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Local labor markets effects of trade exposure in Canada

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Résumé

Les pays développés ont connu, au cours des vingt à trente dernières années, une augmentation significative de leurs échanges commerciaux avec le reste du monde. Cette hausse du commerce international a entrainé des changements fondamentaux dans plusieurs aspects des économies de ces pays, notamment le marché de l'emploi. Entre autres, plusieurs études récentes suggèrent que la hausse des importations chinoises depuis les années 1990 a été un facteur significatif derrière la grande réduction du taux d'emploi manufacturier durant cette même période. J'utilise les techniques qui ont été développées pour quantifier ces phénomènes, principalement étudiés aux États-Unis et en Europe, afin de déterminer l'impact de la hausse de la compétition commerciale provenant de la Chine sur différentes variables du marché de l'emploi au Canada. Pour cela, je me concentre sur l'impact au niveau des marchés locaux d'emplois, afin de déterminer si des différences géographiques de pénétration des importations peuvent expliquer l'évolution de l'emploi. En utilisant des instruments Bartik pour la période 1991-2007, je trouve que la hausse des importations avec la Chine a réduit de manière significative le taux d'emploi manufacturier au Canada. Cette baisse n'a pas été accompagnée d'une baisse du taux d'activité, la plupart de ces emplois ayant été relocalisés dans le secteur des services. De plus, je documente que les travailleurs non qualifiés ont été touchés plus durement, avec un impact négatif sur leur salaire relatif et leur taux d'emploi, alors que ces effets ne sont pas significatifs pour les travailleurs qualifiés. Finalement, je montre que les zones géographiques avec un faible niveau initial de capital humain ont été plus touchées. Cela démontre l'importance du capital humain comme facteur d'adaptation et de polarisation face à certains chocs. Au-delà de ses contributions, ce mémoire suggère plusieurs avenues de recherche sur le sujet afin de déterminer quels ont pu être les effets d'équilibre général d'un choc de commerce international, notamment à l'aide de données au niveau des entreprises ou des industries. Bien documenter les impacts du commerce international, surtout dans un contexte où il est source de débats politiques, est important pour que les décideurs publics aient tous les outils afin d'en limiter les effets négatifs tout en encourageant ses bienfaits.

Abstract

High-income countries have experienced a significant and particularly large increase in international trade over the last two to three decades. This increase in cross-border commerce has fundamentally changed the economies of these countries along several dimensions, including their labor markets. In particular, several studies carried out in recent years suggest that the increase in Chinese imports over the last three decades has been a significant factor in the large reduction in manufacturing employment over the same period and, to a certain degree, wages. In the current study, I use techniques that have been developed to quantify these phenomena, mainly studied in the U.S. and European contexts, to analyze the impact of the increase in Chinese trade competition on various dimensions of the Canadian labor market. To do so, I focus on the impact on local labor markets to determine whether geographic differences in import penetration can explain a variety of employment outcomes. Using Bartik instruments for the period 1991-2007, I find that the increase in imports with China has significantly reduced the manufacturing employment rate in Canada. This decline has not been accompanied by a decline in the participation rate, as most of these jobs have been relocated to the service sector. Low-skilled workers were hit harder, however, with a negative impact on relative wages and the employment rate, while these effects were not significant for high-skilled workers. I also find that areas with low initial human capital were also more affected, suggesting that geographical polarization may have been generated as a result of the shock. This evidence suggests an important role for human capital in adapting to certain shocks, as well as a source of polarization. My work opens up various avenues of future research to explore the general equilibrium effects of this type of shock, notably with the help of firm- or industry-level data. Properly documenting the impacts of international trade, especially at a time when it is the subject of intense political debate, is important so that policymakers have the ability to limit its negative impacts while fostering its benefits.

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1 Introduction

The rapid rate of globalization since the 1980s and the rise of China as a commercial and economic power starting from the end of the 1990s have been the subject of much discussion in the economic profession, policy circles and the general public. While few economists question the aggregate benefits of international trade (Krugman, 1997), some have drawn increased attention to the numerous distributional impacts that higher trade integration could have had, especially on employment outcomes in Western countries following the rise of trade with low-income countries. Even if there are clear benefits to trade, and that the empirical literature on the subject suggests those benefits exceed the cost of trade for high-income countries, it is still highly relevant to understand the distributional impact of trade, since this can have important consequences on several aspects of modern economies. In light of a number if recent influential studies, it now seems quite clear that a growing exposure to trade can induce profound and lasting changes in the structure of labor markets. This is a reality that has to be taken into account by policy makers when assessing the general consequences of trade.

My work contributes to the recent and growing literature on the impact of trade exposure on high-income economies by using empirical evidence from Canada, a small open economy that has been increasingly exposed to foreign markets in the last three decades, through both its imports and exports. More specifically, I investigate the impact of trade exposure on local labor markets and manufacturing jobs in particular. I first document the global trend in international trade over the last three decades, then investigate its specific impact on Canada in order to compare it to other developed countries where such studies have been done recently (especially with the United States). I contribute to this literature by adding empirical evidence from another Western country, given that it has been mainly studied in the U.S. and in Europe. I also analyze both import and export exposure on labor markets in Canada. I add to this literature by testing how the initial level of human capital modulates the impact of higher trade penetration on employment outcomes, and interpreting its implications for future policy decisions.

My results suggest that the expansion of Canada's trade with China generated a significant reduction of the manufacturing share at the local labor market level. Quantitatively speaking, my results are similar in magnitude to those that have been found in the literature for other high-income economies. Specifically, I find that a $1,000 per worker increase in

import exposure reduces manufacturing employment per working-age population by 0.782 percentage point for the period 1991-2007 in Canada. However, I find that in contrast to what has been found by some studies in the United States, the impact of trade exposure on Canadian manufacturing has mainly led to a displacement of jobs towards the service sector rather than driving a significant portion of workers out of the labor force. Indeed, my results suggest that a $1,000 increase in Chinese imports per worker increased the share of service employment to working age population by 0.525 percentage point for the period 1991-2007. As a result, the overall labor market impact of the 'China Syndrome' appears to be milder in Canada than in the United States. For overall wages, I find similar trends in Canada to those documented for the United States: they are negatively impacted -at least temporarily- following the shock (-0.866 log point for overall weekly wages for each $1,000 per worker increase in Chinese import exposure). Both in terms of wages and employment-to-population ratio, I find that low-skilled workers are impacted much more severely from higher Chinese trade exposure than high-skilled workers. The upshot of my results is that the 'China Shock' may have generated important distributional consequences, such as higher wage and employment polarization across Canada. By dividing Canadian regions according to their initial level of human capital stock, I document that areas with relatively low levels of human capital have been impacted more adversely by higher import competition than other regions. This is in line with what has been found in previous studies for the United States and Europe. In addition to human capital, my results could be potentially explained by several factors, including the structure of the economy, institutions, or the distributive scheme. These hypotheses remain to be tested in further research.

The rest of the paper is structured as follows: Section 2 reviews the literature on trade and its impacts on labor markets across different countries. Section 3 discusses and describes the data sources. Section 4 covers the estimation methodology. Sections 5 and 6 presents the empirical results and compare them to those found in the related literature for other countries, mainly the United States. Section 7 concludes.

2 Local Labor Markets and Trade Exposure

Since the beginning of the 1990s, high-income countries have seen a swift decline in their manufacturing share of total employment. The empirical literature has tried to assess both the causes and consequences of such a decline (Autor and Dorn, 2013; Baily and Bosworth, 2014; Pierce and Schott, 2016; Dauth et al., 2017). Two common explanations for the drop in the manufacturing share are the greater adoption of technology in manufacturing in high-income countries and the rise in their trade exposure to low-wage countries. Indeed, cross-border commerce has grown substantially around the world during the same period, and the way goods are produced and traded between countries has changed dramatically. This in turn had important impacts on the economies of the countries that were the most exposed to trade competition.

In the current paper, I focus on the impact of trade on the manufacturing share and other labor market outcomes. In this empirical literature, it is common to use the rapid growth in imports and exports of Western countries after the beginning of the 2000s as a shock that affected labor markets. The standard assumption is that the arrival of China in the World Trade Organization (WTO) in 2001 has been a shock to the structure of trade relations for high-income countries across the world. A widely cited paper in this literature is by Autor et al. (2013), who focus on local labor markets. Others, such as Pierce and Schott (2016), use industry-level data to assess the impact of the growing trade on labor markets. More recent studies have documented the broader effects of trade or have explained in more detail the impact it might have had on the structure of the economy. Examples include studies that explore the effects of both imports and exports on the manufacturing sector and various labor market outcomes (Feenstra et al., 2019; Costa et al., 2016; Dauth et al., 2014). In addition, some studies have explored the role of human capital in shaping an economy's response to the trade shocks (Bloom et al., 2019; Bernard et al., 2020). The idea of the current paper is to take similar approaches to compute both the impact of Chinese imports and world exports on labor markets in Canada, in order to give a full picture of what happened since the considerable rise in trade exposure that occurred in Canada from the beginning of the 2000s.

2.1 Empirical Evidence from the United States

In the midst of the arrival of China in the WTO and of the large impact it had on trade volume, economists have documented the impacts it had on several variables. One of the most cited articles in this literature is Autor et al. (2013), a seminal work that has fundamentally changed the way we look at the empirical consequences of trade on labor markets in the United States. They explore the links between import exposure (defined as within-industry imports per worker in a given local labor market) and the decline of the manufacturing share in the United States from 1991 to 2007. To do so, they use County Business Patterns and Census Integrated Public Use Micro Samples data for the United States over the sample period and define local labor markets as U.S. Commuting Zones. They also consider the broader labor market impact of trade integration, by estimating the effect of trade exposure on other outcomes, like unemployment, wages, labor mobility or the use of government benefits. In their main specification, they find that a $1,000 per worker increase in import exposure reduces manufacturing employment per working-age population by 0.596 percentage point. This in turn allows them to quantify the losses of manufacturing employment caused by higher Chinese competition over the period they consider. Their results suggest that rising Chinese import competition is responsible for 44% of the decline in manufacturing employment in the United States between 1991 and 2007. They then estimate that 48 % of the decline in manufacturing employment for the period can be attributed to a supply shock, and thus that 21 % of the total decline in manufacturing employment between 1991 and 2007 can be attributed to the supply dimension of the rising Chinese import exposure. These results imply that the supply-shock component of the rising Chinese import exposure led to a net reduction in U.S. manufacturing employment of 548,000 workers between 1991 and 2000, and of 982,000 workers between 2000 and 2007.

