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The Impact of the Manufacturing Decline on Local Labour Markets in Canada

by René Morissette

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by

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Abstract

This study quantifies the impact of the manufacturing decline on the wages and employment rates of Canadian workers in their local labour markets. The estimates, drawn from census data from 2000 to 2015, indicate that the decline in manufacturing employment had a sizable adverse effect on the wages and full-year, full-time employment rates of men—especially less educated men. In contrast, relatively few groups of women appear to have been negatively affected by the decline in manufacturing employment. The results also suggest that two-thirds or more of the decline in full-year, full-time employment rates among men observed from 2000 to 2015 in census metropolitan areas such as Montréal, Ottawa–Gatineau, Windsor, Oshawa, Toronto, Hamilton, St. Catharines–Niagara, Kitchener–Cambridge–Waterloo and Guelph can be attributed to the manufacturing decline.

Keywords: manufacturing, automation, local labour markets, wages, employment

Executive summary

From the early 2000s to the mid-2010s, the number of employees in manufacturing fell by roughly half a million in Canada. During that period, the percentage of Canadian men aged 21 to 55 employed mainly full time for at least 48 weeks in a given year fell by 5 percentage points, from 63.6% in 2000 to 58.6% in 2015. This study investigates whether the two trends are connected, i.e., whether the decline in manufacturing employment caused a decline in employment rates and wages among men.

This question is important for a variety of reasons. First, manufacturing used to be a major source of employment for less educated men. The disappearance of manufacturing jobs might therefore decrease employment opportunities for these workers. Second, many manufacturing jobs paid higher-than-average wages. As these jobs disappear, the external options for less educated individuals fall for both those who formerly held jobs in manufacturing and others. This reduces the individual bargaining power of these workers when negotiating wages. Third, through input-output linkages, the manufacturing decline may reduce labour demand in other industries, putting additional downward pressure on the wages of some workers in local labour markets. For these reasons, the manufacturing decline might reduce the wages and employment rates of less educated individuals.

Using census data from 2000 to 2015, the study finds that, on average, a 5 percentage point decline in the share of the population employed in manufacturing in a given census metropolitan area (CMA) or census agglomeration led to a 4.5 percentage point decline in full-year, full-time employment rates among men and at least a 6.9% decline in their real weekly wages. Estimated wage effects are more substantial for less educated men than for men with a bachelor's degree or higher education. In contrast, the results indicate that relatively few groups of women appear to have been adversely affected by the decline in manufacturing employment.

The results also suggest that two-thirds or more of the decline in full-year, full-time employment rates among men observed from 2000 to 2015 in CMAs such as Montréal, Ottawa–Gatineau, Windsor, Oshawa, Toronto, Hamilton, St. Catharines–Niagara, Kitchener–Cambridge–Waterloo and Guelph can be attributed to the manufacturing decline.

1 Introduction

From the early 2000s to the mid-2010s, the number of employees in manufacturing fell by roughly half a million in Canada. During that period, the percentage of Canadian men aged 21 to 55 employed mainly full time for at least 48 weeks in a given year fell by 5 percentage points, from 63.6% in 2000 to 58.6% in 2015. This study investigates whether the two trends are connected, i.e., whether the decline in manufacturing employment caused a decline in employment rates and wages among men.

This question is important for a variety of reasons. Manufacturing used to be a major source of employment for less educated men. The disappearance of manufacturing jobs might therefore decrease employment opportunities for these workers. In addition, many manufacturing jobs paid higher-than-average wages. As these jobs disappear, the external options for less educated individuals fall for both those who formerly held jobs in manufacturing and others. This thereby reduces the individual bargaining power of these workers when negotiating wages. Finally, through input-output linkages, the manufacturing decline may reduce labour demand in other sectors, thereby putting additional downward pressure on the wages of some workers in local labour markets. For these reasons, the manufacturing decline might reduce the wages and employment rates of less educated individuals.

An alternative view is that labour markets are fairly flexible, and the initial declines in the employment and wages of affected workers will prompt them to move to more dynamic local labour markets. This view argues that while the disappearance of manufacturing jobs is expected to reduce wages and employment rates initially, labour market adjustments through migration should fully offset the initial wage and employment rate declines in the longer term.

This view can be challenged. If labour mobility is imperfect for a variety of reasons, labour supply movements might not fully offset the initial wage declines. In addition, even if employment rates eventually return to their initial levels, changes away from high-paying jobs in the industrial composition of employment might reduce the external options of workers, thereby reducing their individual bargaining power and, through this channel, reducing wages in the affected areas (Beaudry, Green and Sand 2012; Green et al. 2019).

It is therefore unclear whether the decline in manufacturing employment will adversely affect workers' labour market outcomes. The goal of this study is to shed light on this question.¹

The study does not attempt to identify which factors caused the decline in manufacturing employment. Labour-saving technological changes and import competition, among other factors, have been cited as potential explanations (Mowat Centre 2014). Yet identifying whether declines in local labour demand are driven by technological changes or by growth in international trade is a challenging task because the two phenomena are interrelated and because of the need to identify the impact of numerous technologies and changes in tariff and non-tariff barriers (Fort, Pierce and Schott 2018). Since the manufacturing decline is arguably driven at least by both of these factors, it provides a useful natural experiment of the degree to which these two external forces, taken together, have affected Canadian local labour markets in recent years by reducing labour demand in a specific sector: manufacturing.

1. In the United States, there is evidence that the decline in manufacturing employment since the early 2000s has reduced the wages and employment rates of men and women. See Charles, Hurst and Notowidigdo (2016, 2019) and Charles, Hurst and Schwartz (2018).

2 Data and methods

The study mainly uses data from the Census of Population for 2001 and 2016. The sample consists of individuals who were aged 21 to 55 and lived in census metropolitan areas (CMAs) and census agglomerations (CAs) during the census reference week.

The study analyzes five labour market outcomes:

- (1) changes in employment rates from May or June 2001 to May or June 2016, where employment rates measure the percentage of the population employed during the census reference week
- (2) changes in average weeks worked (including zero) by individuals from 2000 to 2015
- (3) changes in full-year, full-time employment rates of individuals from 2000 to 2015, where full-year, full-time employment rates measure the percentage of the population that was employed mainly full time and worked at least 48 weeks in 2000 or 2015
- (4) changes in log average real weekly wages received by paid workers from 2000 to 2015² (these average weekly wages are adjusted to control for changes in the composition of the paid worker population by age, education, gender and full-time status from 2000 to 2015³)
- (5) changes in the log population of various groups of individuals from May or June 2001 to May or June 2016.

The study quantifies the degree to which the manufacturing decline observed from 2000 to 2015 in various CMAs and CAs reduced the employment rates; weeks worked; full-year, full-time employment rates; wages; and population of the individuals residing in these CMAs and CAs. To do so, the following equation is estimated:

$$\Delta Y_{rt}^g = \alpha + \beta_1 * \Delta MSHARE_{rt} + \beta_2 * \Delta MSHARE_{rt-1} + \Delta Z_{rt} \lambda_1 + X_{2001} \lambda_2 + u_{rt} \quad (1)$$

where ΔY_{rt}^g denotes the change in a given outcome observed for a given group g in area r from 2000 to 2015 (or 2001 to 2016 when changes in employment rates and in log population are analyzed). The key regressor is $\Delta MSHARE_{rt}$, which denotes the change in the share of the population aged 21 to 55 employed in manufacturing from 2000 to 2015 in area r .

From 2000 to 2015, the Canadian labour market experienced two major shocks: the housing boom of the 2000s and the oil boom that took place mainly from 2001 to 2008. The vector ΔZ_{rt} controls for these two shocks. It includes changes from 2000 to 2015 in the share of the population of area r employed in (1) construction, and (2) oil and gas extraction as well as support activities for mining, and oil and gas extraction. These two variables (herein referred to as change in the share employed in construction and change in the share employed in oil) control for movements in the demand for construction workers and for workers in the natural resource sector that resulted from increases in the demand for housing and energy products.

