Globalization and the Spread of Industrialization in Canada, 1871–1891*

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Abstract

The dramatic decrease in international trade costs in the second half of the nineteenth century led to a global trade boom. In this paper, we examine the consequences of greater openness to international trade for regional economic activity in a small, open economy during the first era of globalization. Specifically, we provide a quantitative assessment of the role that exposure to globalization played in industrialization in Canada between 1871 and 1891. Greater exposure to globalization leads to faster growth of manufacturing and the greater concentration of industry around entrepôts of trade between Canada and the rest of the world.

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1. Introduction

The dramatic decrease in international trade costs in the second half of the nineteenth century led to a global trade boom (Estevadeordal, Frantz and Taylor, 2003; Jacks, Meissner and Novy, 2010; Pascali, 2017). This growth in world trade was accompanied by increased international capital and labor flows as well as the convergence of living standards for countries at the core of the Atlantic world (O'Rourke, Taylor and Williamson, 1996; Hatton and Williamson, 1998; O'Rourke and Williamson, 1999). Although a substantial literature has addressed the role of globalization in narrowing differences *between* countries (Abramovitz, 1986; Maddison, 1987; Williamson, 1996), the potential for greater economic integration to reshape the pattern of regional development and structural transformation *within* countries has received comparatively less attention. Moreover, while the experiences of the largest economies and the connections between them are well understood, this is less true of smaller economies that draw a closer analogy to today's developing world.

In this paper, we examine the consequences of greater openness to international trade for regional economic activity during the first era of globalization. In this broader context we focus on Canada and the increase in the geographic concentration of manufacturing in this period. The case of Canada is illustrative: it was a small open economy with limited ability to affect its terms of trade; there were substantial differences in proximity to international markets across regions due to internal economic geography; and the pace of industrialization was rapid but uneven across regions. The goal of this paper is to link these three facts.

Specifically, we provide a quantitative assessment of the role that exposure to globalization played in regional industrialization in Canada between 1871 and 1891. To motivate our empirical analysis, we draw on recent theoretical work by Coşar and Fajgelbaum (2016). These authors show that domestic trade costs combined with differential openness to international trade across industries leads to a dual economy structure in which some regions are specialized in industries exposed to international markets while other regions are isolated from international markets. As a result, greater exposure to globalization–as Canada experienced in the second half of the nineteenth century–exacerbates differences within countries as mobile factors of production move to regions that provide better access to international markets.

To document the operation of this mechanism in Canada, we use newly digitized data on manufacturing across industries and districts between 1871 and 1891. Following Coşar and Fajgelbaum (2016), we construct a measure of exposure to globalization

that uses two sources of variation. First, we calculate domestic trade costs linking each district to the main entrepôts of trade between Canada and the rest of the world, which are based on the least cost routes between districts' economic hubs and the closest port of entry via the transportation system (e.g., including inland waterways, railroads, and short wagon journeys). Second, we calculate the share of trade (exports and imports) in industry output. This gives us a measure of openness to international trade that we use to quantify the impact of the first era of globalization on the pattern of regional industrialization in Canada.

We find evidence consistent with a role for globalization. In doing so we move beyond the factors emphasized in the literature on the economic history of Canada (Acheson, 1972; Gerriets and Inwood, 1996; Inwood, 1991; Chernoff, 2014) and consider an explanation for economic development that puts Canada in the context of the global economy. Canada–along with the Scandinavian countries, Australia, New Zealand, and Argentina–is typically placed in a group of small and resource-abundant but capital- and (skilled) labor-scarce periphery countries during the first era of globalization. In the absence of large domestic markets or access to capital to the same extent as the United States and the European core, these countries thrived as international factor and product markets integrated. However, the aggregate effects of global market integration mask differences within each country across regions, industries, and people. In the case of Canada, we emphasize how the combined forces of globalization and internal economic geography shaped regional industrialization. In this way, our paper is related to Fajgelbaum and Redding (2021) on structural transformation in Argentina in this period.

Our empirical analysis addresses several challenges associated with identifying the impact of exposure to globalization. Our baseline specification controls for industry-district, industry-year, and district-year fixed effects. In particular, industry-district fixed effects control for the features of industry performance that depend on local geography, but do not vary over time, while industry-year and district-year fixed effects control for the determinants of industrialization emphasized in the literature on the economic history of Canada, including industrial and trade policies, technology choice and scale economies, and domestic market access. Particularly important during this period, and a focus of the literature on Canadian industrial development, is the change in tariff rates due to the 1879 National Policy (Inwood and Keay, 2012; Beaulieu and Cherniwchan, 2014; Harris, Keay and Lewis, 2015; Alexander and Keay, 2018, 2019). In Section 4, we describe several extensions to our baseline specification that address the role of the Na-

tional Policy as well as other identifications concerns.

Our empirical setting has a number of features that are useful for understanding the relationship between regional development and globalization. First, Canadas integration into the world economy was driven by reductions in water and overland transportation costs that facilitated more trade with Europe and the United States. Importantly, the change in transportation costs occurred for reasons that were largely external to the Canadian economy: the steamship decreased transatlantic transportation costs and the extension of the railroad system in the United States increased access to US markets.

Second, we use disaggregated data on industrial activity across Canadian regions in the period prior to the 1890s. This allows us to focus on industrial development due to external factors that predate the dramatic structural transformation that reshaped the Canadian economy during the Wheat Boom (Bertram, 1973). We find that the nineteenth century trade boom was characterized by a high degree of specialization, as in many developing countries today, with resource-intensive industries accounting for a large share of exports. In addition, opportunities for import substitution promoted diversification across industries and technological change that followed from greater capital intensity to take advantage of economies of scale.