They also find that a $1,000 per worker increase in import exposure reduces the employment-to-population ratio by 0.77 percentage point. Out of this reduction, 0.22 percentage point represents a rise in unemployment rate, while 0.55 percentage point is attributed to labor force non-participation. Having such a large and significant impact on labor force non-participation could have lasting and long-term impacts on the structure of the local labor markets they consider, especially the ones more exposed to trade. They also find that these effects are much more pronounced for low-skilled workers (non-college adults): a $1,000 per worker increase in import exposure reduces the employment rate of college adults by 0.42 percentage point and of non-college adults by 1.11 percentage point. In both groups, there

is a large proportion of the shock (about two thirds) that is accounted for by a higher rate of labor force non-participation. This could mean that in addition to causing job losses, this shock could have had significant distributional consequences.

Autor et al. (2013) also estimate that a $1,000 per worker increase in a Commuting Zone's exposure to Chinese imports during a decade reduces mean weekly wages by 0.76 log point (percent). They find that manufacturing wages were not impacted, most probably due to the high rigidity of wages in that sector, but that non-manufacturing wages were impacted negatively by the shock, consistent with manufacturing workers who lost their jobs being a positive labor-supply shock for other sectors. In their estimates, they find that a $1,000 per worker increase in a Commuting Zone's import exposure reduces manufacturing and non-manufacturing employment per population by 0.10 and 0.18 percentage point. This implies that a $1,000 increase in trade exposure has reduced per capita income by $332 through reduced employment and of $156 through reduced weekly earnings among the employed population. This yields a net reduction of $487 per capita for each increase in $1,000 in trade exposure.

It can be inferred from Autor et al. (2013)'s study that at the local labor market level, the impacts of Chinese trade exposure on labor outcomes are broad, and that they are not concentrated in the manufacturing sector. Indeed, rising Chinese import competition had spillover effects that exceeded the manufacturing share, since the shock had a significant and negative impact on employment and wages. In addition to that, a high level of disparity exists in who is affected by these changes, since they affect disproportionately certain categories of the population (such as non-college adults). What is also to note is that from Autor et al. (2013)'s estimates, the losses of jobs in the manufacturing sector did not correspond to a significant increase in jobs in the other non-manufacturing sectors in the United States: those being hit by the shock seem to have moved either to temporary unemployment or have been driven out of the labor force.

Similar patterns to those documented in Autor et al. (2013) have been found by Pierce and Schott (2016). Instead of focusing on labor markets, they consider different U.S. industries after the implementation of permanent normal trade relations (PNTR) with China in 2001. They first document that industries with higher-than-normal trade relation gaps after the adoption of PNTR saw a disproportionate increase in their imports from China; a higher

number of United States firms importing from China; and a higher number of Chinese firms exporting to the United States. They then document that more exposed industries saw large employment declines, and that the greater the NTR gap, the greater the employment loss was. In terms of employment outcomes, the estimates from their main specification imply that moving an industry from a NTR gap from the twenty-fifth to the seventy-fifth percentile of the distribution would lead to an employment loss of 0.08 log point. When they average across all industries, they document a manufacturing employment decline of 0.15 log point relative to a scenario with Zero NTR gap. While being at the industry level and not at the local labor market level, these results are consistent with those of Autor et al. (2013) who find large and persistent effects of higher trade exposure on employment and wages.

In complementary research, Acemoglu et al. (2016) point out that those studies do not take into account the broader general equilibrium effects of growing Chinese imports on U.S. employment. Indeed, several indirect channels can add to the local labor market effects of higher Chinese import exposure. They use industry-level input-output linkages to estimate these general equilibrium effects which could be either positive or negative for labor demand, creating a net employment change that is theoretically ambiguous if not tested empirically. If an industry reduces its output or its labor demand because of increased Chinese import competition, it could cause a reduction in its own domestic demand and its supply to other industries. An industry that is not necessarily a priori affected by higher import competition could thus be affected indirectly by a shock that affects its suppliers or buyers. The downstream effect is ambiguous, because even if trade competition could reduce the supply of certain inputs, this could be offset by the increased supply of imported inputs (which could prove to be a positive effect). However, the effect should be negative consequence for the upstream industry, since suppliers depend on the local industry. Using national data across industries, Acemoglu et al. (2016) estimate that rising import competition has generated 985,000 job losses in the manufacturing sector over the 1999-2011 period. When accounting for input-output linkages, they estimate net job losses for the entire economy of about 1.98 million workers. These results lead them to conclude that for this country and period, inter-industry linkages have increased significantly the size of the employment effects of higher Chinese import penetration, both by increasing the effect within manufacturing industries and by generating a large employment effect outside the manufacturing sector. In a second empirical strategy, they try to estimate reallocation and aggregate demand effects at the local labor market level, in a similar way to what has been done by Autor et al. (2013) but

by adding inter-industry linkages from their first strategy. With this approach, they estimate that higher Chinese trade import competition generated 2.0 to 2.4 millions of job losses for the period 1999-2011. This shows that if Autor et al. (2013) find substantial direct effects of Chinese imports on local labor market outcomes (wages, manufacturing share, unemployment, use of government benefits, labor force non-participation), these effects can propagate to other industries and become of greater magnitude if considered in general equilibrium. If this is true, import competition from China, which surged after 2000, was a major force behind recent reductions in U.S. manufacturing employment. Through input-output linkages, it could also have explained in part the general tendency for relatively weak employment growth for the period in the United States.

More recently, Bloom et al. (2019) study the effect using more precise confidential microdata and over a longer period of time. Based on the U.S. Census Bureau Longitudinal Business Database, they find that there is no evidence that Chinese import competition generated net job losses. While they confirm the result from Autor et al. (2013) that Chinese imports had a robust negative impact on U.S. manufacturing employment, they also find evidence of a positive impact on the services share. This positive impact offsets the manufacturing effect of higher trade competition and makes the total impact insignificant. They also find different effects by initial human capital stock. In low human capital areas, their estimates suggest manufacturing job losses, plant shrinkage and closures. In high human capital areas, they find that the manufacturing share effect was smaller, but that there were a lot of gains in service employment, especially in the research, management and wholesale sectors. This means Chinese competition could have reallocated employment from manufacturing to services, but also from low human capital regions to high human capital regions.

The authors also use firm-level data to determine what types of companies experienced heavy manufacturing employment losses. Their result suggests that a high proportion of manufacturing job losses were in multinational firms that were increasing at the same time their employment in the service sectors. This leads them to conclude that large firms could have offshored manufacturing employment while creating a substantial level of U.S. service sector jobs. Finally, their findings suggest that the impact of Chinese imports was weak after 2007, suggesting that there might be a period of adaptation that is necessary but that the effects might not be persistent in the long run. In the present study, I will rely on a framework that is similar to the one used in Bloom et al. (2019) in order to determine if hu-

man capital could help us understand the employment response to higher trade integration in Canada. This will also serve as a basis of comparison in order to better understand the differences and similarities that can arise between Canada and the United States.

In complement to Bloom et al. (2019), Fort et al. (2018) and Bernard et al. (2017) also find that there has been a broad reallocation during the period following the manufacturing decline, with jobs being allocated mainly to services occupations. Again, these findings contrast with the previous ones from Autor et al. (2013) and Acemoglu et al. (2016). This shows the importance of pursuing empirical research in this field and of evaluating the labor market outcomes of trade exposure in the Western world.

2.2 Empirical Evidence from Other Countries

The large early body of literature on the impacts of trade on labor markets was focused mainly on the United States. The results led researchers to repeat the analysis for other regions of the world, especially high-income countries. Hence, following Autor et al. (2013), many studies have attempted to determine if these findings could also be generalized to other high-income countries. Not all this literature focuses on local labor markets, and some studies are industry- or firm-specific, but the main idea is to try to understand if findings in the United States can be generalized.

Mion and Zhu (2013) test the hypothesis for Belgium, using firm-level data for the 1996-2007 period. They test principally the impact of higher import competition on employment growth and skill upgrading at the firm and industry level. Their results suggest that import competition from China has reduced firm employment growth in manufacturing industries. However, they find that higher import competition from China also generated skill upgrading, more specifically in low-tech manufacturing industries. Interestingly, they find that offshoring of finished goods to China had a positive and significant effect on a firm's probability of survival. In terms of skill upgrading, their results suggest that import competition accounts for 27% of the increase in non-production workers in Belgian manufacturing firms, and for 48% of the increase in high-skilled workers count. This is consistent with Bloom et al. (2019) who find that while there are disemployment effects of higher import competition, skill levels are also impacted positively in high human capital regions. Considering the impact on the probability of firm survival and on skill upgrading at the firm level, this

would also mean that there might be positive labor market effects from outsourcing.

Ashournia et al. (2014) considers the effects of higher Chinese import penetration in Denmark, principally focusing on wages. They use firm-level and worker-level panel data and find that wages are reduced, especially for low-skilled and low-wage employees, following higher Chinese import competition. More specifically, the study finds that each percentage point increase in Chinese imports corresponds to a 0.48% decrease of low-skilled workers wages, an effect that they do not find for high-skilled wages. This suggests that the effects of Chinese import penetration at the firm level could not only have a negative impact on salaries but could also increase wage polarization. Always in Denmark, Utar (2018) analyzes the impact of trade shocks by exploiting the dismantling of the Multifiber Arrangement quotas on products from China upon its WTO accession. He finds that after the 'China Shock', there has been a negative impact on employment and earnings in highly exposed industries and occupations. He does find however high heterogeneity in workers' adjustments to the trade shock. College-degree workers were able to switch easily to service sector jobs, with higher earnings in the long run. On the opposite, workers without college education adjusted more slowly and with higher difficulty. This could also be a polarization trend, as suggested by Ashournia et al. (2014). The results, similarly to Bloom et al. (2019) show the importance of human capital in trade adjustment. The study finds similar results to Mion and Zhu (2013) in Belgium, suggesting that there is skill upgrading (through education) after the shock, thus creating a positive human capital effect. Bernard et al. (2020) exploit information on Danish firms' offshoring and analyze how firms' decisions to relocate their primary activities to low-income countries affect their aggregate employment and output. Concurring with Bloom et al. (2019), they find that offshoring firms change their employment composition so that they ultimately employ a higher share of technology and research-related workers. This means that offshoring production to low-income countries allows firms to reorganize their domestic activities by increasing the number and share of domestic high-skilled workers at the firm. Firms maintain their output but tend to shift their local jobs to technology and high-skilled jobs. This results in generating a greater number of high-skilled jobs for the domestic country, once again suggesting positive human capital effects. However, this could also increase wage and employment polarization in high-income countries.

