# Trade Liberalization and the Labour Market

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## 1. Introduction

The impact of trade liberalization on labour markets has long been a source of controversy in both policy and academic circles. For example, during the debate surrounding the Canada-U.S. Free Trade Agreement (CUSFTA) in the late 1980s, labour unions and other opponents of free trade argued that trade liberalization with the United States would have large adverse impacts on the wages and employment of workers in protected industries. The fact that the introduction of the CUSFTA tariff reductions was shortly followed by a major recession in 1990-92 was viewed by many opponents of free trade as evidence of adverse labour market impacts of free trade.

On the research side, several studies have looked systematically at the impact of industry-specific tariff cuts on wages and employment. The basic idea is to look at whether industries where tariffs declined the most (because they were highest in the first place) also experienced larger relative declines in wage and employment. Using industry aggregates from establishment data, Gaston and Trefler (1995) find some negative effect of tariffs cuts on employment but little impact on wages (see also Beaulieu, 2000). More recently, however, Townsend (2002) found some significant negative effects of tariffs cuts on wages using household data in which it is possible to control for workers' characteristics like education, experience, gender, etc.

In this paper I take a broader look at the implications of trade liberalization on wages in Canada. Under a set of specific assumptions, the well-known factor price equalization (FPE) theorem predicts that trade liberalization between Canada and the United States should eventually lead to an equalization in the wages of different skill groups in the two countries. The broad question I ask is whether the wage structure in Canada and the United States have converged over the last two decades. By wage structure I mean the average wages for different classes of workers defined on the basis of their skills (education and experience) and other characteristics (gender in particular).

I also argue, however, that the hypothesis that the wage structures have become similar in Canada and the United States is too extreme. One reason the hypothesis is too extreme is that FPE is only expected too hold under a relatively restricted set of conditions (see Blackorby et al., 1993). For example, FPE requires technology to be the same and the two economies to be on the "cone of diversification" (produce all goods).

On the more practical side, it does not seem reasonable to expect national wages to be identical in Canada and the United States if wages differ across regions of the same country. In Section 2, I explain that in addition to trade, other factors like workers and capital mobility can help equalize factor prices across countries or regions. In all of these cases, it is reasonable to expect the forces of FPE to be much stronger within the same country than across countries, even in the presence of CUSFTA and NAFTA. This is confirmed by the work of McCallum (1995) and Helliwell (1998) that show large "border effects" in trade and in workers mobility. Presumably, capital markets are also much more integrated across provinces than across international borders.

My empirical strategy is thus to use regional wage dispersion in Canada and the United States as a benchmark for assessing "how different" are the wage structures in the two countries. In particular, I compare average wages and the wage differential between more- and less-educated workers across regions of the two countries in 1984 and 2001. I do so using comparable data for both countries in which it is possible to control for national and regional differences in workers' characteristics. The main finding is that there has been, if anything, a divergence between the wage structures in Canada and the United States over the last 20 years. In many cases, however, Canada-U.S. differences in the wage structure are not large relative to regional differences in the wage structure.

The plan of the paper is as follows. In Section 2, I discuss the theoretical implications of trade liberalization on wages and review the existing empirical evidence for Canada, the United States and Mexico. I discuss the data used in Section 3 and present some descriptive evidence on evolution of the (national) wage structure in Canada and United States from 1984 to 2001 in Section 4. I then contrast the Canada-U.S. differences to regional differences in Section 5, and conclude in Section 6.

## 2. Theory and existing evidence

In this section, I first discuss several predictions of standard trade theory regarding the impact of trade liberalization on wages. I then turn to the empirical evidence for Canada, the United States and Mexico. I focus on the three North American countries for two reasons. First, these are the natural countries to focus on given the scope of this conference on North-American linkages. More importantly, however, the empirical

literature for the three countries is complementary, as it has tended to focus on different impacts of trade liberalization in each country.

*a. Theory*

The standard Hecksher-Ohlin model of international trade can be used to derive a set of interesting predictions on the effect of trade liberalization on wages. Important assumptions of the model include perfect competition, similar preferences and production technologies in the different countries. As countries move from autarky to free trade, the model predicts that countries more endowed in some factors will tend to specialize in the production of goods that use these factors more intensively. For example, relative to Canada and the United States, Mexico is well endowed with less-skilled labour. Under NAFTA, it should increasingly specialize in the production of goods that require an intensive use of this production factor.

The most direct impact of trade liberalization (removal of trade barriers such as tariffs) is to equalize the price of tradable goods across countries. The famous factor price equalization (FPE) theorem states that the equalization of the price of goods should lead to an equalization in the price of production factors (capital and different skill levels of labour) provided that each of the trading countries produce all of the traded goods. The latter condition means that all countries are on the "cone of diversification" in the sense that they do not strictly specialize in the production of a specific subset of goods.

Both Canada and the United States are large countries with highly diversified economies that may well be on the cone of diversification. This is clearly not the case, however, at the regional level. For example, Ontario has no oil and gas extraction industry and Alberta has no automobile industry. So even within the same country, free trade may not be enough to equalize wages across regions. For example, if male high school graduates and high school dropouts are in high demand in the oil industry in Alberta or in the forest industry in British Columbia, they may command higher wages than in other parts of the country even if there is free trade across provinces. This will then create an incentive for other male high school graduates and high school dropouts to migrate from other provinces to Alberta or British Columbia.

Mexico and the United States is another case where migration is clearly a major source of wage adjustment. In this specific case, the assumption that the two countries have the same production technologies is clearly unrealistic. As a result, factor prices will not be equalized even in the presence of free trade. Indeed, wages for given skill levels of labour remain several times higher in the United States than in Mexico almost ten years after the enacting of NAFTA.

Another important assumption in the Hecksher-Ohlin model is that production factors (capital and labour) are perfectly mobile across industries. While this may be true in the long run, this assumption is clearly unrealistic in the short run. For example, it is well known that workers displaced because of mass layoffs experience large and sustained declines in their earnings (see for example Jacobson, Lalonde and Sullivan, 1993). So if the textile and apparel industries were protected by large tariffs prior to CUSFTA and NAFTA, tariffs cuts should have a negative impact on the workers in this specific industry, at least in the short run. Once labour re-adjustments across industries have taken place (as in the Hecksher-Ohlin model), then wages impacts should only depend on change in output prices induced by free trade.

These long run impacts may be quite different from short-term impacts in specific industries. For instance, Canada has relatively less university-educated workers than the United States. In the absence of trade, the price of goods that require university-educated labour more intensively should be higher in Canada than in the United States. With free trade, the Canadian price of these goods will fall which will lead to an adverse impact on the wages of university-educated workers in Canada. So even if the wages of less-educated workers in the textile, apparel and other highly protected industries fall in the short-run, less-educated workers as a whole may gain in the long run as Canada liberalizes trade with United States.

*b. Empirical evidence*

There is a large body of empirical research on the effect of trade liberalization on labour markets in the North American context. Interestingly, however, the focus of studies for Canada, the United States, and Mexico tend to be quite different. In Canada, most studies have focused on the impact of trade and trade barriers on wages and

employment at the industry level. For instance, Gaston and Trefler (1997) and Beaulieu (2000) have looked at the impact of the tariff reductions in the Canada-US Free Trade Agreement (CUSFTA) on wages and employment at the industry level. As discussed earlier, these studies find some negative effect of tariffs cuts on employment but little impact on wages. More recently, however, Townsend (2002) found some significant negative effects of tariffs cuts on wages using household data in which it is possible to control for workers' characteristics like education, experience, gender, etc.

In the United States, research has instead focused on the potential role of trade liberalization with less-developed countries (LDCs) in the growth of wage inequality since the early 1980s. By contrast, the potential impact of CUSFTA on U.S. labour markets has attracted very little interest in either policy or academic circles in the United States. The potential impact of NAFTA has not attracted that much interest either, except perhaps during the 1992 presidential campaign.[1]

The focus on trade liberalization with LDCs has much to do with the well-known fact that, starting in the late 1970s, wage inequality increased steeply in the United States (e.g. Katz and Autor, 1999). In particular, after declining during the 1970s, the wage gap between college and high school-educated workers grew sharply in the 1980s and more slowly in the 1990s. Since trade as a fraction of GDP also increased throughout this period, it is tempting to try to link these two phenomena. The argument goes as follows. Since the United States has a much more educated (skilled) labour force than LDCs, opening up trade between the United States and LDCs should decrease the relative demand for less-skilled workers in the United States. This basic prediction comes from the standard Hecksher-Ohlin model. Since the United States is relatively more endowed with highly skilled labour, trade liberalization should induce U.S. firms to specialize in the production of goods that use highly skilled labour more intensively, while LDCs should specialize in goods that use less-skilled labour more intensively.

