Canada's Wage Structure
in the First Half of the Twentieth Century
(with comparisons to the United States and Great Britain)

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We use tabulations on earnings, employment and weeks worked by detailed occupation from the 1911 - 1941 Canadian Censuses to generate a complete depiction of movements in Canada's wage structure in this period. Previous research has had to rely on examinations of a restricted set of skilled/unskilled wage differentials. We find that the wage structure became much more equal in the WWI decade but this was more than offset by a substantial widening in the 1920s. The net effect is a substantial widening of the wage structure from the pre-WWI period to 1940. We show that this is not due to age, occupation or region composition shifts. This pattern is in strong contrast to the United States where there was substantial wage compression over the same period. Goldin and Katz(2001) argue this arises from the expansion of high school education in the US. We show that Canada underwent a similar educational transformation in this period and argue that the results may reflect the impacts of very different immigration policies in the two countries in the inter-war period.

Keywords: Real wages, inequality, wage structure

Canada's Wage Structure in the First Half of the Twentieth Century

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The first half of the twentieth century was a time of impressive tumult in the Canadian economy. It included two world wars and a major depression but was also a time of considerable structural change, combining the filling of the nearly empty expanses of the west with significant technological change. At the same time, there were substantial changes in institutions affecting the functioning of the labour market, including attempts to introduced unemployment insurance, the introduction of minimum wages, and changing roles of unions. Yet, in spite of the importance of this period in setting many of the foundations of the current Canadian economy, our knowledge about the wage structure in this period is relatively sparse. This is not to say that information is non-existent. Accessible wage and price series have been developed by several authors (Bertram and Percy(1979), Mackinnon(1996), Emery and Levitt(2002)) and there are wage series in the Historical Statistics of Canada (Urquhart and Buckley(1965)). But these are either aggregated or relate only to a few occupations in the construction and manufacturing trades plus labourers. There is, to this point, no research on the evolution of the entire wage structure over this period. In this paper, we present evidence on movements in the entire wage structure, focusing on the period from 1911 to 1941, and relate it to the existing knowledge about movements in some individual wage rates.

Understanding the movements in the overall wage structure is important for two reasons. First, it allows us some insight into the degree and form of inequality among Canadian workers in the first half of the twentieth century. Since this is a period of considerable change in public policies related to the labour market, knowledge about movements in the overall wage distribution could be used in investigations of the impact of different policy regimes on inequality in the Canadian context. It also provides information on the background against which policy decisions were made which ultimately led to the creation of Canada's current redistributive system. Second, relative movements in factor prices, such as the prices of different types of labour, are key to understanding the impact of the major technological, institutional, political and business cycle events that occurred during this period. Competing theories of the impacts of large scale immigration, technological change and mass education, to name a few, can

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ultimately be tested using their implications for relative factor price movements. We do not attempt a thorough assessment of competing theories of how the wage structure moved in this paper. Instead, our goal is to provide the basic grist for that mill.

The lack of previous work on the evolution of the overall wage structure is somewhat surprising given the data availability. In contrast to the US, where the Census did not begin to ask questions about earnings until 1940, Canadian Censuses included questions on earnings and weeks of work throughout our time period. We use data from the 1911, 1921, 1931 and 1941 Censuses to construct wage distributions for each of these points in time. Unfortunately, we do not have access to microdata files from these Censuses, but we do have tables showing number of persons, annual earnings, and annual weeks worked for groups defined by a combination of gender, detailed occupation, and age for a given city. The downside of this data is that we do not observe any within-occupation variation. But the level of detail of the reported occupations is large enough that we can still get a good feeling for movements in the overall wage structure. We use data on 11 cities that had populations over 25,000 in 1911, adding a geographic dimension to the data. Thus, our focus is actually on the urban wage structure. Since this set of cities contained approximately a fifth of the Canadian population in 1911 and a third by 1941, this is a sizeable component of the Canadian labour market that grew strongly in importance in our period. We also constrain our attention to males aged 15 and over, examining female wages and their differences relative to those of males in another paper.

The main result of our investigation is that the inequality in the wage distribution increased immensely between 1911 and 1931. This expansion occurred in two steps. Between 1911 and 1921, wage movements represent a mixed bag in terms of inequality. There were substantial real declines in the lowest percentiles of the wage distribution, relatively small changes near the median, and large real declines in the upper half of the distribution. Thus, if we were to examine the lower half of the distribution alone, we would conclude that there was increased inequality over this period, while an examination of the upper half would lead to the opposite conclusion. Interestingly, the occupation typically used to exemplify low skilled workers, labourers, experiences relatively small wage declines in this period. It is younger workers, particularly in the service sector, who populate the occupations in the lower tail of the distribution that experience large real declines. Thus the Census, with data on a wide variety of

occupations broken down by age group, allows us to see what earlier examinations focusing on a single, age-invariant wage for a few occupations misses.

While the changes from 1911 to 1921 are somewhat confused, the movements in the wage structure in the twenties is very clear. The lower tail of the distribution essentially remains at the low level it descended to by 1921. However, during the 1920's, the upper end of the distribution exhibits a massive increase in inequality. The end result is a substantial increase in overall inequality from 1911 to 1931, with shifts outward in both tails in 1931 relative to 1911. Between 1931 and 1941, there was some tendency toward compression in the wage structure, but the overall movements were small relative to what occurred in the previous two decades and, as a result, the long run picture is still one of increased inequality. This increase in inequality in the wage structure (along with high rates of unemployment in the 1930s) is the backdrop against which Canadian began to consider substantial redistributive policies in the 1930s and 1940s.

We decompose these inequality movements into components related to changes in the age composition of the workforce, changes in the occupational composition, changes in the geographic dispersion, and movements in relative wages across occupational categories. We find that, while age and occupation shifts play some role in determining the shifts in the lower half of the distribution in the 1910s, the overall changes we observe mainly reflect changes in the wage structure. We compare the relative wage movements with those observed by earlier authors using other data for the set of occupations studied by those authors. To reiterate, those occupations (mainly, labourers and machinists) have wages that place them in the centre of the distribution and thus this exercise misses the very substantial movements in the tails of the wage distribution. Of particular interest are comparisons to findings for the US and Great Britain. We show that, across our whole period, differentials comparing the wages of both blue and white collar skilled workers to those of unskilled labourers decline much more substantially in the US and Britain than in Canada, where some of the differentials actually increase across our period. Further, the Canadian differentials increase much more substantially in the 1920s than is generally observed in either the US or Britain.

We argue that these patterns fit with the fact that while the US dramatically curtailed immigration and Britain continued to be an emigration generating country in the post WWI period, Canada continued to have substantial immigration inflows until 1930. Put in Hatton and

Williamson(1998)'s terms, Canada's era of mass immigration continued after that of the US and, with it, the association of increased immigration with increased inequality. Moreover, the differences cannot be attributed to differences in expansion of skills since Canada underwent a similar educational transformation to what was observed in the US in this period. We do not view ourselves as having established immigration as a key factor - leaving further investigation of that point to future work. However, to the extent that differential levels of low skilled immigration into Canada and the US generated the different relative wage movements we see in this data, it fits with arguments in Wylie(1989) and Keay(2000) that Canadian firms used a more labour intensive technology than their American counterparts in the early 20th century. Thus, differences in immigration levels may have set the stage for the two neighbours to follow different technological paths. Our work adds an extra dimension to these considerations since the earlier work does not differentiate labour by skill level.

The paper proceeds in 6 sections. In the next section, we describe the data and set out the basic wage structure patterns. In section 2, we describe movements in the distribution of workers across age, city and occupation categories and investigate the role of those movements in the wage structure shifts. Our data is in the form of weekly wages and in section 3, we transform it into hourly wages using another data source to see if this affects our conclusions. In section 4, we present comparisons of the Census wage data to other Canadian data sources and to relative wages from the US and the UK. In section 5, we present a brief discussion of possible explanations for the various wage patterns, including a description of changes in education in Canada in this period. Section 6 contains conclusions.

1) Weekly Wage Distributions

1.1) Data Sources

We begin with an examination of (somewhat restricted) weekly wage distributions in a set of 11 Canadian cities for males over the age of 15 for the years 1910/11, 1920/21 and 1930/31. The data come from Census tables showing number of persons, total number of weeks worked and total annual earnings in detailed occupations by age categories for each of a set of large cities. We focus on the set of cities that had populations over 25,000 in 1911: Victoria, Vancouver, Calgary, Edmonton, Regina, Winnipeg, Toronto, Montreal, Quebec City, St. John,

and Halifax. Together, the populations of these cities make up 20% of the total population in 1911, 21% in 1921, 23% in 1931 and 30% in 1941.[1] Over this same period, the proportion of the population that was urban as opposed to rural rose from 45% in 1911 to 56% in 1941. Thus, our sample corresponds to wages in larger urban centres which became a steadily more important component of Canada's overall population and of the urban population over this period.

The earnings and weeks worked in these tables refer to the twelve month period preceding June 1 of the Census year. Annual earnings refer to wage, salary, commission or piece rate earnings from all jobs in that period. Weeks worked are constructed by subtracting responses to questions about total weeks of work lost due to lay-off, illness, accident or strike from 52. The tables correspond to "wage-earners" which, in both the introductions to the 1921 and 1931 Censuses is defined as "a person who works for salary or wages, whether he be the general manager of a bank, railway or manufacturing establishment, or only a day labourer." This definition excludes the self-employed (both those who employ others and those who do not) and unpaid family workers (e.g., farmers sons). The 1910/11 data comes from an unpublished tabulation found in Mac Urquhart's papers in the Queen's University archives and were originally gathered as part of Urquhart's work on the Canadian National Accounts. The 1920/21 data is from Table 40 in Volume III of the 1921 Census. The 1930/31 data is from Tables 34 and 35 in Volume V of the 1931 Census. In each case we loaded all of the numbers recorded in the tables into spreadsheets.

The occupation dimension in these tables corresponds to the jobs held at the time of the Census, while earnings and weeks worked correspond to all jobs in the previous twelve months. Thus, when we construct the average weekly wage for an occupation group this is not, strictly speaking, the average weekly price of labour in that group. For example, if workers employed in a semi-skilled occupation at the time of the Census spend parts of their year working as common labourers then our calculated average weekly earnings would be lower than the rate firms paid to semi-skilled workers in that occupation for a week's work. As we will see, though, the weekly wages constructed for various occupations in this way correspond well to other wage data

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[1] Ottawa and Hamilton also fit the definition of having over 25,000 inhabitants in 1911 but there is no 1911 data for these cities and so we drop them from all years for comparability.

sources in this time period. Thus, this appears not to represent a major shortcoming of the data.

The occupation categories for each Census are quite detailed. The 1911 table includes earnings and weeks data for 325 occupations, the 1921 table has data for 442 occupations and the 1931 table has data for 353 occupations. In the age dimension, the 1911 table has three age groupings while the 1921 table has 5 age groupings and the 1931 table has 8 age groupings.[2] Our goal is to compare the weekly wage distribution across the three Census years. To do this, we need to use the same age and occupation groups in each year, otherwise we would likely observe greater variability in the weekly wage in years with more occupation and age categories. Thus, our examinations from this point forward will correspond to the three age groups that are evident in the 1911 Census and that can be constructed from the age categories in the other Censuses: 15-24, 25-64 and 65+. Matching occupation categories to create one consistent set of occupations across Censuses is obviously more difficult and subject to the interpretation of the individual researcher. We created a concordance in which we combined occupations into categories that could be compared across years. We provide a description of our main matching decisions along with a comparison of the distribution constructed from the complete set of data and that based on the concordance matched data in Appendix A1. There we show that the two distributions are, in fact, quite similar and argue that our main conclusions are unlikely to be affected by the fact that we are forced to switch to a restricted but consistent set of occupations. In creating these concordance categories, we were forced to drop some occupations in each Census year which we could not confidently place in a particular concordance occupation group. However, the number of people represented in the remaining occupations correspond to 90% of all male wage earners in Montreal in the 1911 Census, 84% of those in the 1921 Census and 89% of those in the 1931 Census. Thus, we still capture the large majority of workers. When we use the 1911-1931 data, our concordance includes 158 occupations, implying that we have information on 158 occupations times 3 age groups times 11 cities or 5214 cells for each year. In fact, some of the cells are empty, so for 1911, 1921 and 1931 we are left with 452, 464 and 455 occupation-age groups with positive earnings, respectively.

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[2] Table 34 has data on 7 of the age groups (starting at age 20) plus the totals for all workers regardless of age. We use data from Table 35, which has the same data by occupation for various age groupings for 10 to 19 year olds, to construct the numbers for the 15 to 19 year old group.

The 1941 Census data imposes some extra restrictions because there is no age dimension to the 1941 tables. In addition, the set of reported occupations is smaller, leading to a cross-year concordance with only 117 occupations when we include 1941 data. We will present results both with and without the 1941 data throughout the paper so the reader can see what is lost by moving to descriptions without the age dimension and with fewer occupations.

We construct weekly wage distributions from this data by first dividing annual earnings by annual weeks worked within each occupation-age category.[3] We also know the number of wage earners in each occupation-age category. We create a dataset by assigning each of these people the average weekly wage associated with their category. Thus, we effectively weight the occupation-age wages according to the number of wage earners. This creates a dataset in which all of the variability arises across occupation-age groups and which necessarily misses within group variation. We convert all wages into 1913 Toronto equivalent dollars, using the cost of living indexes in Emery and Levitt(2002). Because our earnings data correspond to 12 month periods spanning half of two consecutive calendar years, we actually used the average of the listed 1910 and 1911 values for the first Census, and similar averages for the other Censuses. Unfortunately, this assumption is not completely innocuous. Because of rapid deflations in both 1921 and 1931, choosing to average in this way yields quite different results from just using one year's index value in each case. Thus, the actual index values we use for Montreal (compared to a 1913, Toronto base of 100) are 83 for 1911,148 for 1921 and 127 for 1931. If, instead, we had used the values for 1911, 1921 and 1931, the index values would have been 82, 136 and 116, respectively, thus affecting the 1911-1921 comparisons. However, we believe that the averaging approach is the most reasonable given the timing of the earnings reporting.

1.2) Basic Depiction of the Distributions

In figure 1, we plot the kernel smoothed weekly wage density, constructed as just described, for 1911 for all cities combined.[4] Table 1 contains various percentiles and other

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[3] Note that these are essentially weeks weighted average wages. That is, the weekly wages of workers who work more weeks are weighted more heavily.

[4] The kernel smoothing is done in Stata and uses the Epanechnikov kernel with the smoothing parameter value automatically chosen by Stata.

summary statistics for the distributions to allow for a more concrete comparison. One notable feature of the distribution is its bimodality (a feature shared by the distributions in other years). The first mode is dominated by labourers in the middle age group (25-64) while the second consists mainly of government workers and some skilled workers such as tailors and bricklayers.