Malgouyres (2017) estimates the impact of Chinese import competition on employment and wages at the local labor market level in France. He considers more specifically spillovers

effects that can go beyond manufacturing, such as the impact on employment in the non-traded sectors, on labor mobility and on inequality. He finds a negative effect of rising Chinese import exposure on local employment in manufacturing and in non-manufacturing industries. He finds no evidence of an impact on wage polarization within the manufacturing sector at the local labor market level, since he finds the negative effect on wage is shared across the income distribution for the manufacturing sector. However, he finds that there is an increase in wage polarization in non-manufacturing industries.

Paz (2018) use similar techniques to look at the impacts in Brazil. While Brazil is generally not considered as developed as Canada, the United States or European countries, it is still interesting to see the impact it might have had. The study finds negative effects of higher Chinese import penetration on employment at the industry-level. However, the study finds that manufacturing disemployment effects are compensated by other-industry sector reallocation, similar to Bloom et al. (2019)'s results.

Donoso et al. (2015) explore the links between higher Chinese import exposure and local labor market outcomes using Spanish provinces. They find negative effects of higher Chinese import exposure on manufacturing share. Their main finding implies that a rise of U.S. $1,000 per worker in a province's exposure to Chinese imports for the 2003–2007 period is associated with a decline in manufacturing employment of 2.05 percentage points, with 0.41 percentage point for the 1999–2003 period and 1.66 percentage points for the 2003–2007 period. However, they find that this reduction did not result into a significantly higher proportion of the population being out of the labor force, but rather shifted the jobs from manufacturing industries to non-manufacturing ones.

In Norway, Balsvik et al. (2015) find that Chinese import competition had a negative effect on employment at the local labor market level. This negative employment effect is higher for low-skilled workers, as they are more likely than high-skilled workers to be driven out of the labor force or to be pushed into unemployment. They find no evidence of an impact on wages at the local labor market level. They however find that the 'China Shock' has been of smaller magnitude in Norway than what has been found by Autor et al. (2013) in the United States. Indeed, they estimate that import competition from China explains about 10% of the reduction in the manufacturing employment share from 1996 to 2007 which is half of the effect found in the United States for the same period.

These empirical findings show that European countries had similar trends in their labor market outcomes following a higher exposure to Chinese imports and higher outsourcing. What has been found in most of these countries is a large sector reallocation both within firms and at the local labor market level. This suggests that the reduction of the manufacturing share could be a part of a broader trend that has effects on the whole pool of workers. Some evidence also shows that low-skilled and low-wage workers are more adversely affected, which could generate skill and wage polarization, and thus have distributional consequences.

For Canada, which is the country of interest in the present paper, Albouy et al. (2019) compares the local labor market response to the 'China Shock' to that in the United States using data from 1990-2007. They find that the decline in manufacturing employment in response to imports form China is smaller than in the United States, with -1.3 log points for Canada, not statistically significant, while they have an estimate of -4.2 log points for the U.S. Commuting Zones. They find evidence that the increased import penetration from China decreased employment to population in Canada, but the magnitude is higher in the U.S (double). It thus appears from their results that higher trade competition from China might have had a smaller effect on manufacturing employment in Canada than in the U.S. I extend the analysis in Albouy et al. (2019) by using techniques developed in Feenstra et al. (2019) and Bloom et al. (2019) to further assess the causes and consequences of the trade shocks on the Canadian labor market. I test, in addition to imports, the impact of rising exports on the Canadian local labor market outcomes. I also analyze the impact of the 'China Shock' by differential human capital levels in Canada. First, I test if the impact is different between college degree holders and non-college degree holders. Then, I add a comparative analysis of trends between regions that had high human capital before the shock and regions that had low human capital before the shock.

The results in Albouy et al. (2019) are contrasting with the results found in Murray (2017) that estimate, using the techniques from Acemoglu et al. (2016), total job losses from rising Chinese import competition of 150 to 170 thousand over the 2001-2011 period. The study finds that manufacturing industries account for at least 105 thousand of these job losses, which is of similar order of magnitude to what is found in the United States. Acharya (2017), while not considering local labor markets, finds little evidence of a big shock on employment in Canada following the liberalization of trade in the early 2000s. The contrasting

results of the empirical literature on the effect of trade on labor markets in Canada makes it important to continue research on the topic. This would allow us to have a better understanding of all what is at play with the recent and continuing trend of trade integration in the Western world.

2.3 Exports and Employment

In addition to what has been considered for Chinese import competition, others have tried to give a broader picture of the impacts of trade on labor markets, such as Feenstra et al. (2019), by comparing the impact of import exposure to that of export exposure on employment and local labor market variables in the United States. Feenstra et al. (2019) results for import exposure are similar to the ones found by the literature in the U.S. (Autor et al., 2013; Acemoglu et al., 2016; Pierce and Schott, 2016; Bloom et al., 2019) over the same period. Yet, Feenstra et al. (2019) find that export exposure to the rest of the world leads to a significant and positive employment boom in the U.S. for the same period, making an interesting and compelling case for trade exposure if accounted in whole. They find, similarly to the relevant literature on the subject, that higher Chinese trade exposure reduces manufacturing share at both the industry and local labor market level. However, they document that the great rise in exports of United States produces over the same period also created several jobs, including in the manufacturing sector. Their results suggest that the net job loss of the rising trade exposure, when considering both Chinese imports and world exports, would be of 0.2-0.3 million jobs for the 1990-2007 period. When they extend it to 2011, they find that the net job loss becomes roughly balanced, suggesting that negative manufacturing employment outcomes are limited in time. Overall, the results from Feenstra et al. (2019) suggest that jobs losses due to China are compensated by job booms generated following the general reduction of trade barriers from the U.S. during the same period. A similar trend for reduction in trade barriers can be seen in Canada too.

In Germany, Dauth et al. (2014) estimate that the trade integration following the start of the 1990s (in terms of both imports and exports) has generated 442,000 additional jobs, including in the manufacturing sector. They document that this was due to a significant rise in Eastern Europe exports. A similar approach could be interesting for Canada, since two shocks of trade integration in two different periods have arisen, namely the adoption of the North American Free Trade Agreement, with a significant increase in trade with Mexico

and the United States following it, and then the arrival of China in the WTO. However, the data on trade and employment before 1990 is incomplete in Canada, thus not allowing to build a model similar to the one from Autor et al. (2013) (using a shift-share strategy).

Costa et al. (2016) also test both the imports and exports channels for Brazil, focusing on wages. Their study finds that higher trade with China led to slower manufacturing wages growth for the period 2000-2010. They also observe that regions more exposed to Brazil's exports to China (mainly in the commodity sector) saw faster wage growth. They find that a $1,000 per worker increase in exports to China is associated with higher growth in wages of 1.58 percentage points for the period 2000-2010.

3 Data

3.1 Trade

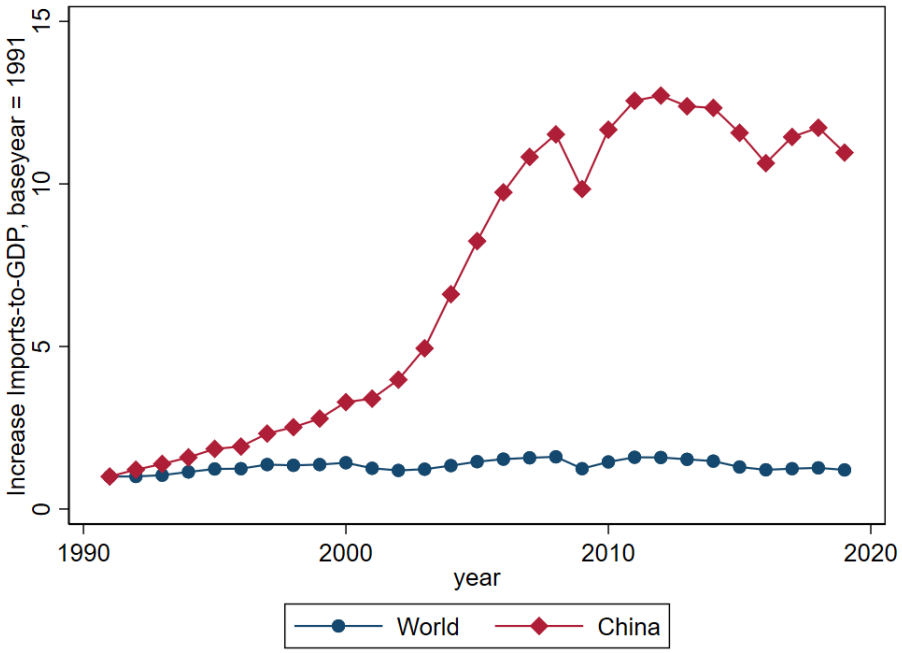
Trade flows have increased considerably in the last three decades in Canada. Between 1991 and 2018, total Canadian imports rose by 173%, while total Canadian exports increased by 152% (Figure 1, Table 1). One of the main drivers of the rise in imports has been China, especially from 2001 onward, the year China entered the World Trade Organization (Figure 2). For example, for the period ranging from 1991 to 2006, total Chinese imports rose by 1313% (Table 1). The trends presented in Table 1 are of similar magnitude when considering the sample of local labor markets and aggregating the data to the national level. Using 1991 as baseline, it is easy to see that China was behind a large share of the rise in Canadian imports for the period 1991-2018. The rise in the ratio of Chinese imports to Canadian GDP from 1991-2018 was over 1000%, while the increase in total imports to GDP was less than 200% (Figure 1). Most of this increase in imports relative to GDP occurred during the 1991-2008 period. Over the same period, the Chinese share in total Canadian imports increased from less than 1% in 1991 to around 13% in 2018 (Figure 2).