As discussed earlier, one testable implication of the Hecksher-Ohlin model is that international trade should affect labour markets through the price of goods. In particular, the U.S. relative price of goods that use highly skilled labour more intensively should

[1] One exception is Presidential candidate Ross Perot who campaigned against NAFTA during the 1992 election campaign.

increase as trade get liberalized. There is little evidence in the data, however, that the relative price of these "highly-skilled" goods increased since the late 1970s. [2] As a result, trade has generally been dismissed as a major source of explanation from the growth in wage inequality in the United States, though this issue remains a matter of some debate in the literature.[3] Recent surveys of the literature such as Katz and Autor (1999) and Acemoglu (2002) rather emphasize the role of skilled-biased technological change in the growth in wage inequality.

It is beyond the scope of this paper to that assess to what extent trade liberalization has played a role in the growth of wage inequality in the United States. The focus of the U.S. literature on trade and overall wage inequality is nonetheless interesting from a Canadian point of view. It highlights one important research gap in the Canadian literature that has not generally focused on the overall impacts of trade liberalization on the wage structure and wage inequality. One contribution of this paper is to start to fill this gap.

The literature on trade liberalization and wages in Mexico represents yet another angle on this issue. As in the case of Canada, the Mexican literature has focused on the impact of trade with the United States, and in particular on the impact of NAFTA. The parallel with the Canadian situation stops there, however. While the levels of wages in Canada are roughly comparable to those in the United States, Mexican wages remain several times smaller than in the United States. But though it would have been unrealistic to see Mexican wages equalized to those in the United States because of NAFTA, one reasonable conjecture is that NAFTA should have helped Mexican wages get closer to those in the United States. Furthermore, since Mexico is well endowed with less-skilled labour, the Hecksher-Ohlin model predicts that opening up trade with the United States should benefit less-skilled workers and reduce wage inequality.

Neither predictions are consistent with the data, however. After some progress just after the enacting of NAFTA, Mexican wages collapsed relative to those in the U.S. during the Peso crisis of the mid-1990s (Hanson, 2003). Furthermore, wage inequality

[2] See Slaughter (2000) for a survey of the "product-price" literature.

[3] Authors such as Feenstra and Hanson (1999, 2002) have for instance argued that focusing on the role of trade in final goods may be misleading. They argue that once trade in intermediary inputs (offshore assembly) is taken into account, trade liberalization emerges as an important factor in the growth in wage inequality.

increased during this period, which is inconsistent with the predictions of the Hecksher-Ohlin model. This prediction should probably be taken with some caution, however, since many of the assumptions of this model are clearly violated in the case of the United States and Mexico. In particular, the assumption of similar production technologies in the two countries is highly unrealistic.

One interesting contribution of the Mexican literature, however, is that it has also looked at implications of trade liberalization for workers' mobility and labour market impacts in different regions. For example, Hanson (2003) shows that employment and relative wages increased in the Maquiladora region (Northern border) where many U.S. manufacturers build assembly plants (Maquiladoras) under NAFTA. Hanson (2003) also documents that many workers moved from the South to the Maquiladora region to take advantage of the employment opportunities there. The predictions of trade theory thus appear to be more consistent with that data once the focus is switched from all of Mexico to the region most likely to be affected by NAFTA (the border region). Robertson (2000) also concludes that regional labor markets in Mexico have become more integrated to the United States during this period.

From a Canadian perspective, the Mexican experience suggests that it may be important to look at the potential impacts of trade liberalization in a context where regional labour markets are not perfectly integrated. The message from Mexico is that trade can have very different impacts on different regions. When factor prices are very different in different regions of the same country, it seems unreasonable to expect trade to equalize factor prices between countries.

As mentioned earlier, McCallum (1995) and Helliwell (1998) show that Canadian provinces trade more extensively with each other than they do with U.S. states nearby. Furthermore, migration flows across provinces are an order of magnitude larger than those between Canada and the United States. This suggest that much more powerful forces should tend to equalize factor prices among provinces than between Canada and the United States. In what follows, I will thus examine Canada-U.S. differences in wages in light of regional dispersion of wages within Canada and the United States.

## 3. Data

The empirical analysis is based on comparable data on hourly wages for Canada and the United States. The best source of detailed information on hourly wages by detailed classes of workers in Canada is the Labour Force Survey (LFS). Since 1997, the LFS has collected information on wages for all wage and salary workers. Individual workers have the option of either reporting their wages on an hourly basis or for longer time periods (weekly, bi-weekly, etc.). In the latter case, the hourly wage can then be computed by dividing earning for the relevant time period by usual hours of work for this period. Since over 100,000 adults are sampled each month in the LFS, large samples are available each year even at the provincial level.[4] In the analysis below, I nonetheless group together the Atlantic provinces and Manitoba and Saskatchewan to get samples of more comparable size for all regions of Canada. I also use the LFS data for 2001 only since this is the last year for which completed yearly data was available at the time this paper was written.

While several sources of wage data are available for year prior to 1997, measures of wages in these surveys are generally not comparable to those in the LFS. One exception is the 1984 Survey of Union Membership (SUM). Like the LFS, the SUM asked about wages on the main job at the time of the survey.[5] Both surveys also contain information on the union status of workers which could be used as an alternative explanation for some regional differences in wages. In what follows, I use the 1984 SUM and the 2001 LFS data to study the evoluation of wages during the period when both CUSFTA and NAFTA were introduced.

For the United States, the outgoing rotation group (ORG) supplement of the Current Population Survey is the data source most comparable to the LFS of SUM. In particular, the ORG supplement of the CPS has been asking questions about wages and union status since 1983 that are very comparable to the question s used in the SUM or the LFS (see Card, Lemieux, and Riddell, 2003, for a more detailed comparison). I only use

[4] Over half a million wage observations are available each year in the LFS, though in many cases wage records are for the same individual in different months. This happens because individuals are normally followed for a six-month period in the LFS. It is not possible, however, to adjust statistical estimates (and standard errors) for group structure in the data since no individual identifiers are provided in the public use files of the LFS.

[5] Several other special surveys like the 1986-1990 Labour Market Activity Survey (LMAS) are based on a work history of jobs in the previous year, which is not strictly comparable to a "point-in-time" survey like the SUM or the LFS.

the data for 1984 and 2001 for the sake of comparison with Canada. I also perform the regional part of the analysis using the nine standard census regions.

When comparing the level and distribution of wages across Canada and the United States or across regions of the two countries, it is important to control for socio-economic characteristics like age, education and gender that are well known to influence wages. For example, wages could be higher in the United States than in Canada simply because Americans have traditionally been more educated than Canadians. While the age structure is not very different in Canada and the United States, the migration of workers across regions of the same countries can induce important differences in the age structure that also need to be controlled for.

From a theoretical point of view, the main reason for controlling for characteristics like age and education is that the FPE theorem implies that wages should be the same (in Canada and the United States) for specific skill groups of workers. So even if the price of all factors (wages by skill group), are equalized across countries, average wages will generally differ unless the countries have workforces with the same distribution of skills. So the implication of FPE is that average wages should only be the same once these skill characteristics have been controlled for.

One drawback of the SUM and LFS is that only coarse measures of age and educational achievement are available in the public use files of these data sets. For example, only five education groups (less than high school, high school attended or completed, some postsecondary schooling, postsecondary diploma, and university diploma) and nine age groups (15-16, 17-19, 20-24, 25-34, 35-44, 45-54, 55-64, 65-69, 70+) are available in the SUM. I only use the six age groups between age 17 and 64 since most individuals under 17 and over 64 are not active in the labour market (because of school attendance and retirement, respectively). The education and age variables are more detailed in the LFS than in the SUM. In particular, it is possible to divide the "high school" group of the SUM into those who have completed and not completed their high school diploma. It is also possible to split university graduates into those with a bachelors degree and those with a post-graduate degree. Workers age 17 to 64 can also be divided into ten groups instead of six.

Whenever possible, I use the most detailed definitions of age and education to control for the age and education structure. The one exception is the case of university-high school wage differences (see below) where I estimate regression equations using the coarser measure from the 1984 SUM for the sake of comparability across years. I also systematically aggregate the more detailed U.S. age and education variables into the same categories as those available for Canada.

All the results reported in the tables and figures are computed using the sampling weights. Allocated wages are also included in the analysis since Statistics Canada (unlike the U.S. Census Bureau) does not provided allocation flags indicating whether wages have been allocated for individuals who failed to report a valid wage in the survey. Finally, I only keep observations with real wages (in 2001 dollars) between 2.5 and 90 dollars to minimize the impact of potential outliers.

## 4. National level evidence

### *4.1 Wage levels*

Table 1 report several measures of average wage rates for Canada and the United States in 1984 and 2001.[6] Given the different secular trends in wages for men and women, I systematically report results for these two groups separately in panels a and b, respectively.

