/region fixed effects. Canadian metro areas those with population greater than 15,000 in 1990; U.S. metro areas have population greater than 50,000 in 1999. Bootstrapped standard errors are in parentheses, with re-sampling stratified by country and decade. The p-value in the bottom row with the hull hypothesis of equality on the coefficients (Δ Log Employment) across the United States and Canada is also bootstrapped by re-sampling within each country and decade. Regressions are weighted by start of period population 24-59. *, **, *** asterisks indicates statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 6: First Stage Estimates – Changes in Local Imports per Worker and Predicted Changes in Imports per Worker

	Dependent variable: Δ imports from China per worker	
	US	CA
	(1)	(2)
Δ imports from China to Other Countries per US worker	0.661***	
	(0.086)	
Δ imports from China to Other Countries per CA worker		0.764***
		(0.051)
Start of period manufacturing share	3.152***	1.822***
	(0.715)	(0.187)
Observations	789	246
R^2	0.587	0.683
ΔIPW from China to Other: US = CA pval	0.297	
Start of Period Manufac Share: US = CA pval	0.071	

Notes: Sample consists of 263 metro areas in the United States – observed in 1990, 2000, 2007, and 2011 – and 82 in Canada – observed in 1991, 2000/1, 2006/7, and 2011. In both columns, controls include decadal fixed effects and census division (column (1), U.S.) or region (column (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), lagged employment, and lagged employment shares. Imports from China to Other Countries for Canada are adjusted using the 1990 relative population between the U.S. and Canada (by multiplying by (27.79 / 249.6)). For Canada in column (2), predicted imports per worker from 1991 to 2000 uses 1991 employment and employment shares as Canadian CBP data is only available beginning in 1991. Canadian metro areas those with population greater than 15,000 in 1990; U.S. metro areas have population greater than 50,000 in 1999. Regressions are weighted by start of period population 24-59. Heteroskedasticity robust standard errors clustered at the state/province level and are in parentheses. *, **, *** indicates statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 7: 2SLS Estimates – Local Labor Market Effects of Imports per Worker from China: 1990 to 2011

	Dependent variable: Decadal Change in						
	Log Manufac Emp	Log Pop	Emp-Pop Ratio	Manufac Local Index	Log Housing Cost	Log Unemp Insur	Log Soc Sec Retire
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: United States							
Start of Period Manufac Share	0.237*	−0.164	−0.001	−0.065	0.056	−0.454	−0.152
	(0.121)	(0.102)	(0.024)	(0.054)	(0.189)	(0.325)	(0.117)
Δ imports from China to CA per worker	−0.037***	0.003	−0.006**	−0.008*	−0.043*	0.054	0.015
	(0.012)	(0.011)	(0.003)	(0.005)	(0.026)	(0.035)	(0.010)
Observations	789	789	789	789	789	774	774
Panel B: Canada							
Start of Period Manufac Share	0.260	−0.010	0.012	−0.065	−0.230***	−0.198	0.525*
	(0.202)	(0.056)	(0.014)	(0.079)	(0.088)	(0.151)	(0.290)
Δ imports from China to CA per worker	−0.047	0.038*	−0.009***	0.018**	0.025**	0.036	−0.098**
	(0.037)	(0.021)	(0.003)	(0.008)	(0.011)	(0.037)	(0.043)
Observations	246	246	246	246	246	189	189
Δ IPW US = CA pval	0.773	0.171	0.638	0.109	0.181	0.856	0.032
Start of Period Manufac Share US = CA pval	0.928	0.413	0.823	0.997	0.445	0.747	0.097

Notes: Sample consists of 263 metro areas in the United States – observed in 1990, 2000, 2007, and 2011 – and 82 in Canada – observed in 1991, 2000/1, 2006/7, and 2011. Not all dependent variables are available for all metro areas. See the notes to table 6 for descriptions of the imports per worker variables. Controls include census division/region and decadal fixed effects. Regressions are weighted by start of period population 24-59. Heteroskedasticity robust standard errors clustered at the state/province level and are in parentheses. *, **, *** indicates statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 8: Average Synthetic Control Matching Errors