It has to be noted that the rise in exports to China from Canada has not been as pronounced, resulting in a large deterioration in the Canadian trade balance with China between the beginning of the 2000s and 2018. From Figure 2, it can be seen that the Chinese share of total Canadian imports was very similar to the Chinese share of total Canadian exports (about 1%) in 1991. In 2019 however, imports from China accounted for 13% of total Canadian imports, while exports to China accounted for only 4% of total Canadian exports.

Similar trends have been observed in the United States and in Europe for the same period. This indicates that if what has been observed in the United States can be generalized to other countries, trends in the local labor market outcomes should be similar for Canada and the United States, at least for the manufacturing sector.

For my imports measures, I follow Autor et al. (2013) and use data on import volumes from China to Canada as well as eight other high-income economies at the six-digit Harmonized System (HS) product level. For my export measures, I use export volumes from Canada to the rest of the world, in line with Feenstra et al. (2019).

Figure 1: Increase in Canadian Imports to GDP : 1991-2019



Notes: Trade values come from Statistics Canada Trade Data Online Database and are deflated to 2002 $CAD using the yearly CPI.

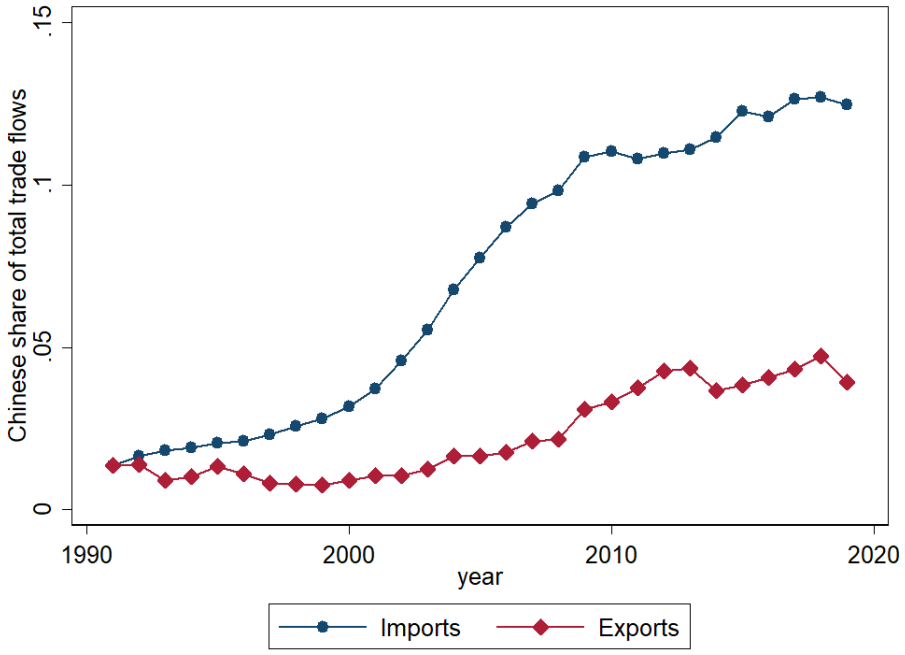
Table 1: Descriptive statistics : Trade trends in Canada 1991-2018

	I. China		II. World	
	Imports (1)	Exports (2)	Imports (3)	Exports (4)
1991	2.2	2.4	163.6	174.3
2006	31.6	7.2	363.8	406.6
2018	56.7	20.8	446.8	438.0
Growth 1991-2006	1313%	196 %	122%	129%
Growth 2006-2018	79%	190%	23%	8.5%

Notes: Data from Statistics Canada Trade Data Online, in Billions of 2002 Canadian dollars.

I convert the Comtrade HS 6-digit trade measure to NAICS 4-digit using Pierce and Schott (2012)'s conversion method. The principal problem arising when converting HS 6-

Figure 2: Chinese Share of Total Canadian Trade Flows : 1991-2019



Notes: Trade values come from Statistics Canada Trade Data Online Database and are deflated to 2002 $CAD using the yearly CPI.

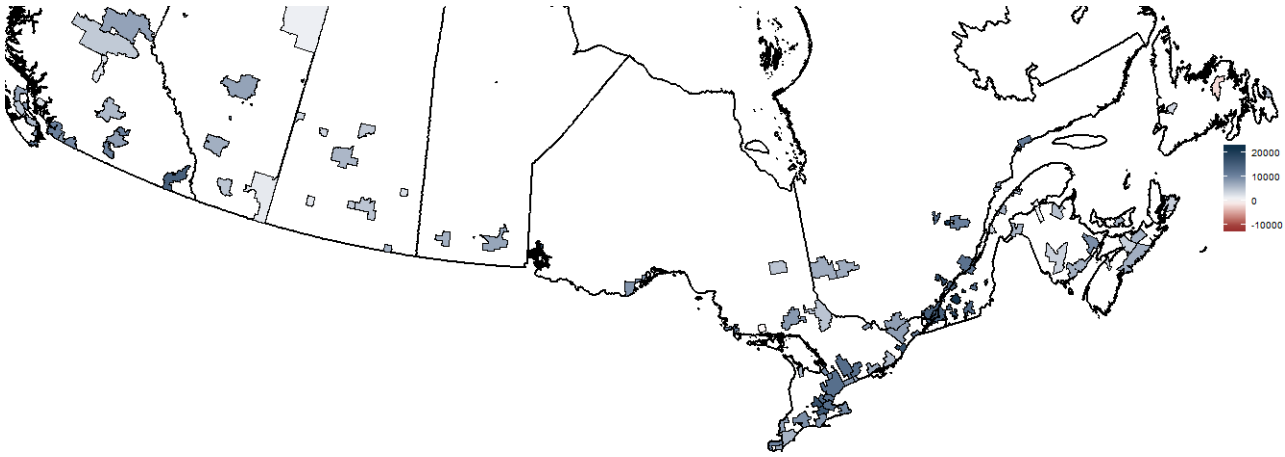
digit to NAICS 4-digit is the fact that it is a many-to-many combination. Since the conversion between HS 6-digit product classes and NAICS 4-digit industries is not straightforward, I build a crosswalk following Autor et al. (2013)'s Online Data Appendix. Specifically, I use Statistics Canada's Trade Data Online and take the average trade between 1995 and 2005 at the HS97 6-digit level in order to compute weights for all corresponding NAICS 2002 codes. This allows me to aggregate all HS-6 trade values from UN Comtrade database to NAICS 2002 industries, comparable through time, in order to build the trade per worker measures.

Since the analysis is done at the local level, I start by defining local labor markets. Albouy et al. (2019) use as local labor markets all Census Metropolitan Areas (CMA) and all Census Agglomerations (CA) that have more than 15,000 of population in the 1991 Census for comparability with their U.S. sample, for a total of 82 distinct local labor markets for Canada. In my case, I instead use all Census Metropolitan Areas and Census Agglomerations that exist continually from 1991 to 2006 (locations with population of 10,000 and more) in my Census data, for a total of 132 local labor markets. Those 132 labor markets are then stacked by year, in order to generate the unit of observations in the regressions (264 units of

observations).

I merge trade values and Individual Census Data aggregated at the CMA/CA level to construct the trade exposure measure. The import and export exposure measures in a given year are calculated as the value of trade per worker in a CMA/CA in that year. An explanation on how the national trade measures are imputed to local labor markets for the regressions, with details on Bartik estimators, is provided in Section 4. In Figure 3, I present the evolution of import exposure between 2001 and 2006 for local labor markets, using imports per establishment counts at the CMA/CA level. Out of 135 CMAs/CAs, only two have seen a drop in Chinese imports per establishment over the sample period.

Figure 3: Difference in Import Exposure by CMA/CA: 2006 − 2001



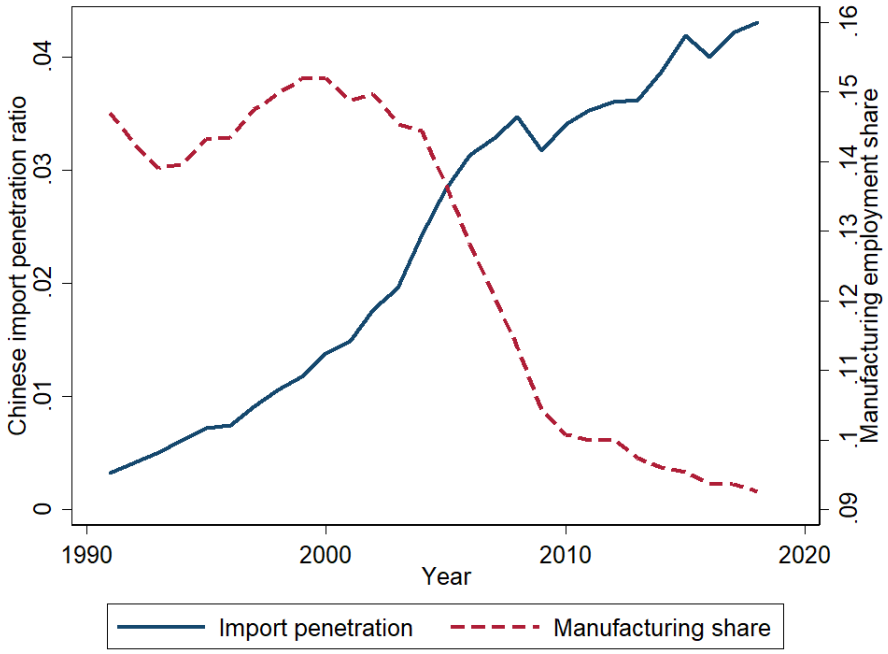
Notes: Values per establishment counts, in 2007 $US.

3.2 Employment and Demographics

Using data from Statistics Canada, I show the evolution of the manufacturing share in Canada from 1991 to 2018 in Figure 4. This is comparable to the trend observed in the U.S. and most high-income countries. The manufacturing share of total employment has dropped from 15% in 1991 to as low as 9% in 2018. Interestingly, the drop in the manufacturing share starts only at the end of the 1990s, unlike in the United States where this trend starts a bit sooner in the decade.

For the regressions, I use data from the Individuals file of the Canadian Census Master

Figure 4: Import penetration and manufacturing share : 1991-2018



Notes: Trade values come from Statistics Canada Trade Data Online Database and are deflated to 2002 $CAD using the yearly CPI. Import penetration ratio is calculated as the share of Chinese imports on total consumption expenditure in Canada.