The vector X_{2001} includes several potential local labour supply shifters: (1) the share of immigrants in area r in 2001, (2) the share of individuals with a bachelor's degree or higher education in area

2. The national Consumer Price Index (all items) is used to compute real weekly wages.

3. To perform this adjustment, the 2015 data are reweighted to replicate the 2000 distribution of paid workers by age (seven five-year groups: 21 to 25 years, 26 to 30 years, ... 51 to 55 years), education (three education categories: high school or less, postsecondary education below a bachelor's degree, bachelor's degree or higher education), gender, and full-time status within a given area.

r in 2001, and (3) the participation rate among women in area r in 2001.⁴ These variables account for the possibility that (1) CMAs and CAs with a large share of immigrants in 2001 may have attracted a relatively large number of new immigrants from 2001 to 2016, (2) CMAs and CAs with a large share of highly educated workers may have attracted proportionately more new workers during that period, and (3) CMAs and CAs with relatively low participation rates among women in 2001 may have experienced larger increases in the labour supply of women during that period.

If the local labour market adjustment to shocks is gradual, contemporaneous changes in labour market outcomes might partly capture the effect of past changes in local labour demand (Jaeger, Ruist and Stuhler 2018). For example, contemporaneous declines in wages might partly reflect previous declines in the relative importance of manufacturing. To control for this possibility, Equation (1) includes $\Delta MSHARE_{r,t-1}$, which is the change in the share of the population aged 21 to 55 employed in manufacturing from 1985 to 2000 in area r .^{5,6,7}

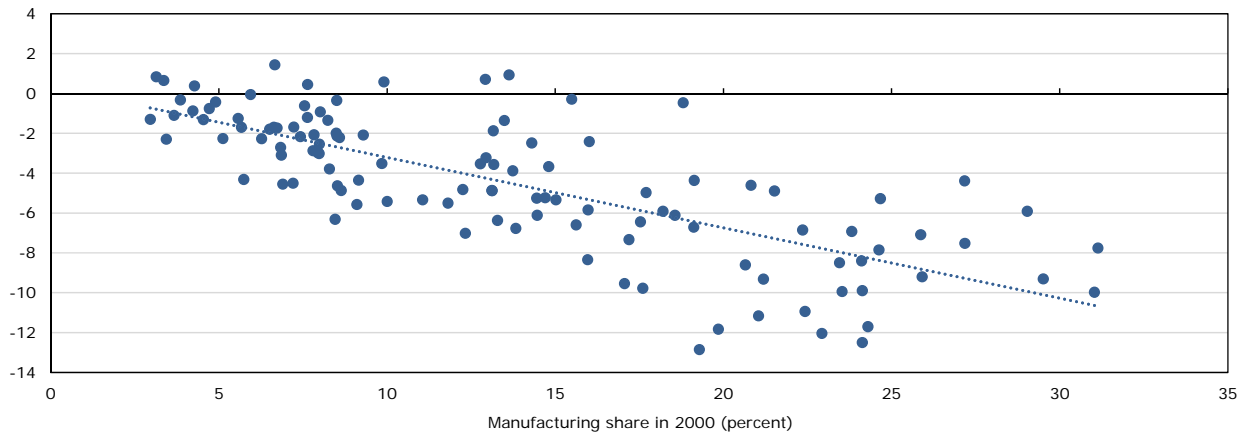
As Charles, Hurst and Schwartz (2018) point out, there are at least two threats to the identification of β_1 . First, an increase in local labour demand outside manufacturing could pull individuals out of manufacturing while simultaneously increasing local employment rates. Second, local declines in labour supply can simultaneously reduce local employment rates while drawing individuals out of the manufacturing sector. To overcome these endogeneity issues, the share of the population of area r employed in manufacturing in 2000 ($MSHARE_{r,2000}$) is used as an instrumental variable for the key regressor ($\Delta MSHARE_{r,t}$). The rationale for this instrumental variable is that areas that relied heavily on manufacturing in 2000 were more **exposed** than other areas to the labour-saving shocks of automation and import competition from 2000 to 2015. As a result, the manufacturing share is expected to fall more in these areas than in other areas. Chart 1 confirms this hypothesis: areas that had relatively high shares of the population employed in manufacturing in 2000 generally experienced greater declines in their shares employed in manufacturing from 2000 to 2015.

-
4. These three variables are defined with respect to individuals aged 21 to 55.
 5. The share of the population aged 21 to 55 employed in manufacturing in 1985 is computed using the 1986 Census of Population.
 6. The research design of this study is similar to that used by Charles, Hurst and Schwartz (2018). That is, first differences in outcomes in local labour markets are estimated over an approximate 15-year period. In addition, Equation (1) and the reweighting scheme used for wages are similar to those used by Charles, Hurst and Schwartz (2018). This research design allows the impact of the manufacturing decline to be compared between Canada and the United States.
 7. An alternative empirical strategy would be to estimate first differences over five-year intervals from 2000 to 2015. In principle, this could be done using the Census of Population for 2001, 2006 and 2016, and the 2011 National Household Survey (NHS). This strategy is not pursued for two reasons. First, the goal of the study is to assess how local labour markets adjusted to the manufacturing decline over a fairly long time interval. A 15-year interval satisfies this criterion. In addition, estimating first differences over five-year intervals from 2000 to 2015 requires using the NHS, which has only a 69% response rate, compared with a 94% response rate for the 2006 Census. Given its relatively low response rate, it is unclear whether the NHS can deliver reliable results for local labour markets.

Chart 1

Change in the share of the population aged 21 to 55 employed in manufacturing (Y) from 2000 to 2015, and manufacturing share in 2000, by census metropolitan area and census agglomeration

Y (percentage points)



Note: The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.
Source: Statistics Canada, Census of Population, 2001 and 2016.

Equation (1) is estimated for various g groups: men and women of various ages (21 to 35 years and 36 to 55 years) and education levels (high school or less, postsecondary education below a bachelor's degree, and a bachelor's degree or higher education). Whenever Equation (1) is estimated, the dependent variable is group-specific, but all explanatory variables remain unchanged across groups.⁸

The study gives a causal interpretation to β_1 but not to λ_1 . This is because the two threats to identification outlined above also apply to λ_1 . Without instrumental variables for changes in the shares employed in construction and in oil, λ_1 cannot be given a causal interpretation. Nevertheless, β_1 can be given a causal interpretation as long as the instrumental variable, $MSHARE_{r,2000}$, is uncorrelated with the error term u_{rt} after conditioning results on the set of controls included in Equation (1) (Stock and Watson 2011). This hypothesis is the identifying assumption of the study.

Equation (1) captures the direct effect of changes in the share of the population employed in manufacturing on labour market outcomes. That is, it measures this effect while holding constant changes in the share employed in construction and the share employed in oil. Since changes in manufacturing employment affect economic activity, they will likely also affect the housing market (through an income effect that will affect housing demand) and the share employed in oil (through movements in the demand for energy from manufacturing firms). These indirect effects, which induce movements in the demand for construction workers and workers in the oil and gas sectors, are not captured by Equation (1), but reflect part of the total impact of changes in manufacturing employment. Since these indirect effects are expected to be positive, β_1 will provide a

8. For example, changes in average weeks worked by men and changes in average weeks worked by women will be regressed on the same set of explanatory variables.

conservative estimate of the overall impact that the manufacturing decline will have on local labour markets.⁹

One concern with estimating Equation (1) for all 145 CMAs and CAs of the 10 Canadian provinces is that those located in the oil-producing provinces of Newfoundland and Labrador, Alberta, and Saskatchewan faced a more dynamic economic environment than others from 2000 to 2015. As a result, the nationwide average effects might conceal important cross-regional differences. To address this concern, Equation (1) is also estimated for the subset of 115 CMAs and CAs that are located in the seven non-oil-producing provinces (Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba and British Columbia).

Throughout the paper, heteroscedasticity-robust standard errors are used.

3 Descriptive evidence

From 2001 to 2016, the number of Canadian employees working in manufacturing fell by roughly half a million, dropping from 1.98 million in 2001 to 1.48 million in 2016 (Table 1). Six industries accounted for about 60% of the employment decline: clothing manufacturing (12.8%), transportation equipment manufacturing (10.3%), computer and electronic product manufacturing (10.2%), paper manufacturing (10.2%), wood product manufacturing (8.8%), and primary metal manufacturing (7.5%).