	RMSFE / Sd
Panel A: Synth Predicted Variables	
Census Bartik	0.439
CBP Bartik	0.497
Δ Imports per Worker	0.388
Panel B: Synth Matching Variables	
Manufacturing Emp Share	0.240
Construction Emp Share	0.285
Oil Emp Share	0.230
Public Admin Emp Share	0.279
Finance Emp Share	0.257
Population 1990	0.046
Census Bartik 1980-90	0.116
Log Univ/HS Labor	0.208

Notes: For each variable used in Synthetic matching algorithm (left column), the right columns shows the root mean-squared forecast error (RMSFE) divided by the standard deviation and then averaged across Canadian metro areas. Synthetic matches for each of the 71 Canadian metro areas are constructed from a linear combination of 263 US metro areas.

Table 9: Selected Synthetic Control Matches

City	US Synth Weights
Guelph	Rochester 0.45; Kalamazoo 0.34; Bloomington 0.19; Elkhart 0.01; Bloomington 0.01
Hamilton	Detroit 0.52; Charlotte 0.16; Fayetteville 0.11; Pittsburgh 0.09; Rochester 0.08; FortWayne 0.04
Montreal	NewYork 0.79; Hickory 0.19; SanFrancisco 0.02
Ottawa	SanFrancisco 0.48; Washington 0.28; SantaFe 0.24
Toronto	NewYork 0.78; Hickory 0.09; SanFrancisco 0.09; Bloomington 0.03
Vancouver	NewYork 0.47; Gainesville 0.16; LosAngeles 0.16; Detroit 0.08; Rochester 0.05; Visalia 0.04; Richland 0.03
Windsor	Youngstown 0.82; Fayetteville 0.18

Notes: The left column shows selected Canadian Cities. The right column shows the match and weight on each US city. For brevity, only US cities with positive weights are listed.