Datafile, because the Public Use Microdata Files do not allow for disaggregation into local labor markets. Indeed, public Census files do not allow to distinguish between Census Agglomerations that are relatively small. Census data for the 1991, 2001 and 2006 Censuses is used. This allows to generate the 1991-2007 estimates, defined in this way for comparison with Autor et al. (2013).

Census data on industry and employment are used to create the manufacturing share and the local trade per worker measures. I use individual data on employment from the Census that I aggregate to the industry level, and then to the CMA/CA level to generate the outcome variables. Several outcomes are considered. In the main specification (Table 2, column 1), the outcome is the change in the ratio of manufacturing employment to working age population for a given period. Other outcome variables are constructed similarly for Table 2. For instance, in column 2, I take the change in services employment to working age population. In Tables on wages (3, 6), I use Census annual wages and divide them by 52 weeks to generate a value of weekly wages, and take the log difference. In Tables on employment-to-population

ratio (4, 7), I compute the ratio of log employment to working age for a given education level.

The Census data allows me to generate a rich set of demographic controls that I use in the regression (equation 2). I also use Census data in order to generate the offshorability index and the routine share in all the CMAs/CAs. In order to generate those measures, I create a crosswalk from the U.S. Standard Occupational Classification (SOC), for which the data on offshorability and routine share used in Autor and Dorn (2013) is publicly available, to Canada's National Occupational Classification (NOC). I then use the crosswalk between the NOCs of different years provided by Statistics Canada in order to generate an offshorability index and a routine-occupation measurement. I use individual Census data that I aggregate to the occupational-code level, and then merge to the offshorability index/share of routine occupations in order to generate an offshorability index and a routine occupations share by CMA/CA.

An important contribution of this work is its focus on the role of human capital (Section 6). For this purpose, I leverage the 1991 Census data in order to generate a variable for the level of human capital in a given CMA/CA *before* the 'China Shock' happens. Similarly to Bloom et al. (2019), I use the proportion of the working age population holding a college degree or higher in a CMA/CA in order to define the human capital level. I then split the sample between high human capital ('HHC') and low human capital ('LHC') areas. A high (low) human capital labor market is defined as a CMA/CA that is above (below) the median level of human capital (proportion of college-degree holders) in 1991.

4 Methodology

4.1 China Shock

My unit of observation is the local labor market, in line with the specifications in Autor et al. (2013), Feenstra et al. (2019) or Albouy et al. (2019). As described previously, CMA/CAs are used as the local labor markets (and thus units of observations) for Canada. The main idea is to compare local exposure to trade and analyze how this exposure affected the labor market outcomes following the "China import shock" of the beginning of the 2000s. In order to proceed, I follow Autor et al. (2013) and build a local imports per worker measure, which will be the main independent variable in the model specification:

$$\Delta IPW_{ict} = \sum_{j} \frac{E_{ijt}}{E_{jct}} \frac{\Delta M_{jct}}{E_{it}}. \tag{1}$$

where ΔIPW_{ict} is the difference in imports per worker in region i, country c (Canada), at time t. It is computed using the difference in total Canadian imports in a given industry, ΔM_{jct}. Since there is no data on local city-industry value of trade-flows, I proxy it using a shift-share (Bartik) strategy, i.e. by using the local share of industry employment at the beginning of the period $\frac{E_{ijt}}{E_{jct}}$ (Bartik, 1991). The value is consequently divided by total employment in the CMA/CA (E_{it}) to obtain the per worker measure.

This approach allows me to stack those imports-per-worker measures over two decades analyzed in order to build the following model:

$$\Delta L_{it} = \gamma_t + \beta_1 \Delta IPW_{ict} + \boldsymbol{X}'_{it}\beta_2 + \epsilon_{it}. \tag{2}$$

where L_{it} is the labor market outcome that is considered, γ_t is a decade-specific dummy, ΔIPW_{ict} is defined as above, and X_{it} is a rich set of demographic controls that includes women's employment rate in the CMA/CA, the proportion of immigrants in the CMA/CA, and the proportion of college degree holders in the CMA/CA. In addition, the model controls for the start-of-period manufacturing share in the CMA/CA in order to focus on variations in Chinese trade exposure coming from within local labor market differences in industry mix. As described in Section 3, I also control for the CMA/CA offshorability index and share of routine occupations, since those have been shown to have an important effect on local manufacturing share of employment (Autor and Dorn, 2013). Autor et al. (2013) use a regional dummy following the U.S. Census Bureau Designated Regions divisions in order to

account for regional fixed effects. Here, I use Albouy et al. (2019)'s specification for Canada, and separate Canada in five regions that are described as being similar to U.S. Census Bureau Designated Regions divisions. These five regions are Maritimes (Nova-Scotia, New-Brunswick, Prince Edward Island and Newfoundland), Quebec, Ontario, Prairies (Alberta, Saskatchewan, Manitoba) and British Columbia.

4.2 Limitations

Inevitably, endogeneity concerns can arise. Indeed, imports from China could be correlated with unobserved local demand shocks in Canada that could also affect labor market outcomes. For this reason, I use an instrumental variable strategy in order to account for this potential endogeneity problem. Since it is widely documented that during the same period, other high-income countries have experienced similar patterns in imports growth, I follow Autor et al. (2013) and Albouy et al. (2019) and instrument growth in Canadian imports from China with industry-imports growth in eight other high-income countries [1] :

$$\Delta IPW_{iot} = \sum_{j} \frac{E_{ijt}}{E_{jot}} \frac{\Delta M_{jot}}{E_{it}}. \tag{3}$$

where the difference between the instrument and the main variable is the fact that I use ΔM_{jot}, or the industry-level difference in trade for other high-income countries, which generates ΔIPW_{iot}, imports from *other countries* per Canadian workers. Using this instrument strategy, the model is identified if the movements of the imports at the industry-level for Canada and the other high-income countries come from Chinese productivity growth or reduced trade costs.

Note that some other problems could arise from using this methodology. It is possible that local demand shocks (that affect both imports and labor market outcomes in the same direction) are, at a given time, correlated between high-income countries. In a robustness check, Autor et al. (2013) account for this by using a gravity model of bilateral trade over the 1991 to 2007 period and have estimates that are not particularly different from the IV-strategy model. It is also conceivable that imports are driven by high-income productivity shocks, and not Chinese ones. While it cannot be totally excluded, it is very likely that

[1] Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland

Chinese productivity shocks had an impact. Indeed, Chinese productivity growth in manufacturing over the 1991-2007 period has been largely higher than that of any high-income country (Brandt et al., 2012).

It is also important to discuss the limitations of the Bartik (shift-share) instrument strategy, and to have those limitations in mind when assessing the results of the present paper and of other studies that use similar techniques in the context of the 'China shock'. Goldsmith-Pinkham et al. (2020) show that Bartik-like instruments are numerically equivalent to Generalized Method of Moments estimators (GMM) with local industry shares as instruments. This means that if considering the Bartik instruments in this framework, in order to satisfy the exogeneity conditions, one must ensure that the start of period industry shares are uncorrelated with the changes in the outcome variable. They test this hypothesis for the China shock using Autor et al. (2013)'s data, with pre-trends and over-identification tests. Their results suggest possible misspecification of the model if considered as a GMM model with local industry shares as instruments. However, they do not rule out the potential interpretation of these results as being heterogeneity in treatment effects underlying the overall estimate. Borusyak et al. (2019) take another approach and show a numerical equivalence between Bartik-like instruments and designs in which a large number of different shocks to industries are being used as instruments. In this framework, the exclusion restriction holds when there is a large number of these different shocks, that they are independently assigned and that they have a reasonable amount of dispersion in their exposure level. They test it in the context of the China shock, using Autor et al. (2013)'s data. They use different tests of sensitivity, falsification and over-identification and estimate that using their framework (shocks-driven instruments), the China shock estimate can be considered as exogenous in the United States context.

4.3 Extensions

In the second part of the analysis, I use an analogous method to what is defined for Chinese imports. This follows more closely the related literature (Feenstra et al., 2019; Costa et al., 2016; Dauth et al., 2014) on the impact of increased export exposure on employment and labor market outcomes. A world exports per worker variable is created in the same way as above:

$$\Delta EPW_{ict} = \sum_{j} \frac{E_{ijt}}{E_{jct}} \frac{\Delta X_{jct}}{E_{it}}. \tag{4}$$

The same instrument technique is used. The identification of the export model is defined in the same way as that for the import model. The identification goal is to avoid exports that are driven by Canadian shocks, since they should be affected only by increased demand for Canadian goods in the rest of the world. This demand would then generate different labor market outcomes in Canada. This identification can also be found in Feenstra et al. (2019) and Costa et al. (2016), and is closely related to what I use in the first part of the analysis on Chinese imports. The instrument is created using exports to the rest of the world for the same eight high-income countries as above:

$$\Delta EPW_{iot} = \sum_{j} \frac{E_{ijt}}{E_{jot}} \frac{\Delta X_{jot}}{E_{it}}. \tag{5}$$

Those variables are then fitted in equation (2) and used to create a similar instrumental-variable strategy as described for Chinese imports. In this case, the model is identified if differences in industry-level exports are explained by higher demand for Canadian goods in the rest of the world, or by lower trade costs, under the assumption that shocks in Canada are not systematically correlated with shocks in the rest of the world, which is an assumption that is used in the literature on the subject. I add, similarly to Feenstra et al. (2019), both trade exposure in a common model, in order to account for the general effects of trade in one common model.

$$\Delta L_{it} = \gamma_t + \beta_1 \Delta IPW_{ict} + \beta_2 \Delta EPW_{ict} + \boldsymbol{X}'_{it}\beta_3 + \epsilon_{it}. \tag{6}$$

In a third specification, I use Bloom et al. (2019)'s model in order to test for the difference in the impact of the shock for high human capital versus low human capital regions in Canada. This is done by introducing a variable at the CMA/CA level that captures the proportion of the population having a college-degree or above in 1991. As said in Section 3, a high human capital CMA/CA is defined as being above the median proportion of higher-education degree holders of the whole CMA/CA sample. This specification allows to verify if the 2SLS coefficient for the impact of the 'China Shock' is significantly different if the zone has a low versus high human capital *before* the shock. The equation is defined as:

$$\Delta L_{it} = \gamma_t + \beta_1 1(HHC) \Delta IPW_{ict} + \beta_2 1(LHC) \Delta IPW_{ict} + \boldsymbol{X}'_{it}\beta_3 + \epsilon_{it}. \tag{7}$$

where 1(HHC) is a dummy for high human capital CMA/CA in the base year 1991 and 1(LHC) is dummy for low human capital CMA/CA in the base year 1991.