The first two rows of each panel show the evolution of average wages expressed both in nominal and real terms. With the exception of Canadian males for which real wages declined slightly, real wages grew for all other groups. Consistent with many other studies, the rate of growth of female wages strongly outpaced the rate of growth of male wages in both Canada and the United States. As a result, the ratio of female to male wages grew from 74 percent to 81 percent in Canada, and from 71 percent to 81 percent in the United States.

The next set of rows express Canadian real wages in U.S. dollars using the actual and the purchasing power parity (PPP) exchange rates.[7] When expressed in U.S. dollars

[6] For the sake of consistency with the rest of the analysis where log wages are used as the variable of interest, I report geometric averages of wages in Table 1.

[7] I use Statistics Canada's PPP exchange rate for household final consumption (Cansim II series V13930579). The PPP exchange rates are 0.78 and 0.80 in 1984 and 2001, respectively. The small

using the actual exchange rate, real wages in Canada fall dramatically relative to the United States. For both men and women, Canadian wages decline from close to parity in 1984 to only 74 of U.S. wages in 2001. The relative decline in Canadian wages is not as dramatic when PPP exchange rates are used instead. Males wages nonetheless fall from 98 percent to 92 percent of U.S. wages. The decline is more pronounced for Canadian women whose wages drop from 101 percent to 92 percent of U.S. wages.

The last row of Table 1 shows that the decline in Canadian relative to U.S. wages is more pronounced when observed characteristics are controlled for. The numbers reported in this row are computed by first running a regression of log wages on a full set of interactions between age and education dummies. The regression estimates for the United States are then used to predict the wages that would prevail if U.S. workers had the same distribution of age and education as in Canada. For example, in 1984 U.S. males would have earned 4 percent less ($13.62 instead of $14.18) under this counterfactual scenario, while they would have earned 2.8 percent less in 2001. This gap narrows over time as Canadian workers tend to catch-up in terms of their skills relative to U.S workers.[8] Since these improvements in skills should have helped increase the relative wages of Canadian, the results reported holding the distribution of characteristics constant (at their Canadian level) show a more significant decline in Canadian relative to U.S. wages.

In summary, the evolution of average wages in Canada relative to the United States is clearly inconsistent with the view that further trade integration should have lead to a convergence in the level of wages. In fact, Canadian and U.S. wages have actually diverged over the last two decades, going from about parity in 1984 to a significant Canadian disadvantage in 2001. Several other factors not linked to trade integration may explain part of this evolution, however. For example, Figure 5 illustrates the poor labour market performance (measured in terms of employment/population ratio) of Canada relative to the United States during the 1990s. Whatever factors explain this poor labour

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appreciation in the Canadian dollar is consistent with the fact that CPI inflation was slightly lower in Canada than in the United States during this period. By contrast, the actual exchange rate plummeted from 0.77 to 0.65 during the same period.

[8] For example, both Murphy, Riddell, and Romer (1998) and Card and Lemieux (2001) show that educational achievement grew faster in Canada than in the United States during the 1980s and 1990s.

market performance may also account for some of the poor wage growth in Canada relative to the United States during the 1990s.

*4.2 The Distribution of Wages*

As mentioned in Section 2, the FPE theorem has important implications for the distribution of wages. In the special case where two countries have access to the same technology (and are on the cone of diversification), FPE implies that they should also have the same distribution of wages, as measured by standard measures of wage dispersion. I report several of these standard measures of wage dispersion in Table 2. I then examine what role differences in the distribution of skills play in differences in wage dispersion in Table 3.

The first measure of wage dispersion reported in Table 2 is the standard deviation of log wages. Consistent with other studies (e.g. Card, Lemieux, and Riddell, 2003), the table shows that the standard deviation of log wage grew much less in Canada than in the United States between 1984 and 2001. Furthermore, since the U.S. standard deviation was either similar (for women) or already larger (for men) than the Canadian standard deviation in 1984, wage dispersion actually diverged between the two countries during this period. Similarly, the gap between the $90^{th}$ and the $10^{th}$ centiles of (log) wages also expanded faster in the United States than in Canada during this period. Interestingly, in both Canada and the United States, the growth in the 90-10 gap was driven by a large expansion in inequality at the upper end of the distribution (90-50 gap).

I also report the wage gap between university and high-school education in the last row of both panels a and b. This wage gap is estimated from a regression of log wages on a set of dummy variables for age and education categories. For the sake of comparability over time, I use the coarser 1984 definitions of age and education in the regression models. The university-high school wage gap is simply the difference between the coefficient on the dummy variable for university education (bachelor's degree or more) and the coefficient on the dummy variable for high school education (some or completed).[9]

[9] The regression equations control for age instead of potential experience, which is more commonly used in Mincer-type earnings equations. It is not possible to construct an accurate measure of potential experience

Consistent with the other measures of wage dispersion, the university-high school wage gap grows faster in the United States than in Canada. The growth in this wage gap is nonetheless substantial for men in Canada, going from 0.28 to 0.39. Expressed in percentage terms, these log wage gaps correspond to a 33 percent wage advantage for university graduates in 1984. This gap increases to 48 percent in 2001. On the one hand, this increase is surprising in light of many studies that indicate very little change in the university-high school wage gap in Canada during the 1980s and 1990s (see, for example, Murphy, Riddell and Romer, 1998, and Burbidge, Magee, and Robb, 2002). On the other hand, this finding is consistent with recently released estimates from the 2001 Canadian Census which show a substantial increase between 1990 and 2000 in the earnings of male university graduates relative to high school-educated workers.[10] Interestingly, these recently released results indicate little change in the university-high school wage gap for women, which is also consistent with the results reported in Table 2.

Table 3 explores the role of Canada-U.S. differences in the distribution of skills (age and education) in differences in the standard deviation of log wages. The table compares the actual standard deviation of log wages to the standard deviation that would prevail if one country has the same distribution of skills as the other. For example, the second row in the table shows the standard deviation with the Canadian distribution of skills. The results indicate that the U.S. standard deviation decreases --from 0.541 to 0.533 in 1984 and from 0.579 to 0.561 in 2001-- when the U.S. skill distribution is replaced by the Canadian skill distribution. The counterfactual standard deviations are obtained using the re-weighting technique describes in Lemieux (2002).

Though some of the Canadian-U.S. difference in wage inequality can be explained by differences in the distribution of skills, this does not affect the basic finding that inequality grew much more in the United States than in Canada between 1984 and 2001. It is nonetheless interesting to notice that about one quarter of the Canada-U.S.

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because age is reported in very broad categories (mostly 10 years intervals) in the SUM. One consequence of controlling for age instead of experience is to (typically) reduce the university-high school gap. Another consequence is that the university-high school wage gap will tend to increase as the average age of the population increase. This is due to the well-known fact that the university-high school typically grows as a function of age. See Card and Lemieux (2001) for more discussion of this.

[10] See the graphs for all full-time full-year workers in Statistics Canada (2003).

difference in the standard deviation of log wages can be attributed to differences in the skill distribution.

In summary, the analysis at the national level indicates that, if anything, the structure of wages has diverged between Canada and the United States in the 1984-2001 period. Both the level and the dispersion of wages in Canada declined relative to the United States. These findings are clearly inconsistent with the hypothesis that economic integration should have tended to equalize wages on the two sides of the border

## 4. Regional differences in wage structure

As mentioned earlier, it is unreasonable to expect wages to be equalized between Canada and the United States when there are large differences in wages across different regions of these two countries. Since the forces of wage equalization across regions of the same country should be much stronger than across countries, differences in the regional wage structure are a good benchmark for assessing "how different" the wage structures could be in the two countries. In this Section, I compare average wages and the wage differential between more- and less-educated workers across regions of the two countries in 1984 and 2001.

### *4.1 Wages levels*

Figures 1 and 2 and Table 4 show differences in wages by region in Canada and the United States (all figures are in 2001 US dollars using PPP exchange rates). Wages are adjusted for differences in characteristics across regions using regression methods (unadjusted wages are reported in Appendix Table 1). The regression models include a set of region dummies as well as a full set of interactions between age and education dummies. The coarse set of age and education categories (six age and five education dummies) is used in 1984 while the finer set of age and education dummies (ten age and seven education dummies) is used in 2001. The adjusted wage rates reported in Figures 1 and 2 and Table 4 are simply the predicted regional wages computed at the average values of the age and education dummies for Canada. Since the dependent variable used in the regression models is log wages, the predicted log wages are converted in wage levels using the exponential function.

Table 4 reports the adjusted regional wages sorted in ascending order. Figures 1 and 2 display the same information graphically. Since the population is distributed unevenly across regions, the proportion on the national workforce in each region is plotted on the vertical axis. For example, Figure 1a indicates that close to 40 percent of the Canadian workforce is in Ontario, compared to less than 10 percent in the Maritimes or in the Prairies.