It is instructive to consider what occupations and age groups are represented in each part of the distribution. Table 2 provides a listing of some of the occupations in each part of the overall weekly wage distribution in 1921, broken down by age. Thus, for example the top left cell in the table says that workers age 15 - 24 whose wages placed them in the bottom decile of the overall (i.e., workers of all ages combined) distribution worked in personal service and the other listed occupations. The centre column of the table, which shows the occupations for the numerically largest, 25-64 age group, shows a progression of occupations that is much as one might expect. At the bottom of the distribution are servants and other service workers whose work is primarily related to cleaning. Just above them, but still relatively low in the overall distribution, are hotel and restaurant service workers and gardeners. Next in the order, in the category just below the median, are mainly skilled and semi-skilled workers in the non-metallic manufacturing sectors. At the bottom end of this category are labourers, messengers and sailors. Between the 50th and 75th percentiles of the overall distribution are workers mainly in the elite blue collar occupations: carpenters, blacksmiths, millers, cabinet makers. Teachers are also in the middle of this group. The range between the 75th and 90th percentiles includes more skilled manufacturing workers (tool makers and engine makers) as well as physicians, and some, likely union, workers from the transportation and communication sectors. Between the 90th and 95th percentiles are mainly managers and foremen as well as dentists. Above the 95th percentiles are a range of managers and professionals.

The ranking for the middle age group differs substantially from that for the younger and older age groups. The bottom two categories for the 15-24 year old age group include labourers, apprentices for skilled and semi-skilled manufacturing occupations, and some occupations where one expects to see young workers (messengers and boot blacks). The lowest paid occupations in this age group (and thus the lowest paid overall) are boot blacks and messengers. In the 25th to 50th percentile range are young workers in the elite blue collar occupations (carpenters, blacksmiths, millers) along with young professionals and workers in the transportation and

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communications industries. From an examination of the occupations where apprentices are separated from other workers, this wage range appears to include few apprentices. Instead, it contains mainly young workers at the start of their careers in occupations that we saw above the median for the middle age group. The remaining categories for the youngest workers mainly contain workers who have attained management jobs at a young age. Thus, through much of the distribution, one can see the youngest workers in a given occupation in a wage category one or more categories below where they can expect to be as they gain experience. The same is true, to some extent, for the over age 65 group. While there are often some of the same occupations in a given wage range as are observed for the middle age group there is also a strong tendency for occupations to be observed in a lower category than for the middle group. Thus, the table reflects a trajectory in which workers in a given occupation see their wages first rise then fall with age.

1.3) Movements in the Wage Structure Over Time (1911-31)

Figure 2 contains a depiction of the changes in the real weekly wage distribution over time. The solid line in this figure corresponds to the difference between the log weekly wage in 1921 and the log weekly wage in 1911 at each percentile, and thus roughly shows the percentage differences in the distributions at each percentile. The line with squares shows the same difference between 1931 and 1911. The horizontal dashed line corresponds to zero change between the years. It is worth noting that we are comparing percentiles not specific occupations across years. Thus, when we report that, say, the 10th percentile declined by 15% this does not necessarily mean that the occupation that was at the 10th percentile in 1911 experienced a decline of 15% in its wage. The occupation at the 10th percentile in 1921 may be different. Thus, the movements depicted in this figure reflect a combination of shifts in real wages within occupations, related changes in rankings of occupations, and changes in the proportion of workers in each occupation. In figures of this type, a line sloping up to the right reflects an increase in inequality between the pair of years because in that case increases at the top of the distribution are greater than at the bottom (or decreases are less). Looking at the line capturing the difference between 1911 and 1921, there is clear evidence of an increase in inequality below the median, and especially below about the 35th percentile. Between the median and the 85th percentile there is evidence of a decrease in inequality as the higher percentiles decline more than the lower. Finally, there are mixed movements in the top decile.

The comparison of the 1911 and 1931 distributions indicates similar sized real declines below the 5th percentile to those between 1911 and 1921. That is, there is only limited improvement from the low point reached in 1921 for those at the bottom end. However, between about the 15th and 45th percentiles there is generally little difference between the 1911 and 1931 distributions, corresponding to a gain relative to 1921 through much of this range. Above the 45th percentile, the 1931 distribution is dramatically superior to both earlier distributions, with the extent of its advantage generally increasing across the upper half of the distribution.

These patterns are also reflected in the summary statistics in Table 1. The standard deviation first declines between 1911 and 1921 and then increases dramatically between 1921 and 1931. The squared coefficient of variation (a measure of inequality that is most sensitive to movements at the top of the distribution) yields similar conclusions. Both the variance and the coefficient of variation are susceptible to being strongly influenced by outliers. The log 90-10 ratio provides an alternative measure that does not suffer from these difficulties. According to that measure, inequality rose slightly from 1911 to 1921 and then rose dramatically between 1921 and 1931. The 50-10 and 90-50 ratios break this movement down into lower and upper tail components. These measures support what is evident from Figure 2: inequality rises in the lower tail of the distribution between 1911 and 1921 as the median stays the same but the lower tail experiences substantial declines. As we discussed earlier, the right tail of the distribution also shifts left in this period and this implies a decrease in inequality in the upper tail of the distribution. The result, as the previous lines in the table show, is conflicting results about the change in inequality from different summary measures of inequality. From 1921 to 1931, though, the movements are less equivocal. There is a slight increase in inequality in the left side of the distribution due to small changes in lower end wages but there is a massive increase in inequality in the right tail of the distribution. Thus, we observe a large increase in inequality from the 1911 to the 1931 distribution that occurs in two steps. In the first, the bottom tail drops substantially and in the second, the very lowest tail of the distribution roughly stays at its new, lower level while the upper tail rises substantially.

1.4) Bringing in the 1930s

We next introduce the 1941 data. As discussed earlier, we do not observe the age dimension in this data and, as a result, there is less variation in our wages. This means the

distribution constructed using our 1941 data is not directly comparable to the distributions we constructed for the earlier years. To provide a point of comparison, we create new versions of the 1911, 1921, and 1931 data in which we act as if we do not observe age. Figure 3 contains a re-plotting of the 1931-1911 distribution difference using the non-age varying data along with the 1941-1911 difference. The pattern evident in the 1931-1911 line is broadly consistent with that seen in Figure 2, where age variation is included. In particular, the non-age varying data again shows large increases in wage inequality between 1911 and 1931 at the top end of the distribution, substantial real declines at the very bottom and little change in much of the remainder of the bottom half of the distribution. The main differences are that the non-age varying data shows some increases near the 10th percentile and the range over which there is little real change extends higher in the distribution. The 1911-41 difference line is very similar to its 1911-31 counterpart, indicating that there were few substantial changes between 1931 and 1941. There were, nonetheless, some shifts in various parts of the range between the 20th and 60th percentiles and a substantial change above the 90th percentile where there were noticeable equalizing adjustments between 1931 and 1941. In the end, the picture that emerges is one of substantial increases in inequality between 1911 and 1941, driven partly by real wage declines at the very bottom of the distribution but mainly by increased inequality above the median. It is against the backdrop of two decades of expanding wage inequality (not to mention the high and unequally distributed levels of unemployment in the 1930s) that policy makers began to establish Canada's redistributive system in the late 1930s and 1940s.

2) Investigating the Changes Across Censuses

Given the nature of our data, there are four possible explanations for the changes in the weekly wage distribution in this period that we can investigate: 1) changes in the age distribution of workers; 2) changes in the distribution of workers across cities; 3) changes in the occupational distribution of workers; and 4) changes in the wage structure, i.e., in relative wages between city-age-occupation cells. As a first step in investigating these factors, we examine whether there were, in fact, changes in the age, regional and occupational composition of the workforce.

2.1) Age Dimension

Table 3 contains the age distribution of male wage earners in each of the three Censuses for which we observe age. The results show a clear shift away from the youngest age group

toward the middle group, as the proportion of the workforce aged 15 to 24 declines from .29 in 1911 to .22 in 1931. This, alone, would tend to increase average wages across Censuses given the observations from Table 2 that the lowest part of the distribution is disproportionately composed of youth. Instead, as we have seen, the lower tail of the distribution fell between 1911 and 1921 then recovered in the next decade but just back to 1911 real levels. This implies that the young workers who dominate the lower tail fell behind older workers in terms of wages in this period. This, in turn, could arise because there was an increase in "returns to experience" over this period, because young people just happen to be concentrated in occupations in which there were particularly large wage declines for all workers, or because the occupational distribution for the young shifted toward lower wage occupations. Changes in returns to experience would be reflected, in our data, in increased wage differentials between young and older workers within occupations. To isolate these returns, we construct the ratio of the average wage for mid age (25 to 64 year old) workers to that for young (15 to 24 year old) workers within each occupation and city cell in each year. We then average across these cells in a given year using the proportions in each occupation/city cell for mid aged workers in 1911. Thus, the final average ratios we calculate hold occupation and city constant. These ratios are 1.35 in 1911, 1.44 in 1921, and 1.52 in 1931. These numbers indicate a relatively constant increase in what is typically referred to in the labour economics literature as returns to experience over this period. Interestingly, this occurred at a time when the proportion of workers who were under age 25 was declining. Thus, a simple story built on the relative sizes of birth cohorts cannot explain this phenomenon.

2.2) City Distribution

The geographic distribution of workers does not change markedly over time in our sample period. The 6 western cities in our sample (Victoria, Vancouver, Calgary, Edmonton, Regina and Winnipeg), for example, make up 30% of the sample in 1911 and 29% in 1941. There are some shifts within regions (Vancouver rises in importance while Winnipeg falls, and Montreal gains slightly while Toronto falls slightly) but none of these are sizeable. In contrast, the distribution of average wages by city changes substantially over this period. The ratio of the difference between the mean wage in the highest wage city and that in the lowest wage city to the overall average wage in a year takes values of .35 in 1911, .27 in 1921, .25 in 1931 and .27

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in 1941. This suggests a regional convergence in real wages between the pre and post WWI periods. However, this pattern may reflect differential shifts in the occupational composition of employment across cities as well as any general city specific effects. To isolate the latter, we can look within specific occupations. For labourers, this measure of relative dispersion stays constant at .3 between 1911 and 1941. In comparison, the same ratio for machinists declines somewhat from .3 in 1911 to .25 by 1941. Overall, within occupations, there is only limited evidence of regional convergence in real wages. This echoes Emery and Levitt (2002)'s findings for the same period with very different data (data collected by local correspondents from the Department of Labour's *Labour Gazette*). There is also some tendency over time for the emergence of a West to East gradient in real wages but, as Emery and Levitt note, the dispersion measures imply that this does not correspond to the emergence of separate regional labour markets

2.3) Occupation Distribution

Table 4 contains the distribution of wage earners across broad occupational groups for the three Censuses. The rise of white collar occupations as a share of the workforce jumps out strongly from these numbers. Clerical workers formed only about 5% of the workforce in 1911 but 12% in 1921 and 1931. Combining professionals, clerical workers and managers, the overall white collar sector rose from 8.5% in 1911 to 19.1% in 1921 to 19.5% in 1931. This increase accords well with US evidence of increases in the share of workers listed as "non-production" workers among manufacturing workers between 1909 and 1919 (Goldin and Katz(1998)).These increases were balanced by declines in construction and manufacturing occupations. Since labourers and managers for all industries are collected in other categories, these occupations essentially correspond to semi-skilled and skilled trades workers. At the same time, labourers maintain a constant proportion of the workforce between 1911 and 1921 then increase in importance substantially between 1921 and 1931. This contrasts with evidence reported in Goldin and Katz(1998) that labourers declined in importance in US manufacturing during and after WWI. It seems possible that this difference could relate to immigration policy, as we discuss in section 5).

Of course, these compositional changes have a greater effect on the wage distribution the greater are the differences in occupational wages. The entries in Table 2 indicate a systematic allocation of occupations across the distribution much as one might predict. The actual

differences in wages across those occupations are substantial. For example, machinists and tailors in Montreal in 1911 received weekly wages that were approximately double those received by young servants. Accountants and engineers weekly wages were closer to 3.5 times the servants' wages.

2.4) Decomposing the Changes Across Censuses

To investigate the relative importance of these compositional changes and shifts in the wage structure, we carry out a decomposition of the changes depicted in Figure 2. We do this in three stages for each of our decennial changes. Thus, to decompose the 1911-1921 change we construct counterfactual 1921 distributions in which we hold the age distribution constant, the age and city distribution constant, and the age, city and occupation distributions constant, respectively. To understand the decomposition, suppose, for the moment, that there is no city dimension and consider that the wage density in a period, 2, can be written as,

$$1) \quad f_2(w) \quad = \quad \iint g_2(w/x,z)\, h_{12}(x/z)\, h_{22}(z)\, dx\, dz$$

where w is the wage, x is occupation, z is age, and the g's and h's are densities with the subscript 2 denoting the second period. In words, the overall wage density can be obtained by integrating the wage density conditional on the joint distribution of age and occupation with respect to that joint distribution. The joint distribution of age and occupation can, in turn, be broken down into a conditional and a marginal distribution. In our case, with wages constant within a given age/occupation cell, the g() density has point mass at the wage value relevant for the given cell. It is standard to construct decompositions of changes in densities between period 1 and period 2 by first creating a counterfactual density which has the same form as 1) except that $h_{22}(z)$ is replaced with $h_{21}(z)$, the marginal density for age in period 1. This generates an estimate of what the density in period 2 would have looked like if the age distribution from period 1 had continued to hold but any change in the distribution of occupations for a given age group was allowed to occur and the wage structure (i.e., the wages paid for a given age/occupation cell) was also allowed to change to its period 2 value. The second step in the decomposition is to replace both $h_{22}(z)$ and $h_{12}(x/z)$ with their period 1 values. The counterfactual generated in this way holds the complete distribution of conditioning factors at their period 1 values so that the only

difference between it and the true first period density is due to changes in the wage structure.

In practice, the implementation of this decomposition is quite straightforward in our case. Recall that we created our "phantom" dataset for a given year by creating as many phantom people as there were people recorded as working in a given occupation/age/city cell and assigning to each of them the wage for that cell and year. Creating the counterfactual distributions then just involves rescaling the number of workers in a cell before creating the phantom people. For example, to create a distribution for 1921 but with the 1911 age/city/occupation distribution, we can simply use the 1911 cell numbers to determine how many people to create for each cell but assign them the 1921 wage for that cell.[5]

We present the results of this decomposition exercise for the 1911-21 changes in Figure 4. It turns out that holding the city distribution constant has little added impact beyond simply holding the age distribution constant so rather than presenting each of these stages separately, we go straight to the counterfactual in which we hold the joint age and city distributions at their 1911 values. In Figure 4, the solid line without symbols corresponds to the true difference in percentiles between the 1911 and 1921 distributions taken from Figure 2. The dashed line with squares shows the difference between the 1911 distribution and what the 1921 distribution would have been had the age and city distributions stayed as they were in 1911 but the occupation distribution and wage structure taken their 1921 values.[6] This counterfactual difference lies generally below the true line, particularly below the 65th percentile and shows less change in inequality than what was actually observed. Thus, while the true log(50/10) differential rose

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[5] With more than two conditioning factors, the counterfactual in which the first factor is switched to its period 1 distribution is straightforward and so is the one with all factors switched. In our case, the rescaling factors needed for the case where both age and city distributions are held constant are a little more complicated since we need to rescale the numbers in a cell so that we both get the ratios of the numbers of workers in the various age groups to equal their 1911 values and to get the number of workers in a given city to equal their 1911 values.