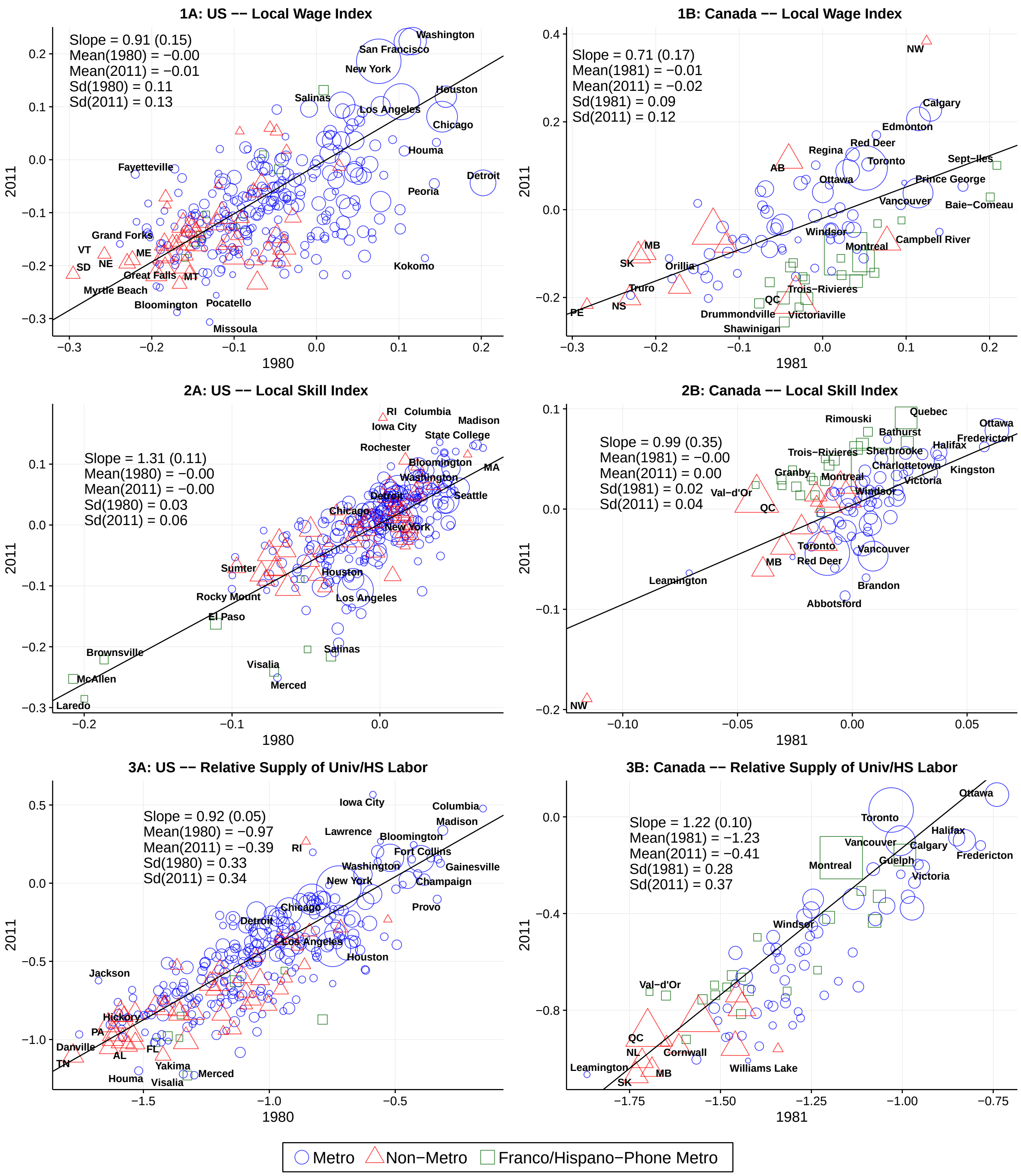
Table 10: 2SLS Estimates Using Synthetic Weights – Local Labor Market Effects of Sectoral Shifts Predicted at the National Level (Bartik): 1990 to 2011

	Dependent variable: Decadal Change in									
	Local Wage Index	Log Housing Cost	Log Pop	Emp-Pop Ratio	Unemp Rate	Log Univ/HS Labor	Log Univ/HS Wage	Log # of Firms	Log Unemp Insur	Log Soc Sec Retire
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Population Weights										
Census Bartik	0.571***	1.704***	0.544***	0.309***	−0.169***	−0.336**	0.153	0.665**	−3.925***	−0.370
	(0.128)	(0.492)	(0.178)	(0.079)	(0.033)	(0.157)	(0.101)	(0.314)	(0.894)	(0.252)
Census Bartik × Canada	0.207	−1.243**	0.066	−0.164	0.031	0.646**	−0.111	1.341**	2.556**	1.817
	(0.185)	(0.548)	(0.456)	(0.100)	(0.045)	(0.295)	(0.188)	(0.626)	(1.126)	(1.376)
Panel B: Synthetic Control and Population Weights										
Census Bartik	0.725**	0.850	0.223	0.618***	−0.308***	−0.434	0.146	0.778**	−8.975***	−0.583*
	(0.281)	(1.187)	(0.250)	(0.207)	(0.098)	(0.274)	(0.170)	(0.384)	(2.297)	(0.317)
Census Bartik × Canada	0.030	−0.376	0.269	−0.486**	0.176*	0.696*	−0.101	1.217*	7.775***	2.814*
	(0.312)	(1.211)	(0.544)	(0.215)	(0.103)	(0.367)	(0.230)	(0.631)	(2.392)	(1.439)
Observations	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	963	963

Notes: See the notes for table 5. Panel A shows the baseline results results where the regression is weighted by the population ages 24 - 59. These estimates mimic the table 5. Panel B weights US observations by population and according to the Synthetic weights that match American cities to Canadian Cities.