One clear pattern from the table and figures is that there are very large wage gaps across regions of the same country. For example, the wage gap between the Maritimes and British Columbia ranges between $2 and $3.50 depending on year and gender. By contrast, the wage gap between Canada and the United States never exceeds around one dollar (Table 4). Another interesting pattern is that the average adjusted wage in Canada is always within the range of wage variation over the nine regions of the United States. For example, the average 1984 male wage in Canada ($13.92) is above the wage in all but two U.S. regions (East North Central and Pacific). By 2001, however, the average mal wage in Canada ($13.43) is below the wage in all but two U.S. regions (East South Central and West South Central.

Another interesting case is Ontario, the largest province which also accounts for the bulk of Canada-United States trade. Wages in this province tend to be very close to average U.S. wages. For example, male wages in Ontario were seven cents above the U.S. average in 1984, and twelve cents below in 2001. Female wages in Ontario are also very close to those in the United States.

By contrast, male wages in British Columbia and Alberta move from about two dollars above the U.S. average in 1984 to 30-40 cents below in 2001. So, unlike Ontario wages that closely track down U.S. wages, wages in these two Western provinces appear to be hit by some adverse labor market conditions between 1984 and 2001. One potential explanation for this pattern of regional wages is that labour markets in Alberta and British Columbia are disproportionately affected by factors that do not play much role in either Ontario or the United States. Though a detailed investigation of these factors is beyond the scope of this paper, it is tempting to think about the natural resources sector as a potential explanation for the poor performance of relative wages in Alberta and British Columbia.

As is well known, the oil and gas sector is relatively much larger in Alberta than in the rest of North America. Similarly, the BC economy disproportionately depends on the forest industry and related sectors. Figure 6 shows that real commodity prices declined throughout the 1984-2001 period. It is reasonable to think that these lower commodity prices had an adverse impact on wages in these two provinces.

In summary, the earlier conclusion that U.S. and Canadian wages have diverged between 1984 and 2001 is weakened when regional wage differences are used as a benchmark for assessing the extent of wages differences at the national level. In particular, part of the poor wage performance of Canada over this period could be due to a decline in commodity prices that disproportionately affected the Western provinces. By contrast, wages in Ontario remained very close to the U.S. average. Finally, U.S.-Canada wage differences are systematically smaller than the range of regional wage dispersion observed in each country.

*4.2 University-High School Wage Gap*

Table 5 and Figures 3 and 4 report estimates of the university-high school wage gap across regions of Canada and the United States. These wage gaps are obtained by estimating separate log wage regressions for men and women in each region. The explanatory variables used are a set of age and education dummies. As before, the university-high school wage gap is defined as the difference between the coefficient on the dummy variable for university degree and the dummy variable for high school education (some or completed).

Table 5 and Figure 3 show that, with the remarkable exception of British Columbia, the regional distribution of the university-high school wage gap for men is very similar in Canada and the United States. By 2001, however, the university-high school wage gap in all nine U.S. regions exceeds the wage gap in all regions of Canada but the Maritimes. The average wage gap for Canada (0.391, Table 5), is substantially below the range of wage gaps in the United States (from 0.457 in West North Central to 0.588 in the Pacific region). So even when regional variation is used as a benchmark, there is no question that there was a sharp divergence between the university-high school wage gap in Canada and the United States over the 1984-2001 period.

The situation for women is quite a bit different. In 1984, the university-high school wage gap was larger in all Canadian regions but British Columbia than in all U.S. regions. By 2001, however, the wage gap in all Canadian regions but Quebec and the Maritimes is either lower (Ontario and British Columbia) or at the lower end of the range of variation (Alberta and Prairies) in this wage gap across U.S. regions. Leaving aside British Columbia, using regional variation as a benchmark indicates that the university-high school wage gap in Canada went from clearly above the United States in 1984 to similar or lower than in the United States in 2001. The evolution of the university-high school wage gap for women is thus the only case where there is evidence of U.S.-Canada convergence in the wage structure over the 1984-2001 period.

One striking feature of Table 5 and Figures 3 and 4 is the extent to which British Columbia has a lower university-high school wage gap than anywhere else in North America. The most striking example is men in 1984 where the university-high school wage gap is only 0.110, which is between 25 and 45 percent of the gap in all other regions! Coupled with the fact that British Columbia had the highest wage level in 1984, this means that wages of high school educated workers were extraordinarly high in British Columbia relative to the rest of North America in 1984. Perhaps the high demand for men with a high school diploma or less in the forest industry and related sectors could explain some of this pattern. The very low wage gap between university and high school educated workers in British Columbia remains nonetheless a puzzle that would be worth examining in future research.

## 5. Conclusion

This paper looks at whether the trade liberalization between Canada and the United States has induced some wage convergence between the two countries. The empirical strategy is to use regional variation in wages as a benchmark for assessing the extent of U.S.-Canada difference in wages. The empirical evidence based on comparable surveys for 1984 and 2001 provides little support for the hypothesis that trade liberalization has lead to wage convergence between the two countries.

Wages levels were quite comparable in Canada and the United States in 1984. There was thus little scope for further equalization effects of trade liberalization. If anything, however, wages levels have diverged during this period because of a substantial decline in Canadian relative to U.S. wages.

In terms of the wage distribution, the results are more mixed. On the one hand, the is a clear divergence between the university-high school gap for U.S. and Canadian males. By any account, this wage gap is now clearly larger in the United States than in Canada, unlike the situation in 1984 where the wage gaps were relatively comparable. On the other hand, there is some evidence that the university-high school gap became more similar for U.S. and Canadian females in 2001 than they were in 1984.

Overall, there is thus little evidence that trade liberalization with the United States has put much pressure on the Canadian wage structure. What appears to be more of a puzzle is the extent of wage differences across regions of the same country. This topic deserves more attention in future research. Possible explanations for regional wage differences such as the industrial structure of employment (natural resources in the Western provinces, etc.) and the extent of unionization (Appendix Table 2) are possible avenues to be explored in the future.

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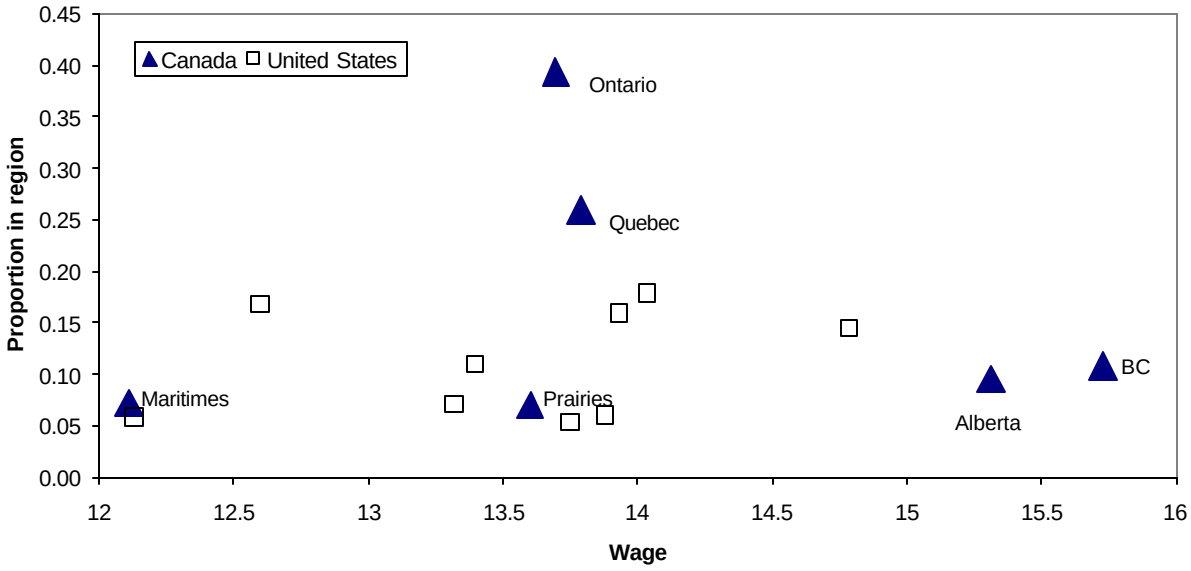
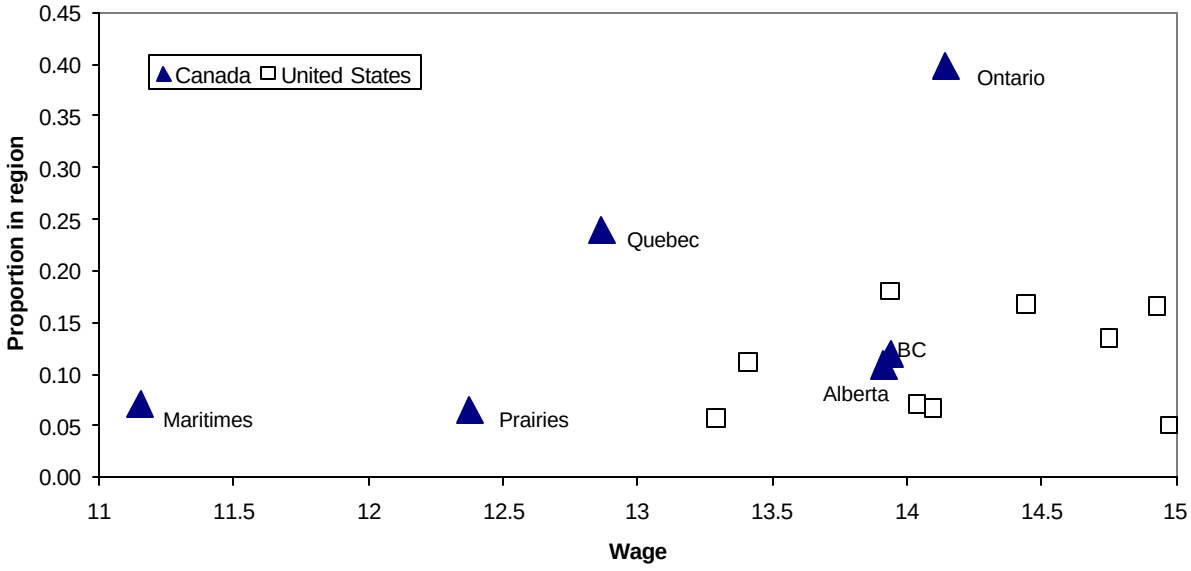
**a. 1984**