[6] This description of the counterfactual is, in fact, only accurate if there are no general equilibrium effects altering the wage structure when the age distribution shifts. While this is the standard assumption in this type of decomposition, it is unlikely to hold. For that reason, the decomposition should be seen as a way of summarizing complicated changes in the distributions of conditioning factors rather than as what the distribution would truly have looked like in this alternative scenario.

from .35 to .43 between 1911 and 1921, the same differential in this counterfactual distribution took a value of .39, implying that half the increase in inequality in the lower half of the distribution was due to shifts in the age distribution. In particular, the relatively strong performance near the median in 1921 compared to the rest of the distribution was partially accounted for by the increased number of middle age workers.

The solid line with triangles in Figure 4 shows the difference between the 1911 distribution and the distribution that would have occurred in 1921 had the joint distribution of workers across age, city and occupation categories remained as it was in 1911 but the wage structure had changed to its 1921 value. This line is very similar to the previous counterfactual difference, corresponding to only changing the age and city structure; though, with a further move down in the counterfactual 50th percentile the log(50/10) ratio falls to .36 - essentially its 1911 value. Thus, the increase in inequality between 1911 and 1921 in the lower half of the distribution can be accounted for purely from shifts in the age and occupation distribution (recalling that city distribution shifts appear to have little impact). At the same time, the difference between this counterfactual difference and the horizontal line at zero represents the impact of changes in the wage structure alone. These appear to have amounted to a relatively constant 10 to 15% drop in real wages for everyone below the 50th percentile across this decade. In contrast, the upper half of the distribution shows even more compression when we hold the age/city/occupation distribution constant. While the log(90/50) differential changed only slightly from .35 in the true 1911 distribution to .34 in the true 1921 distribution, in the counterfactual distribution it falls to .27. The figure makes it apparent that the relatively good performance in the range between the 85th and 95th percentiles in the true 1921 distribution arose entirely because of composition shifts. These shifts effectively offset a change in the wage structure in which those in the upper tail of the distribution faced real wage declines that were about 10 to 15% larger than what was faced by the workers in the middle and lower half of the distribution. Thus, the overall shifts in the wage structure were in an equalizing direction in this decade.

Figure 5 contains a similar decomposition of the long term shift in the wage distribution between 1911 and 1931. Here, holding age and city constant actually implies an increase in measured inequality as the lower half of the distribution shows greater reductions relative to what actually happened while the upper tail changes are unaffected once we control for age and

city shifts. The impacts in the lower half of the distribution are largely reversed once we also control for the occupation distribution, however, implying that the age and occupation composition changes worked in offsetting directions. In fact, the change using the counterfactual holding age, city and occupation distributions constant is very similar to the true change apart from in the range between the 85th and 95th percentiles. The relatively strong increases in that particular range between 1911 and 1931 turn out to be due to compositional shifts. The implication of the overall patterns, though, is that most of the long run change in inequality between 1911 and 1931 is due to shifts in wage structure rather than composition. In particular, the substantial increase in weekly earnings in the upper half of the distribution in the 1920s is mainly due to shifts in the wage structure. For example, the 90th percentile of the actual distribution increased by .32 log points between 1921 and 1931 while the 90th percentile of the distribution holding age, city and occupation distributions constant at their 1911 values increased by .26 log points. Thus, while the increased inequality in the lower tail of the distribution between 1911 and 1921 is almost entirely due to compositional shifts, the increase in inequality between 1921 and 1931 is due to shifts in the wage structure that favoured those in the upper half of the distribution.

3) Hourly Wages

Our discussion to this point has been in terms of weekly wages, which is what is directly available in the Census. However, as Altman(1999) discusses, this is also a period of substantial changes in hours of work per week. Using data from the Labour Gazette and the Canada Year Book, Altman constructs regional hours per week indexes for manufacturing and construction workers. His final summary series for Canada shows average hours moving from 55.1 in 1910 to 52.5 in 1918 and then falling to 49.9 by 1920. Examining series from the Labour Gazette for specific trades in Montreal (a city that was very much the norm in terms of wage movements in this era), one finds that machinists in metal trades are reported to work 55 hours per week from 1901 through to 1919, with hours then falling to 50 in 1919 and 1920. Similarly, carpenters are reported as working 54 hours per week from 1904 through 1917 but then experience declines to 50 hours per week in 1918 and 48 hours per week in 1920. Herb Emery has constructed hours and hourly wage series for common labourers in factories from 1911 to 1940 using supplements to the Labour Gazette. His series show 58 hours per week on average from 1911 through to 1917

and then falling to approximately 53 hours per week by 1920. The closest one can get to white collar workers in these publications is telegraphers. Their hours per week in Montreal are constant at 60 from 1901 to 1917 and then fall precipitously to 48 by 1920. For all the occupations reported, hours worked per week change much less in the 1920's.

We wish to draw two conclusions from these movements in hours worked per week. First, the period directly following the end of WWI was clearly a time of great upheaval and change in the Canadian labour market. As we will see in a moment, some of the implications of our wage data differ from those drawn from other sources in this period and this upheaval may provide part of the explanation for why this is the case.

The second, more substantive, conclusion is that hours declined sharply between our 1911 and 1921 observations. The Labour Gazette based series appear to indicate a relatively robust finding of a decline in hours worked per week of approximately 9% over this period. This is the number reported in Altman's constructed index and is present in many of the individual series for 1921. The implication is that the 8.4% decline in real weekly earnings between 1911 and 1921 reported in Table 1 corresponds to a slight increase in average real hourly earnings. For labourers in Montreal, the implied real hourly wages, using Emery's common factory labourer's number for hours per week, are .22 in 1911, and .23 in both 1921 and 1931. For machinists, the implied real hourly wages are .33, .33, and .36 for 1911, 1921 and 1931, respectively. In comparison, the weekly wages of labourers in Montreal fell 6.8% between 1911 and 1921, and those of machinists fell 9.8%. Thus, in both cases the declines in real weekly wages between 1911 and 1921 correspond to constant real hourly wages plus declining hours per week. Inspection of individual hours series in the Labour Gazette does not reveal a noticeable pattern of larger or smaller declines for more versus less skilled workers and, thus, there is no reason to question the types of relative wage movements presented in our figures. However, the general decline in hours per week does alter our picture of what happened to wage levels over this period. If we assume that all occupations experienced a 9% decline in hours per week then, in contrast to the weekly wage distribution where negative changes are recorded at all percentiles between 1911 and 1921, the implied hourly wage series shows either no real declines or small real increases throughout the range from the 25th to the 95th percentiles. Both tails of the distribution continue to show real declines. In the 1920's, hours per week appear to have changed

very little, implying that the weekly and hourly wage distributions experience similar changes over that decade.

4) Comparisons with Other Data and Other Countries

Virtually all of the previous work on movements in inequality and the wage structure, both for Canada and for other countries, has been framed in terms of wage ratios between pairs of occupations. By far the most common approach is to present the ratio of the wages of skilled blue collar workers (such as carpenters and machinists) to those of common labourers. In large part, this approach has been adopted because these are the only series that are available on a consistent basis over an extended period of time. In Table 5, we present our data in this form, showing a set of wage ratios that match what is commonly presented plus some others.

In the upper portion of Table 5, we present wage ratios of several occupations relative to common labourers. All ratios correspond to the 25-64 age group, in order to hold age composition effects constant. The first ratios in the table compare manufacturing and construction trade workers wages to those of labourers. Between 1911 and 1921, these ratios decline relatively substantially, with the ratios declining by at least .1 in all cases. From 1921 to 1931, in constrast, the skilled trade/labourer ratios invariable increased and generally reached higher levels than had existed before the war. A similar fall then more than compensating rise is also seen in comparisons of semi-skilled and skilled white collar workers to labourers. Reflecting the earlier discussion of the left tail of the distribution, servants' wages fell relative to labourers from 1911 to 1921 and did not recover from 1921 to 1931.

In the lower part of the table, we provide other comparisons. The standard comparisons of labourers to tradesmen is generally seen as demonstrating returns to investment in training: labourers in construction or manufacturing might be seen as men who were potential candidates to enter the trades at some point in their lives. A similar type of comparison might be made between servants and more skilled service workers, who are likely also separated from one another by some combination of training and capital. While both servants and barbers earn less than their manufacturing counterparts (labourers and skilled tradesmen), the ratio of the wages of the latter to the former are similar in magnitude to the skilled/unskilled ratios in manufacturing. The ratio also follows a pattern of increasing in the 1920s to a level above its 1911 level. In the case of this specific ratio, though, there was also an increase between 1911 and 1921. Using a

similar argument, we further compare clerks to accountants and engineers. Clerical workers would undoubtedly have had more education than labourers (and, as seen in Table 3, were paid 67% more) but would have been positioned similarly at the lower end of a pay structure, below others with further training in the same broad set of skills. Comparing the wages of workers holding more of those skills, we witness mixed relative changes between 1911 and 1921 followed by strong increases in returns to skill between 1921 and 1931.

4.1) Comparisons With Other Canadian Sources

We next turn to extending our discussion to a comparison of the real wages from the Census with those from other sources. The two series that cover much of the same time period as ours are the hourly wage series in Emery and Levitt(2002), based on Labour Gazette data, and the wage data from the Canadian Pacific Railway records collected by Mary Mackinnon (Mackinnon(1996)). It is worth noting at the outset that there is some degree of controversy about the reliability of both data sources. As Mackinnon(1996) discusses, the Labour Gazette data for the metal trades, printing trades and building trades are likely union scales and may not have corresponded to what was paid to non-union workers, or even to what was actually paid to unionized workers.[7] However, Altman(1999) argues that some of the non-metal manufacturing data corresponds more to non-union workers so series such as Emery's common factory labourer wages, constructed as average wages across labourers in manufacturing firms reporting to the Labour Gazette, may be more representative. On the other side, the CPR data comes from company pension-related records. As such, they are likely to be accurately recorded but might be questionable in terms of their representativeness relative to the rest of the workforce. Mackinnon(1996) examines and rejects the main potential objections to the data on these grounds but she also states that government control of railway wages and prices between 1917 and 1921 led to disproportionately large increases in wages in that period relative to the rest of the workforce. In fact, even in 1925, the Labour Gazette reports that wages in all the principal railways "are fixed according to agreements between the several railways and the organization of railway employees"(Canada (1925)) implying that it is actually the railway data that reflect

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[7] Urquhart and Buckley(1965) report that unionized labour made up 8% of the non-agricultural workforce in 1911, 14% in 1920 and 11% in 1931.

union scales. Both Mackinnon(1996) and Emery and Levitt(2002) provide comparisons across the various data sources, including the Census. We will discuss their conclusions as we proceed.[8]

Since both the Gazette and CPR series correspond to hourly wages, we need to convert the Census data from weekly to hourly wages to make comparisons. Herb Emery has collected hours series from the Gazette. We have access to the data on hours for common factory labourers and machinists, allowing us to create comparisons for a standard type of skilled/unskilled wage ratio. In order to control for differences in regional coverage across the dataset, we focus our attention on Montreal. We present the results of this comparison in Table 6. The first column contains the set of ratios constructed using the Census weekly wage combined with hours per week from the Gazette.[9] The Census skilled/unskilled wage ratio first declines slightly between 1911 and 1921 then increases sharply to 1931. Finally, between 1931 and 1941, the ratio experiences a small contraction. These patterns fit well with the movements in the middle part of the distribution described earlier. Thus, the ratio of the 75th to the 25th percentile weekly wages for Montreal takes values of 1.52, 1.47, and 1.57 in 1911, 1921 and 1931, respectively. The similarity in these movements is not surprising since labourers have wages that put them near the 25th percentile and the skilled trades tend to have wages near the 75th percentile.

Column 2 contains wage ratios from Emery and Levitt(2002)'s Gazette data. As with the Census data, this data shows a strong increase in the skill differential between 1911 and 1931 followed by a contraction (to a point that is, nonetheless, higher than the 1911 ratio) to 1941. The two datasets differ in the fact that the ratio is larger in the Gazette data and in the timing of the increase between 1911 and 1931. The Census data shows this increase as happening in the 1920s while the Gazette data shows it happening mainly between 1911 and 1921. The difference in the size of the differential may reflect the point mentioned earlier that data collection in the Census implies that a person who reports that they are in a given occupation will have all their earnings

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[8] Another point of comparison is found in Meltz and Stager(1979), who examine wages in 52 occupations across the 1931,41,51,61 and 71 Censuses. They argue that the 1931-41 and 1941-51 periods are both characterized by compression. As we will see, this fits with the patterns from both the Census and Gazette data.

[9] The 1941 Census tables do not have break downs by age. In order to have comparability across Censuses, we also use overall average (i.e., not conditioning on age) wages for the earlier Census years.

assigned to that occupation, even if they spent a substantial part of the year working in another occupation. As we will see below, the implied hourly wages for labourers in the Census match the Labour Gazette data very well. Thus, the difference in the ratio is mainly due to different levels of wages for trades workers. If trades workers main alternative employment option when not working in their own trade is unskilled work then it would make sense that the Census data would display lower average wages for skilled workers and lower wage ratios.

The CPR based ratios shown in column 3 (like the Census) show a strong increase in the skill differential in the 1920s but show a very strong decline in the ratio in the 1910's. The net result from these two within-decade shifts is a slight decline in the skill ratio between 1911 and 1931 - a result that is much different from what is observed in the other two data sets. The sources of this discrepancy are best discussed in terms of the individual wage series that make up the ratio, and we turn to that next.