The magnitude of the decline in the relative importance of manufacturing differed across CMAs and CAs. In Ontario, the share of the population aged 21 to 55 employed in manufacturing fell by 6.8 percentage points or more in Toronto, Hamilton, St. Catharines–Niagara, Kitchener–Cambridge–Waterloo, Brantford, Guelph, Stratford and Windsor (Table 2). In contrast, the share employed in manufacturing fell by no more than 3.8 percentage points in several CMAs and CAs in the Atlantic provinces, Saskatchewan, Alberta and British Columbia.¹⁰

The data shown in Charts 2 and 3 suggest that the manufacturing decline caused a decline in the employment rates and wages of men. Areas that experienced a relatively large decline in the share employed in manufacturing generally displayed less favourable movements in full-year, full-time employment rates (Chart 2) and wages (Chart 3) among men than other areas. The next section investigates whether these patterns hold in multivariate analyses for men and women of different ages and education levels.

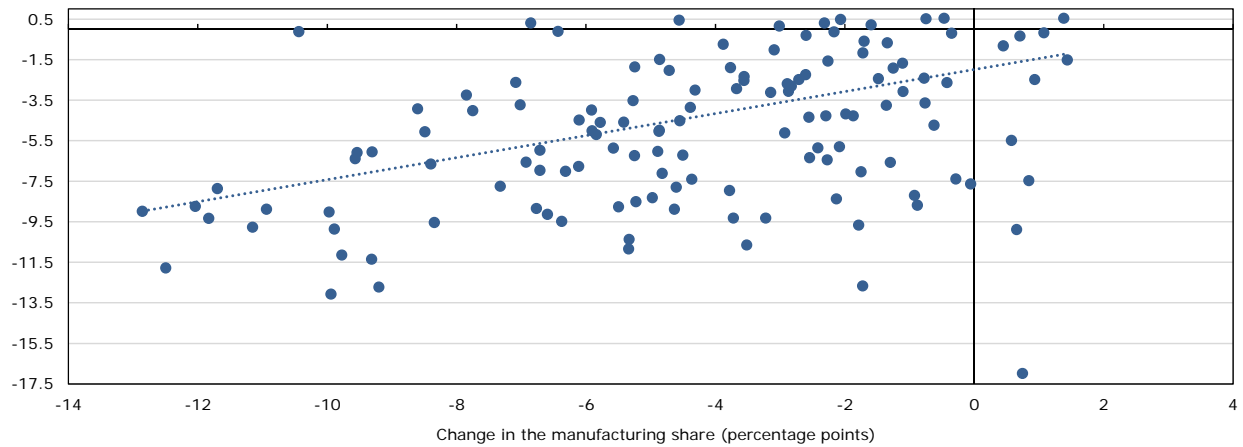
9. To measure the overall impact that the manufacturing decline has on local labour markets, the degree to which (1) the manufacturing decline reduces labour demand in the construction and the oil and gas sectors and (2) lower labour demand in the construction and oil and gas sectors affects labour market outcomes need to be assessed. The second condition requires that a causal interpretation be given to λ_1 . Without instrumental variables for changes in the shares of the population employed in construction and in oil, this second condition cannot be satisfied. For this reason, this study is focused on estimating the direct effect of the manufacturing decline on local labour markets, that is, estimating β_1 .

10. For the 145 CMAs and CAs included in this study, the unweighted average decline and median decline in the share employed in manufacturing from 2000 to 2015 amounted to 4.2 and 3.7 percentage points, respectively. The change in the share employed in manufacturing amounted to -9.3 percentage points at the 10th percentile and -0.4 percentage points at the 90th percentile. See Appendix Tables 1 and 2 for details.

Chart 2

Change in the manufacturing share and changes in the percentage of men employed full year, full time, by census metropolitan area and census agglomeration, 2000 to 2015

changes in the percentage of men employed full year, full time (percentage points)

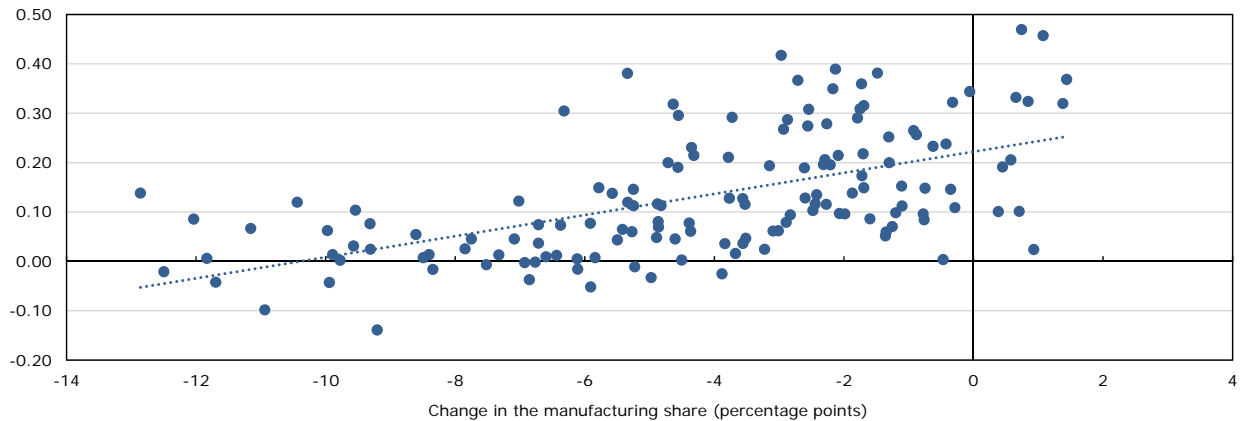


Note: The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.
Source: Statistics Canada, Census of Population, 2001 and 2016.

Chart 3

Change in the manufacturing share and changes in the log real weekly wages of men, by census metropolitan area and census agglomeration, 2000 to 2015

changes in the log real weekly wages of men



Notes: Changes in weekly wages control for compositional effects by age, education and full-time status within a given census metropolitan area or census agglomeration. The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.
Source: Statistics Canada, Census of Population, 2001 and 2016.

4 Regression results

Table 3 shows results from Equation (1), estimated for men and women separately. Parameter estimates for β_1 are shown for (a) weighted regressions (in which observations are weighted by the size of the population aged 21 to 55 in a given area in 2001) and unweighted regressions¹¹ (in which each area receives a weight equal to 1), and (b) all provinces and the seven non-oil-producing provinces.

Regardless of the weighting scheme and the set of provinces considered, the numbers indicate that the manufacturing decline reduced wages, average weeks worked, and full-year, full-time

11. Weighted regressions mitigate the larger-than-average measurement error present in small areas. Unweighted regressions allow analysts to treat each CMA or CA as a distinct local labour market that receives an equal weight in the analysis.

employment rates among men. For example, parameter estimates for full-year, full-time employment rates among men calculated from weighted regressions equal roughly 0.90, thereby suggesting that a 5 percentage point decline in the share of the population employed in manufacturing led to a 4.5 percentage point decline in the percentage of men working full-year, full-time in a given CMA or CA. Parameter estimates for wage changes among men in non-oil-producing provinces equal roughly 1.70, thereby suggesting that a 5 percentage point decline in the share of the population employed in manufacturing led to a 0.085 log point decline in wages among men (i.e., about an 8.5% decline in wages among men).¹²

In contrast, the data provide little support for the hypothesis that the manufacturing decline reduced wages, average weeks worked, or full-year, full-time employment rates among women.

Table 4 investigates the issue in greater depth for men. It provides parameter estimates for β_1 for men of different ages and education levels.¹³ Among men aged 21 to 55, the manufacturing decline reduced wages, average weeks worked, and full-year, full-time employment rates within each education level. This is true both for all 145 CMAs and CAs and for only those in the seven non-oil-producing provinces. However, in each case, the impact on wages is almost twice as high for men with no bachelor's degree than for more educated men.

Table 4 also highlights interesting age differences among men with a postsecondary credential below a bachelor's degree. For this group, the numbers indicate that the effect of the manufacturing decline on employment rates, weeks worked and full-year, full-time employment rates was at least twice as pronounced among younger workers (aged 21 to 35) than among older workers (aged 36 to 55). For instance, in the non-oil-producing provinces, a 5 percentage point decline in the manufacturing share was associated with a 7.2 percentage point decline in the full-year, full-time employment rates of younger men (0.05 times 1.45) and a 3.3 percentage point decline in the full-year, full-time employment rates of older men (0.05 times 0.66).