Canada
United States
Ontario
Quebec
Maritimes
Prairies
Alberta
BC
Proportion in region
Wage
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
12
12.5
13
13.5
14
14.5
15
15.5
16

**b. 2001**


Canada
United States
Ontario
Quebec
BC
Alberta
Maritimes
Prairies
Proportion in region
Wage
0.45
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0.20
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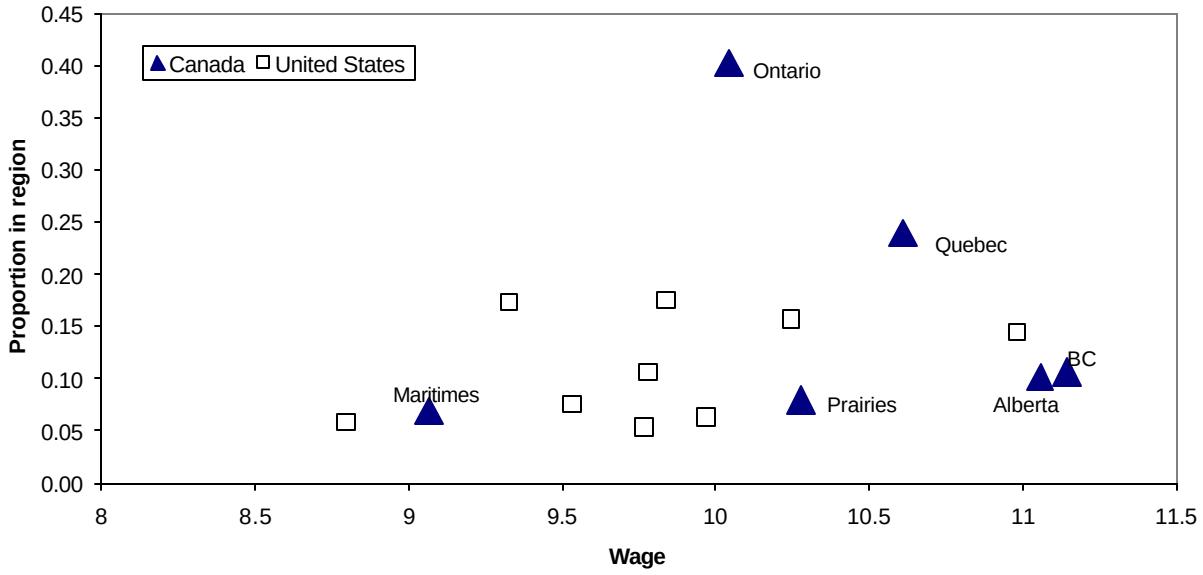
15

**Figure 1: Average male wages by region, adjusted for age and education**

**a. 1984**




**b. 2001**

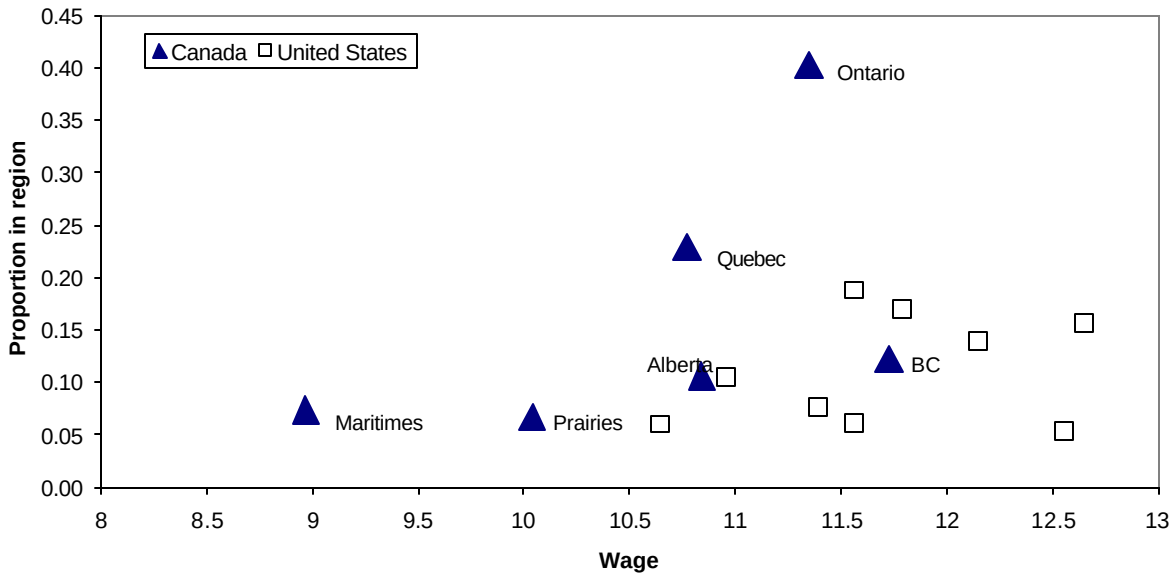
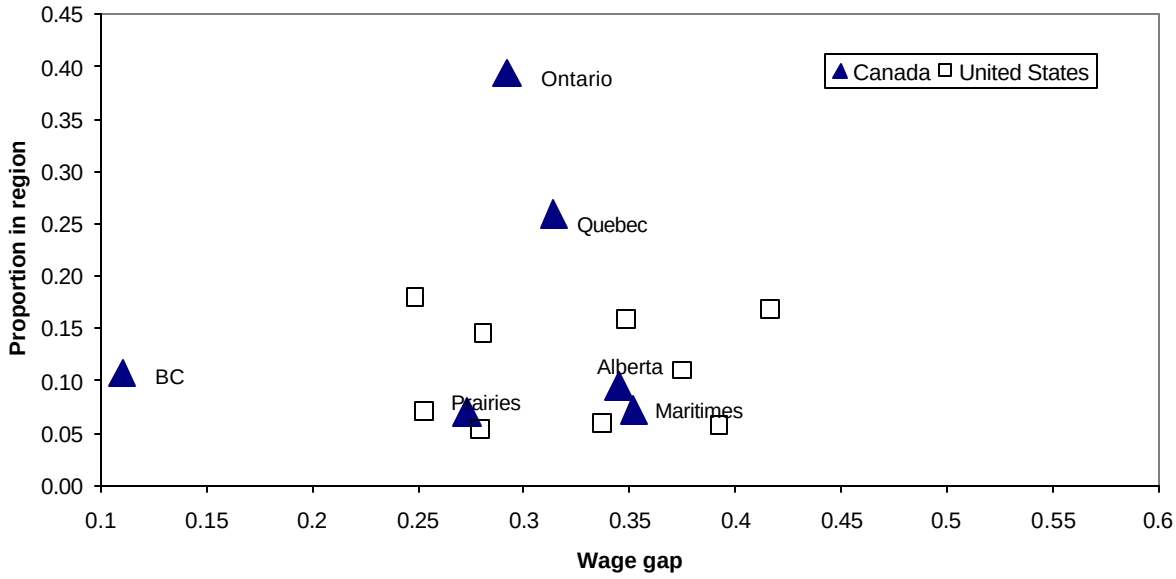