In Figure 6 we plot Emery and Levitt(2002)'s common labourers in factories wage series and Mackinnon(1996)'s CPR labourer's series for Montreal.[10] We also plot the implied hourly wage rates for Montreal from the Census data using Emery's hours per week for common factory labour to convert to hourly wages. We plot the Census numbers with a linear interpolation linking each point. In all cases, we deflate the wages using Emery and Levitt(2002)'s price index for Montreal and report all numbers in 1910/11 real Toronto dollars to match our reporting of the Census numbers above. Two features stand out in this figure. The first is the relatively high value for 1921 in the CPR data. This occurs because the official nominal wage for labourers actually increases in a year with substantial deflation. The second feature is the relative values of wages from the three sources. Putting aside the seemingly anomalous result from the CPR in 1921, which may be a reflection of special contracting conditions at the railway, the interpolated Census value and the observed values for the Labour Gazette and CPR data are extremely close to one another in 1920 and in 1930. The Census and Labour Gazette data are also very close in 1911, with both being substantially above the CPR wage. This pattern echoes a remark made by Emery and Levitt(2002). Commenting on Mackinnon(1996)'s claim that weekly wages in the

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[10] We are grateful to Herb Emery for providing us with his common labourers in factories series. This series was constructed by collecting all the plant specific wages for each city reported in the supplements to the Wages and Hours publications.

1911 Census may have been abnormally high because workers were putting in overtime, Emery and Levitt note that dividing Census weekly wages by their common factory labour hourly wage yields implied hours per week that are very close to those reported in the Labour Gazette.

There are some other sources against which to compare the various wage series. Mackinnon(1996) reports daily wages for labourers employed by the government to work on the canals around Montreal. In 1911, these reported wages were $1.50 per day. If these labourers worked 9 hour days then this would correspond to an hourly wage (in Toronto dollars) of approximately 17 cents per hour. This is between the CPR (15 cents) and the Census and Gazette numbers (22 and 21 cents, respectively). The Labour Gazette in February 1912 reports that 1,800 street labourers working for the city of Montreal received an increase in pay from $2.00 to $2.10 per day in January, 1912 (Department of Labour(1912)). If we then assume that the $2.00 figure is relevant for 1911 and again assume a 9 hour day, the implied hourly wage (in 1910/11 Toronto dollars) is 0.23. If we assume they worked a 10 hour day then the relevant hourly wage is 0.21. In either case, the hourly wage is very close to those derived from the Census data and reported in the common factory labourers series from the Labour Gazette. In the end, the congruence of two such different sources (the Gazette data and the Census) combined with the evidence on street labourers' wages and the evidence that the CPR data seems to be habitually below other sources in the pre-war period suggests to us that we should put more credence in the Gazette and Census wages. Those sources indicate an essentially flat real wage for labourers across the decades. One implication from this conclusion is that the sharp drop in the machinist/labourer wage ratio between 1911 and 1921 in the CPR data, which is largely driven by the combination of the low initial labourer's wage and its abnormally high value in 1921, is unlikely to represent general movements in the skilled/unskilled wage ratio in this period.

In Figure 7, we repeat this exercise but examine machinists wages. Machinists are a skilled trade for which wages are readily available from all three sources.[11] Both Emery and

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[11] The Labour Gazette publications on hours and wages actually include two different versions of the machinists' wages for Montreal for 1921. In the reports near the actual date (Reports number 4 and 6), the wage range for machinists is listed as, .55 to .70 cents per hour. However, starting with report 7 the range is listed as .55 to .90. We used the mid-point of the former range because this is in closer accord with other evidence, particularly machinists' wages in Toronto. Throughout the Labour Gazette data the Toronto wage ranges have mid-points very similar to those for Montreal. The one exception to this is the

Levitt(2002) and Mackinnon(1996) emphasize the broad agreement of various sources on skilled wages. All three sources are in close agreement on the real wage for this occupation in 1911 and all three suggest relatively substantial increases in machinists real wages between 1911 and 1930/31. However, there are also some strong differences among the series. In particular, both the CPR and Gazette data show large increases in machinists real wages between the pre-war period and the immediate post-WWI period. In contrast, the Census data indicates that the real wage for machinists was essentially unchanged between 1911 and 1921. It is worth noting that the Labour Gazette data is again closer to the implied Census data than the CPR data. The differences between the implied Census hourly wages and the other two series in 1921 might be accounted for by the extremely tumultuous nature of the labour market in the immediate post-war years. As we have already discussed, hours per week changed dramatically in the span of a few years. There was also rapid deflation in 1921. The common factory labourers' wage series tracks this deflation quite closely while the more skilled workers' official wages follow with a lag. It is possible that the relative lack of flexibility in machinists' wages induced other adjustments, such as in hours of overtime available. In the longer run, though, the Census data also shows increases in the real wage of machinists to a degree comparable to but not quite as large as what is observed in the Labour Gazette data.

Data on the wages of other skilled trades workers in the Gazette show a mixed pattern. The building trades show declines relative to the common factory labour series throughout the war years and for a few years afterward, fitting with the pattern for machinists in the Census data (and the pattern in the ratio of weekly wages for carpenters and labourers in Census data shown in Table 5).[12] The ratio of Montreal carpenter's to labourer's wages, for example, decline from 1.8 to 1.63 between 1911 and 1921. The series for printing trades also shows relative declines during the war years but with upward surges beginning around 1917 rather than around 1919 or 1920. The metal trades (blacksmiths, boilermakers, iron moulders, machinists, and sheet metal

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1921 range listed for Montreal in Reports 7 and later. In 1921 the listed wage range for machinists in Toronto is .50 to .75. Thus, we believe that data was added later on a plant that was an outlier and stick with the earlier listed data.

[12]We are grateful to Herb Emery for providing us with the building trade series.

workers) on the other hand follow a common pattern of constancy relative to labourers until sometime between 1915 and 1918, followed by strong relative increases. The exact turning point varies across the trades but the machinists differ only in that they make the move first, not in the basic pattern. By the late 1920's, though, the building and printer trades wages have reached or surpassed the ratios of the metal trades to labourer's wages, suggesting that the differences in the skill differentials are more to do with timing (which is likely strongly influenced by war dictates) than ultimate outcomes.

One reason to examine the sources other than the Census is that this allows us to compare wages at cyclically similar points. The 1911 Census was taken at the time of a boom while the 1921 and 1931 Censuses correspond to a recession and a depression of differing severity. To get more cyclically constant results, we could compare the real wages in 1911 with a prosperous year from the 1920s such as 1927. The common factory wage labourers real wages in those two years are very similar ($0.20 and $0.21, respectively). For machinists, the Labour Gazette data shows a marked increase from $0.31 to $0.38. Thus, the picture from the Census that skilled wages had increased substantially while unskilled wages had changed little from the pre-war period to the end of the 1920s appears to hold up to comparison at cyclically similar points.

Finally, it is worth reiterating that these standard occupational comparisons correspond to a narrow part of the wage range. As we pointed out earlier, the skilled/unskilled ratios we have been discussing roughly correspond to the ratio of the 75th to the 25th percentile weekly wages which, for Montreal take values of 1.52, 1.47 and 1.57 for 1911, 1921 and 1931, respectively. In comparison, the ratio of the 90th to the 10th percentile weekly wages are 1.84 in 1911, 1.94 in 1921 and 2.35 in 1931. Thus, they follow the broad pattern discussed for the overall distribution: possible increases in dispersion over the first decade and very large increases over the second. Focusing just on trades and labourers wages is equivalent to focusing just on movements in the centre of the distribution. But, as Figures 1 and 2 show, the real action is in the bottom and top tails. The clear conclusion is still that there was a massive increase in inequality between 1911 and 1931.

4.2) Comparisons with the United States and Great Britain

Examinations of movements in the wage structure has a long tradition in the United States (e.g.,Ober(1952), Brown(1977), Williamson and Lindert(1980), Goldin and Margo(1992),

Hatton and Williamson(1998), Goldin and Katz(1998, 2001)). Unlike in Canada, the US Censuses do not contain information on earnings or wages before 1940 and so movements in wage differentials before WWII are mainly studied through comparisons of intermittent wage series for different occupations. In Table 7, we present wage ratios for skilled relative to unskilled blue collar workers for the United States from Goldin and Margo(1992) and compare them to ratios from out data that are constructed to be as similar as possible to their US counterparts. The first panel in the table shows the ratio of hourly wages of machinists to those of labourers. The US series does not extend back before the early 1920s but the data from that point through to 1940 show a small increase in the differential during the 1920s followed by a larger (though still not substantial) decline in the differential over the 1930s. For the same period, the same ratio from Canadian Census data shows a more substantial increase in the skill differential over the 1920s followed by a smaller decline in the 1930s. The net effect over the period from just before WWI to the start of WWII for Canada is essentially stability in the differential, albeit with some large swings within the period. The first column in the second panel contains data (also from Goldin and Margo(1992)) originally reported by Ober(1952) and shows the ratio of skilled to unskilled manufacturing sector hourly wages. The pattern between 1920 and 1940 is much like that for the machinists/labourers ratio in the first panel (as is the pattern in the National Industrial Conference Board data shown in the second column in the panel) . The pre-WWI observation also available in this data shows that there was a substantial compression in the skill differential between the pre and post WWI periods. The Canadian data also reveal a compression between 1910 and 1920, though to a much smaller extent than what is observed in the US series. Overall, as Goldin and Katz(2001) point out, the US series can be summarized as showing a major skill differential compression between about 1910 and the early 1920s followed by relative stability thereafter. In contrast, the Canadian series show much less compression across the whole period (or, possibly, none at all), generated as the result of compressions both in the 1910s and 1930s being offset by a substantial increase in the differential between 1910 and 1920. Finally, it is worth keeping in mind that these various time patterns start from a point at which the US had higher wage-skill differentials than any other English speaking country - something which is reflected in the higher US ratios here (Allen(1994).

In Table 8, we continue this comparative exercise but with a focus on the ratio of clerical workers to blue collar workers. This comparison plays a key role in Goldin and Katz(2001)'s discussion of the importance of the expansion in high school education in determining wage structures - a point to which we will return in the next section. The first three columns of Table 8 contain the ratios of wages of clerks to labourers for different periodicities and from different sources. The first two columns correspond to data from railroad records as reported in Goldin and Margo(1992). Both the monthly and hourly wage series agree on a pattern of substantial increase in this differential between the early 1920s and 1930 followed by a smaller contraction over the 1940s. The end result is an expansion of the differential over the whole period. The third column contains the same ratio (reported for weekly wages) for male clerks and labourers in factories in New York State (Goldin and Margo(1992)). While the source of the data is quite different from the first two columns, the substantial increase during the 1920s is the same. In this series, though, that increase is more than offset by a compression in the 1930s. The Canadian series in column 4 follows a very similar pattern to the US railway series. Over the longer run, the Canadian series show a compression of the white collar/blue collar differential between 1910 and 1940 but the compression is not large and conceals a substantial increase during the 1920s - an increase that is mirrored in the US data.

The conclusion that the white collar/blue collar differential underwent a significant increase during the 1920s in the US does not fit with the conclusions drawn by Goldin and Katz(2001). Their conclusion is much the same as the one they drew for the blue collar skill differentials: that the differential declined substantially during the decade of the First World War and then was relatively stable. This is based on their series showing the ratio of the weekly wages of male clerical to production workers in manufacturing, recreated here in the second panel in Table 8. Matched with this series is a matching series from the Canadian Census data. The Canadian series also shows a long run compression, though of less than half the size of the US compression. It also shows a substantial increase in the differential between 1920 and 1930. Thus, whether the Canadian and US white/blue collar differentials are in agreement in the inter-war period depends heavily on which US series we examine. The differences in the series, of course, may reflect differences in the denominator. The series used in Goldin and Katz(2001) corresponds to all production workers in manufacturing. That is, it will include the wages of, for

example, the machinists examined in Table 7 and other skilled workers. Depending on the weights placed on the various skill series, we might witness the lack of an increase in the series in the second panel because the denominator actually reflects increased returns to skill as well. In that case, it is the first panel series that are showing the true pattern in the differential between clerks and unskilled workers - the comparison on which the Goldin and Katz(2001) argument is notionally built.[13]

In Table 9, we present annual earnings ratios for both university professors and engineers to blue collar workers. Based on these series, Canada and the US both experienced a pattern of very substantial compression in the earnings differential between professors and labourers between 1910 and 1920 followed by very substantial increases in that differential across the decade of the 1920s and then strong compression in the 1930s. The compression in the 1910's is much larger for the US and the expansion in the 1920's is much larger for Canada but the overall pattern is similar. The net result is a long run reduction in this differential between 1910 and 1940 for the US but an expansion for Canada. The same general pattern, in which both countries follow the same decadal pattern but Canada's differential expands in the long run while the US differential contracts, is evident in the comparison of engineer's earnings to labourer's earnings in the second panel of Table 9. It is worth noting that the US engineer ratio differs from what is discussed in Goldin and Katz(2001). Goldin and Katz(2001) discuss the ratio of engineer's earnings to the average earnings for all manufacturing workers. That series shows the same compression in the decade of WWI but is essentially flat thereafter. We believe that a comparison purely to low skilled workers provides a cleaner basis for discussing relative factor price movements and so convert to the ratio of engineer to labourer wages presented here.

It is interesting to consider the levels of real wages for the unskilled labour that forms the

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[13] A rough check on this point can be obtained by using the Assistant Professors/ Labourers and Assistant Professors/Manufacturing Workers series from Goldin and Katz(2001). With them we can construct a ratio of Labourers to Manufacturing workers wages and then use that to readjust the Clerk/Production Workers series in Table 8. When we do so, the implied ratio of clerk's to labourer's wages become 1.9, 1.3, 1.44 and 1.38 in 1909, 1919, 1929 and 1939, respectively. Thus, the pattern is still one of large long run decline but it includes a substantial increase in the 1920's. This comparison is only rough because the Professor ratios are to the average wage of all workers in manufacturing while the clerical comparison is to all production workers in manufacturing. Still, the results are suggestive.

denominators in many of these ratios. As we have seen earlier, the real hourly wage for labourers in Canada was very flat over our period of observation. In comparison, the NICB series for real hourly wages of low skilled workers takes values of .18, .23, .27 and .40 in 1914, 1920/21, 1930/31 and 1940/41, respectively. Thus, in a period when labourers wages change little in Canada, they increase substantially in the US.

In Table 10, we present comparisons of wage ratios of skilled to unskilled blue collar workers for Canada and Great Britain. The Great Britain series (bricklayers/labourers and shipwrights/labourers) show the same broad pattern of contraction in the 1910s, expansion in the 1920s and contraction in 1930s that we have now seen in these skill ratios in both Canada and the US. Interestingly, the series for Great Britain show a greater similarity to the US than the Canadian series in the magnitude of these movements. As with the US series, the British series show substantially more contraction in the WWI decade, less expansion in the 1920s and clearer long run contraction than is evident in the Canadian series.