Cross-educational wage differences are also observed within each age group, especially among younger workers. Regardless of the provinces considered, the parameter estimate β_1 for wage changes is at least twice as high for younger men with no bachelor's degree than for their more educated counterparts.

In sum, while the data indicate that the impact of the manufacturing decline was fairly widespread among men (i.e., not limited to specific age groups or education levels), they also show that younger and less educated men were more adversely affected than other groups of male workers.

In contrast, relatively few groups of women appear to have been adversely affected by the decline in manufacturing employment. Regardless of the provinces and outcomes considered, no statistically significant effects are detected for women aged 36 to 55 (Table 5). While there is evidence that young women experienced a decline in wages and full-year, full-time employment rates, the estimated effects are smaller and generally less precisely estimated than for young men.

Tables 4 and 5 show no evidence that older men and women moved to more economically dynamic areas following declines in manufacturing employment. In contrast, there is robust evidence that younger men and women with a bachelor's degree migrated to other regions in response to the manufacturing decline. For example, estimates excluding the oil-producing provinces indicate that a 5 percentage point decline in the manufacturing share of a given area

12. The corresponding estimates from the ordinary least squares estimator are similar. They suggest that a 5 percentage point decline in the manufacturing share led to (a) a 4.5 percentage point decline in the percentage of men working full year, full time in a given CMA or CA, and (b) a 0.073 log point decline in wages among men.

13. The remainder of the paper follows Charles, Hurst and Schwartz (2018) and shows results obtained from weighted regressions.

led to a decline of 0.12 to 0.13 log points in the population of younger workers with a bachelor's degree or higher education in that area.

5 Robustness checks and relevance

The wage estimates shown so far are based on the Consumer Price Index (CPI) for Canada and therefore neglect region-specific movements in the cost of living. If areas that experienced large declines in the share employed in manufacturing also experienced large declines in housing costs, the wage estimates shown so far may overestimate the magnitude of the declines in real weekly wages.

To address this issue, Table 6 compares the initial wage estimates—those based on the national CPI and referred to as Model 1—with estimates obtained after adding changes in log average home prices from 2001 to 2016 to Equation (1). The second set of estimates is referred to as Model 2. Controlling for home price growth somewhat reduces the wage estimates but does not alter the main findings. For example, parameter estimates for wage changes among men in non-oil-producing provinces drop from approximately 1.70 to 1.40, suggesting that a 5 percentage point decline in the share of the population employed in manufacturing led to a log point decline of at least 0.069 (about 6.9%) in real weekly wages among men.

Another concern is that some of the effects observed might be driven by selectivity based on unobservable factors. If the decline in manufacturing employment in a given area led to the out-migration of the best workers (within each education cell considered), then part of the decline in full-year, full-time employment rates and wages among men observed within education categories might reflect changes in the composition of the workforce toward lower-ability workers.

Table 7 investigates this issue for wage estimates. It compares initial weekly wage estimates for young men based on census data with panel data estimates based on the Canadian Employer–Employee Dynamics Database (CEEDD). The panel data estimates are based on the same group of men who were aged 21 to 35 in 2000 and were in the same CMA or CA in 2000 and 2015. While this group of workers is not representative of the population of young men in 2000, it allows for an analysis that controls for time-invariant, but unobserved, worker abilities.

Because CEEDD data can provide only estimates of annual wages, Table 7 also shows annual wage estimates for young men based on census data. Consistent with the fact that average weeks worked by men fell in response to the manufacturing decline, the annual wage estimates derived from census data are somewhat higher than the initial weekly wage estimates. More importantly, the annual wage estimates from panel data equal between 77% and 89% of the annual wage estimates from census data. This finding implies that most of the wage effects observed based on non-panel (census) data remain when using panel data. Therefore, selectivity based on unobservable factors does not play a major role.

To highlight the relevance of the main findings, Table 8 shows what they imply for specific CMAs and CAs in Quebec and Ontario, the two main manufacturing provinces. Multiplying the parameter estimate β_1 obtained for changes in full-year, full-time employment rates among men living in the non-oil-producing provinces (0.91) by the change in an area's share of the population employed in manufacturing yields an estimate of the changes in full-year, full-time employment rates resulting from the manufacturing decline. The results indicate that two-thirds or more of the decline in full-year, full-time employment rates among men from 2000 to 2015 in CMAs such as Montréal, Ottawa–Gatineau, Windsor, Oshawa, Toronto, Hamilton, St. Catharines–Niagara, Kitchener–Cambridge–Waterloo and Guelph can be attributed to the manufacturing decline.

Likewise, an estimate of the changes in real weekly wages resulting from the manufacturing decline can be calculated by multiplying the wage parameter estimate obtained from Model 1 for

men living in non-oil-producing provinces (1.66), by the change in an area's share of the population employed in manufacturing. This estimate indicates that the manufacturing decline tended to reduce real weekly wages among men in the aforementioned CMAs by around 10%.

Table 9 provides a sense of the degree to which the manufacturing decline reduced wages and full-year, full-time employment rates among men nationwide.¹⁴ Changes in male wages and full-year, full-time employment rates resulting from the manufacturing decline are calculated as follows: multiply the group-specific parameter estimates from the left panel of Table 4 by the actual change in the share of individuals aged 21 to 55 employed in manufacturing at the national level. The results indicate that the manufacturing decline (a) accounted for at least half of the decline in full-year, full-time employment rates among men, and (b) tended to reduce wages more among less educated men than among those with a bachelor's degree or higher education.

Overall, the numbers shown in Tables 8 and 9 indicate that the manufacturing decline had a substantial impact on the wages and full-year, full-time employment rates of men in several CMAs and CAs as well as nationwide.¹⁵

The main findings of the study are similar to those of Charles, Hurst and Schwartz (2018) for men, but differ for women. Canadian data from 2000 to 2015 suggest that a 5 percentage point decline in the share of the population employed in manufacturing led to a log point decline of at least 0.069 (about 6.9%) in real weekly wages among men in local labour markets. U.S. data from 2000 to 2016 suggest that the corresponding estimated decline in real hourly wages among men was very similar to the findings in this study, at about 6.2% (i.e., 1.23 times 0.05—see Table 2 from Charles, Hurst and Schwartz [2018]). A 5 percentage point decline in the share of the population employed in manufacturing reduced employment rates among men by about 2 percentage points in both countries.¹⁶ Charles, Hurst and Schwartz (2018) found that the negative impact of the manufacturing decline on wages and employment rates was similar for men and women. In contrast, the Canadian data provide little evidence that the manufacturing decline reduced wages and employment rates among women. Which factors underlie this cross-country difference is a question for future research.

In line with Gould (2019), data from both countries suggest that the manufacturing decline tended to increase wage inequality between less educated men and their better-educated counterparts within local labour markets. This can be seen by noting that the wage parameter estimate for men aged 21 to 55 with high school or less education is, when considering all provinces, about twice as large as that for men with a bachelor's degree or more (Table 6). In the United States, Charles, Hurst and Schwartz (2018) obtain a parameter estimate that is about three times as large for less educated men than for those with a bachelor's degree.¹⁷

14. These estimates should be viewed as a first-order approximation of the impact of the manufacturing decline on the national labour market since they are based on cross-regional estimates, which accurately measure the effect of the manufacturing decline on aggregate wages and employment only under certain conditions (see Charles, Hurst and Schwartz 2018).

15. Similar results are obtained when economic regions (rather than CMAs and CAs) are used to define local labour markets.

16. This number is obtained by multiplying the parameter estimate of 0.38 (reflecting changes in employment rates among men), as shown in the upper left corner of Table 4, by 0.05. The corresponding parameter estimate from Charles, Hurst and Schwartz (2018) equals 0.37.

17. For both countries, at the 5% level, a one-tailed test rejects the hypothesis that the wage parameter is the same for both groups of workers.

6 Conclusion

This study quantifies the impact of the manufacturing decline on the wages and employment rates of Canadian workers in their local labour markets. The results reject the view that local labour markets return to their initial (full-year, full-time) employment rates several years after a sector-specific negative labour demand shock. Instead, they suggest that movements in full-year, full-time employment rates among men have a structural component. The estimates, obtained over a 15-year period, indicate that the manufacturing decline had a sizable adverse effect on the wages and full-year, full-time employment rates of men. In contrast, relatively few groups of women appear to have been adversely affected by the decline in manufacturing employment.