Figure 2: Average female wages by region, adjusted for age and education

**a. 1984**

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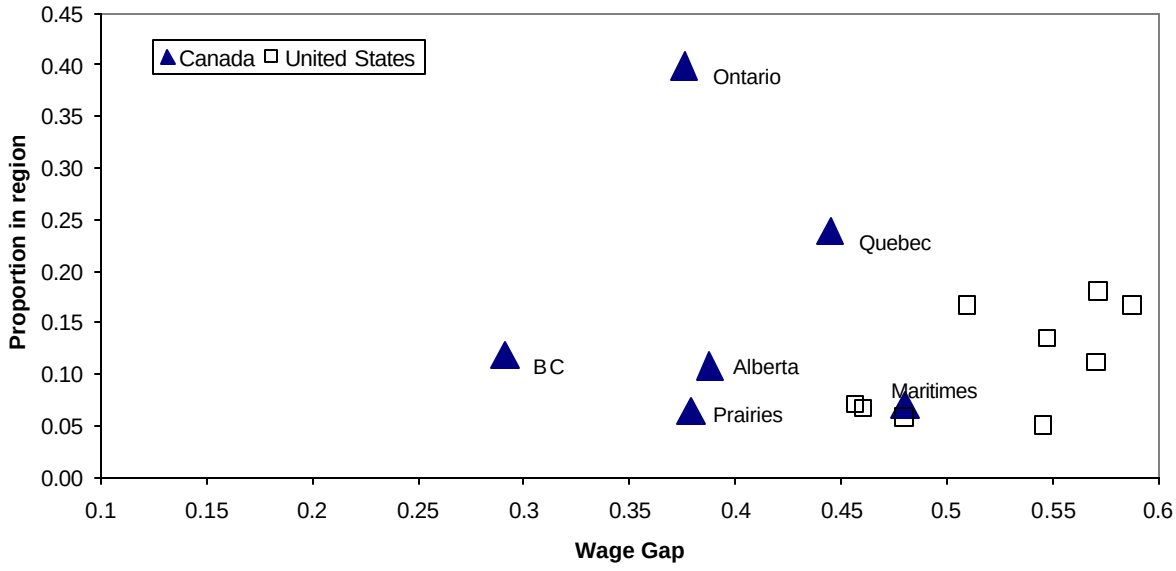
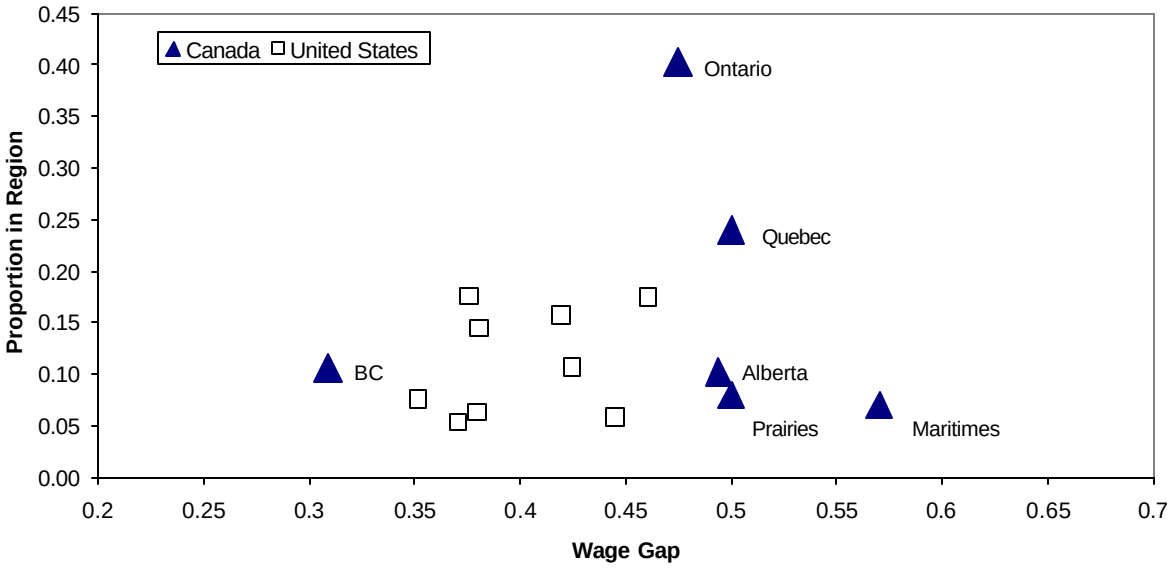