Third, we show that industrialization during this period involved substantial reallocation of manufacturing across space within Canada. The change in the location of industrial activity reflected the emergence of major new sources of comparative advantage shaped by regional proximity to international ports of entry and, hence, markets for exporting final goods and importing intermediate goods. This allows us to link the broad emphasis placed on Canada's rugged and expansive geography to explain the pattern of regional economic activity (Mackintosh, 1923; Creighton, 1937; Faucher and Lamontagne, 1953; Innis, 1956; Easterbrook and Aitken, 1956) with a specific causal mechanism due to changes in trade costs and Canada's status as a small, open economy.

2. Historical Setting

In 1868 John Jack and Edward Beaton opened an iron foundry in Bear River, Nova Scotia. In the 1870s Bear River had a population of approximately 900, and in addition to Jack, Beaton and Co. there was a tannery and a cluster of saw mills operating in and around the village-center. The closest port of entry for import and export goods was the customs house in the town of Digby, located about 10 miles west of Bear River, which boasted a fairly active deep-water port.[1] Annapolis Royal was another nearby market

[1]Ports of entry in late nineteenth century Canada were defined by the presence of a customs house. Digby's customs house was moderately busy, handling just under $134,000 in trade in 1871. Approx-

town 16 miles north of Bear River, and in 1871 it was home to the last station on the Windsor-Annapolis Railway, which had connections to central Canadian and US markets through the Grand Trunk and Intercolonial rail lines. Halifax, by far the largest commercial center in the Maritime region, is located 130 miles north-east of Bear River. Jack, Beaton and Co.'s four employees, which included the two proprietors, produced a few Franklin Stoves and a wide range of iron castings, but they specialized in the production of ploughs and plough-parts, generating $3,000 in gross revenue from their sale in 1871.

Just over 900 miles to the west of Jack, Beaton and Co.'s foundry, Charles Thaine also operated an establishment producing castings and agricultural implements in downtown Guelph, Ontario. In 1871, Thaine's shop had three employees including the proprietor, and they generated $1,777 in gross revenue, primarily from the sale of double-mould ploughs and the eponymous Thaine's 'Self-Regulating Turnip Sower.' The biggest difference between Thaine's shop and Jack and Beaton's foundry is that Guelph was, and continues to be, a very different place than Bear River. Located in the heart of south-western Ontario, just 47 miles from Toronto and 95 miles from Buffalo, Guelph's 6,500 residents had their own very active customs house, and in 1871 the Great Western and Grand Trunk rail lines passed right through the center of town.

Also located in downtown Guelph, James Parker and John Harvey ran a small tannery in the early 1870s. They employed three men and produced $9,000 in sole leather in 1871. Like Thaine's establishment, Parker and Harvey's tannery was favorably located with easy access to transportation infrastructure, and foreign and domestic markets. However, unlike agricultural implements, finished sole leather was not a widely traded product in the late nineteenth century. Alexander and Keay (2018, p. 14) report that the historical trade elasticity for Canadian finished leather products was just -1.7, while the elasticity of substitution between foreign and domestically produced agricultural implements was -4.6. This difference in trade elasticities is reflected in differences in the industries' openness to trade. In 1871, imports and exports accounted for four times more of the Canadian agricultural implement market than the market for finished leather products: 59.3 versus 14.8 percent.

By 1891, John Jack and Edward Beaton's foundry in Bear River was no longer in operation, neither man appears in the business directories of Nova Scotia, and the total value of agricultural implement production in Annapolis County, Nova Scotia, had fallen to zero. James Parker and John Harvey's tannery in Guelph was also closed, and the gross

imately $627,000 in imports and exports passed through Guelph's customs house. The largest port of entry in Canada was Montreal, which processed over $52 million in imports and exports in 1871.

value of finished leather products produced in Guelph had fallen by over half. In contrast, Charles Thaine still managed a thriving business, and the agricultural implements industry in Guelph had increased from 8 to 12 establishments, 36 to 105 employees, and from $34,000 in gross production to more than $163,000. Jack and Beaton's foundry, Parker and Harvey's tannery, and Thaine's agricultural implement shop are not isolated examples of differential late nineteenth century industrial performance in Canada.

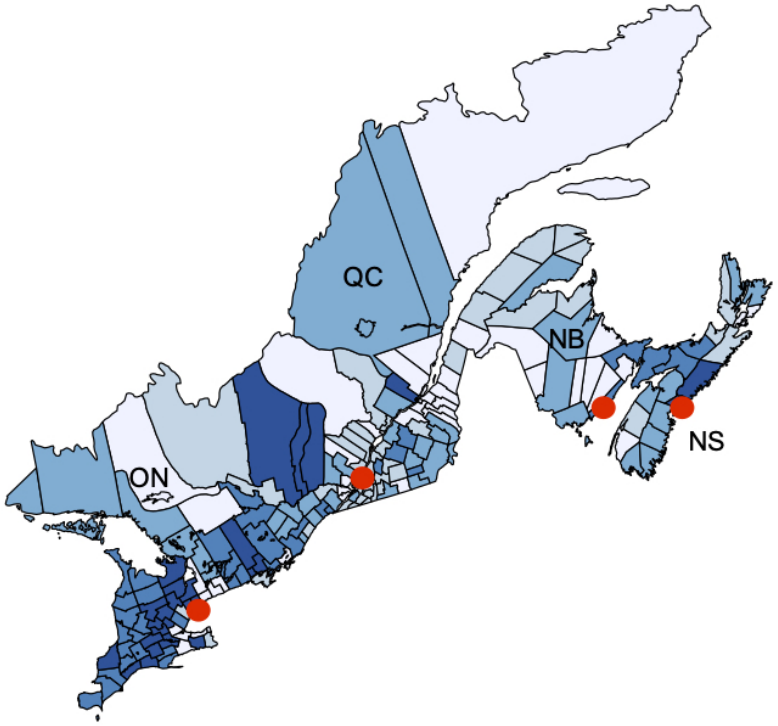
In the decades after 1870, Canada and other resource-rich economies experienced rapid economic growth (Urquhart, 1993; O'Rourke and Williamson, 1999). For Canada, GNP per capita increased by 30.9 percent between 1871 and 1891, compared with 43.1 percent for the United States and 17.3 percent for Great Britain (Inwood and Keay, 2012; Harris et al., 2015), and population increased 27.6 percent despite net negative international migration for part of this period (Urquhart, 1993, p. 24-26). For manufacturing as a whole, the number of establishments increased by 72 percent, employment rose by 86 percent, and industrial output doubled.