7 Tables

Table 1
Number of employees in manufacturing, Canada, 2001 to 2018, selected years

	2001	2016	2018	Change from 2001 to 2016	Contribution to the change from 2001 to 2016
	number				percent
Manufacturing	1,977,618	1,482,131	1,552,714	-495,487	100.0
Food manufacturing	231,063	221,653	238,085	-9,410	1.9
Beverage and tobacco product manufacturing	34,925	37,252	43,069	2,327	-0.5
Textile mills	26,122	7,621	6,985	-18,501	3.7
Textile product mills	19,707	9,469	9,961	-10,238	2.1
Clothing manufacturing	82,770	19,380	19,393	-63,390	12.8
Leather and allied product manufacturing	9,480	3,265	2,568	-6,215	1.3
Paper manufacturing	103,703	53,178	54,121	-50,525	10.2
Printing and related support activities	83,347	49,081	49,871	-34,266	6.9
Petroleum and coal product manufacturing	15,305	19,057	17,791	3,752	-0.8
Chemical manufacturing	93,412	89,005	91,660	-4,407	0.9
Plastics and rubber products manufacturing	125,248	97,934	99,552	-27,314	5.5
Wood product manufacturing	135,758	92,281	93,631	-43,477	8.8
Non-metallic mineral product manufacturing	53,719	49,935	53,745	-3,784	0.8
Primary metal manufacturing	91,185	53,900	56,878	-37,285	7.5
Fabricated metal product manufacturing	184,269	151,467	156,652	-32,802	6.6
Machinery manufacturing	134,897	127,363	137,614	-7,534	1.5
Computer and electronic product manufacturing	105,761	55,159	56,791	-50,602	10.2
Electrical equipment, appliance and component manufacturing	48,723	32,677	34,249	-16,046	3.2
Transportation equipment manufacturing	242,700	191,902	205,100	-50,798	10.3
Furniture and related product manufacturing	98,601	64,744	67,101	-33,857	6.8
Miscellaneous manufacturing	56,922	55,804	57,898	-1,118	0.2

Source: Statistics Canada, Table 14-10-0202-01 (based on data from the Survey of Employment, Payrolls and Hours).

Table 2
Selected statistics for census metropolitan areas and census agglomerations,
2000 to 2015

	Share employed in manufacturing in 2000	Change in share employed in manufacturing from 2000 to 2015	Change in percentage of men working full year, full time from 2000 to 2015	Change in log average real weekly wages of men from 2000 to 2015
	percent	percentage points		logarithmic values
All CMAs and CAs (unweighted average)	12.5	-4.2	-4.3	0.13
Newfoundland and Labrador				
St. John's	3.9	-0.3	2.6	0.32
Bay Roberts	7.9	-3.0	13.5	0.42
Grand Falls-Windsor	8.5	-6.3	-7.0	0.30
Corner Brook	9.2	-4.4	2.9	0.23
Prince Edward Island				
Charlottetown	5.6	-1.3	-1.9	0.07
Summerside	13.6	0.9	-2.5	0.02
Nova Scotia				
Halifax	4.7	-0.8	-3.6	0.08
Kentville	12.8	-3.5	1.2	0.12
Truro	13.1	-4.9	-5.0	0.12
New Glasgow	17.1	-9.5	-6.1	0.10
Cape Breton	4.5	-1.3	1.8	0.25
New Brunswick				
Moncton	8.0	-3.0	0.2	0.06
Saint John	7.8	-2.1	0.5	0.10
Fredericton	3.7	-1.1	-3.1	0.11
Bathurst	8.5	-2.0	-4.2	0.10
Miramichi	12.3	-7.0	-3.7	0.12
Campbellton	7.6	-1.2	3.4	0.10
Edmundston	17.5	-6.4	-0.1	0.01
Quebec				
Matane	14.3	-2.5	12.0	0.10
Rimouski	4.3	0.4	2.0	0.10
Rivière-du-Loup	12.9	0.7	-0.3	0.10
Baie-Comeau	20.7	-8.6	-3.9	0.05
Saguenay	13.2	-3.6	-2.3	0.04
Alma	13.5	-1.4	-3.8	0.05
Dolbeau-Mistassini	13.7	-3.9	-0.7	-0.03
Sept-Îles	7.6	0.4	-0.8	0.19
Québec	8.2	-1.3	-0.7	0.06
Saint-Georges	24.7	-5.3	-3.5	0.06
Thetford Mines	18.8	-0.5	0.5	0.00
Sherbrooke	19.1	-6.7	-6.0	0.04
Cowansville	27.2	-7.5	2.4	-0.01
Victoriaville	21.5	-4.9	-6.0	0.05
Trois-Rivières	14.8	-3.7	-2.9	0.02
Shawinigan	18.6	-6.1	-4.5	-0.02
Drummondville	25.9	-7.1	-2.6	0.05
Granby	31.0	-10.0	-9.0	0.06
Saint-Hyacinthe	20.8	-4.6	-7.8	0.05
Sorel-Tracy	24.6	-7.8	-3.2	0.03
Joliette	12.9	-3.2	-9.3	0.02
Saint-Jean-sur-Richelieu	18.2	-5.9	-4.0	0.08
Montréal	14.5	-6.1	-6.8	0.01
Salaberry-de-Valleyfield	24.1	-12.5	-11.8	-0.02
Lachute	17.7	-5.0	-8.3	-0.03
Val-d'Or	7.2	-1.7	1.8	0.32
Amos	8.6	-2.2	8.3	0.20
Rouyn-Noranda	6.6	-1.7	-0.6	0.22

Note: The boundaries used to define census metropolitan areas (CMAs) and census agglomerations (CAs) are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Table 2
Selected statistics for census metropolitan areas and census agglomerations,
2000 to 2015 (continued)

	Share employed in manufacturing in 2000 percent	Change in share employed in manufacturing from 2000 to 2015 percentage points	Change in percentage of men working full year, full time from 2000 to 2015	Change in log average real weekly wages of men from 2000 to 2015 logarithmic values
Ontario				
Cornwall	19.9	-11.8	-9.3	0.01
Hawkesbury	23.5	-9.9	-13.1	-0.04
Ottawa–Gatineau	7.2	-4.5	-6.2	0.00
Brockville	21.0	-11.2	-9.8	0.07
Pembroke	9.1	-5.6	-5.9	0.14
Petawawa	3.4	-2.3	-4.3	0.21
Kingston	6.9	-3.1	-1.0	0.06
Belleville	16.0	-5.8	-5.2	0.01
Cobourg	21.2	-9.3	-11.4	0.08
Port Hope	22.9	-12.0	-8.7	0.09
Peterborough	11.8	-5.5	-8.8	0.04
Kawartha Lakes	13.3	-6.4	-9.5	0.07
Centre Wellington	23.5	-8.5	-5.1	0.01
Oshawa	17.6	-9.8	-11.1	0.00
Ingersoll	31.1	-7.7	-4.0	0.05
Toronto	13.8	-6.8	-8.8	0.00
Hamilton	17.2	-7.3	-7.7	0.01
St. Catharines–Niagara	16.0	-8.3	-9.5	-0.02
Kitchener–Cambridge–Waterloo	24.1	-9.9	-9.9	0.01
Brantford	24.1	-8.4	-6.7	0.01
Woodstock	27.2	-4.4	-3.9	0.08
Tillsonburg	29.0	-5.9	-5.0	-0.05
Norfolk	19.1	-4.4	-7.4	0.06
Guelph	23.8	-6.9	-6.6	0.00
Stratford	29.5	-9.3	-6.1	0.02
London	14.7	-5.2	-8.5	-0.01
Chatham-Kent	22.4	-10.9	-8.9	-0.10
Leamington	22.4	-6.9	0.3	-0.04
Windsor	25.9	-9.2	-12.7	-0.14
Samia	15.0	-5.3	-10.4	0.12
Owen Sound	14.4	-5.2	-6.2	0.15
Collingwood	19.3	-12.9	-9.0	0.14
Barrie	15.6	-6.6	-9.1	0.01
Orillia	9.8	-3.5	-10.6	0.05
Midland	24.3	-11.7	-7.9	-0.04
North Bay	6.3	-2.3	-6.4	0.12
Greater Sudbury	5.7	-1.7	2.9	0.15
Elliot Lake	3.0	-1.3	-6.6	0.20
Temiskaming Shores	7.5	-0.6	-4.7	0.23
Timmins	5.1	-2.3	-1.6	0.28
Sault Ste. Marie	13.1	-4.9	-5.0	0.08
Thunder Bay	10.0	-5.4	-4.6	0.06
Kenora	8.6	-4.9	-1.5	0.07