Finally, it is worth pointing out that because of the available data from the US and Britain, this series has necessarily taken the form of comparisons of individual skill ratios. The figures shown earlier provide a clearer overall picture of the movements in the wage structure for Canada. They point more clearly to an expansion in the differential between the top paying occupations and labourers over the long run. They also indicate real losses in the lower tail of the Canadian distribution that are missed in standard comparisons because those comparisons do not typically include lower paying service jobs. The overall picture is one of a more substantial increase in inequality in the Canadian wage structure than is evident in individual skill differentials, largely because the latter focus on differences corresponding roughly to the inter-quartile range. Whether one would form a somewhat different picture of movements in the overall wage structure for other countries if such data were available is unclear.

5) A Brief Consideration of Explanations

For Canada, the US and Great Britain, one clear pattern that emerges is the contraction of wage differentials between skilled workers of various kinds and labourers over the decade of WWI. An obvious explanation for this is the impact of the war itself which implied both an increase in demand for labour and a reduction in supply. The latter occurred mainly because of a shut down in immigration for the US, because of losses on the battlefield for Britain, and

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because of a combination of the two for Canada. As Goldin and Katz(1998) argue (quoting earlier sources) , there was an evident reduction in supply of unskilled labourers in particular, leading to a compression in skill differentials. The key question is why the skill differentials followed such different patterns in Canada, the US and Britain in the inter-war years. Why was this compression more than reversed in Canada but (in spite of some reversal in the 1920s) not in the US and Britain?

In a series of papers, Goldin and Katz argue that the expansion of public education in the US is the main reason why the skill differential compression was not reversed in that country (Goldin and Katz(1998, 2001)). They argue that the US experienced a major technological revolution in the inter-war period that made education more productive. Since, under the new technologies, both clerical workers and skilled blue collar workers made use of the types of skills taught in the expanding high school system, one would expect this to have led to an increase in wage differentials between clerical workers and unskilled labourers and between skilled blue collar workers and unskilled labourers - all else being equal. However, they argue, what they see as the unique position of the US in expanding public education generated a supply effect that more than offset the skill biased demand increase; ultimately leading to the maintenance of the skill differentials at the lower levels established during WWI.

Our reading of the evidence presented to this point in this paper is that it points to other factors being as important as (or possibly more important than) education in understanding wage movements in this set of countries. In terms of the British data, we have seen a similar pattern and overall size of compression in the skilled blue collar/labourer differentials relative to what is observed in the US series. Since Britain did not undergo the same expansion in public education at this time, this casts some doubt on making education the key determinant of international differences in labour market developments.

The Canadian data also suggests a need to look at other factors. Canada went through an educational expansion that appears to be very similar to that in the US in this period. While we do not have evidence that matches the Goldin and Katz(2001) data exactly, a 1931 Census manuscript provides details on school attainment over the previous decades for Canada (McClean(1931)). Goldin and Katz report an increase in high school enrollment for 14 to 17 year olds from approximately 39% in 1921 to 55% in 1931. McClean reports that 44% of 14 to 17

year olds were in school in Canada in 1921, increasing to 56% in 1931. Since these numbers likely include some students who are in a grade below high school (which started in grade 8 in Canada in this period), the level of Canadian secondary school attendance may not match its US counterpart as closely as these number suggest, but the growth rate is apparently of the same order of magnitude. Indeed, much of McClean's discussion focuses on the substantial expansion of school attendance among older age teenagers in Canada in this period. The idea that Canada underwent a similar educational transformation to the US in this period is important for considering the source of the wage patterns presented here. Since Canada presumably had access to similar technologies, the fact that Canadian skill differentials expanded in the inter-war period indicates a need to look to factors beyond education to obtain a complete explanation for movements in the wage structure of both countries.

A natural candidate for another important driving force is immigration (Hatton and Williamson(1998)). During the period from 1890 to 1914 both Canada and the US operated essentially laissez-faire immigration policies. Restrictions on who were to be admitted were minimal. In the main, they came down to excluding the sick, the poor, and criminals; all other prospective immigrants gained immediate access. As a result, immigration levels were driven mainly by market forces and during the first decade of the 20th century, the US admitted approximately to a million immigrants a year. Although the Canadian inflow never reached this total, it averaged about 150,000 per year between 1900 and 1910 and reached very high peak levels (over 400,000 in 1913) in the few years just before WWI. Considering that the US population was ten times Canada's, it is clear that immigration played as important a role in shaping developments in Canada as it did in the US.

Two events finally slowed the level of inflow . The first was the outbreak World War I, which effectively stopped the exodus from Europe The second was new legislation. In the US this took the form of the passage of Immigration Act of 1917 which began the process of restricting immigration. Although it subsequently proved largely ineffective, nevertheless Goldin (1994) claims it signaled the end of mass migration. In 1919 Canada followed suit by passing an amendment to its 1910 Immigration Act requiring a literacy test, echoing that in the US.

The 1920's witnessed a major divergence in the evolution of immigration policy between the two countries. In the United States the Quota Act of 1921 followed the restrictionist pattern

set by the 1917 Act. In particular, it set numerical limits for immigrants from areas outside the Western Hemisphere. The 1921 Act was followed by the Quota Act of 1924. These latter two acts (1921 and 1924) were designed to control not only annual total arrivals but were also meant to restrict the inflow from southern and eastern Europe by allocating quota points based on the proportion of the total population of a given country as recorded in the 1920 census. The quota system was imposed gradually during the decade of the twenties. The effect was (a) to lower the total inflow to around 200,000 to 300,00 a year (b) to admit relatively more migrants from northern and western Europe than from southern and eastern Europe. By the end of the twenties not only had the level of the flow been sharply reduced but the composition was increasingly determined by migrants from traditional source regions of northern and western Europe.

In contrast to the US, Canada adopted a more flexible immigration policy in the 1920's. Under the Canadian system, the annual inflow of immigrants was determined by short run economic conditions in Canada. Hence as the domestic labour market tightened (i.e. unemployment rates fell), the government opened the doors to the admittance of more immigrants. By the mid-1920s, Canada's immigration inflow was between 150,000 to 200,000 per year, approximately the same level as in the first decade of the twentieth century. The opposite occurred when unemployment levels increased. This "tap on tap off " or absorptive capacity model became one of the key defining features of Canadian immigration policy. Furthermore, US policy remained fixed until the Immigration Act was changed. Immigration policy in Canada was set by Order-in Council, i.e. by the Cabinet. Short run changes in immigration levels, therefore, did not need the approval of Parliament to be implemented.

This administrative flexibility was used by Canada to effectively shut down immigration with the onset of the Great Depression. In 1931, under Order-in-Council PC 695, all immigration was prohibited except for British citizens, immigrants from the US, farmers, domestics, and wives and dependent children. As a result, immigration levels fell to 27,000 in 1931. In comparison, the US made only a few minor changes to who was eligible for admission in the 1930s. They still faced a downturn in immigration levels (35,000 immigrants in 1935) but Gemery(1994) argues that this was driven by economic forces rather than policy. In essence, for both countries, immigration was largely suspended between 1930 and 1950.

It is interesting to consider the relative movements in the Canadian and US wage

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structures in light of the similarity in their educational expansions and the difference in their immigration experience. While real wages for low skilled workers in Canada were flat between 1910 and 1930, with a small rise over the 1930s, the low skilled wage in the US rose by 50% between the immediate pre-war period and 1930 then rose by another 50% between 1930 and 1940. Recall, also, that while unskilled labourers made up a declining proportion of the workforce in the US in this era, Table 4 shows that the proportion accounted for by labourers increased substantially between 1921 and 1931 in Canada. These are the types of differences one might expect between a country that had substantial immigration and one that did not. Similarly, given the unskilled nature of Canada's immigration in the 1920s, immigration may help explain why inequality in the wage structure appeared to rise so much more sharply than in the US in that decade. In the 1930s, when immigration was shut down in both countries, skill differentials contracted in both. This fits with Hatton and Williamson(1998)'s arguments that mass migrations had substantial impacts in widening wage structures in receiving countries in this era. Although, Allen(1994) argues that migration flows were not sufficient to completely equalize real wages across English speaking countries between 1879 and 1913 - a lesson worth keeping in mind in these results, which show that Canada and the US apparently maintained quite different wage structures in spite of migration flows between the two.

This is not to suggest that the substantial educational changes occurring in both countries were not important. One way to read these data is that the US wage structure evolved along the lines indicated in Goldin and Katz's explanation because the lack of immigration put emphasis on developments in domestic supply. The data on differentials between white collar and unskilled blue collar workers presented here, however, suggest the story may have an extra wrinkle relative to what they describe. In particular, those differentials appear to have risen during the 1920s in the US - possibly to a considerable extent. Thus, it is possible that the technical changes they describe did lead to substantial rises in skill differentials (in the 1920s) before enough of a stock of more educated workers was built up to offset them to some degree (in the 1930s). The data in Goldin(1998) indicate that high school graduation rates rose by about 15% between 1920 and 1930 but by 20% between 1930 and 1940. The idea that there could have been an expansion in inequality in the 1920s in the US seems to fit with popular descriptions of the age as well (Friedman(2005)).

The possibility that differences in immigration had substantial impacts on the wage structures in Canada and the US has important implications for the development of the two economies. Wylie(1989) and Keay(2000) argue that Canadian and US firms within the same industries used quite different technologies in the early 20th Century, with Canadian firms using more labour intensive production techniques. The result, according to Keay(2000), is that Canadian firms look very unproductive when compared using a simple output per unit labour measure of productivity but much more comparable when using TFP measures. Wylie(1989) argues that the more labour intensive approach of Canadian firms stemmed from combinations of greater reductions in the costs of electricity, higher capital costs (due to tariff considerations) and greater immigration in Canada relative to the US. The result was that labour was less productive and, hence, would have lower wages. It is important to recognize that this earlier work does not break labour down by skill. Our work indicates that it is unskilled labour in particular that became relatively less expensive. Given the wage structures we have presented, one would expect Canadian industries to also be less human capital intensive than their US counterparts, with the ultimate reason for differences lying in different immigration policies. In the US, where there is an expansion of the supply of skilled labour through education but a cut off in immigration (and hence the supply of unskilled labour), the relative price of skills contracted and firms adopted technologies that, as Goldin and Katz(1998) argue, were more skilled labour intensive. In contrast, in Canada, where there was also an increase in skilled labour but it was matched with an increase in the supply of unskilled labour (through immigration), the relative price of skilled labour either expanded or fell by much less than in the US. This raises the possibility that Canadian firm opted for more unskilled labour intensive production techniques; though, this remains simple speculation at this point.[14]

6) Conclusions

In this paper, we examine movements in the Canadian wage structure over the first half of the twentieth century. We primarily rely on Census data and focus our attention on the 1910/11, 1920/21 and 1930/31 Census years. We enter tabulated data on weekly earnings for

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[14]See Acemoglou(1998) and Beaudry and Green(2003) for recent models of technological choice driven by relative factor supplies. The idea of factor supply induced technological change, of course, has a long history (e.g., Hicks(1939)).

males over age 15 in 11 major Canadian cities by detailed occupation and age categories and use this to construct a version of the wage distribution. Because it is based on occupation-age group level earnings, we miss variation within occupations and, thus, likely understate the dispersion in the distribution. Nonetheless, the occupational coding is detailed enough to suggest that we are able to capture a significant portion of wage inequality. We are certainly able to depict the cross-occupation wage structure and its movements.

Using this data, our main finding is that the wage distribution experienced a dramatic increase in dispersion between 1911 and 1931 followed by a smaller contraction between 1931 and 1941. The increase occurred in two steps. Between 1911 and 1921, the real wages corresponding to the lowest percentiles of the distribution fell sharply, those in the middle fell by much less, and those in the top half of the distribution fell quite strongly. The result is a mixed bag in terms of inequality movements: there is an increase in inequality in the lower half of the distribution but a decrease in the upper half. Between 1921 and 1931, the lower tail of the distribution essentially remained at the inferior values attained by 1921, the middle part of the distribution showed large real increases and the top 15 percentiles grew even more dramatically. As a result, by 1931, both the lower and upper tails of the distribution had shifted out substantially relative to 1911. By 1941, reductions in higher level earnings implied some compression in the wage structure, though to an overall structure that was still much more unequal than what was observed before WWI. It is worth emphasizing that the main movements in the wage structure occurred in the tails of the distribution. Standard discussions are expressed in terms of comparisons of wages of blue collar skilled workers and clerical workers to those of labourers. Since this amounts, essentially, to comparing workers at the 75th percentile to those at the 25th percentile of the overall distribution, such comparisons tend to understate or miss entirely the most dramatic of the wage structure shifts documented here. Those shifts are important because they are the backdrop against which Canadians began to debate installing a redistributive system in the 1930s and 1940s.

Underlying these overall patterns are shifts in the distributions of workers across geographic, age, and occupation categories. Decompositions of the movements in the distributions reveal that geographic shifts play little role in explaining movements in the wage distribution. In contrast, shifts in the age structure can explain approximately half of the increase

in inequality in the lower half of the wage distribution between 1911 and 1921. Once we hold both the age and occupation distributions constant, there is no increase in inequality in the lower tail: all occupations below the median experience an approximately 10 to 15% real decline. The decline in real wages in the upper tail, holding city, age and occupation constant is even greater, implying an overall compression of the wage structure. Over the period from 1911 to 1931, holding age, city and occupation constant has relative small effects on the distribution, implying that the large compression in the upper half of the wage distribution in the 1910s and the much more substantial increase in real wages in that part of the distribution in the 1920s is mainly a reflection of shifts in the wage structure rather than being due to compositional shifts. Using this data, we can also examine occupation and city constant age-earnings differences, which reveal a relatively constant increase in what might roughly be interpreted as the "returns to experience" over our period.

We compare the results using the Canadian Census data to both US and British data. The discussion in those countries is mainly in terms of wage ratios of skilled white and blue collar workers relative to unskilled labourers. Using the same ratios for Canada reveals that Canada experienced much smaller declines (or, in some instances increases) in the blue collar skilled/unskilled ratios over the long run (from just before WWI to 1940) than either the US or the UK. The same is true for comparisons of skilled white collar wages to those of labourers in Canada and the US. We argue that, since Canada and the US underwent similar expansions in their high school education systems in this period, these very different experiences may well be due to substantial differences in immigration policy. The US effectively shut down immigration in the inter-war period while Canada continued to have large immigration inflow between WWI and 1930. These results fit with Wylie(1989) and Keay(2000)'s findings that Canadian firms adopted more labour intensive production techniques than their American counterparts in the same industries. Those results are based on aggregate labour measures. Our results point to further differentiation between the two countries in relative skill price movements. The evidence presented here, however, really only serves to raise the possibility that immigration is important and further investigation is warranted. The point of this paper is to document the shifts in the overall wage structure with the hope that they will serve as an important input for future investigations of developments in this crucial period in the Canadian economy.