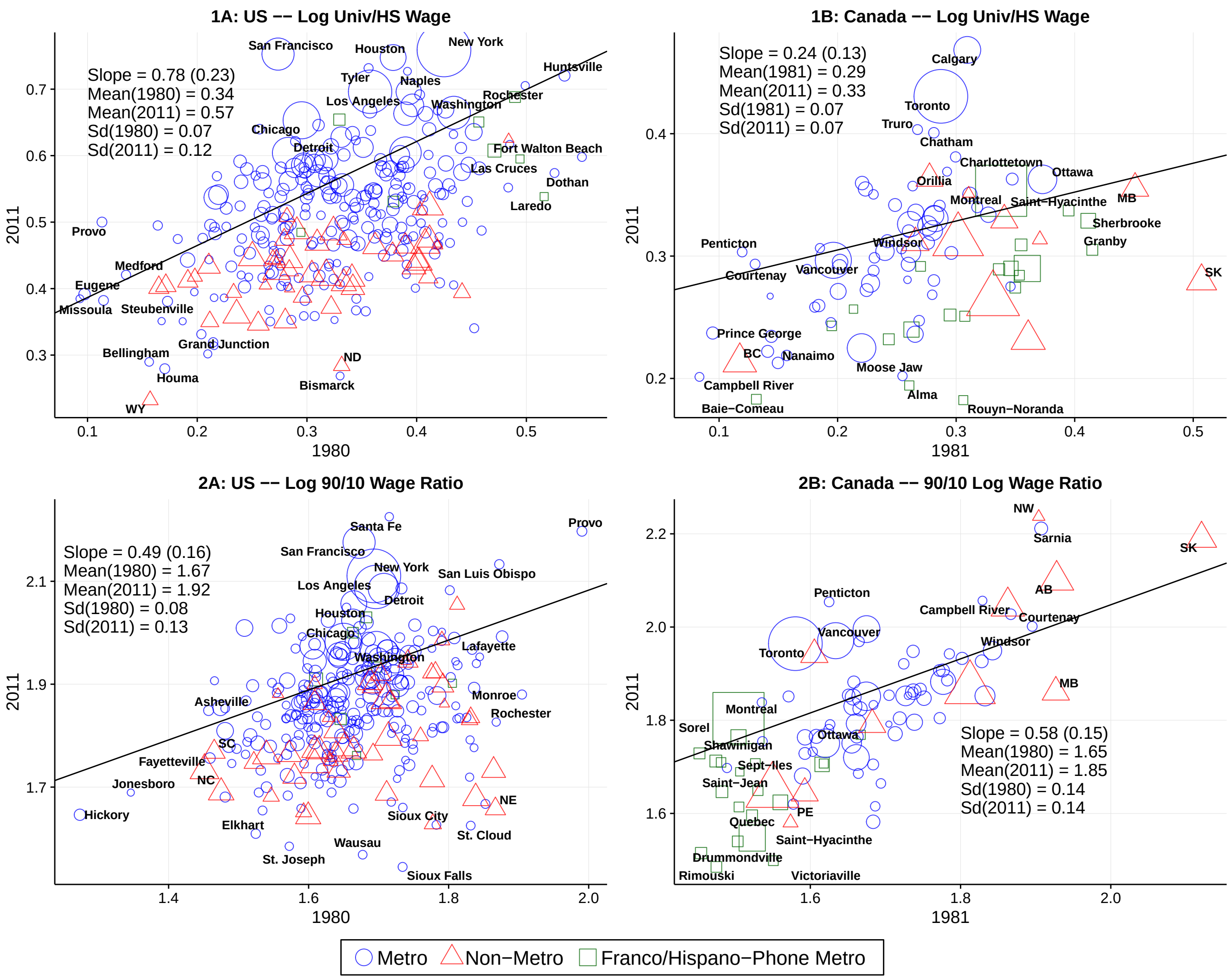
A Appendix - Figures

Figure A1: Local Wages, Skills, and University-High School Labor Supply