Note: The boundaries used to define census metropolitan areas (CMAs) and census agglomerations (CAs) are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Table 2
Selected statistics for census metropolitan areas and census agglomerations,
2000 to 2015 (continued)

	Share employed in manufacturing in 2000 percent	Change in share employed in manufacturing from 2000 to 2015 percentage points	Change in percentage of men working full year, full time from 2000 to 2015	Change in log average real weekly wages of men from 2000 to 2015 logarithmic values
Manitoba				
Winnipeg	12.2	-4.8	-7.1	0.11
Steinbach	16.0	-2.4	-5.9	0.14
Portage la Prairie	8.5	-0.4	-0.2	0.15
Brandon	9.9	0.6	-5.5	0.21
Thompson	3.1	0.8	-7.5	0.32
Saskatchewan				
Regina	4.9	-0.4	-2.6	0.24
Yorkton	6.7	1.4	-1.5	0.37
Moose Jaw	7.4	-2.2	-0.1	0.35
Swift Current	6.8	-2.7	-2.5	0.37
Saskatoon	7.8	-2.9	-3.1	0.29
North Battleford	6.9	-4.6	-4.5	0.30
Prince Albert	5.7	-4.3	-3.0	0.21
Estevan	3.4	0.7	-9.9	0.33
Alberta				
Medicine Hat	8.5	-4.6	-8.9	0.32
Brooks	15.5	-0.3	-7.4	0.11
Lethbridge	9.3	-2.1	-5.8	0.21
Okotoks	6.5	-1.8	-9.7	0.29
High River	13.2	-1.9	-4.3	0.14
Calgary	8.3	-3.8	-8.0	0.21
Strathmore	11.1	-5.3	-10.8	0.38
Canmore	4.2	-0.9	-8.7	0.26
Red Deer	8.0	-0.9	-8.2	0.26
Sylvan Lake	6.7	-1.7	-12.7	0.36
Lacombe	8.5	-2.1	-8.4	0.39
Camrose	5.9	-0.1	-7.6	0.34
Edmonton	8.0	-2.5	-6.3	0.31
Lloydminster	7.4	-3.7	-9.3	0.29
Cold Lake	1.3	0.7	-17.0	0.47
Grande Prairie	5.9	-1.7	-7.0	0.31
Wood Buffalo	1.8	1.1	-0.2	0.46
Wetaskiwin	7.2	-1.5	-2.4	0.38

Note: The boundaries used to define census metropolitan areas (CMAs) and census agglomerations (CAs) are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Table 2
Selected statistics for census metropolitan areas and census agglomerations,
2000 to 2015 (continued)

	Share employed in manufacturing in 2000	Change in share employed in manufacturing from 2000 to 2015	Change in percentage of men working full year, full time from 2000 to 2015	Change in log average real weekly wages of men from 2000 to 2015
	percent	percentage points		logarithmic values
British Columbia				
Cranbrook	7.4	-2.9	-5.1	0.27
Penticton	8.9	-2.6	-2.2	0.19
Kelowna	9.5	-4.7	-2.0	0.20
Vernon	10.1	-3.1	-3.1	0.19
Salmon Arm	10.5	-2.4	2.0	0.12
Kamloops	6.3	-1.7	-1.2	0.17
Chilliwack	8.0	-0.7	0.5	0.15
Abbotsford-Mission	11.4	-2.8	-2.8	0.09
Vancouver	8.0	-2.9	-2.7	0.08
Squamish	6.6	-3.8	4.0	0.04
Victoria	3.8	-0.8	-2.4	0.10
Duncan	11.9	-5.2	-1.9	0.11
Nanaimo	6.3	-2.6	-0.3	0.13
Parksville	5.9	-2.3	0.3	0.20
Port Alberni	16.6	-9.6	-6.4	0.03
Courtenay	4.2	-1.6	0.2	0.09
Campbell River	9.4	-5.8	-4.6	0.15
Powell River	13.5	-6.7	-7.0	0.07
Williams Lake	13.6	-4.6	0.5	0.19
Quesnel	18.2	-1.1	-1.7	0.15
Prince Rupert	15.3	-10.4	-0.1	0.12
Terrace	7.5	-3.6	-2.5	0.13
Prince George	10.8	-3.8	-1.9	0.13
Dawson Creek	6.9	-2.6	-4.3	0.27
Fort St. John	3.1	1.4	0.5	0.32

Note: The boundaries used to define census metropolitan areas (CMAs) and census agglomerations (CAs) are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Table 3
Impact of the decline in the share of the population employed in manufacturing on
labour market outcomes, by sex

	All provinces (145 CMAs and CAs)		Excluding oil-producing provinces (115 CMAs and CAs)	
	Men	Women	Men	Women
parameter estimates				
Panel 1 — Weighted data (changes)				
Employment rates	0.38 *	-0.11	0.46 ***	-0.01
Percentage employed full year, full time	0.89 ***	0.29 †	0.91 ***	0.29 †
Average weeks worked	26.40 ***	-2.10	26.60 ***	0.40
Log real weekly wages	2.41 ***	0.92 †	1.66 ***	0.14
Log population	1.18 †	1.00	0.39	0.37
First-stage F statistic	249.10	249.10	157.20	157.20
Panel 2 — Unweighted data (changes)				
Employment rates	0.09	-0.29 *	0.32 *	0.01
Percentage employed full year, full time	0.54 ***	0.05	0.69 ***	0.18
Average weeks worked	17.80 **	-11.90 *	21.70 ***	0.60
Log real weekly wages	3.25 ***	1.75 ***	1.75 ***	0.29
Log population	2.63 ***	2.27 **	0.81	0.60
First-stage F statistic	194.90	194.90	171.20	171.20

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

† significantly different from reference category ($p < 0.10$)

Notes: Each number represents a parameter estimate for β_1 , the impact of a change in the share of the population employed in manufacturing on labour market outcomes. Models are estimated using two-stage least squares. Changes in the manufacturing share of a given area from 2000 to 2015 are instrumented using the share of the population aged 21 to 55 employed in manufacturing in that area in 2000. Control variables include the share of the population aged 21 to 55 who were immigrants in 2001, the share of the population aged 21 to 55 who had a bachelor's degree or higher in 2001, the participation rate of women aged 21 to 55 in 2001, changes in the share of the population employed in manufacturing in a given area from 1985 to 2000, changes in the share of the population aged 21 to 55 employed in construction from 2000 to 2015, and changes in the share of the population aged 21 to 55 employed in oil and gas extraction as well as support activities for mining, and oil and gas extraction from 2000 to 2015. Panel 1 shows results weighted by the population aged 21 to 55 of a given area in 2001. Panel 2 shows unweighted results, in which each area receives an equal weight. The boundaries used to define census metropolitan areas (CMAs) and census agglomerations (CAs) are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Table 4

Impact of the decline in the share of the population employed in manufacturing on the labour market outcomes of men, by age group and education level