Figure 3: University-High School wage gap by region, men

**a. 1984**




**b. 2001**

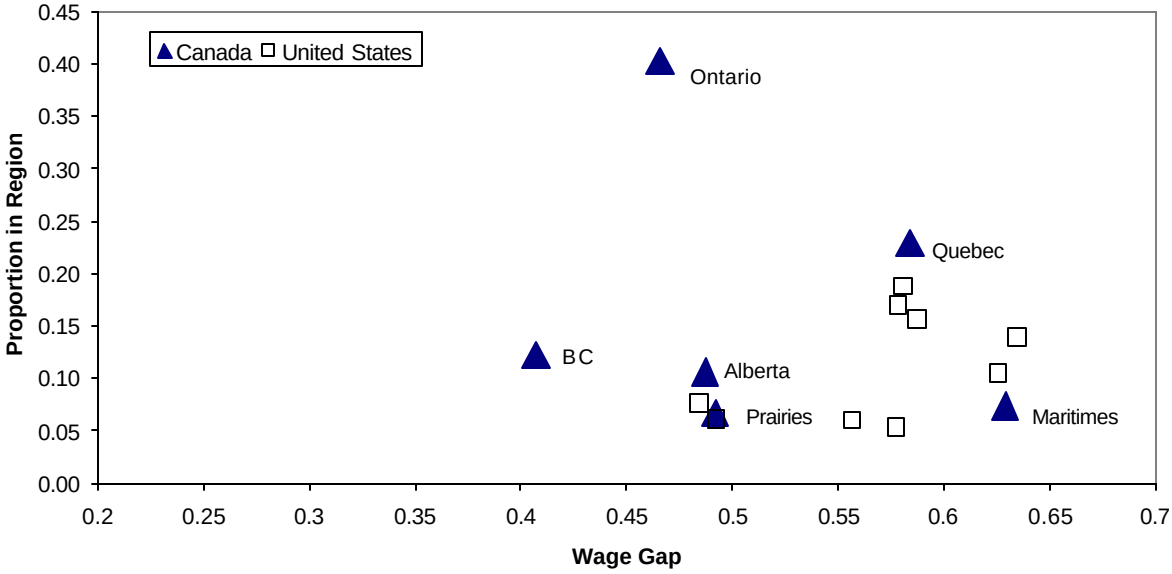



Figure 4: University-High School wage gap by region, women

**Figure 5: Employment rate in Canada and the United States**

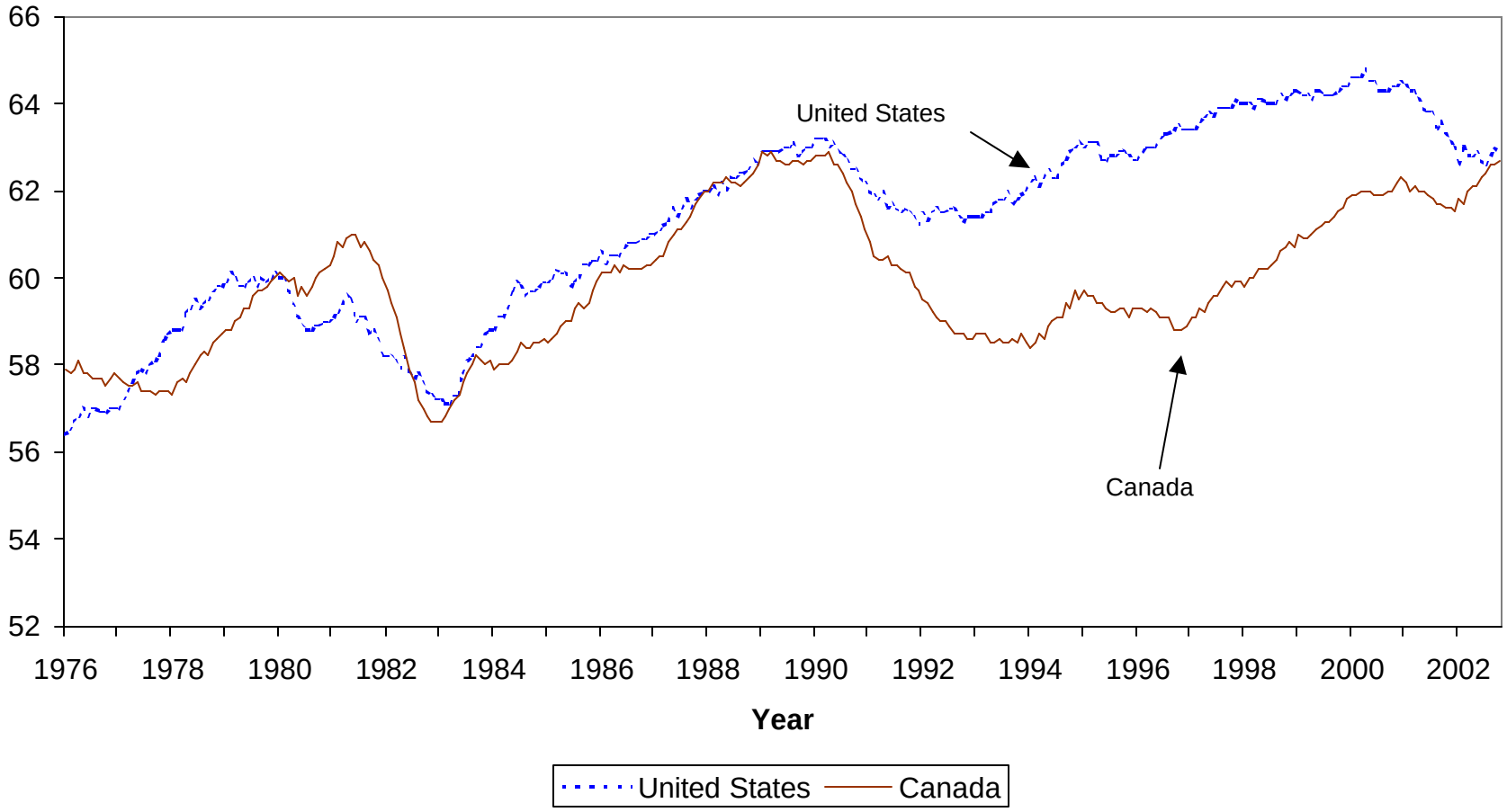


**Figure 6: Real commodity price indexes**
**(price in US dollars deflated by US CPI)**

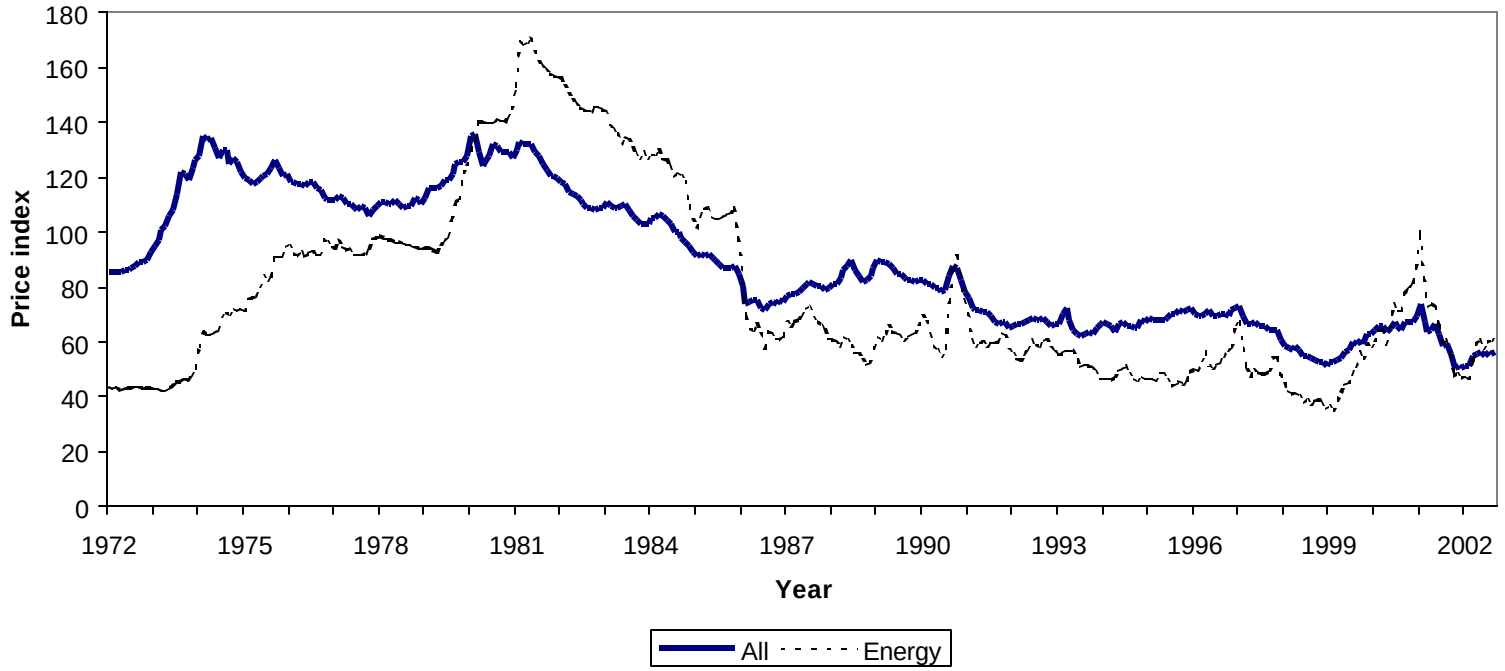


Table 1: Average wages in Canada and the United States

| | Canada | | United States | | Canada/U.S. | |
|---|---|---|---|---|---|---|
| | 1984 | 2001 | 1984 | 2001 | 1984 | 2001 |
| **a. Men** | | | | | | |
| Nominal | 10.49 | 16.79 | 8.32 | 14.67 | 1.26 | 1.14 |
| Real (2001 $) | 16.93 | 16.79 | 14.18 | 14.67 | 1.19 | 1.14 |
| Real US $ (er) | 13.80 | 10.85 | 14.18 | 14.67 | 0.97 | 0.74 |
| Real US $ (ppp) | 13.94 | 13.43 | 14.18 | 14.67 | 0.98 | 0.92 |
| With Canadian characteristics | 13.94 | 13.43 | 13.62 | 14.26 | 1.02 | 0.94 |
| **b. Women** | | | | | | |
| Nominal | 7.77 | 13.65 | 6.01 | 11.93 | 1.29 | 1.14 |
| Real (2001 $) | 12.55 | 13.65 | 10.24 | 11.93 | 1.23 | 1.14 |
| Real US $ (er) | 10.23 | 8.82 | 10.24 | 11.93 | 1.00 | 0.74 |
| Real US $ (ppp) | 10.34 | 10.92 | 10.24 | 11.93 | 1.01 | 0.92 |
| With Canadian characteristics | 10.34 | 10.92 | 9.87 | 11.76 | 1.05 | 0.93 |

Table 2: Summary measures of (log) wage dispersion

| | Canada | | | United States | | |
|---|---|---|---|---|---|---|
| | 1984 | 2001 | Change | 1984 | 2001 | Change |
| **a. Men** | | | | | | |
| Std deviation | 0.498 | 0.503 | 0.005 | 0.541 | 0.579 | 0.038 |
| 90-10 gap | 1.318 | 1.372 | 0.054 | 1.439 | 1.520 | 0.081 |
| 50-10 gap | 0.817 | 0.772 | -0.045 | 0.790 | 0.721 | -0.069 |
| 90-50 gap | 0.507 | 0.600 | 0.093 | 0.649 | 0.799 | 0.150 |
| Univ-HS gap | 0.284 | 0.394 | 0.110 | 0.332 | 0.545 | 0.213 |
| **b. Women** | | | | | | |
| Std deviation | 0.477 | 0.484 | 0.007 | 0.480 | 0.536 | 0.056 |
| 90-10 gap | 1.280 | 1.326 | 0.046 | 1.216 | 1.375 | 0.159 |
| 50-10 gap | 0.692 | 0.679 | -0.013 | 0.566 | 0.588 | 0.022 |
| 90-50 gap | 0.588 | 0.647 | 0.059 | 0.650 | 0.787 | 0.137 |
| Univ-HS gap | 0.468 | 0.502 | 0.034 | 0.414 | 0.586 | 0.172 |

Table 3: Effect of the distribution of characteristics (age and education) on the standard deviation of (log) wages

| | 1984 | | | 2001 | | |
|---|---|---|---|---|---|---|
| | Canada | U.S. | Difference | Canada | U.S. | Difference |
| **a. Men** | | | | | | |
| Actual Char. | 0.498 | 0.541 | 0.043 | 0.503 | 0.579 | 0.076 |
| Cdn Char. | 0.498 | 0.533 | 0.035 | 0.503 | 0.561 | 0.058 |
| U.S. Char. | 0.510 | 0.541 | 0.031 | 0.515 | 0.579 | 0.064 |
| **b. Women** | | | | | | |
| Actual Char. | 0.479 | 0.481 | 0.002 | 0.484 | 0.536 | 0.052 |
| Cdn Char. | 0.479 | 0.474 | -0.004 | 0.484 | 0.522 | 0.038 |
| U.S. Char. | 0.492 | 0.481 | -0.011 | 0.497 | 0.536 | 0.039 |