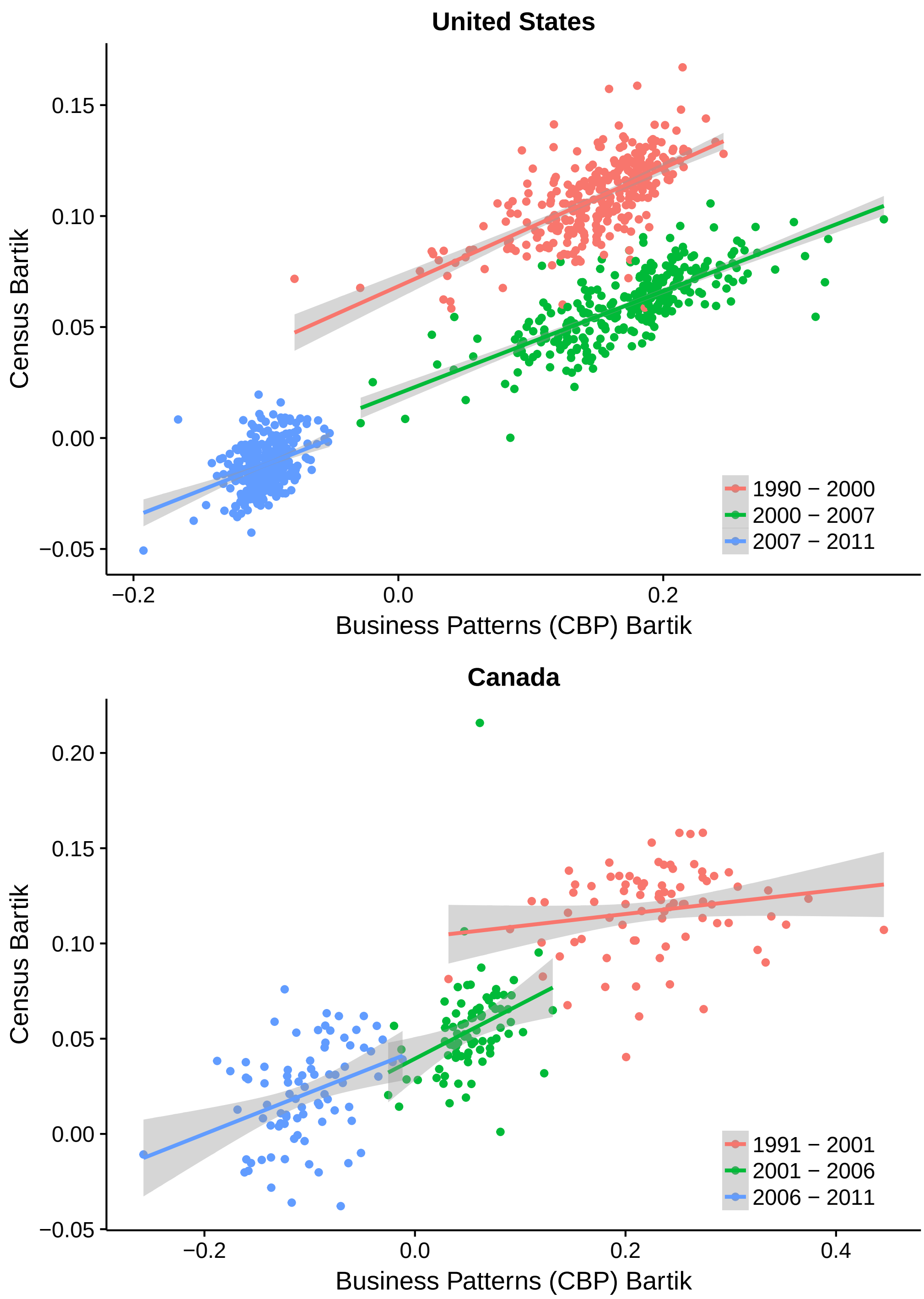
Notes: The points, means, standard deviations, and the regression line are weighted by population 24-59.