5 Trade Competition and Labor Markets

This section provides results for the local labor market impacts of higher trade competition in Canada. I also compare my results in Canada to results in other countries, mainly the United States. More specifically, the main results will be for the impact of Chinese import competition on manufacturing employment outcomes in Canada, and for the period 1991-2007. This is done for two main reasons: to be able to have a basis for comparison with literature on the subject (mainly Autor et al., 2013), and to avoid contamination with the impacts of the Great Recession.

I also explore in the first specification how other outcomes than manufacturing share have responded, in order to understand the impacts this shock might have had on the broader structure of labor markets at the regional level in Canada (for instance, the impact on the service share or on the unemployment rate in a given CMA/CA). Wages effects will also be considered and compared to the effects in other countries. In a similar way, I will test the impact on the employment-to-population ratio. I also disaggregate results by education level in order to understand if this shock has affected more adversely low-skilled workers, which is an assumption often made in this literature.

I then extend the results to analyze further the impact of trade by adding world exports following Feenstra et al. (2019) in order to allow comparisons between Chinese import exposure and world export exposure, and to compare the results for Canada to those found in the United States.

5.1 Changes in Employment Outcomes

Table 2 reports the results for import exposure at the local labor market level (CMA/CA). All the specifications in Table 2 and in all subsequent tables control for regional dummies, the start of period share of manufacturing employment, the start of period percentage of employment in routine occupations and the start of period average offshorability index as defined in Autor and Dorn (2013). They also include the same demographic controls as in Autor et al. (2013), i.e. the start of period share of college educated population, the start of period share of foreign-born population and the start of period women employment rate. First thing to note is that in Panel II, the instrumental variable seems to be a good predictor

Table 2: Imports from China and Changes in Employment Outcomes in CMAs/CAs, 1991–2007: 2SLS Estimates

Dependent variable: 10 × annual change in (in % pts)

	I. 1991–2007 stacked first differences				
	Manufacturing share	Service share	Unemployment share	NILF	Unemployment benefits
	(1)	(2)	(3)	(4)	(5)
Δ Imports from China /Workers	-0.782***	0.525***	0.366***	0.232	0.259*
	(0.236)	(0.121)	(0.120)	(0.145)	(0.138)
R^2	0.717	0.821	0.651	0.534	0.870
	II. 2SLS first stage estimate				
Δ Imports to other countries /Workers	1.053***	1.053***	1.053***	1.053***	1.053***
	(0.159)	(0.159)	(0.159)	(0.159)	(0.159)
$F - stat$	43.81	43.81	43.81	43.81	43.81

Notes: N = 264. All the regressions include a constant, a dummy for the 2001–2007 period and the full set of controls described in Section 4. Models are weighted by start of period CMA/CA share of national population. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

for Δ *Imports from China per worker*, which is consistent with the literature on the subject. The first-stage F-statistic is above usual thresholds.

The main findings of the 2SLS regressions are similar to those found in Autor et al. (2013) and other literature on the subject from Europe. I find that a $1,000 (USD) per worker increase in Chinese import exposure reduces the share of manufacturing employment to working-age population by 0.782 percentage point for the period 1991-2007 (column 1). This is comparable, although slightly higher in magnitude, to the results found in Autor et al. (2013) for the United States for the same period (-0.596). This suggests that there has been a significant impact of Chinese imports on the structure of the local labor markets in Canada. In order to ease the interpretation, note that the CMAs/CAs in my dataset have an average increase in per worker import exposure of $1,820 for the 15-year period considered. The CMA/CA at the 75th percentile of the distribution has a difference in import exposure of +$2,670 per worker while the CMA/CA at the 25th percentile of the distribution has a difference in import exposure of +$630 per worker.

Differences between Canadian and U.S. results can be seen from the results in columns (2) to (5), which look at the broader effects of higher trade with China on labor markets in Canada. In column (2), the results I get for the 1991-2007 stacked first difference model is that a $1,000 increase in Chinese imports per worker increases the share of service employment by 0.525 percentage point, which acts as a significant counterbalance to the drop in the manufacturing share. In a similar way, the results suggest that higher Chinese trade exposure has a significant positive impact on the unemployment rate of a CMA/CA, with an increase of 0.366 percentage point for a $1,000 per worker increase in Chinese import exposure for a given CMA/CA. Consistent with this, the results in column 5 of the 2SLS regression suggest that there has been a higher share of people who received unemployment benefits in the previous year for CMAs/CAs that have been more exposed to Chinese import competition for the period 1991-2007. The coefficient (0.259 percentage point) is significant at the 10% level and of similar order of magnitude to the coefficient for unemployment share of total working age population (0.366).

The main difference I find with results in the United States from Autor et al. (2013) is that there is no significant impact of the 'China Shock' in Canada for the period 1991-2007 on the share of population that is not in the labor force (column 4). In their study, Autor et al. (2013) find a significant and positive effect of the shock on the labor force non-participation share that is of the same order of magnitude as the manufacturing share negative impact (-0.553 percentage point). On the other hand, they do not find an impact on the non-manufacturing share of employment ($-$ 0.274 percentage point, not significant), in contrast to my findings on the share of employment in services in Canada ($+$ 0.525 percentage point). This appears to indicate that the local labor market response to the shock has been different between Canada and the United States. While the initial response has been similar (a significant and negative shock to the manufacturing share), in the United States this resulted mainly in a higher unemployment rate and a higher proportion of the population outside of labor force, with a small and insignificant effect on the share of employment in non-manufacturing activities. In Canada, on the other hand, the shock mainly resulted in a shift in the structure of local labor market employment opportunities, with little effect on the share of the population out of the labor force. Chinese import competition had a significant and positive effect on unemployment at the local labor market level in Canada too, but unemployment is generally temporary and is a normal response to labor shocks in the short run. The main issue that can arise if the shock drives people out of the labor force

is that quitting the labor force could be more lasting and have larger consequences in the long run. From my results, this seems not to be the case in the Canadian context.

Taken together, my results seem to indicate that the effects of the 'China Shock' could have been milder in Canada. A higher proportion of the population seems to have been able to reallocate their employment into other industries within a CMA/CA (mainly in services, from my results), rather than quitting the labor force due to fewer employment outcomes available for them. One possible explanation for it, that is detailed in Bloom et al. (2019) for the United States, could be that most of the employment decline in Canada could have come from large multinational firms that outsourced manufacturing to China, but increased local services jobs instead, indeed creating new outcomes. However, to confirm that hypothesis, firm-micro data would be necessary, and this goes beyond the scope of this study that is focused on regional labor markets as a whole. Yet, this does point out to the fact that studying the reasons behind the differences in outcomes between certain regions could prove useful.

5.2 Wages and Employment to Population Ratio

I also try to find if there has been an impact on wages. Autor et al. (2013) in the United States find that there is a significant and negative impact on wages following the 'China Shock'. I find that for Canada, there is a negative and significant impact on wages of similar order of magnitude to the one found in the U.S. for the same period (Table 3). With the main specification (Table 3), I find that a $1,000 increase in Chinese imports per worker diminishes weekly wages by 0.866 log point for the whole pool of workers in a given CMA/CA. The effect is only significant for non-college degree holders. What these results mean is that *wage growth* for the period 1991-2007 has been significantly lower for CMAs/CAs that have been more exposed to Chinese import competition. A relative reduction in wages is a normal response to a labor demand shock, which is the shock that follows a higher exposition to Chinese import competition. Indeed, if there is lower demand for some industry jobs and that this results in higher unemployment and displacement of jobs into other sectors, the higher relative inflow of labor supply is compensated, at least in the short-term, by lower wages, if there is no significant change in labor migration. Autor et al. (2013) do not find that population counts change significantly between the periods. In my case, the structure of the Census data that I use does not allow me to do this analysis in a way that would be as precise as Autor et al. (2013), but it is a reasonable assumption to make that there is low labor

mobility following a labor demand shock at the local labor market level, given that responses to local labor shocks are often slow and incomplete (Blanchard and Katz, 1992; Topel, 1986).

Table 3: Imports from China and Wages Changes in CMAs/CAs, 1991–2007: 2SLS Estimates

Dependent variable: Ten-year equivalent change in average log weekly wage (in log pts)

	All workers (1)	College degree (2)	No College degree (3)
Δ Imports from China /Workers	-0.866** (0.408)	-1.132 (1.140)	-0.627* (0.356)
R^2	0.883	0.426	0.688

Notes: N = 264. All the regressions include a constant, a dummy for the 2001–2007 period and the full set of controls described in Section 4. Robust standard errors in parentheses are clustered on province. Models are weighted by start of period CMA/CA share of national population. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

I test the impact on employment-to-population ratio, in a similar way to what has been done by Albouy et al. (2019). I find that there is a significant decline in log employment-to-population ratio for CMAs/CAs that have been more exposed to Chinese trade competition, which is consistent with Albouy et al. (2019). A $1,000 increase in Chinese imports per worker diminishes the employment-to-population ratio by 1.26 log points (percent) in a given local labor market (Table 4). I then disaggregate the data to determine if there are differences in the impact on employment-to-population ratio by education level. The impact of higher Chinese trade exposure on employment-to-population ratio is a lot higher for non-college degree holders (-1.56 log points) as compared to college degree holders (-0.315 log point, not significant). This means that there could have been different outcomes of higher exposure to trade within a CMA/CA depending on the education level. This could have had distributional consequences, possibly generating employment polarization. This is consistent with the results found in Autor et al. (2013) and Bloom et al. (2019), namely that the negative impact of China import penetration is higher for people that have low human capital. Given that most manufacturing jobs are of low human capital and do not necessitate a college-degree (Autor and Dorn, 2013), it is normal that non-college degree holders are the most affected by the shock. Such a finding indicates that it could be interesting to evaluate the impact of trade by dividing it by the initial human capital level of a given CMA/CA in order to capture not only the within CMA/CA human capital effect, but also the between

CMA/CA difference that could exist (Bloom et al., 2019).