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Table 1
Summary Statistics For Census Based Weekly Wage Distributions
(1913 Dollars)

Statistic	1911 Census	1921 Census	1931 Census
Mean	18.07	16.56	20.23
Standard Dev.	7.74	5.99	10.1
Percentile			
1	8.21	6.41	6.22
5	10.27	9.12	9.93
10	11.88	10.5	11.34
25	13.84	12.7	14.18
50	16.91	16.16	18.13
75	20.77	18.83	23.27
90	23.91	22.81	31.53
95	29.27	27.35	40.77
99	45.14	37.86	60
Squared Coef. Of Variation	0.183	0.131	0.249
log 90-10 Ratio	0.7	0.78	1.02
log 90-50 Ratio	0.35	0.34	0.55
log 50-10 Ratio	0.35	0.43	0.47

Based on Census tables described in text.

Table 2 :
Occupations by Location in Overall Weekly Wage Distribution and Age

Percentile Range	Age 15-24	Age 25-64	Age 65 +
Below 10th Percentile	- personal service (char workers) - apprentices (construction, boot and shoe making) - teachers - messengers	- service related to cleaning (char workers, laundrymen) - servants	- service related to cleaning - some non-metal manufacturing (tobacco makers) - messengers
10th - 25th Percentile	- manuf., likely mostly apprentices (pottery makers, canners) - barbers - drivers - clerks - labourers	- hotel and restaurant service (janitors, hotel workers) - resource workers (agricultural labourers, shantymen)	- resource workers - hotel and restaurant workers - labourers
25th - 50th Percentile	- construction trades, not including apprentices - metal manuf. trades, mainly not apprentices - millers - professionals (electrical engineers, lawyers) - transportation and comm. skilled and semi-skilled (baggagemen, conductors)	- barbers -cooks - non-metal manufacturing skilled and semi-skilled (Textile workers, bakers) - messengers - sailors - labourers	- skilled and semi-skilled construction - non-metal manufacturing skilled and semi-skilled - teachers - salesmen - longshoremen - clerks
50th - 75th Percentile	- managers and foremen in service and non-metallic manufacturing - skilled and semi-skilled transportation (brakemen, street rr conductors)	- construction trades - metallic manuf. skilled (blacksmiths, machinists) - skilled clothing (hat and glove makers) - millers - furniture makers - teachers - transportation skilled (conductors) - longshoremen	- construction trades - metallic manufacturing, skilled - skilled clothing - millers - transportation skilled and semi-skilled - warehousemen

75th - 90th Percentile	- construction and transportation managers - civil and mechanical engineers	- tailors - skilled metal (tool makers, boiler makers) - artists - physicians and surgeons - transportation and communication skilled and semi-skilled (telephone linemen)	- transportation and communications skilled and semi-skilled (brakemen, locomotive engineers, telephone linemen)
90th - 95th Percentile	- Pulp and paper managers - Steam RR managers	- construction foremen - service, food, beverage manuf. managers - dentists	- manufacturing managers - mechanical engineers
Above 95th Percentile	-	- constr. managers - manuf. managers (pulp and paper, chemical) - professionals (engineers, lawyers, accountants, professors) - financial managers - retail managers - steam rr and communications managers	- manufacturing managers - professionals - financial and insurance managers - steam rr managers

75th - 90th Percentile	- construction and transportation managers - civil and mechanical engineers	- tailors - skilled metal (tool makers, boiler makers) - artists - physicians and surgeons - transportation and communication skilled and semi-skilled (telephone linemen)	- transportation and communications skilled and semi-skilled (brakemen, locomotive engineers, telephone linemen)
90th - 95th Percentile	- Pulp and paper managers - Steam RR managers	- construction foremen - service, food, beverage manuf. managers - dentists	- manufacturing managers - mechanical engineers
Above 95th Percentile	-	- constr. managers - manuf. managers (pulp and paper, chemical) - professionals (engineers, lawyers, accountants, professors) - financial managers - retail managers - steam rr and communications managers	- manufacturing managers - professionals - financial and insurance managers - steam rr managers

Table 3
Age Distribution of Wage Earners, By Census Year

Age Group	1911 Census	1921 Census	1931 Census
15-24	0.29	0.23	0.22
25-64	0.69	0.75	0.76
65 +	0.018	0.024	0.027

Table 4
Occupational Distribution of Wage Earners

Occupation	1911 Census	1921 Census	1931 Census
Construction Trades	0.18	0.11	0.12
Service	0.045	0.04	0.056
Government	0.036	0.047	0.021
Resource Sector	0.004	0.0071	0.0064
Non-Metal Manufacturing	0.15	0.11	0.088
Metal Manufacturing	0.08	0.078	0.057
Professional	0.018	0.029	0.037
Transportation, Trade and Communication	0.26	0.27	0.21
Clerical	0.047	0.12	0.12
Labourers	0.16	0.15	0.24
Managers and Foremen	0.02	0.042	0.038

Table 5
Weekly Wage Ratios

Occupation	1911 Census	1921 Census	1931 Census
Ratios Relative to Labourers			
Bakers	1.28	1.16	1.28
Tool Makers	1.43	1.37	1.62
Machinists	1.45	1.33	1.5
Boiler Makers	1.48	1.33	1.49
Carpenters	1.39	1.29	1.46
Bricklayers	1.59	1.35	1.73
Servants	0.91	0.68	0.7
Barbers	1.24	1.08	1.13
Clerks	1.67	1.4	1.62
Accountants	2.46	2.17	2.7
Civil Engineers	2.55	2.08	3.19
Service Managers	1.94	1.72	2.32
Financial Managers	3.46	2.73	4.36
Other Comparisons			
Barbers/Servants	1.37	1.58	1.62
Accountants/Clerks	1.47	1.55	1.66
Civil Engineers/Clerks	1.52	1.48	1.97

Table 6
Ratios of Machinists to Labourers Hourly Wages
Various Canadian Sources

Year	Census	Labour Gazette	CPR Data
1910/11	1.46	1.54	2.18
1920/21	1.42	1.87	1.88
1930/31	1.62	1.88	2.08
1940/41	1.6	1.78	-

Sources: Census data is the data described in section 2 of the paper but restricted to Montreal. Conversion to hourly wages is done using Herb Emery's hours series constructed from the Labour Gazette. The Labour Gazette data is a continuous series underlying the data reported in Emery and Levitt(2002). Note that the value in the 1910/11 row is actually just for 1910 and the value in the 1940/41 row is actually for 1938. We are grateful to Herb Emery for providing us with this series and the hours series. The CPR series is from Makinnon(1996) and is based on Canadian Pacific Railway administrative series.

Table 7
Skilled/Unskilled Wage Differentials
Blue Collar Workers, Canada and the United States

	Machinists/ Labourers		Manuf Skilled/ Unskilled		
Year	US	Canada	US(1)	US(2)	Canada
1910/11	-	1.49	2.05	-	1.35
1920/21	2.03	1.41	1.75	1.41	1.24
1930/31	2.06	1.57	1.8	1.39	1.36
1940/41	1.92	1.52	1.65	1.35	1.25

Notes: The dates in the first column correspond to the years for the Canadian Census observations. US data correspond to the closest dates available, as listed below. The Machinists/Labourers ratio relate to hourly wages. The Canadian series is constructed as in Table 6 but for all of Canada rather than just Montreal. The US series is from Goldin and Margo(1992), Table 7, and corresponds to wages on Class I steam railroads. The actual years reflected are:1922, 1930/31, and 1940/41. The US(1) series is from Goldin and Margo(1992) Table 7 and are originally from Ober(1952). They correspond to hourly wages in various skilled and unskilled manufacturing occupations in urban areas and reflect data from: 1907, 1918, 1931 and 1938. The US(2) is also from Goldin and Margo(1992) and comes originally from National Industrial Conference Board data. It corresponds to the ratio hourly wages in skilled and semi-skilled manufacturing production occupations to those in unskilled manufacturing production occupations, with the actual years reported being 1922, 1930/31 and 1940/41. Both US series are compared to a ratio of weekly wages from Canadian Census data with the numerator consisting of all skilled and semi-skilled occupations in manufacturing and the denominator corresponding to all labourers

Table 8
Ratios of Wages for Clerks to Blue Collar Workers
United States and Canada

	Clerks/	Labourers			Clerk/	Prodn
Year	US(1) monthly	US(2) hourly	US(3) weekly	Canada weekly	US weekly	Canada weekly
1910/11	-	-	-	1.41	1.65	1.3
1920/21	1.57	1.57	1.89	1.27	1.2	1.16
1930/31	1.86	1.73	2.33	1.43	1.13	1.3
1940/41	1.69	1.67	1.83	1.33	1.15	1.12

Notes: The dates in the first column correspond to the years for the Canadian Census observations. US data correspond to the closest dates available, as listed below. US(1) and US(2) are from Goldin and Margo(1992) and is based on data for workers in Class I Steam Railroads. They represent the ratio of either monthly or hourly wages for clerks to labourers. The actual years are: 1922, 1930/31, and 1940/41. US(3) is also from Goldin and Margo(1992) and represents the ratio of weekly wages for male clerks in New York State factories to the unskilled NICB series (used in US(2) in Table 7). The actual years are: 1923, 1930/31, and 1940/41. The Canadian series is the ratio of weekly wages for clerks to those for labourers in all industries. The US Clerk/Prodn series is from Goldin and Katz(2001) and represents the ratio of weekly wages of all male clericals other than supervisors in manufacturing to production workers in manufacturing. The actual years are:1909, 1919, 1929 and 1939. The Canadian series is the ratio of weekly wages for all clericals (excluding managers) to all skilled and unskilled workers in manufacturing occupations.

Table 9
Ratios of Earnings of Professionals to Blue Collar Workers
Canada and the United States

	Professors/	Labourers	Engineers/	Labourers
Year	U.S.	Canada	U.S.	Canada
1910/11	2.83	2.23	1.38	1.93
1920/21	1.93	1.91	1.09	1.53
1930/31	2.74	3.86	1.32	2.36
1940/41	2.18	3.04	1.21	2.01

Notes: The dates in the first column correspond to the years for the Canadian Census observations. US data correspond to the closest dates available, as listed below. The Profs/Labour series for the US is the ratio of annual earnings of Assistant Professors at land grant universities to the NICB low skilled workers series and is from Goldin and Katz(2001). The years are those given in the first column. The Canadian series is the ratio of annual earnings of university professors (of all ranks) to those of labourers from all industries. The US Engineers/Manuf. Workers series also from Goldin and Katz(2001) and combines the ratio of annual earnings of starting engineers to average earnings in manufacturing with two series on the ratio of professors' earnings to blue collar workers to construct the ratio of engineer's earnings to those of labourers. The Canadian data is the ratio of annual earnings of civil engineers (of all seniority levels) to the average in all manufacturing occupations.

Table 10
Skilled/Unskilled Wage Differentials
Blue Collar Workers, Canada and Great Britain

	Bricklayers/	Labourers	Shipwrights/	Labourers
Year	UK	Canada	UK	Canada
1910/11	1.5	1.59	1.81	1.49
1920/21	1.24	1.4	1.32	1.41
1930/31	1.34	1.76	1.46	1.57
1940/41	1.28	1.43	1.31	1.52

Notes: The dates in the first column correspond to the years for the Canadian Census observations. British data correspond to the closest date available, as listed below. Both the Bricklayers/Labourers and Shipwrights/Labourers series for the UK come from Knowles and Robertson(1951). The data for Bricklayers and Labourers in the first ratio correspond to the averages of weekly wages in the respective occupations in 39 large towns in Great Britain. The data in the second ratio correspond to weekly wages paid in the shipbuilding industry in 9 major centres in Great Britain. The actual years correspond to: 1913, 1920/21, 1930/31, and 1940/41. For Canada, all numbers correspond to weekly wages. Labourers are from all industry groups. Shipwrights are not reported separately and so we use the "Machinists and Millwrights" occupation as a comparator.

Appendix A
Occupational Concordance across the 1911, 1921 and 1931 Censuses

In this appendix, we describe some of the main decisions we made in generating a consistent set of occupational categories for comparisons across Censuses. The Excel spreadsheets containing the actual data (including occupation numbers assigned by us) and a concordance linking our assigned occupation numbers from each Census to the Concordance Grouping occupations is available upon request. From those files, the reader can see every decision we made and make different ones of their own. In this appendix, we explain only the major decisions we made.

Labourers are reported under separate industry categories in both the 1911 and 1921 Censuses but are collected together in one category for the 1931 Census. Thus, we create one "labourer" category in all three years. The introduction to Volume V in the 1931 Census says that the labourer categories in the 1921 Census include "a number of males in the occupations, 'boiler firemen' and 'packers'" who are classified elsewhere in the 1931 tables. In response to this, we added the "packers, wrappers and labellers" category to the labourers in 1931. There is also a separate "boiler firemen" category in 1931 but the average wage in that occupation is $4 per week higher than for labourers and so we decided to leave it in the "electrical and gas workers" category rather than move it into the labourers category.

Clerical workers are listed separately by industry in the 1921 Census but grouped together in the 1931 Census and sub-divided according to occupations. We match all the 1921 clerical workers with the clerical occupations in the 1931 Census. In addition, the introduction to volume 5 in the 1931 Census states that the 1921 clerical group includes data on the same occupations as for 1931 plus, shippers, proofreaders, weighmen, accountants and postmen. We include the shippers, proofreaders, weighmen and postmen in our general clerical category. We did not incorporate accountants because there is a separate accountant category to match with in the 1921 Census and because accountants earn approximately $30 per week more than other clerical workers in the 1931 Census, suggesting they do not truly belong in the clerical worker category. For the 1911 Census, the clerical group is formed from "office employees" in all industries plus "stenographers and typists".

Both the 1921 and 1931 Censuses report data on separate "managers" and "foremen" categories for various industries. However, the 1911 Census documentation typically only states "managers and superintendents" in each industry, with "and foremen" written in for some cases. It seemed plausible to us that this category included foremen in all cases in 1911 and so we combined managers and foremen in 1921 and 1931. We constructed an alternative "conservative" concordance in which, among other decisions, foremen were omitted from the 1921 and 1931 data. Our general conclusions were unaffected by this change.

The 1911 documentation lists "agents" as a separate category in many industries. We matched those with "sales and purchasing agents" in 1921 and with "purchasing agents and buyers", "sales agents, canvassers, demonstrators" and "commercial travelers" in 1931. In both of the latter years, these categories are collected in one place rather than being listed separately by industry.

The 1911 documentation lists a "builders and contractors" category. There is no such category in the other Censuses. It is worth recalling that there are no "own account" workers in

these tabulations for any of the Census years. We suspect that these are actually carpenters or other tradesmen who sometimes work on their own and sometimes hire themselves out. Their weekly wages are certainly very close to those of carpenters in 1911 ($16.95 per week versus $16.34 for carpenters). We group them with carpenters in our main data. In our conservative concordance, we drop them altogether.