This growth was accompanied by significant structural changes due to mass migration, technological innovation, railway building, protectionist trade policies, and sharply falling inter- and intra-continental transportation costs. Exposure to these forces was not uniform across industries or regions. The result was that manufacturing output shifted south and west between 1871 and 1891. Traditional narratives attribute uneven growth to internal factors and innovative economic policymaking (Acheson, 1972; Inwood, 1991; Gerriets and Inwood, 1996; Chernoff, 2014). In particular, the diffusion of technologies characterized by strong internal and external scale economies and capital intensification facilitated a concentration of market power and political influence among the largest producers in the most densely populated urban areas (Bliss, 1987; Wylie, 1989). In pursuit of market share and economic rents, the beneficiaries of this concentration used their influence to shape trade, migration, and transport policies, most notably those embodied in the 1879 National Policy (Dorval, 2018; Inwood and Keay, 2005; Alexander and Keay, 2019).

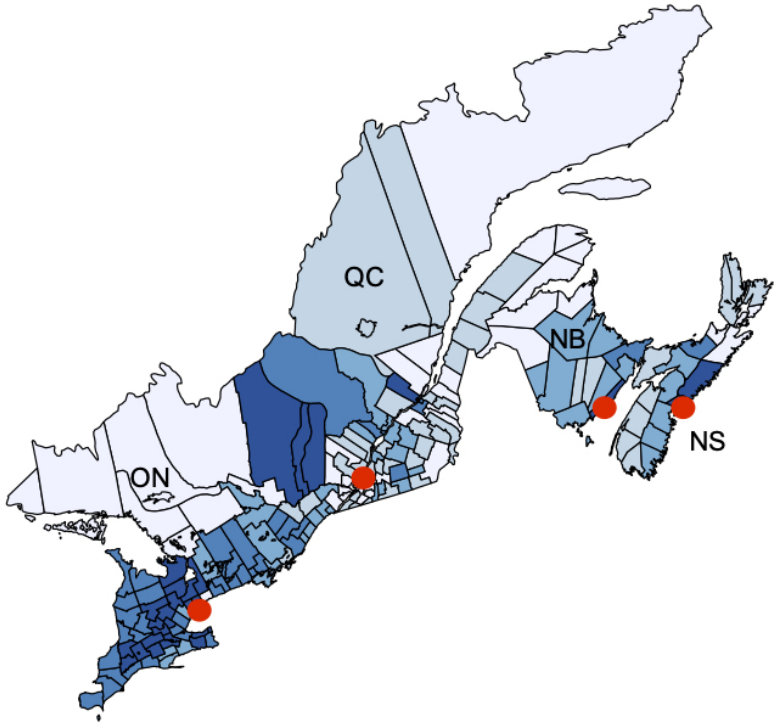
In this paper, we put these internal factors in the context of decisive changes in the world economy and an increasing role for globalization to shape economic development–especially in small, open economies–after 1870. In particular, we argue that the case studies discussed earlier in this section and the unevenness in the growth of manufacturing output from 1871 to 1891 depicted in Figure 1A were partially due to differences in exposure to globalization in 1871 shown in Figure 1B. In the remainder of the paper, we use disaggregated data to provide quantitative evidence that links exposure to

Figure 1: Manufacturing Growth and Exposure to Globalization

A. Change in manufacturing output, 1871–1891



B. Average exposure, 1871



Notes: The maps show census districts with positive production in 1871 and 1891 in Nova Scotia, New Brunswick, Quebec, and Ontario. From east to west, the cities marked with a "•" are Halifax, St. John, Montreal, and Toronto, respectively. Panel A shows the growth in manufacturing output across all industries from 1871 to 1891 for each census district. Panel B shows exposure to globalization averaged over all industries in 1871 for each census district. The growth in manufacturing output is the log difference in total district manufacturing output between 1871 and 1891. Panel B shows our measure of exposure to globalization defined in Section 3 then averaged over all industries for each district (weighted by 1871 total output). Darker shaded districts had higher manufacturing output growth between 1871 and 1891 (Panel A) or more exposure in 1871 (Panel B).

globalization to regional industrialization in Canada between 1871 and 1891.