	Education level							
	All provinces				Excluding oil-producing provinces			
	All	High school or less	Postsecondary below a bachelor's degree	Bachelor's degree or higher	All	High school or less	Postsecondary below a bachelor's degree	Bachelor's degree or higher
	parameter estimates							
Changes in employment rates								
21 to 55 years of age	0.38 *	0.36	0.32 *	0.23 †	0.46 ***	0.40 *	0.42 ***	0.30 *
21 to 35 years of age	0.55 **	0.38	0.65 **	0.50 *	0.63 ***	0.40 †	0.80 ***	0.55 *
36 to 55 years of age	0.29 †	0.36	0.13	0.10	0.38 **	0.41 *	0.21 †	0.18
Changes in percentage employed full year, full time								
21 to 55 years of age	0.89 ***	0.95 ***	0.69 ***	0.65 ***	0.91 ***	0.91 ***	0.87 ***	0.70 ***
21 to 35 years of age	1.27 ***	1.20 ***	1.35 ***	1.18 ***	1.21 ***	1.10 ***	1.45 ***	1.14 ***
36 to 55 years of age	0.74 ***	0.87 ***	0.43 *	0.53 **	0.82 ***	0.89 ***	0.66 ***	0.58 **
Changes in average weeks worked								
21 to 55 years of age	26.4 ***	28.5 **	19.0 **	14.1 **	26.6 ***	25.2 **	24.6 ***	16.4 **
21 to 35 years of age	39.0 ***	36.7 **	39.4 ***	29.6 **	37.0 ***	31.2 *	46.0 ***	26.7 *
36 to 55 years of age	20.1 **	24.6 *	9.3	9.6 †	21.9 ***	23.0 *	14.5 *	13.1 *
Changes in log real weekly wages								
21 to 55 years of age	2.41 ***	2.65 ***	2.53 ***	1.32 ***	1.66 ***	1.81 ***	1.82 ***	1.07 **
21 to 35 years of age	2.94 ***	3.22 ***	3.15 ***	1.38 **	2.03 ***	2.20 ***	2.27 ***	0.97 *
36 to 55 years of age	2.14 ***	2.35 ***	2.21 ***	1.21 **	1.46 ***	1.58 ***	1.56 ***	0.98 *
Changes in log population								
21 to 55 years of age	1.18 †	0.97	1.87 †	2.06 †	0.39	0.12	1.08	1.04
21 to 35 years of age	2.34 ***	1.82 *	3.58 ***	4.22 ***	1.38 **	0.86	2.40 *	2.71 ***
36 to 55 years of age	0.34	0.22	0.64	0.68	-0.35	-0.57	0.08	-0.08
First-stage F statistic	249.1	249.1	249.1	249.1	157.2	157.2	157.2	157.2

* significantly different from reference category (p < 0.05)

** significantly different from reference category (p < 0.01)

*** significantly different from reference category (p < 0.001)

† significantly different from reference category (p < 0.10)

Notes: Each number represents a parameter estimate for β_1 , the impact of a change in the share of the population employed in manufacturing on labour market outcomes. Models are estimated using two-stage least squares. Changes in the manufacturing share of a given area from 2000 to 2015 are instrumented using the share of the population aged 21 to 55 employed in manufacturing in that area in 2000. Control variables include the share of the population aged 21 to 55 who were immigrants in 2001, the share of the population aged 21 to 55 who had a bachelor's degree or higher in 2001, the participation rate of women aged 21 to 55 in 2001, changes in the share of the population employed in manufacturing in a given area from 1985 to 2000, changes in the share of the population aged 21 to 55 employed in construction from 2000 to 2015, and changes in the share of the population aged 21 to 55 employed in oil and gas extraction as well as support activities for mining and oil and gas extraction from 2000 to 2015. Results are weighted by the population aged 21 to 55 of a given area in 2001. The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Table 5
Impact of the decline in the share of the population employed in manufacturing on the labour market outcomes of women, by age group and education level

	Education level							
	All provinces				Excluding oil-producing provinces			
	All	High school or less	Postsecondary below a bachelor's degree	Bachelor's degree or higher	All	High school or less	Postsecondary below a bachelor's degree	Bachelor's degree or higher
	parameter estimates							
Changes in employment rates								
21 to 55 years of age	-0.11	-0.10	-0.17	-0.03	-0.01	-0.11	0.04	0.16
21 to 35 years of age	0.12	0.00	0.04	0.06	0.16	-0.15	0.32 †	0.24
36 to 55 years of age	-0.25	-0.17	-0.31 †	-0.05	-0.12	-0.09	-0.16	0.12
Changes in percentage employed full year, full time								
21 to 55 years of age	0.29 †	0.24	0.40 *	0.24	0.29 †	0.17	0.44 *	0.29
21 to 35 years of age	0.67 ***	0.52 *	0.85 ***	0.53 *	0.57 **	0.35	0.80 **	0.57 *
36 to 55 years of age	0.08	0.13	0.15	0.16	0.13	0.13	0.23	0.17
Changes in average weeks worked								
21 to 55 years of age	-2.10	-2.70	1.59	0.95	0.40	-4.50	8.20	8.50
21 to 35 years of age	14.10 †	4.30	21.30 **	15.90 †	13.10 †	-5.00	29.30 ***	24.80 **
36 to 55 years of age	-11.80	-6.40	-10.70	-6.10	-7.30	-3.20	-5.80	-1.90
Changes in log real weekly wages								
21 to 55 years of age	0.92 †	0.97	0.83 †	0.73 *	0.14	0.06	0.05	0.29
21 to 35 years of age	1.30 *	1.48 *	1.05 *	1.23 **	0.61 *	0.75	0.25	0.70 †
36 to 55 years of age	0.70	0.77	0.67	0.38	-0.13	-0.24	-0.09	0.00
Changes in log population								
21 to 55 years of age	1.00	0.62	0.16	1.65 *	0.37	-0.23	-0.49	0.95 †
21 to 35 years of age	1.41 *	0.50	1.44	3.52 ***	0.58	-0.35	0.32	2.44 ***
36 to 55 years of age	0.67	0.43	-0.78	0.06	0.20	-0.37	-1.12 †	-0.33
First-stage F statistic	249.10	249.10	249.10	249.10	157.20	157.20	157.20	157.20

* significantly different from reference category (p < 0.05)

** significantly different from reference category (p < 0.01)

*** significantly different from reference category (p < 0.001)

† significantly different from reference category (p < 0.10)

Notes: Each number represents a parameter estimate for β_1 , the impact of a change in the share of the population employed in manufacturing on labour market outcomes. Models are estimated using two-stage least squares. Changes in the manufacturing share of a given area from 2000 to 2015 are instrumented using the share of the population aged 21 to 55 employed in manufacturing in that area in 2000. Control variables include the share of the population aged 21 to 55 who were immigrants in 2001, the share of the population aged 21 to 55 who had a bachelor's degree or higher in 2001, the participation rate of women aged 21 to 55 in 2001, changes in the share of the population employed in manufacturing in a given area from 1985 to 2000, changes in the share of the population aged 21 to 55 employed in construction from 2000 to 2015, and changes in the share of the population aged 21 to 55 employed in oil and gas extraction as well as support activities for mining and oil and gas extraction from 2000 to 2015. Results are weighted by the population aged 21 to 55 of a given area in 2001. The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Table 6

Impact of the decline in the share of the population employed in manufacturing on the weekly wages of men, by age group and education level

	Education level							
	All provinces				Excluding oil-producing provinces			
	All	High school or less	Postsecondary below a bachelor's degree	Bachelor's degree or higher	All	High school or less	Postsecondary below a bachelor's degree	Bachelor's degree or higher
	parameter estimates							
Changes in log real weekly wages:								
Model 1								
21 to 55 years of age	2.41 ***	2.65 ***	2.53 ***	1.32 ***	1.66 ***	1.81 ***	1.82 ***	1.07 **
21 to 35 years of age	2.94 ***	3.22 ***	3.15 ***	1.38 **	2.03 ***	2.20 ***	2.27 ***	0.97 *
36 to 55 years of age	2.14 ***	2.35 ***	2.21 ***	1.21 **	1.46 ***	1.58 ***	1.56 ***	0.98 *
First-stage F statistic	249.10	249.10	249.10	249.10	157.20	157.20	157.20	157.20
Changes in log real weekly wages:								
Model 2								
21 to 55 years of age	2.11 ***	2.29 ***	2.24 ***	1.20 **	1.37 ***	1.46 ***	1.53 ***	0.96 *
21 to 35 years of age	2.52 ***	2.71 ***	2.88 ***	1.00 †	1.62 ***	1.74 ***	1.97 ***	0.59
36 to 55 years of age	1.92 ***	2.07 ***	1.92 ***	1.22 **	1.23 ***	1.30 ***	1.26 ***	1.00 *
First-stage F statistic	149.50	149.50	149.50	149.50	122.70	122.70	122.70	122.70

* significantly different from reference category (p < 0.05)

** significantly different from reference category (p < 0.01)

*** significantly different from reference category (p < 0.001)

† significantly different from reference category (p < 0.10)

Notes: Model 1 includes the control variables defined in Tables 3 to 5. Model 2 adds changes in log home prices in a given area from 2001 to 2016 to Model 1. The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Table 7
Estimates based on panel data versus versus non-panel data

	All provinces	Excluding oil-producing provinces
	parameter estimates	
Non-panel data		
Changes in log real weekly wages, men aged 21 to 35 years		
Model 1	2.94 ***	2.03 ***
Model 2	2.52 ***	1.62 ***
Changes in log real annual wages, men aged 21 to 35 years		
Model 1	3.21 ***	2.43 ***
Model 2	2.77 ***	2.03 ***
Panel data		
Changes in log real annual wages, men aged 21 to 35 years in 2000		
Model 1	2.85 ***	2.14 ***
Model 2	2.20 ***	1.56 ***

*** significantly different from reference category ($p < 0.001$)

Notes: Model 1 includes the control variables defined in Tables 3 to 5. Model 2 adds changes in log home prices in a given area from 2001 to 2016 to Model 1. First-stage F statistics equal 122.6 or more. The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.