Apprentices are sometimes listed as a separate occupational category affiliated with another category (e.g., "boot blacks apprentices"). However, only in the case of the building trades are these apprentice categories consistently listed across all three Censuses. In the other cases, we believe that apprentices have been combined with other workers in the main occupational category (e.g., boot blacks) when they do not appear as a separate category and we set up our occupational groupings accordingly. In our conservative concordance, we simply drop apprentices in all cases other than the building trades.

Government employees are reported in varying degrees of specificity in the various Censuses. To form a consistent categorization, we combined all government workers other than labourers from all levels of government into one category. This is a very diverse category, including everything from firemen to managers in the federal government.

In all Census years there are miscellaneous manufacturing occupation categories. We matched these together but did not throw into them occupations for which we could not find a match in other years. The latter types of categories we simply dropped.

The categories in all years are really combinations of occupations and industries. For example, there are separate entries for managers in different manufacturing industries. The 1931 tables have more aggregated industry categories than the earlier Censuses and, as a result, it is those groupings we are forced to use when building the concordance. In both the 1911 and 1921 data, iron and steel manufacturing is separated from other metal manufacturing but this is not the case in 1931. Thus, we are forced to combine categories from iron and steel with non-ferrous metal manufacturing in the 1911 and 1921 data, creating, for example, one machinist occupation category rather than two.

The key question for our purposes is whether merging and dropping categories in this way significantly alters the distributions we are considering. In figure A1, we plot the kernel smoothed density for 1911 constructed using all the data at our disposal with the density for the same year based only on the data that we could use in our concordance categories. The two densities are extremely similar, with the 95/5 ratio for the full dataset (2.85) being very similar to that for the concordance categories distribution (2.80). The same pattern exists for the other two years, suggesting that using the concordance categories in order to allow comparisons across years will not affect our conclusions.

Figure 1:
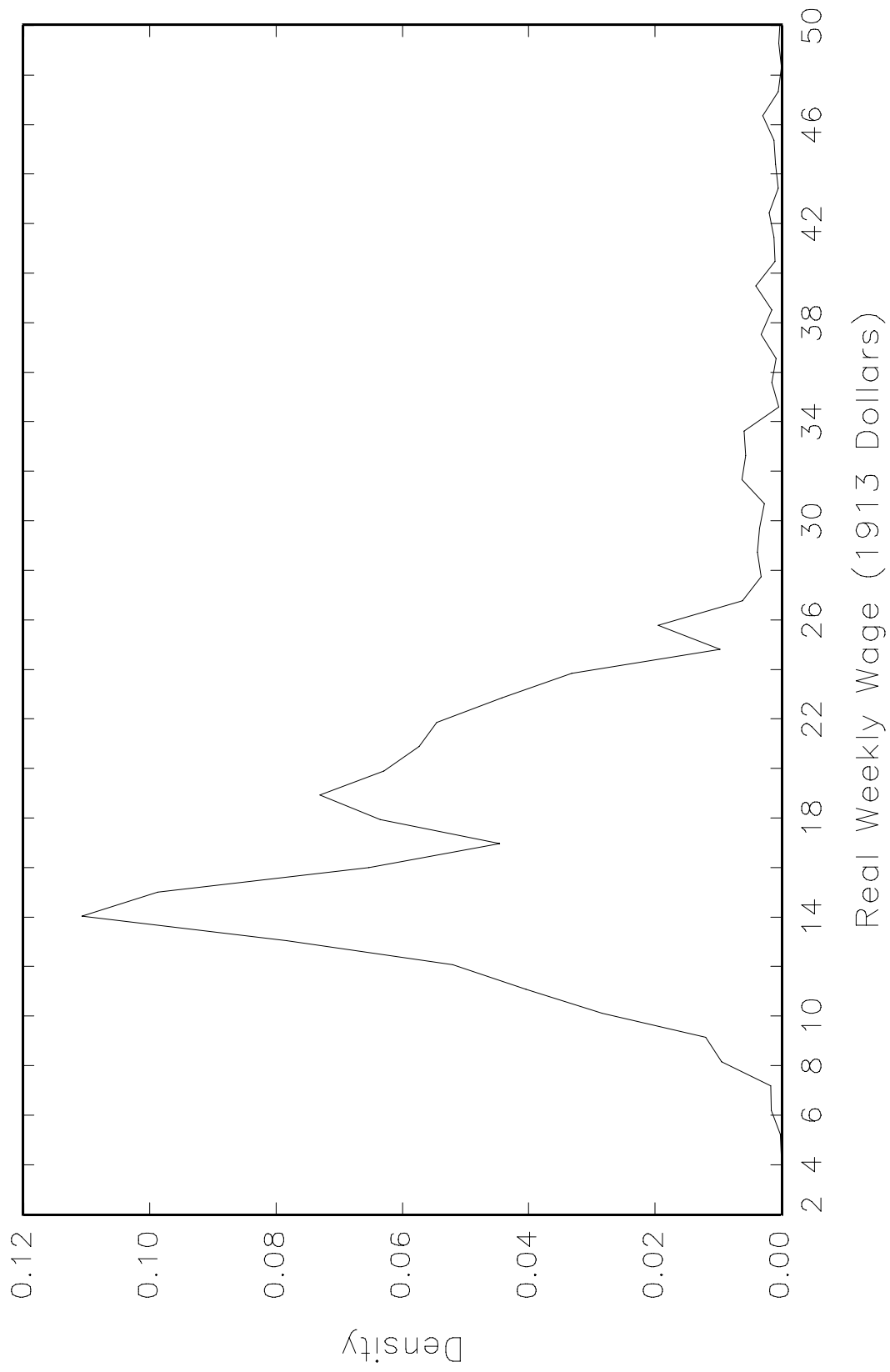Kernel Density Plot For 1911, Males

Figure 2: Differences in Log Percentiles,
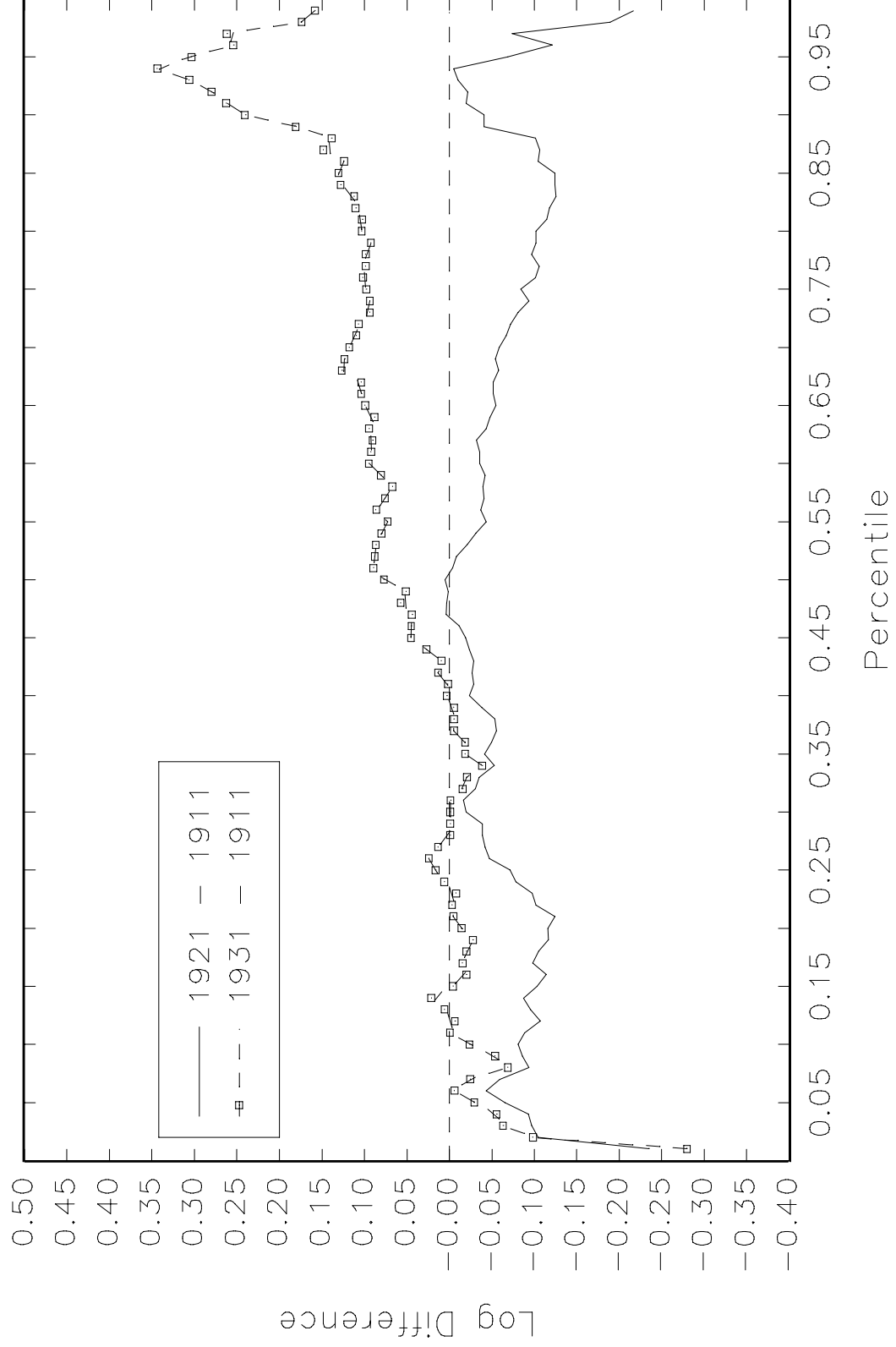Weekly Wages, 1921 versus 1911 and 1931 versus 1911

Figure 3: Differences in Log Percentiles,
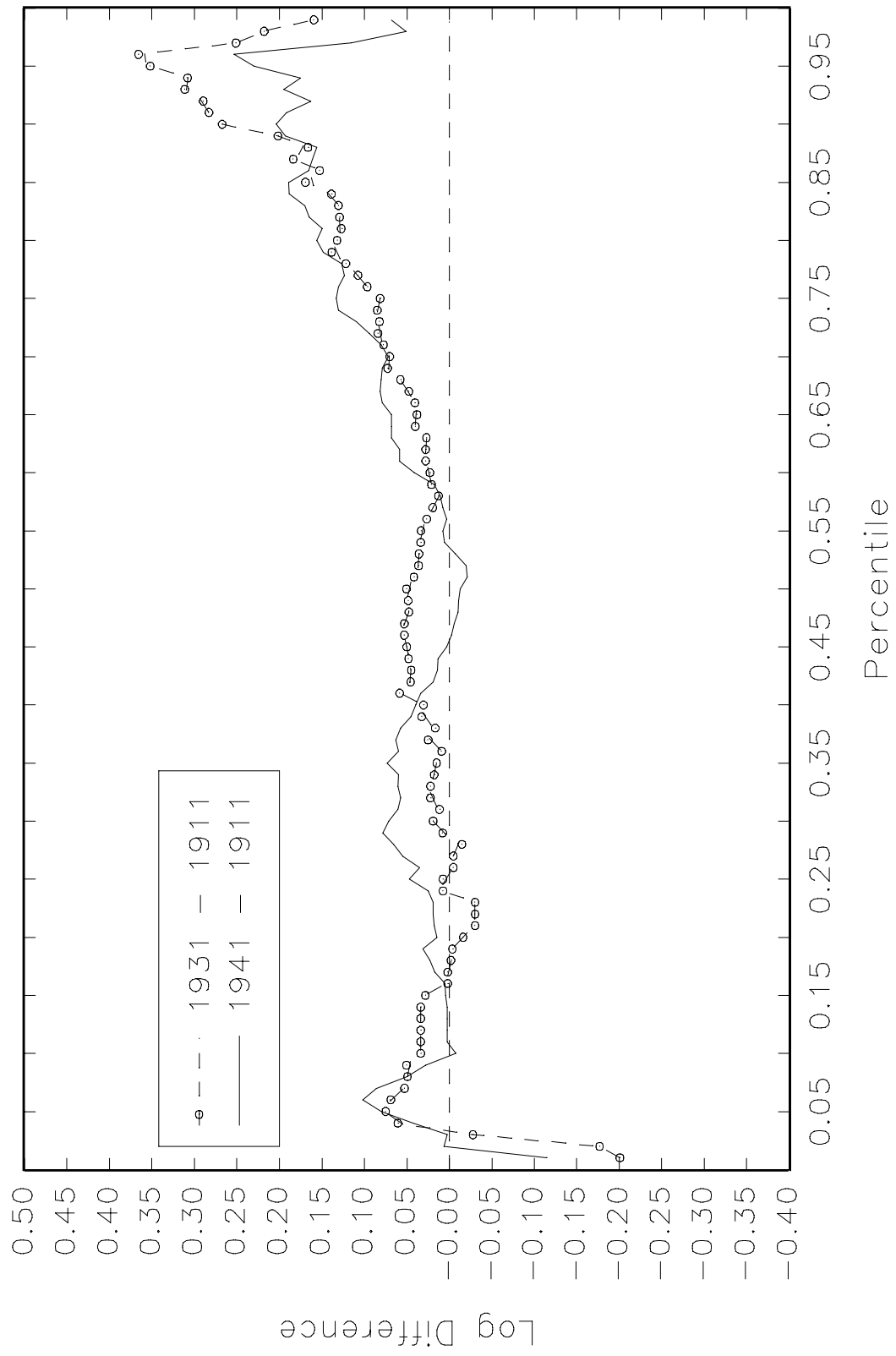Weekly Wages, 1931 and 1941 versus 1911