3. Data

Our empirical analysis uses newly digitized district and industry level data for 1871 and 1891 from the Canadian censuses of industrial establishments (Canada, 1875, 1894). We harmonize districts across years to maintain 1871 geographic boundaries and combine industries using the 1948 four-digit Standard Industrial Classification (SIC). This gives 200 districts with up to 135 industries. The censuses include information on output, employment, and number of establishments at the industry-district level, which we link to information on exports and imports from the Canadian Trade and Navigation Tables in the Parliamentary Sessional Papers (Canada, 1872, 1892). Production occurred in 6,206 of the industry-districts pairs in 1871 or 1891. These observations are the focus of our empirical analysis.

We measure regional industrial activity in three ways: gross output, number of establishments, and gross output per establishment. Between 1871 and 1891, output increased by 82 percent, the number of establishments increased by 47 percent, and output per establishment increased by roughly 50 percent.

To measure exposure to globalization across industries and regions we use two sources of variation. The first reflects internal trade costs between each district's economic hub and the closest port of entry via the transportation system. Across all districts, the mean cost to move one ton of freight to the closest port of entry in 1871 was 50.73, which is roughly equivalent to moving two ton-miles by wagon, 102 ton-miles by water, or 79 ton-miles by rail. The second source of variation reflects differential openness to international trade across industries, which is measured as the value of trade relative to the size of the domestic market for each industry. Canada was remarkably open to industrial trade flows after 1870. Exports and imports accounted for over 25 percent of the Canadian market for the average industry in 1871. Specifically, export and import intensities measured as a share of gross domestic production were roughly 7 and 20 percent, respectively, in 1871. By 1891, more than a decade after the imposition of the National Policy, trade openness was just over 85 percent of domestic market.

We construct the following variable to measure exposure to globalization in 1871 that combines these sources of variation:

$$\textbf{Exposure}_{ij1871} = \underbrace{\ln \frac{\text{trade volume}_i}{\text{economic distance}_i}}_{\text{Proximity of district } i \text{ in 1871}} \times \underbrace{\ln \frac{\text{trade volume}_j}{\text{market size}_j}}_{\text{Openness of industry } j \text{ in 1871}}$$

which is calculated using data from 1871 to reflect initial exposure. The first term on the right-hand side measures district proximity to international markets as the (log) ratio of the volume of trade through the closest port of entry to district i to the economic distance from the closest port of entry to each district's economic hub.[2] The second term on the right-hand side measures industry openness as the (log) ratio of the trade volume in industry j as a share of domestic market size.[3] In both terms, trade volumes are measured using the sum of exports and imports, although we also consider the role of exports and imports separately as robustness.

4. Empirical Analysis

The goal of our empirical analysis is to quantify the impact of exposure to globalization on regional industrialization in Canada during the first era of globalization. Figure 2 provides initial evidence at the district level. The x-axis shows the mean of our exposure variable and the y-axis shows the growth in manufacturing output between 1871 and 1891 in each district. The positive relationship suggests that more exposure to globalization is associated with an increase in manufacturing activity.

The model of Coşar and Fajgelbaum (2016) formalizes this connection between proximity to ports of entry across districts, openness to trade across industries, and the uneven growth of industrial activity. In the model producers face location-specific domestic and international trade costs, and trade must pass through international ports of entry so proximity to these ports introduces heterogeneity in trade costs across regions. As a result, producers in regions initially closer to ports of entry are more specialized and economic activity is higher, while producers in regions farther away are incompletely specialized and economic activity is lower. The solid black line in Appendix Figure **??** shows the distribution of economic activity by distance to the nearest port.

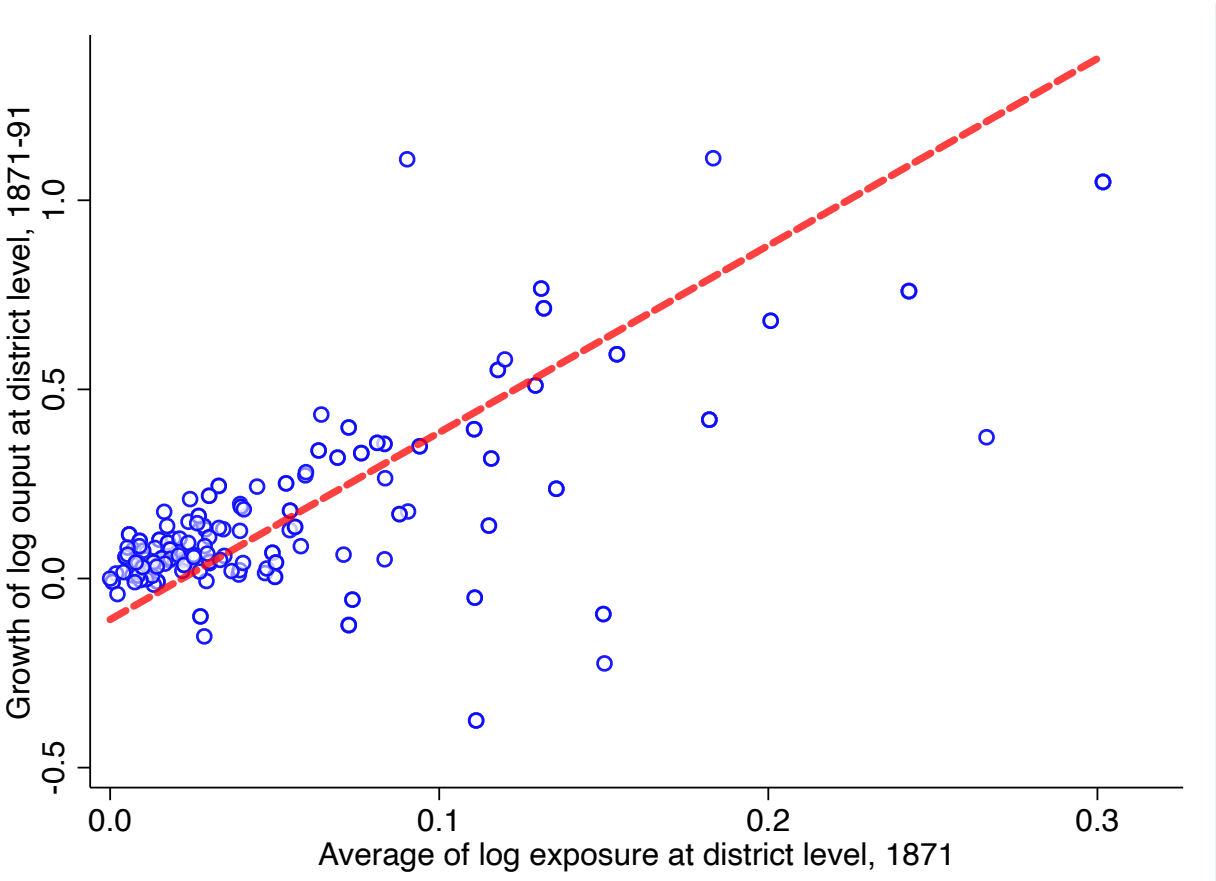
In this paper, we are interested in the impact of a decrease in trade costs, primarily due to the reduction in the costs of international trade.[4] Focusing on the effect of reducing international trade costs, the dashed blue line in Appendix Figure **??** shows the corresponding change in the location of economic activity as a function of initial proximity to ports of entry. The result is a further reallocation of economic activity to