Sources: Statistics Canada, Census of Population, 2001 and 2016, and Canadian Employer–Employee Dynamics Database (CEEDD).

Table 8
Actual and predicted changes in selected labour market indicators, selected census metropolitan areas and census agglomerations

	Change in percentage of men working full year, full time		Change in log weekly wages of men	
	Actual	Predicted	Actual	Predicted
	percentage points		log points	
Quebec				
Saguenay	-2.3	-3.2	0.04	-0.06
Québec	-0.7	-1.2	0.06	-0.02
Saint-Georges	-3.5	-4.8	0.06	-0.09
Sherbrooke	-6.0	-6.1	0.04	-0.11
Trois-Rivières	-2.9	-3.3	0.02	-0.06
Granby	-9.0	-9.1	0.06	-0.17
Saint-Hyacinthe	-7.8	-4.2	0.05	-0.08
Joliette	-9.3	-2.9	0.02	-0.05
Saint-Jean-sur-Richelieu	-4.0	-5.4	0.08	-0.10
Montréal	-6.8	-5.6	0.01	-0.10
Ontario				
Ottawa–Gatineau	-6.2	-4.1	0.00	-0.08
Oshawa	-11.1	-8.9	0.00	-0.16
Toronto	-8.8	-6.2	0.00	-0.11
Hamilton	-7.7	-6.7	0.01	-0.12
St. Catharines–Niagara	-9.5	-7.6	-0.02	-0.14
Kitchener–Cambridge–Waterloo	-9.9	-9.0	0.01	-0.16
Guelph	-6.6	-6.3	0.00	-0.11
London	-8.5	-4.8	-0.01	-0.09
Windsor	-12.7	-8.4	-0.14	-0.15
Samia	-10.4	-4.9	0.12	-0.09

Note: The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Table 9
Actual and predicted changes in male full-year, full-time employment rates and wages due to the manufacturing decline, by education level

	Change in percentage of men working full year, full time		Change in log weekly wages of men	
	Actual	Predicted	Actual	Predicted
	percentage points		log points	
All education levels	-5.90	-4.60	0.07	-0.13
High school or less	-9.50	-4.90	0.07	-0.14
Postsecondary education below a bachelor's degree	-5.90	-3.50	0.08	-0.13
Bachelor's degree or higher	-3.40	-3.30	0.04	-0.07

Notes: The predicted changes are calculated by multiplying the group-specific parameter estimates from Table 4 by the actual change in the share of the population employed in manufacturing for individuals aged 21 to 55. The sample consists of men aged 21 to 55 living in the 145 census metropolitan areas and census agglomerations of the 10 Canadian provinces. The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Appendix

Appendix Table 1
Descriptive statistics on key variables

	Men				Women			
	Percentile				Percentile			
	Mean	50th	10th	90th	Mean	50th	10th	90th
CMAs and CAs in all provinces (145 CMAs and CAs)								
Weighted data								
Change in share employed in manufacturing (percentage points)	-5.0	-5.5	-7.3	-1.3	-5.0	-5.5	-7.3	-1.3
Change in employment rate (percentage points)	-1.6	-1.9	-5.1	2.4	1.9	1.9	-1.3	6.2
Change in full-year, full-time employment rate (percentage points)	-6.0	-6.8	-8.8	-1.5	0.1	-0.3	-4.3	6.9
Change in average weeks worked (number)	-1.8	-1.7	-3.1	-0.3	-0.1	-0.3	-1.9	2.7
Change in adjusted log average real weekly wages	0.07	0.01	0.00	0.21	0.07	0.04	0.01	0.23
Change in log population	0.09	0.08	-0.07	0.25	0.09	0.09	-0.06	0.22
Unweighted data								
Change in share employed in manufacturing (percentage points)	-4.2	-3.7	-9.3	-0.4	-4.2	-3.7	-9.3	-0.4
Change in employment rate (percentage points)	-1.4	-1.3	-6.4	3.7	3.6	2.8	-1.4	11.0
Change in full-year, full-time employment rate (percentage points)	-4.3	-4.3	-9.5	0.5	3.9	3.1	-1.1	11.1
Change in average weeks worked (number)	-1.3	-1.4	-3.4	0.8	1.2	0.5	-1.6	5.2
Change in adjusted log average real weekly wages	0.13	0.10	0.00	0.32	0.11	0.08	0.02	0.25
Change in log population	0.00	-0.03	-0.23	0.25	0.00	-0.03	-0.23	0.24
CMAs and CAs in non-oil-producing provinces (115 CMAs and CAs)								
Weighted data								
Change in share employed in manufacturing (percentage points)	-5.4	-6.1	-7.3	-1.7	-5.4	-6.1	-7.3	-1.7
Change in employment rate (percentage points)	-1.3	-1.9	-4.1	2.4	2.4	2.3	-0.9	6.3
Change in full-year, full-time employment rate (percentage points)	-6.1	-6.8	-8.8	-1.2	0.2	-0.2	-4.3	7.1
Change in average weeks worked (number)	-1.8	-1.7	-3.4	-0.3	0.1	-0.2	-1.9	2.9
Change in adjusted log average real weekly wages	0.04	0.01	0.00	0.11	0.05	0.04	0.01	0.09
Change in log population	0.06	0.07	-0.07	0.16	0.06	0.06	-0.08	0.17
Unweighted data								
Change in share employed in manufacturing (percentage points)	-4.7	-4.6	-9.8	-0.8	-4.7	-4.6	-9.8	-0.8
Change in employment rate (percentage points)	-0.7	-0.8	-4.6	3.7	4.4	3.7	-0.8	11.3
Change in full-year, full-time employment rate (percentage points)	-4.0	-4.0	-9.3	0.5	4.5	3.5	-1.0	11.8
Change in average weeks worked (number)	-1.3	-1.3	-3.4	0.8	1.6	1.2	-1.3	5.2
Change in adjusted log average real weekly wages	0.09	0.08	-0.01	0.20	0.07	0.07	0.01	0.14
Change in log population	-0.06	-0.06	-0.25	0.15	-0.06	-0.06	-0.26	0.14

Note: The boundaries used to define census metropolitan areas (CMAs) and census agglomerations (CAs) are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

Appendix Table 2
Selected statistics for census metropolitan areas and census agglomerations,
by province

Provinces	Share employed in manufacturing in 2000	Change in share employed in manufacturing from 2000 to 2015	Change in percentage of men working full year, full time from 2000 to 2015	Change in log average real weekly wages of men from 2000 to 2015
	percent	percentage points		logarithmic values
Newfoundland and Labrador	4.9	-1.3	3.0	0.32
Prince Edward Island	7.3	-1.1	-2.0	0.06
Nova Scotia	6.4	-1.8	-2.0	0.11
New Brunswick	8.0	-2.9	-0.2	0.08
Quebec	13.9	-5.2	-5.3	0.03
Ontario	14.8	-6.9	-8.2	0.01
Manitoba	11.9	-4.2	-6.9	0.12
Saskatchewan	6.4	-1.9	-2.9	0.27
Alberta	8.0	-3.0	-7.0	0.28
British Columbia	8.0	-2.8	-2.3	0.10

Notes: Share employed in manufacturing refers to the percentage of the population aged 21 to 55 employed in manufacturing. The boundaries used to define census metropolitan areas and census agglomerations are those of 2011.

Source: Statistics Canada, Census of Population, 2001 and 2016.

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