Table 4: Imports from China and Employment-to-population ratio Changes in CMAs/CAs, 1991–2007: 2SLS Estimates

Dependent variables: Ten-year equivalent changes in log employment-to-population ratio (in log pts)

	All workers (1)	College degree (2)	No College degree (3)
Δ Imports from China /Workers	-1.262** (0.509)	-0.315 (0.554)	-1.563** (0.646)
R^2	0.491	0.243	0.658

Notes: N = 264. All the regressions include a constant, a dummy for the 2001–2007 period and the full set of controls described in Section 4. Robust standard errors in parentheses are clustered on province. Models are weighted by start of period CMA/CA share of national population. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

5.3 Extensions

I turn to the other side of trade in a similar way to what has been done by Feenstra et al. (2019) for the United States or Dauth et al. (2014) for Germany, by incorporating world exports in the model in addition to Chinese imports. The idea of using world exports, that have also considerably increased during the considered period of time (Table 1), is to try to estimate a broader impact of trade exposure than only the one from imports. Because the differences in import exposure over the decades 1990-2010 were mainly coming from China, I use Chinese imports following the relevant literature on the subject. However, there is not one country that has contributed to the rise in Canadian exports to the same extent that China did for the rise of Canadian imports. For this reason, I analyze, in an analogous way to what I have done for Chinese imports, the impact of Canadian exports to the rest of the world on labor market outcomes. The results for my analysis of exports are shown in Annex Table A.1. I do not find that the increase of Canadian exports for the period 1991-2007 had a positive impact on manufacturing share, contrarily to the results from Feenstra et al. (2019) in the United States. Rather, they have contributed, although mildly, in the same direction as imports for both manufacturing and service shares, i.e. higher export exposure

for a CMA/CA led to an increase in the service share and a decrease in the manufacturing share. This could be because the exports boom from Canada during the period has not been particularly driven by manufacturing exports, but mostly other exports. It is also possible that it is caused by high input-output linkages between importing and exporting firms within a given CMA/CA (Acemoglu et al., 2016). It also highlights the importance of trying to better compile and describe the *trade of services* in future research, as this trade has expanded over the course of the last 20 years. However, my results might not be as precise as those from Feenstra et al. (2019). Indeed, in addition to the integration of China in the World Trade Organization, Feenstra et al. (2019) use a second instrument in their identification strategy in order to get better precision for their results on exports. They use quantitative data on the reduction in tariffs faced by U.S. local firms in the similar period as an identification strategy. Given that I do not have the same data for Canada, I could not construct a second instrument similar to theirs. It is possible that by having a better instrument for exports, I could find different outcomes.

When I extend the analysis to the period 1991-2011, I find that the effects are no longer significant (Annex Table A.2). This is consistent with the results of Bloom et al. (2019) in the U.S. who find that the effects are higher in the short run, but tend to diminish as time passes, most probably because labor markets start to adjust with a certain delay. However, one must be cautious with the interpretation of my 1991-2011 results. Indeed, most of the variables are constructed based on the Census. In 2011 in Canada, Census was replaced by a National Household Survey (NHS) that is not exactly the same, and was filled on a voluntary basis, leading to potential problems in the accuracy of the results [2].

It is also to note that there might be some comparability issues between the United States and the Canadian results. First, the statistical units that are compared are not the same. Commuting Zones in the United States can often have a greater population base than most of the Canadian CMA/CAs. To be defined as a CMA/CA, a city must have at least 10,000 inhabitants in Canada, whereas Commuting Zones in the U.S. are agglomerations of more than 50,000 inhabitants. The results in Canada could also be more imprecise because the sample is considerably smaller in Canada (n= 264) than in the US (n=1,444).

[2]See Statistics Canada on the 2011 NHS for more details.

6 Human Capital and the Response of Employment to Trade

In this section, I use the methodology from Bloom et al. (2019) in order to investigate whether the initial level of human capital stock in a given region could be an explanation for the magnitude of the impact of the 'China Shock'. I apply the model both to the change in employment shares and to the changes in wages and employment-to-population ratio in order to have a broad comprehension of the role of human capital in the response of employment to trade.

6.1 Changes in Employment Outcomes

I estimate the model described in equation (7) for the main specification. By doing this, I test the assumption that regions that had a low human capital stock at the beginning of the reference period (1991, before the 'China Shock') could have been impacted more adversely by the shock. As mentioned in Section 4, human capital is defined as the proportion of college degree holders in 1991. A high (low) capital region is a CMA/CA that has a higher (lower) than median human capital stock in 1991. I find that there is no significant difference in the effect of higher Chinese trade exposure on the manufacturing share for low (-0.621 percentage point) versus high (-0.836 percentage point) human capital regions (Table 5). This suggests that for the manufacturing sector, the impact of higher Chinese import competition has been very similar in order of magnitude between high human capital and low human capital regions in Canada for the 1991-2007 period.

However, there are some differences for other outcomes (Table 5). The impact on the service share is significant in both low and high human capital regions, but the order of magnitude is not the same. In high human capital regions, a $1,000 increase in Chinese imports per worker has led to an increase of 0.629 percentage point in the service share. In low human capital regions, this increase has been of only 0.320 percentage point. This means that most of the the impact of the manufacturing share decline has been compensated for by a service share increase (displacement) in high human capital regions. In low human capital regions, it is only about half of the impact that has been compensated for by displacement into the service sector. In terms of unemployment share impact, it is of similar magnitude in both cases (0.355 percentage point and 0.371 percentage point, not significantly different). However, I find that in low human capital regions, there has been

Table 5: Imports from China and Changes in Employment Outcomes by Human Capital Level in CMAs/CAs, 1991–2007: 2SLS Estimates

Dependent variable: 10 × annual change in (in % pts)

	Manufacturing share (1)	Service share (2)	Unemployment share (3)	NILF (4)	Unemployment benefits (5)
Δ Imports from China /Workers x 1(LHC)	-0.621*** (0.110)	0.320*** (0.089)	0.355*** (0.094)	0.324** (0.134)	0.369** (0.156)
Δ Imports from China /Workers x 1(HHC)	-0.836** (0.360)	0.629*** (0.158)	0.371** (0.145)	0.186 (0.155)	0.204 (0.157)
R^2	0.718	0.822	0.652	0.535	0.872
p-val $LHC = HHC$	0.443	0.007	0.868	0.18	0.001

Notes: N = 264. All the regressions include a constant, a dummy for the 2001–2007 period and the full set of controls described in Section 4. Robust standard errors in parentheses are clustered on province. Models are weighted by start of period CMA/CA share of national population. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

a positive impact on the share of population outside the labor force (Table 5, column 4). For low human capital regions, I find that a $1,000 increase in Chinese imports per worker has led to a 0.324 increase in the labor force non-participation share. As a comparison, for the whole sample (Table 2, column 4), I did not find any significant impact on labor force non-participation. The impact on labor force non-participation is also not significant for high human capital regions. The pattern is similar when I consider column (5) (share of the population who received unemployment benefits in the previous year). The impact is positive and statistically significant for low human capital regions (0.369 percentage point), but not significant for high human capital regions.

Those results suggest that the impact of the higher Chinese import competition following the 2000s has not been very different for low and high human capital regions in terms of shock to the manufacturing share. However, the effect was different on other labor market outcomes following the shock. High human capital regions have mainly absorbed the shock through higher unemployment and a high rate of displacement to services jobs. On the other hand, in low human capital regions, the shock resulted in a significant increase in labor force non-participation and a smaller displacement to the service sector. Given these results, low human capital regions seem to have had less adaptability to the labor demand shock that followed the 'China Shock'.

6.2 Wages and Employment to Population Ratio

I extend the equation (7) analysis to wages (Table 6) and employment-to-population ratios (Table 7) and divide it by education level (college degree holders and non-college degree holders). When considering the whole worker sample, my results suggest that the impact on wages is negative and not statistically different for low human capital and high human capital regions. When considering only college-degree (high-skilled) workers, I find no significant impact on wages for both low human capital and high human capital regions. This is consistent with the fact that import competition affects mainly low human capital workers and industries (e.g. manufacturing). When considering the sub-sample of population without a college degree, I find that the 'China Shock' had a negative effect on wages only on non-college degree holders from low human capital regions.

Table 6: Imports from China and Wages Changes by Human Capital Level in CMAs/CAs, 1991–2007: 2SLS Estimates

Dependent variable: Ten-year equivalent change in average log weekly wage (in log pts)

	All workers (1)	College degree (2)	No College degree (3)
Δ Imports from China /Workers x 1(LHC)	-1.181** (0.533)	-1.834 (1.159)	-0.952** (0.485)
Δ Imports from China /Workers x 1(HHC)	-0.706** (0.336)	-0.775 (0.996)	-0.462 (0.301)
R^2	0.883	0.429	0.688
p-val $LHC = HHC$	0.117	0.007	0.229

Notes: N = 264. All the regressions include a constant, a dummy for the 2001–2007 period and the full set of controls described in Section 4. Robust standard errors in parentheses are clustered on province. Models are weighted by start of period CMA/CA share of national population. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Considering log employment-to-population ratio changes (Table 7), I find that there is a negative and significant impact for both high and low human capital regions, and that they are of the same order of magnitude (-1.20 log points and -1.29 log points). For the non college educated sub-sample of population, the impact on the employment-to-population

ratio is always negative and of greater magnitude to what is found for the whole sample of the population. For college educated workers, I find only a statistically significant negative difference in low human capital areas. For high human capital regions, there is no impact on the employment-to-population ratio of college educated workers. It is however not the case for college educated workers in low human capital regions, suggesting that the initial structure of human capital in a region could affect differently highly educated workers.

The analysis provided in Table 5 through 7 show that there have been high differences between low and high human capital regions in Canada in terms of their employment response to the 'China Shock'. Overall, the results presented suggest that high human capital regions have been more prepared to counter this shock. They have adapted more smoothly, without any impact on proportion of population out of labor force or on wages. This is consistent with literature on the subject, mainly Bloom et al. (2019) that finds similar trends in the United States, with low human capital regions being more affected by the Chinese shock on manufacturing. This suggests that actions could be taken by policy makers to increase human capital, since it seems to play a role in the labor market responses to trade shocks. Within CMAs/CAs, people with a high stock of human capital seem to have had better outcomes than people with low human capital, but differences also arise from regional clusters of human capital stock.