[2] Economic distance for district i is constructed as the lowest travel cost route to the closest port of entry using the available water, rail, and wagon transportation in 1871. As the economic hub for each district, we use the sub-district with the largest manufacturing output in 1871.

[3] Domestic market size for industry j is calculated as the total value of gross output plus imports minus exports.

[4] For Canada trade flows were dominated by exchange with the United States and Great Britain. International trade costs, particularly intra-continental costs associated with US trade, moved together with domestic trade costs.

Figure 2: The Relationship between District-Level Manufacturing Growth and Exposure to Globalization, 1871-91



Notes: The figure shows the relationship between (log) exposure to globalization in 1871 on the x-axis and the growth of (log) manufacturing output between 1871 and 1891 at the district level on the y-axis. Each dot represents one Canadian district. Districts with (log) exposure greater than 0.4 are not included in the scatter plot, but are used to calculate the dashed line-of-best-fit.

be closer to ports of entry, while the change in the boundary between specialized and incompletely specialized regions induces a shift out of regions that are farther from international markets.

In the context of late nineteenth century Canada, we provide evidence that industries in districts that were more exposed to globalization in 1871 grew faster over the next two decades than regions that were less exposed. To do this, we use disaggregated data for districts (i), industries (j), and years (t) to estimate regressions of the form,

$$\ln Y_{ijt} = \beta \textbf{Exposure}_{ij1871} \times \mathbf{1}\{t = 1891\} + \phi_{ij} + \phi_{it} + \phi_{jt} + \mathbf{Z}_{ij}\delta_t + \varepsilon_{ij} \tag{1}$$

where Y_{ijt} is a measure of manufacturing activity (output, number of establishments, or output per establishment) in district i, industry j, and year t. The exposure variable combines variation in the proximity of each district i to closest port of entry with the openness of each industry j to international trade in 1871. Our exposure variable is interacted with a indicator for 1891 so that the coefficient β measures the relative impact of increasing exposure to globalization on the growth of manufacturing activity between 1871 and 1891. In the presence of a reduction in international trade costs–as occurred in the 1870s and 1880s–districts and industries more exposed to globalization are expected to grow more rapidly and the predicted sign of β is positive. We use two-way clustered standard errors at the district-year and industry-year level.[5]

The identification assumption is that in the absence of differential exposure to globalization in 1871 (and the change in international trade costs between 1871 and 1891) industries would have experienced a similar pattern of growth across districts. Including fixed effects relaxes this assumption. For example, time-invariant characteristics of districts that favor growth of particular industries are addressed with district-industry fixed effects (ϕ_{it}). In addition, district-year fixed effects (ϕ_{it}) control for changes in the strength of agglomeration economies, natural advantages, and transportation connections that affect all industries in a particular district, while industry-year fixed effects (ϕ_{jt}) control for changes in trade policy, economies of scale, and national input and output markets that are features of specific industries regardless of location. Particularly

[5]To address the potential for spatial correlation (Kelly, 2019), we consider several alternatives. First, we calculate Moran's *I* for manufacturing output growth at the district level does not reject the null hypothesis of spatial randomness. Second, we calculate Moran's *I* for the residuals from our baseline specification estimated independently for each industry. Third, we calculate Conley (1999) standard errors with bandwidths of 100, 300, 500, and 1,000 kilometers. Finally, we also consider alternative clustering on industry- and port of entry-year. Each approach suggests a limited role for spatial dependence relative to the results reported below.

important during this period, and a focus in the literature on Canadian industrial development is the change in tariff rates that followed protectionism introduced by the 1879 National Policy (Beaulieu and Cherniwchan, 2014; Alexander and Keay, 2018, 2019). Although it is not the only approach we adopt, industry-year fixed effects control for industry-specific tariff changes that may drive differential growth across industries.