Table 4: Average real wages by region in 2001 dollars, 1984 and 2001. Wages adjusted for characteristics (age and education)

| Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|
| 1984 | | 2001 | | 1984 | | 2001 | |
| **Maritimes** | **12.11** | **Maritimes** | **11.15** | E S Central | 8.80 | **Maritimes** | **8.97** |
| E S Central | 12.13 | **Prairies** | **12.38** | **Maritimes** | **9.07** | **Prairies** | **10.04** |
| South Atlantic | 12.60 | **Quebec** | **12.87** | South Atlantic | 9.33 | E S Central | 10.65 |
| W N Central | 13.32 | E S Central | 13.30 | W N Central | 9.53 | **Quebec** | **10.77** |
| W S Central | 13.40 | W S Central | 13.41 | Mountain | 9.77 | **Alberta** | **10.84** |
| **Prairies** | **13.60** | **Alberta** | **13.91** | W S Central | 9.78 | W S Central | 10.96 |
| **Ontario** | **13.69** | **Brit. Columbia** | **13.94** | E N Central | 9.84 | **Ontario** | **11.35** |
| Mountain | 13.75 | South Atlantic | 13.94 | New England | 9.97 | W N Central | 11.39 |
| **Quebec** | **13.79** | W N Central | 14.04 | **Ontario** | **10.04** | South Atlantic | 11.57 |
| New England | 13.88 | Mountain | 14.10 | Middle Atlantic | 10.25 | Mountain | 11.57 |
| Middle Atlantic | 13.93 | **Ontario** | **14.14** | **Prairies** | **10.28** | **Brit. Columbia** | **11.72** |
| E N Central | 14.04 | E N Central | 14.45 | **Quebec** | **10.61** | E N Central | 11.79 |
| Pacific | 14.79 | Middle Atlantic | 14.75 | Pacific | 10.98 | Middle Atlantic | 12.16 |
| **Alberta** | **15.31** | Pacific | 14.93 | **Alberta** | **11.06** | New England | 12.56 |
| **Brit. Columbia** | **15.73** | New England | 14.98 | **Brit. Columbia** | **11.14** | Pacific | 12.65 |
| | | | | | | | |
| **Canada** | **13.94** | **Canada** | **13.43** | **Canada** | **10.34** | **Canada** | **10.92** |
| United States | 13.62 | United States | 14.26 | United States | 9.87 | United States | 11.76 |

Table 5: University-High School Wage Gap, 1984 and 2001.

| Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|
| 1984 | | 2001 | | 1984 | | 2001 | |
| **Brit. Columbia** | **0.110** | **Brit. Columbia** | **0.291** | **Brit. Columbia** | **0.309** | **Brit. Columbia** | **0.407** |
| E N Central | 0.249 | **Ontario** | **0.376** | W N Central | 0.352 | **Ontario** | **0.466** |
| W N Central | 0.253 | **Prairies** | **0.379** | Mountain | 0.371 | W N Central | 0.485 |
| **Prairies** | **0.273** | **Alberta** | **0.388** | E N Central | 0.376 | **Alberta** | **0.487** |
| Mountain | 0.280 | **Quebec** | **0.445** | New England | 0.380 | **Prairies** | **0.492** |
| Pacific | 0.281 | W N Central | 0.457 | Pacific | 0.381 | Mountain | 0.493 |
| **Ontario** | **0.292** | Mountain | 0.461 | Middle Atlantic | 0.420 | E S Central | 0.557 |
| **Quebec** | **0.314** | **Maritimes** | **0.480** | W S Central | 0.425 | New England | 0.578 |
| New England | 0.337 | E S Central | 0.480 | E S Central | 0.445 | E N Central | 0.579 |
| **Alberta** | **0.345** | E N Central | 0.510 | S Atlantic | 0.461 | S Atlantic | 0.581 |
| Middle Atlantic | 0.349 | New England | 0.546 | **Ontario** | **0.475** | **Quebec** | **0.584** |
| **Maritimes** | **0.352** | Middle Atlantic | 0.548 | **Alberta** | **0.494** | Pacific | 0.588 |
| W S Central | 0.375 | W S Central | 0.571 | **Quebec** | **0.500** | W S Central | 0.626 |
| E S Central | 0.393 | S Atlantic | 0.572 | **Prairies** | **0.500** | **Maritimes** | **0.629** |
| S Atlantic | 0.417 | Pacific | 0.588 | **Maritimes** | **0.570** | Middle Atlantic | 0.635 |
| | | | | | | | |
| **Canada** | **0.286** | **Canada** | **0.391** | **Canada** | **0.474** | **Canada** | **0.502** |
| United States | 0.327 | United States | 0.539 | United States | 0.406 | United States | 0.578 |

Appendix Table 1: Average real wages (unadjusted) by region in 2001 dollars, 1984 and 2001.

| Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|
| 1985 | | 2001 | | 1984 | | 2001 | |
| **Maritimes** | **12.05** | **Maritimes** | **11.15** | E S Central | 8.97 | **Maritimes** | **8.97** |
| E S Central | 12.23 | **Prairies** | **11.89** | **Maritimes** | **9.12** | **Prairies** | **9.83** |
| South Atlantic | 12.99 | **Quebec** | **12.91** | South Atlantic | 9.64 | **Alberta** | **10.64** |
| **Prairies** | **13.34** | W S Central | 13.20 | W N Central | 9.80 | E S Central | 10.70 |
| W S Central | 13.55 | E S Central | 13.40 | W S Central | 10.02 | W S Central | 10.73 |
| **Ontario** | **13.75** | **Alberta** | **13.58** | **Ontario** | **10.04** | **Quebec** | **10.79** |
| W N Central | 13.75 | **Brit. Columbia** | **14.03** | E N Central | 10.13 | **Ontario** | **11.42** |
| **Quebec** | **13.82** | Mountain | 14.16 | **Prairies** | **10.19** | Mountain | 11.44 |
| Mountain | 14.26 | **Ontario** | **14.28** | Mountain | 10.21 | W N Central | 11.64 |
| E N Central | 14.61 | South Atlantic | 14.42 | New England | 10.41 | **Brit. Columbia** | **11.76** |
| New England | 14.62 | W N Central | 14.59 | **Quebec** | **10.55** | South Atlantic | 11.81 |
| Middle Atlantic | 14.88 | E N Central | 14.88 | Middle Atlantic | 10.69 | E N Central | 11.89 |
| **Alberta** | **15.22** | Pacific | 15.28 | **Alberta** | **11.16** | Middle Atlantic | 12.65 |
| **Brit. Columbia** | **15.76** | Middle Atlantic | 15.68 | **Brit. Columbia** | **11.26** | Pacific | 12.76 |
| Pacific | 15.79 | New England | 16.02 | Pacific | 11.62 | New England | 13.32 |

Appendix Table 2: Union coverage rate by region, 1984 and 2001.

| Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|
| 1986 | | 2001 | | 1984 | | 2001 | |
| W S Central | 0.130 | W S Central | 0.082 | W S Central | 0.089 | W S Central | 0.071 |
| S Atlantic | 0.164 | S Atlantic | 0.099 | S Atlantic | 0.111 | S Atlantic | 0.078 |
| Mountain | 0.186 | Mountain | 0.109 | Mountain | 0.125 | E S Central | 0.084 |
| E S Central | 0.208 | E S Central | 0.124 | E S Central | 0.127 | Mountain | 0.091 |
| New England | 0.257 | New England | 0.165 | W N Central | 0.152 | W N Central | 0.118 |
| W N Central | 0.269 | W N Central | 0.179 | New England | 0.18 | New England | 0.142 |
| Pacific | 0.296 | Pacific | 0.191 | E N Central | 0.195 | E N Central | 0.156 |
| **Alberta** | **0.331** | **Alberta** | **0.219** | Pacific | 0.221 | Pacific | 0.179 |
| E N Central | 0.342 | E N Central | 0.232 | Middle Atlantic | 0.258 | Middle Atlantic | 0.218 |
| Middle Atlantic | 0.364 | Middle Atlantic | 0.253 | **Ontario** | **0.315** | **Ontario** | **0.266** |
| **Ontario** | **0.431** | **Ontario** | **0.289** | **Alberta** | **0.34** | **Alberta** | **0.269** |
| **Prairies** | **0.442** | **Maritimes** | **0.315** | **Maritimes** | **0.376** | **Maritimes** | **0.303** |
| **Maritimes** | **0.468** | **Prairies** | **0.324** | **B.C.** | **0.389** | **B.C.** | **0.34** |
| **B.C.** | **0.530** | **B.C.** | **0.348** | **Prairies** | **0.404** | **Quebec** | **0.377** |
| **Quebec** | **0.538** | **Quebec** | **0.415** | **Quebec** | **0.449** | **Prairies** | **0.381** |
| | | | | | | | |
| **Canada** | **0.463** | **Canada** | **0.323** | **Canada** | **0.369** | **Canada** | **0.311** |
| United States | 0.260 | United States | 0.166 | United States | 0.171 | United States | 0.133 |