Table 7: Imports from China and Employment-to-population ratio Changes in CMAs/CAs, 1991–2007: 2SLS Estimates

Dependent variables: Ten-year equivalent changes in log employment-to-population ratio (in log pts)

	All workers (1)	College degree (2)	No College degree (3)
Δ Imports from China /Workers x 1(LHC)	-1.205*** (0.338)	-1.345** (0.597)	-1.369*** (0.403)
Δ Imports from China /Workers x 1(HHC)	-1.291** (0.641)	0.209 (0.494)	-1.662** (0.835)
R^2	0.492	0.252	0.660
p-val $LHC = HHC$	0.851	0.001	0.625

Notes: N = 264. All the regressions include a constant, a dummy for the 2001–2007 period and the full set of controls described in Section 4. Robust standard errors in parentheses are clustered on province. Models are weighted by start of period CMA/CA share of national population. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

7 Conclusion

I analyze local labor markets in Canada following the rapid rise of China as a major trade partner since its arrival in the WTO in 2001. I use the conceptual framework developed in Autor et al. (2013) to evaluate the impact this trade exposure had on several labor market outcomes (e.g. manufacturing share, service share, unemployment, wages, employment-to-population ratio). Trade exposure effects are analyzed at both the imports and exports levels in a similar way to what is done by Feenstra et al. (2019). I also divide the analysis by human capital level following Bloom et al. (2019), in order to see if regions with relatively low levels of human capital have been impacted more adversely by the shock than other regions.

My results suggest that higher Chinese trade competition had a significant effect on the labor market structure in Canada. The channel through which it operates is by reducing the share of manufacturing jobs in a certain region. The more the region is exposed to Chinese imports, the more its share of manufacturing jobs diminishes. However, contrarily to what some studies have found in the United States, this has not been followed by a significantly higher proportion of workers leaving the labor force. Instead, I find that most of the job losses in manufacturing have been compensated by a displacement to service occupations. There have also been unemployment effects that came along with such changes in the local labor market structure.

I find that the impact on wages is negative and of similar order of magnitude to what is found in the United States for the same period, i.e. that regions that are relatively more exposed to Chinese trade competition had lower wage growth than other regions. The employment-to-population ratio has also been impacted negatively, and the impact has been higher for non college degree holders, suggesting distributional consequences that could lead to higher polarization within local labor markets.

By analyzing the trends comparatively between high and low human capital regions, I find that regions with relatively low human capital suffered higher consequences of the Chinese trade shock of the beginning of the 2000s. I find that in low human capital regions, the impact had a significant effect on labor force non-participation, contrarily to high human capital regions where the shock was absorbed more smoothly through job displacement. This suggests a regional distributional difference in the impact of trade on labor market outcomes, that policy makers should be aware of when considering the challenges posed by higher trade

integration.

Data limitations did not allow me to convey analysis in terms of industry specific impacts, or input-output linkages, which could be interesting research questions to pursue, especially to compare it to local labor market effects in Canada and to international related studies. Industry or firm-level data could provide useful in order to document other patterns in link with the current research, such as skill upgrading or the impact of outsourcing. Research is open in this area to allow for a better broad comprehension of what are all the mechanisms at play.

References

Acemoglu, D., Autor, D., Dorn, D., Hanson, G. H., and Price, B. (2016). Import Competition and the Great US Employment Sag of the 2000s. *Journal of Labor Economics*, 34(S1):S141–S198.

Acharya, R. C. (2017). Impact of Trade on Canada's Employment, Skill and Wage Structure. *The World Economy*, 40(5):849–882.

Albouy, D., Chernoff, A., Lutz, C., and Warman, C. (2019). Local Labor Markets in Canada and the United States. *Journal of Labor Economics*, 37(S2):S533–S594.

Ashournia, D., Munch, J. R., and Nguyen, D. (2014). The Impact of Chinese Import Penetration on Danish Firms and Workers. *IZA Discussion Paper 8166*.

Autor, D., Dorn, D., and Hanson, G. H. (2013). The China Syndrome: Local Labor Market Effects of Import Competition in the United States. *American Economic Review*, 103(6):2121–68.

Autor, D. H. and Dorn, D. (2013). The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market. *American Economic Review*, 103(5):1553–97.

Baily, M. N. and Bosworth, B. P. (2014). US Manufacturing: Understanding Its Past and Its Potential Future. *Journal of Economic Perspectives*, 28(1):3–26.

Balsvik, R., Jensen, S., and Salvanes, K. G. (2015). Made in China, Sold in Norway: Local Labor Market Effects of an Import Shock. *Journal of Public Economics*, 127:137–144.

Bartik, T. J. (1991). *Who Benefits from State and Local Economic Development Policies?* W.E. Upjohn Institute. Kalamazoo, MI.

Bernard, A., Smeets, V., and Warzynski, F. (2017). Rethinking Deindustrialization. *Economic Policy*, 32(89):5–38.

Bernard, A. B., Fort, T. C., Smeets, V., and Warzynski, F. (2020). Heterogeneous Globalization: Offshoring and Reorganization. Working Paper 26854, National Bureau of Economic Research.

Blanchard, O. J. and Katz, L. F. (1992). Regional Evolutions. *Brookings Papers on Economic Activity*, 23(1):1–76.

Bloom, N., Handley, K., Kurmann, A., and Luck, P. (2019). The Impact of Chinese Trade on US Employment: The Good, The Bad, and The Debatable. In *American Economic Association Annual Meetings*, volume 2019.

Borusyak, K., Hull, P., and Jaravel, X. (2019). Quasi-Experimental Shift-Share Research Designs. Working Paper 24997, National Bureau of Economic Research.

Brandt, L., Van Biesebroeck, J., and Zhang, Y. (2012). Creative Accounting or Creative Destruction? Firm-level Productivity Growth in Chinese Manufacturing. *Journal of Development Economics*, 97(2):339–351.

Costa, F., Garred, J., and Pessoa, J. P. (2016). Winners and Losers from a Commodities-for-manufactures Trade Boom. *Journal of International Economics*, 102:50–69.

Dauth, W., Findeisen, S., and Suedekum, J. (2014). The Rise of the East and the Far East: German Labor Markets and Trade Integration. *Journal of the European Economic Association*, 12(6):1643–1675.

Dauth, W., Findeisen, S., and Suedekum, J. (2017). Trade and Manufacturing Jobs in Germany. *American Economic Review*, 107(5):337–342.

Donoso, V., Martín, V., and Minondo, A. (2015). Do Differences in the Exposure to Chinese Imports lead to Differences in Local Labour Market Outcomes? An Analysis for Spanish Provinces. *Regional Studies*, 49(10):1746–1764.

Feenstra, R. C., Ma, H., and Xu, Y. (2019). US Exports and Employment. *Journal of International Economics*, 120:46 – 58.

Fort, T. C., Pierce, J. R., and Schott, P. K. (2018). New Perspectives on the Decline of US Manufacturing Employment. *Journal of Economic Perspectives*, 32(2):47–72.

Goldsmith-Pinkham, P., Sorkin, I., and Swift, H. (2020). Bartik Instruments: What, When, Why, and How. *American Economic Review*, 110(8):2586–2624.

Krugman, P. (1997). What should Trade Negotiators Negotiate About? *Journal of Economic Literature*, 35(1):113–120.

Malgouyres, C. (2017). The Impact of Chinese Import Competition on the Local Structure of Employment and Wages : Evidence from France. *Journal of Regional Science*, 57(3):411–441.

Mion, G. and Zhu, L. (2013). Import Competition from and Offshoring to China: A Curse or Blessing for Firms? *Journal of International Economics*, 89(1):202 – 215.

Murray, A. (2017). The Effect of Import Competition on Employment in Canada: Evidence from the 'China Shock'. Technical report, Centre for the Study of Living Standards.

Paz, L. S. (2018). The Effect of Import Competition on Brazil's Manufacturing Labor Market in the 2000s: Are Imports from China Different? *The International Trade Journal*, 32(1):76–99.

Pierce, J. R. and Schott, P. K. (2012). A Concordance between Ten-digit US Harmonized System Codes and SIC/NAICS Product Classes and Industries. *Journal of Economic and Social Measurement*, 37(1, 2):61–96.

Pierce, J. R. and Schott, P. K. (2016). The Surprisingly Swift Decline of US Manufacturing Employment. *American Economic Review*, 106(7):1632–62.

Topel, R. H. (1986). Local Labor Markets. *Journal of Political Economy*, 94(3):S111–S143.

Utar, H. (2018). Workers beneath the Floodgates: Low-Wage Import Competition and Workers' Adjustment. *The Review of Economics and Statistics*, 100(4):631–647.

Appendix

Table A.1: World Exports and Changes in Employment Outcomes by in CMAs/CAs, 1991–2007: 2SLS Estimates

Dependent variable: 10 × annual change in (in % pts)

	Manufacturing share (1)	Service share (2)	Unemployment share (3)	NILF (4)	Unemployment benefits (5)
Δ Imports from China /Workers	-0.833***	-0.603***	0.373***	0.240	0.279
	(0.270)	(0.144)	(0.125)	(0.149)	(0.173)
Δ World Exports /Workers	-0.053***	0.0803***	0.007	0.008	0.020
	(0.014)	(0.017)	(0.015)	(0.018)	(0.027)

Notes: N = 264. All the regressions include a constant, a dummy for the 2001–2007 period and the full set of controls described in Section 4. Robust standard errors in parentheses are clustered on province. Models are weighted by start of period CMA/CA share of national population. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table A.2: Imports from China and Changes in Employment Outcomes in CMAs/CAs, 1991–2011: 2SLS Estimates

Dependent variable: 10 × annual change in (in % pts)

	Manufacturing share (1)	Service share (2)	Unemployment share (3)	NILF (4)	Unemployment benefits (5)
Δ Imports from China /Workers	-0.949	9.358	2.077	3.620	0.905
	(1.829)	(7.622)	(1.424)	(3.344)	(0.619)

Notes: N = 264. All the regressions include a constant, a dummy for the 2001–2007 period and the full set of controls described in Section 4. Robust standard errors in parentheses are clustered on province. Models are weighted by start of period CMA/CA share of national population. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.