Three extensions to our baseline specification allow us to further relax the identification assumption. First, we include three additional variables ($\mathbf{Z}_{ij}$) interacted with an 1891 year fixed effect to proxy for potential alternative explanations for differential growth across regions and industries. Specifically, we control for the joint effects of: trade and immigration policy by including an interaction between the change in industry-specific tariff rates due to the National Policy and the initial foreign-born population share across districts; scale economies by including an interaction between average establishment size by industry and population density across districts, both measured in 1871; and internal market access based on whether an industry's output is tradeable and proximity to a major urban area.[6] In each case these variables are constructed to combine variation at both the industry i and district j levels.

Second, our main approach uses only industry-district observations with positive manufacturing activity. To address concerns that this restriction introduces sample selection, we use the two-step approach of Heckman (1979) to correct for this bias. In the first stage the excluded variable reflects variation in fixed entry costs across industries to predict whether an industry-district has positive output. We include the resulting non-selection hazard ratio in our baseline specification to control for selection.[7]

Our last extension uses instrumental variables to isolate exogenous variation in exposure to address omitted demand-side factors that drive both international trade and domestic production decisions. We follow Coşar and Fajgelbaum (2016) by isolating supply-side determinants of comparative advantage. Specifically, we construct instruments for exposure that exploit variation in capital and raw material factor intensities in the United States across industries in 1870, combined with the physical distance between districts and ports in Canada. The intuition for this approach is to focus on variation in Canadian comparative advantage that is due to those aspects of the relevant

[6] We recognize that some of these factors–trade policy and scale in particular–may be endogenous. In our robustness checks we use an instrumental variables strategy to confirm that any potential endogeneity does not qualitatively affect our conclusions regarding the importance of our exposure variable.

[7] In additional robustness checks we estimate the impact of exposure across all industry-district pairs (not just those with strictly positive outcomes), and we directly test for the impact of exposure on industry entry along the geographic margin.

technology that are shared with the United States and not related to underlying demand determinants that drive both exposure and industrialization.

5. Results

Exposure to Globalization

Table 1 presents the results from estimating equation (1). Recall that our measure of exposure to globalization combines variation in district proximity to ports of entry and industry openness to international trade. Proximity is measured as the *inverse* of the cost to move one ton of freight from each district's primary production node to the closest port of entry, scaled by the volume of trade passing through that port in 1871. Openness is measured as each industry's exports and imports in 1871 divided by domestic market size. In column 1, the dependent variable is the log of industry-district output and the estimated coefficient on our exposure variable (interacted with an 1891 year effect) is 1.093, which is statistically significant at the 1 percent level.

During the late nineteenth century Canadian producers more exposed to globalization, either because they were exporting into foreign markets or because they faced import competition on domestic markets, and producers who were located closer to the most active ports of entry, grew faster than more insulated and more remote producers. In other words, even before the dramatic structural transformation of the 1890s Wheat Boom, the reduction in trade costs costs during the late nineteenth century significantly affected the composition of the Canadian manufacturing sector, and this disproportionately favored industries that were both more open to international trade and districts that were closer to ports of entry.

To understand the relevance of the coefficient in column 1, we can revisit John Jack and Edward Beaton's iron foundry in Bear River, and Charles Thaine's, and James Parker and John Harvey's establishments in Guelph. To access foreign markets, Jack and Beaton had to ship their ploughs through the customs house in Digby, just over 10 miles east of Bear River. By wagon this trip would have taken a little over four hours. Charles Thaine, on the other hand, only had to get his ploughs to the Guelph customs house less than four blocks from his shop. The difference in the economic distance to the closest port of entry for Jack, Beaton and Co., relative to Thaine's agricultural implement shop, was approximately equal to one standard deviation in the distance measure used to construct our exposure variable. At the mean of the data, a one standard deviation increase in economic distance would have led to a decrease in output of 10.7 percentage points, while the average Canadian manufacturing industry grew over this period.

Table 1: The Effect of Exposure to Globalization on Manufacturing Growth

	Baseline:					Margins of Adjustment:			Controls:
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Gross Output	Gross Output	Gross Output	Gross Output	Gross Output	Gross Output > 0	Number of Establishments	Output per Establishment	Gross Output
Exposure $\times$ 1891	1.093				0.358	0.430	0.621	0.579	1.105
	(0.399)				(0.137)	(0.174)	(0.209)	(0.277)	(0.414)
Exposure, export $\times$ 1891		0.958		0.953					
		(0.322)		(0.314)					
Exposure, import $\times$ 1891			1.180	1.174					
			(0.450)	(0.436)					
Policy $\times$ 1891									1.701
									(0.986)
Scale $\times$ 1891									0.099
									(0.048)
Internal Market $\times$ 1891									4.303
									(1.968)
Industry-District Observations	6,206	6,206	6,206	6,206	27,000	27,000	6,206	6,206	6,206

Notes: This table presents results from estimating versions of equation (1). The dependent variable in columns 1 through 4 and column 9 is the log of manufacturing gross output in district i, industry j, and year t. The dependent variable in column 5 is the inverse hyperbolic sine of gross output to accommodate industry-district observations with zero output. In the remaining columns, the dependent variable is an indicator for districts with positive gross output in 1871 and 1891 (column 6), the log number of establishments (column 7), and the log of gross output per establishment (column 8). District-industry, district-year, and industry-year fixed effects are included in all columns. Standard errors in parentheses are clustered on district-year and industry-year.