Figure A2: University-High School and 90-10 Wage Ratios



Notes: The points, means, standard deviations, and the regression line are weighted by population 24-59.

Figure A3: Census and CBP Bartik



Notes: The Census and CBP Bartik instruments. The points and the regression line are un-weighted.

B Appendix - Tables

Table B1: 2SLS Estimates – Local Labor Market Effects Of Sectoral Shifts Predicted at the National Level (Bartik): Unrestricted First Stage

	Dependent variable: Decadal Change in									
	Local Wage Index	Log Housing Cost	Log Pop	Emp-Pop Ratio	Unemp Rate	Log Univ/HS Labor	Log Univ/HS Wage	Log # of Firms	Log Unemp Insur	Log Soc Sec Retire
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δ Log Employment × United States	0.544***	1.754***	0.540***	0.308***	−0.155***	−0.421***	0.127	0.674**	−3.712***	−0.339
	(0.120)	(0.472)	(0.171)	(0.074)	(0.030)	(0.145)	(0.088)	(0.287)	(0.869)	(0.250)
Δ Log Employment × Canada	0.675***	0.313	0.857***	0.154**	−0.127***	0.397	0.025	1.579**	−1.526*	−1.205
	(0.133)	(0.270)	(0.234)	(0.063)	(0.027)	(0.268)	(0.170)	(0.640)	(0.848)	(1.087)
Observations	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	963	963
US = CA p-value	0.235	0.005	0.138	0.055	0.241	0.004	0.295	0.096	0.034	0.220

Notes: In the first stage, the CBP and Census Bartik estimates are unrestricted across the U.S. and Canada. Sample consists of 263 metro areas in the United States – observed in 1990, 2000, 2006, and 2011 – and 82 in Canada – observed in 1991, 2001, 2006, and 2011. Not all dependent variables are available for all metro areas. The Census and CBP Bartik instruments are calculated using census data and County (US) or Canadian (CA) Business Patterns Surveys, respectively. Both the CBP and Bartik instruments are calculated using the start of period as the base year. Within each panel, controls include decadal and census division/region fixed effects. Canadian metro areas those with population greater than 15,000 in 1990; U.S. metro areas have population greater than 50,000 in 1999. Bootstrapped standard errors are in parentheses, with re-sampling stratified by country and decade. The p-value in the bottom row with the hull hypothesis of equality on the coefficients (Δ Log Employment) across the United States and Canada is also bootstrapped by re-sampling within each country and decade. Regressions are weighted by start of period population 24-59. *, **, *** indicates statistical significance at the 10, 5, and 1 percent levels, respectively.

C Variation in Local Wage structures

With the distribution of educational attainment between the U.S. and Canada, it is interesting to note whether their wage structure differs at all. To consider this we adopts a framework from Katz and Murphy (1992), but here applied spatially, instead of over time. We examine how the log wages, w_{je} of those with an education level e in city j, vary across space with the wages of those with exactly a high-school degree w_{jH} and those with exactly a Bachelor's degree w_{jB}. The equation takes the form

$$w_{je} = \beta_H^k w_{jH} + \beta_B^k w_{jB} \tag{9}$$

where no constant is used.

The evidence presented in table **??** relies on a specification that may or may not include year indicators as controls. The education categories, e, include less than high school, some college (any level between high-school Bachelor's), and more than Bachelor's.

Overall, the evidence found in the cross-section is remarkably similar to that in the time series. A worker The main surprise is that the wages rewarded to Canadians less than a Bachelor's degree is closer to high school. This is true despite the fact that the estimated return is roughly similar in both countries.