Figure 4: Differences in Log Percentiles,
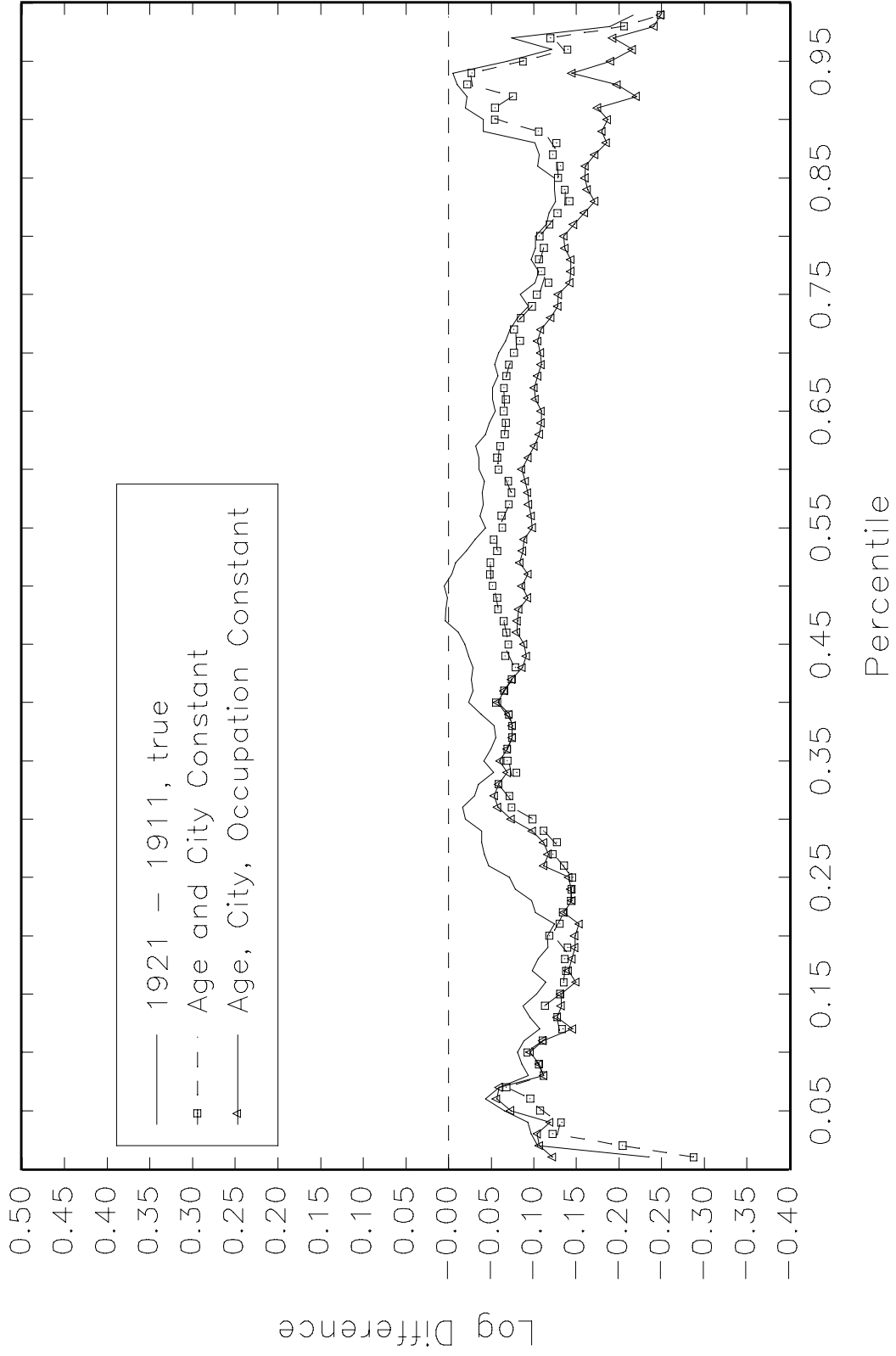Decomposition of the 1921 − 1911 Difference

Legend:
1921 − 1911, true
Age and City Constant
Age, City, Occupation Constant

Percentile

Log Difference

Figure 5: Differences in Log Percentiles,
Decomposition of the 1931 – 1911 Difference

Legend:
1931 – 1911, true
Age and City Constant
Age, City, Occupation Constant

Log Difference

Percentile
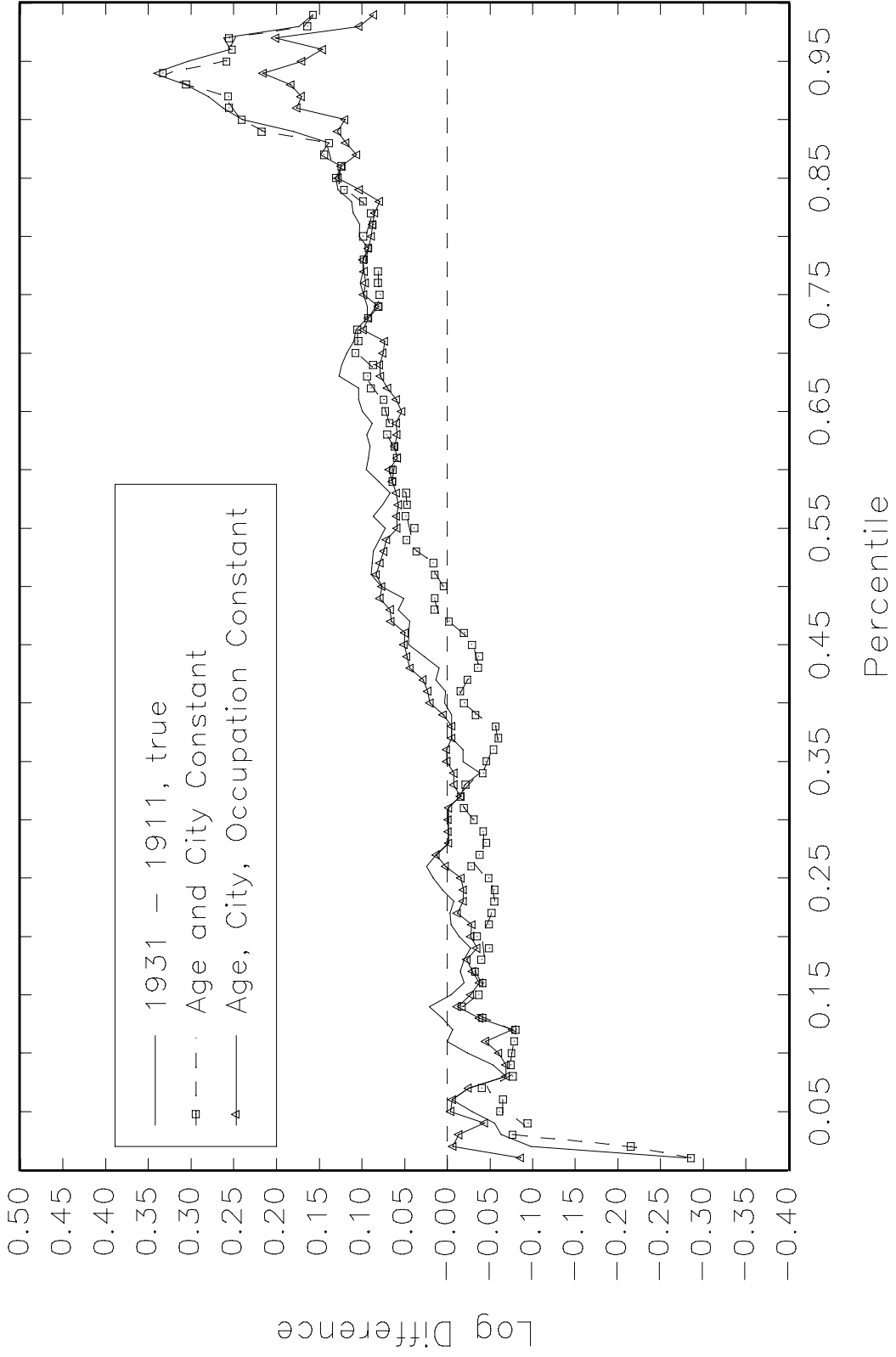
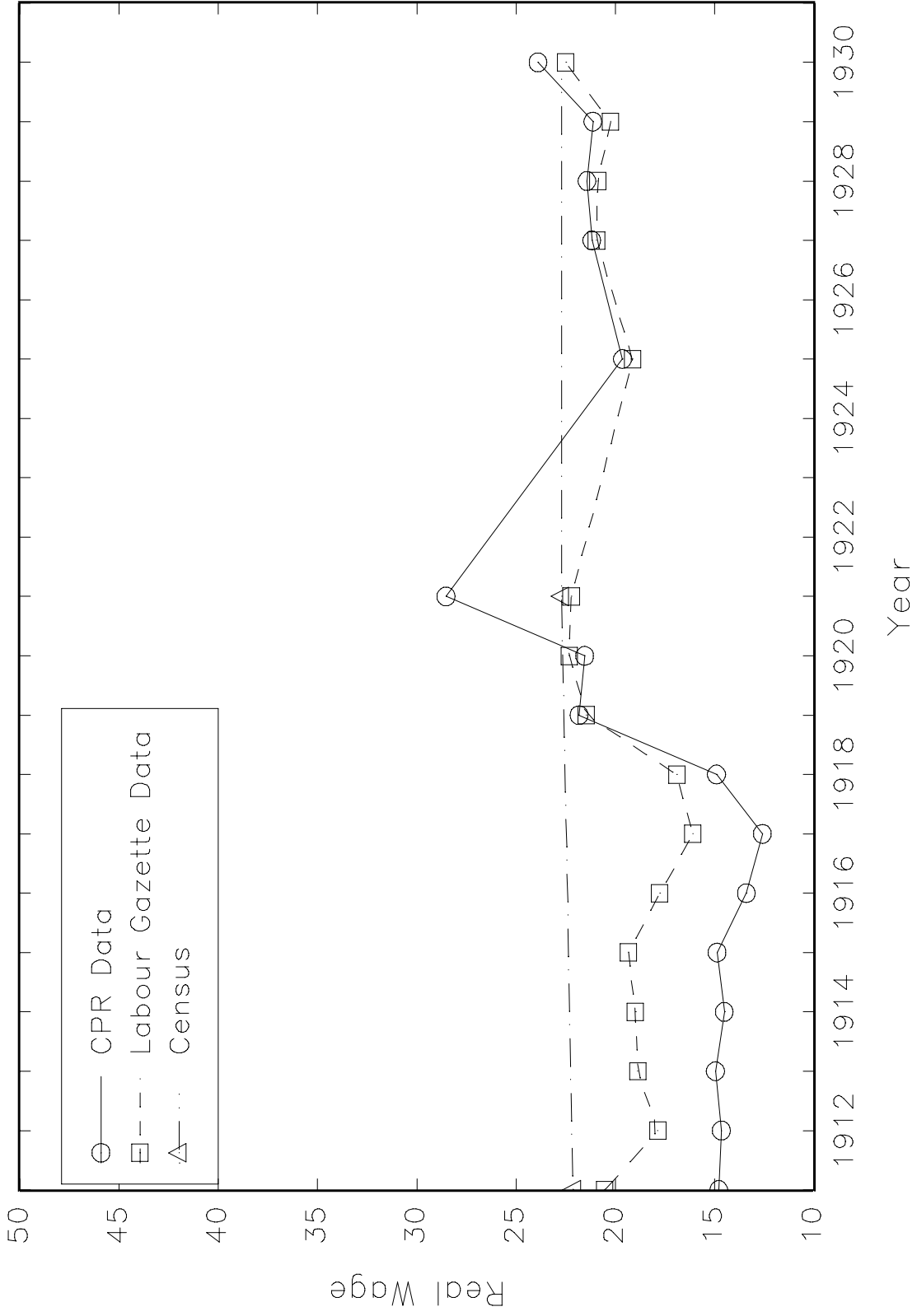Figure 6: Real Hourly Wages in Montreal, Labourers

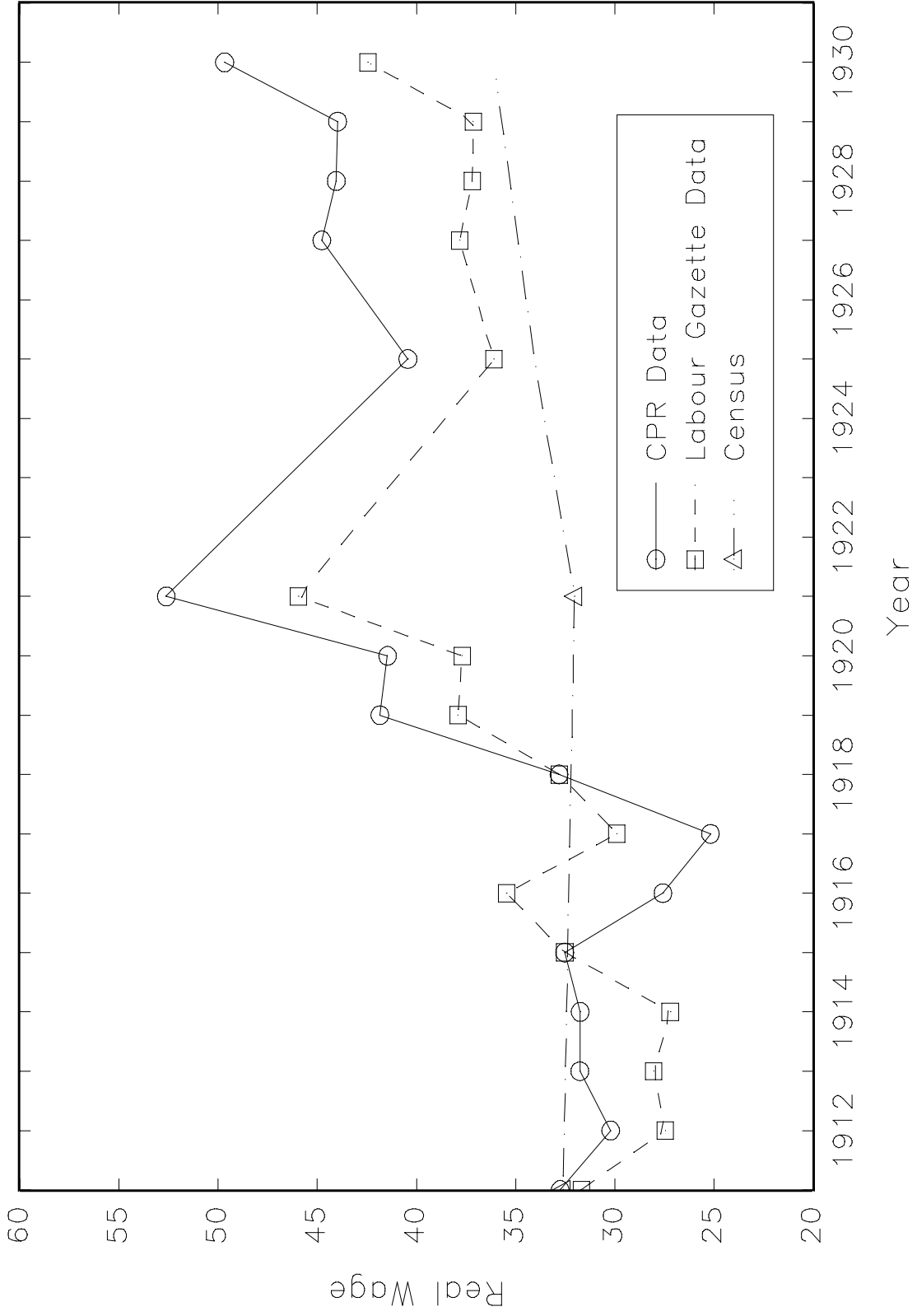Figure 7: Real Hourly Wages in Montreal, Machinists

Figure A1:
Kernel Density Plot For 1911, Males,
With and Without Concordance

Density

Real Weekly Wage (1913 Dollars)

Concordance
Non-Concordance