For Parker and Harvey's tannery, it was not the distance to the closest port of entry that mattered, it was the industry's openness to trade. Finished leather was not a widely traded product in 1871: the value of all imports and exports of leather products accounted for only 15 percent of the Canadian market. In contrast, nearly 60 percent of the domestic agricultural implement market was comprised of traded goods in 1871. The difference in the industry openness term included in our exposure variable for tanneries relative to agricultural implement producers is 1.38, or approximately one third of a standard deviation in openness measured across all 200 industries. At the mean of the data, a decrease in openness by 1.38 log-points is associated with a 22.4 percentage point decrease in gross industrial output growth between 1871 and 1891. This decrease in output growth would have accounted for nearly half of the reduction in output experienced by tanneries in Guelph's Wellington County between 1871 and 1891. Together, these calculations suggest that the economic consequences implied by our baseline estimates were considerable.

It is possible that the mechanisms driving the connection between exposure to globalization and industrial output were different depending on whether exposure was primarily due to exports or imports. We allow for this possibility by recalculating our exposure variable using either exports or imports in 1871 (interacted with an 1891 year effect). Columns 2 through 4 show that measures of exposure calculated using only exports or imports have a similar effect. In addition, in column 5, we allow for the possibility that there is additional information about the impact of exposure among the industry-districts with no production in 1871 or 1891 by estimating equation (1) over all 27,000 industry-district pairs using the inverse hyperbolic sine transformation to allow for gross output to be zero. Although this change reduces the size of the effect, the estimated coefficient still implies a statistically significant increase of manufacturing activity.

Globalization could have increased industrial output along at least three margins: establishments may have entered 'empty' districts (the geographic margin); more establishments may have opened (the extensive margin); and establishments that were already in operation may have increased output (the intensive margin). In column 6 of Table 1 we report results from a Probit model in which the dependent variable takes the value of one for industry-districts with strictly positive production during the late nineteenth century.[8] The strongly positive connection to exposure indicates that indus-

[8]To account for any incidental parameter bias associated with the inclusion of industry and district fixed effects, we make bias corrections as described by Cruz-Fernandez, Fernandez-Val and Weidner (2017).

trial output in Canada expanded between 1871 and 1891 in part because production spread into previously empty industry-districts that were initially more exposed to foreign competition. The results in columns 7 and 8 reveal that there was also an increase in the number of establishments in the most exposed industry-districts, and an increase in output per establishment in those regions. In other words, manufacturing moved into new areas, more establishments entered, and existing establishments got bigger.[9]

Up to this point we have shown that after including a broad set of fixed effects, exposure to globalization had a significant impact on the location and composition of Canadian manufacturing during the late nineteenth century. However, fixed effects specifications do not allow us to identify effects specific to the other factors emphasized in the literature on industrial development in Canada during this period. In the last column in Table 1 we report the results from including three additional variables (interacted with an 1891 year effect) in equation (1). The policy variable interacts industry-specific changes in average weighted tariffs following in introduction of the National Policy, with each district's foreign born population share in 1871.[10] The scale variable interacts employment per establishment for each industry, with district population density.[11] The variable for internal market size interacts an indicator for industries with more than $1,000 in total imports and exports in 1891, and the inverse of the physical distance from each district centroid to the closest major urban center.[12]

The results support the traditional narratives regarding late nineteenth century industrial development in Canada. Industry-districts with larger tariff increases under the National Policy and larger foreign-born population shares enjoyed significantly more rapid industrial output growth between 1871 and 1891, as did more densely populated districts with larger establishments, and industries producing tradeable products in

[9] In addition, at the national level, these changes were associated with an increase in the number of products in line with evidence in Huberman, Meissner and Oosterlinck (2017) for Belgium–the number of import products listed in the Canadian Trade and Navigation Tables increased by 92 percent, while the number of export products increased by 54 percent (Alexander and Keay, 2019).

[10] Because the non-manufacturing industries in the *All Other* industry group were not the target of the National Policy tariffs, they received very small, or in some cases negative tariff changes in 1879. These six industries are dropped.

[11] For a small number of industries employment per establishment in 1871 already far exceeded estimates of 'minimum efficient scale' for late nineteenth century North American industrial technology (Sokoloff, 1984; Inwood and Keay, 2012). Industries with an average of more than 15 employees per establishment are dropped.

[12] Using alternate indicators to identify industries producing tradeable products, including modern trade elasticity estimates and other trade volume thresholds, does not affect our qualitative conclusions. Halifax and St. John are included as urban centers even though large surrounding rural areas in their census districts reduce their population densities well below those of other cities.

close proximity to the largest domestic urban markets.[13] However, the key point is that including these variables does not erode the importance of exposure to globalization. Even with these controls the interaction between industry openness and district proximity to a port of entry remains strongly and significantly related to more rapid industrialization. This reinforces the view that exposure to globalization *in addition to* scale economies, tariff and immigration policies, and domestic market expansion, promoted industrialization in Canada during this period.

Addressing Selection and Endogeneity

In Table 2 we address two threats to identification in our baseline estimates. First, producers in particular industries may have selected the most desirable locations and this selection means that the industry-districts with no production may have been quite different from districts with positive production. Second, producers' technological choices may have been endogenous to local conditions and therefore reflected unobserved productivity differentials across industries within Canada.

To address selection we use a two-step approach (Heckman, 1979). In the first step, we estimate a Probit to predict the likelihood of positive industry-district production as a function of our exposure variable and an excluded instrument that captures industry-district entry costs. More specifically, we use industry-specific US average capital per worker ratios in 1870 interacted with the latitude of each district's centroid. The first stage results from this Probit are reported in column 1 of Appendix Table **??**. The intuition is that the excluded instrument captures fixed investment costs associated with entry that predict industry-district production, but are not directly related to subsequent output growth. We calculate the non-selection hazard ratio from the first step (the inverse Mills ratio), and include it as a control in the second step estimation of the first-difference version of equation (1). The estimated coefficient on our exposure variable in column 1 of Table 2 is similar although slightly larger relative to our baseline specification. The coefficient on the inverse Mills ratio is not statistically significant, which suggests a limited role for selection.

In column 2 in Table 2, we address concerns about the endogeneity of our expo-

[13] Alexander and Keay (2019) and Keay (2019) suggest that tariff changes under the National Policy may have been influenced by lobbying, while Inwood and Keay (2012) suggests that firm size was related to investment and technological choice. To address potential simultaneity linking the change in tariffs under the National Policy and employment per establishment to output growth, we adopt an instrumental variables approach. The excluded instrument for National Policy tariff changes is the level of industry-specific US tariff rates in 1870. The excluded instrument for employment per establishment is the unconstrained Cobb-Douglas industry-level returns to scale estimates used in Inwood and Keay (2012). The estimated coefficients in the second stage are qualitatively similar.

Table 2: Second Stage Results for Selection and Instrumental Variables

	(1) Gross Output	(2) Gross Output
Exposure	1.386	1.467
	(0.353)	(0.438)
Inverse Mills Ratio	1.313	
	(0.914)	
Exogeneity Tests		2.510
		(0.113)
Weak Instrument Test		7.463
		(0.001)
Valid Instrument Test		0.020
		(0.888)
Industry-Districts Observations	6,206	6,206

Notes: This table presents the results from estimating first-difference versions of equation (1). The dependent variable in columns 1 and 2 is the change in log of manufacturing gross output in district i and industry j from 1871 to 1891. Column 1 shows the second-stage results from the Heckman selection correction procedure; the first-stage results are shown in column 1 of Appendix Table **??**. Column 2 shows the second-stage results from the instrumental variables approach; the first-stage results are shown in column 2 of Appendix Table **??**. The remaining rows of column 2 present test statistics (with p-values in parentheses) for the null hypotheses that endogenous regressors may be treated as exogenous (exogeneity), excluded instruments are weakly identified in first stage (weak instrument), and excluded instruments are uncorrelated with second stage error term and correctly excluded from the second stage (valid instrument). District and industry fixed effects are included in both columns. Standard errors in parentheses are clustered on district and industry.

sure variable. In particular, we follow Coşar and Fajgelbaum (2016, p. 42-43) and use 1870 US industry-specific factor shares as instruments for Canadian industry openness in the first stage. In addition, although we do not anticipate endogeneity linking individual industry-districts to trade-weighted economic distances to the ports of entry, the US factor share instruments are interacted with the physical distance from each district centroid to the closest urban location. The first stage results from this specification are reported in column 2 of Appendix Table **??**.[14] The validity of our excluded instrument relies on the idea that industry-specific factor shares from the United States capture exogenous variation in exposure due to industry technology rather than variation in unobserved local productivity or correlated features specific to Canadian factor markets. In column 2 we report the second stage results from estimating the first-difference version of equation (1). The coefficient is statistically significant and of similar magnitude to the results obtained from our baseline specification using ordinary least squares.

6. Conclusion

Jack, Beaton and Co. shut down their foundry, and agricultural implement production disappeared from Annapolis County in Nova Scotia sometime during the 1870s. James Parker and John Harvey's tannery in Guelph went out of business in the first few years of the 1880s. Charles Thaine, on the other hand, continued to sell ploughs and turnip sowers into the early twentieth century in Guelph. The contraction of the finished leather industry in Guelph and movement of agricultural implement production out of rural Nova Scotia was coincident with rapid growth in aggregate industrial production in Canada, particularly in southern Ontario and south-western Quebec. This shift in the composition of industrial activity during the post-1870, pre-Wheat Boom period appears to have been related to differences in scale economies, the policy environment, the abundance of urban-industrial migrants, access to railways, and proximity to rapidly expanding urban markets in and around Toronto and Montreal. In this paper, we offer support for the traditional narratives that emphasize the role played by these internal factors in the regional and industrial development of the late nineteenth century Canadian economy. However, we find evidence for an under-appreciated explanation for these patterns in regional industrialization that better places Canada within its global context.

[14] At the bottom of column 2 we report diagnostic tests for the first stage. From the Hausman exogeneity test, we (marginally) cannot reject the null that openness is exogenous in equation (1). The Hansen valid-instrument test indicates that US factor shares are exogenous in the second stage. The Kleibergen-Paap weak instrument test confirms that our excluded instruments significantly predict openness in the first stage.

After 1870, industrial activity in Canada was moving south and west, towards large, urban producers in and around Toronto and Montreal. At the same time, the reduction in trade costs triggered globalization and global market integration. For Canada, we find that greater exposure to these forces was associated with greater output growth across locations and industries. This occurred because new establishments entered previously empty industry-districts, new establishments opened in districts with domestic incumbents, and existing establishments increased their output levels.

Late nineteenth century globalization marked a sharp break in the international trading system: the volume and extent of global trade expanded at historically unprecedented rates for nearly 45 years after 1870. Canada was a small-open economy that was actively engaged in this globalization process, and this shaped the pattern of industrial development. Our results not only help understand why the specific experiences of Jack, Beaton and Co., and Parker and Harvey were so different from the experience of Charles Thaine, but they also shed light on the processes underlying industrial development in Canada during this period.

More generally, our results suggest that in addition to the influence the process of globalization exerts on economic performance *between* countries, it also shapes the fortunes of regions and industries *within* countries. The importance of this finding extends to the present where it provides valuable context for the experience of regional development (and decline) in developed economies–such as Canada–as well as the future of regions within developing countries that are experiencing structural change due to globalization.

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