

Technological Change and Declining Immigrants' Earnings Outcomes: Implications for Income Inequality in Canada

Casey Warman and Christopher Worswick

IMMIGRATION CAN AFFECT INCOME INEQUALITY IN THE RECEIVING COUNTRY THROUGH immigrants' own incomes and through the impact their presence in the labour market has on the earnings of other workers. The decline in immigrants' earnings in Canada in the 1980s and 1990s and into the 2000s was large and has been well documented (see, for example, Green and Worswick 2012). This raises the possibility that changes in immigrants' earnings may have played a substantial role in driving increases in overall inequality. In an article in the *Canadian Journal of Economics* (Warman and Worswick, forthcoming) that mirrors the work of Picot and Hou (in this volume) but focuses more on the role of education and occupational outcomes, we assess whether this is the case.

The causes and consequences of changes in immigrants' earnings depend heavily on how immigrants are affected by other forces that drive changes in inequality. For example, the large decline in immigrants' earnings over the past several decades coincided with rapid changes in information technology (IT). Autor, Levy and Murnane (2003) identify the adoption of computers and the resulting differentiation of tasks that can be routinized by computers and those that cannot as an important reason for the growing earnings gap between workers with university and high school education in the United States. These same technological shifts might have changed the way immigrants' education and work experience are valued in the Canadian labour market, making it more difficult for immigrants to integrate successfully.

Technological change, however, also coincided with significant changes in Canada's immigration policy that resulted in, first, a large increase in the intake of immigrants coupled with a pronounced shift in the selection process toward highly educated

immigrants and, second, a shift away from traditional immigrant source countries, such as the United Kingdom, other European countries and the United States, and toward countries in Asia, Africa and Latin America (Sweetman and Warman 2013, 2014). These more highly educated immigrants should have benefited from technological changes in the Canadian economy, but only if they were able to find jobs in occupations advantaged by such changes. If, for instance, the shift in source countries meant that immigrants' language skills were weaker than those of earlier arrivals from traditional source countries and as a result they ended up in occupations that did not reflect their higher education, then technological changes would have worsened, rather than improved, their economic outcomes. Thus, our other main objective in Warman and Worswick (forthcoming) is to assess how technological changes have affected immigrants' earnings and whether the interaction of technological changes and immigration has played an important role in Canada's changing earnings distribution.

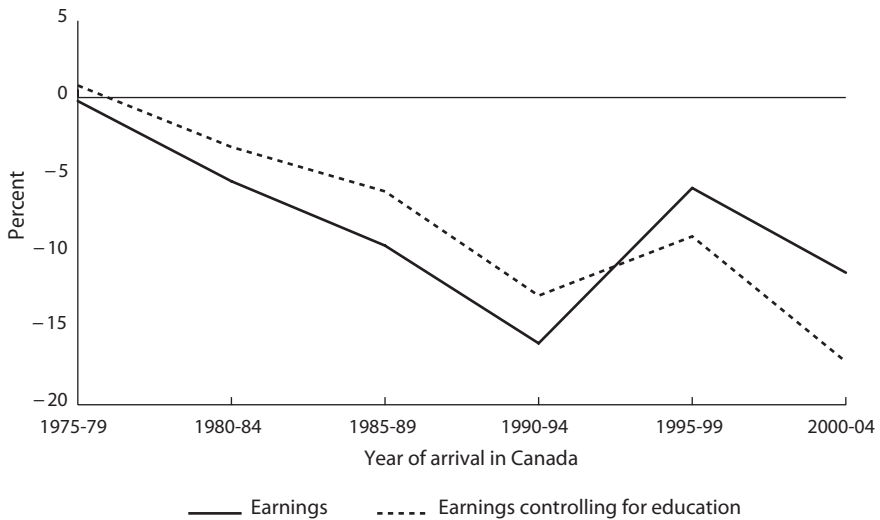
Immigrants' Earnings in Canada since the 1970s

TO UNDERSTAND HOW THE CHANGING COMPOSITION OF IMMIGRANTS INTERACTED WITH the changing role of computer technology in the Canadian labour market between the early 1970s and the early 2000s, we need to compare immigrants' earnings across different arrival periods. Figure 1 shows the differences in the earnings of male immigrants who arrived between 1975 and the early 2000s relative to the earnings of those who arrived between 1970 and 1974.¹ (We repeated this analysis for female immigrants, with broadly similar findings.) As the figure indicates, the relative decline in the earnings of each successive cohort of new arrivals between 1975 and the early 1990s was large: the earnings of the 1990-94 cohort were 16 percent below those of immigrants who arrived between 1970 and 1974.

The earnings of newly arrived male immigrants rebounded in the mid-1990s — although they were still 5.9 percent below those of the 1970-74 cohort — which coincided with a greater emphasis on postsecondary education in the point system under which immigrants to Canada are selected. The importance of this change can be seen in the dashed line in figure 1, which shows what the earnings pattern would have been if the educational composition of male immigrants had not changed across cohorts. Once we control for education changes in this way, the improvement in immigrant earnings in the mid-1990s was much smaller, suggesting that the shift toward higher education in immigrant selection was effective in slowing down, and even

Figure 1

Change in real earnings of later cohorts of male immigrants relative to those of the 1970-1974 cohort, by arrival cohort, Canada, 1975-2004



Source: Authors' calculations based on Statistics Canada, Census of Canada, 1991, 1996, 2001 and 2006, confidential master files.

reversing for a while, the decline in immigrant earnings. The fact remains, however, that the immigrants admitted in the late 1990s and early 2000s, who on average tended to be very highly educated, had lower earnings than the immigrants who arrived in the early 1970s and on average tended to be less educated. This suggests that more recent immigrants were unable to find jobs corresponding to their educational levels, and did not benefit from the rapid technological changes that were occurring at the time, which, at least in the United States, were increasing the wages of individuals with postsecondary education relative to those with secondary education or less.

Occupational-Task Requirements of Immigrants to Canada since the 1970s

WHAT ROLE, IF ANY, DID THE ONSET OF THE IT REVOLUTION PLAY IN SHAPING THE wages of immigrants — in particular, highly educated immigrants? To answer this question, we consider the occupational-task requirements of the jobs

male immigrants held and how these changed for immigrants admitted in the 1990s and early 2000s relative to those admitted in the 1970s and 1980s. The basic idea is that occupations can be viewed as bundles of key tasks:

- > *cognitive* or *analytic* tasks that are complemented by IT capital (machinery, equipment and software) and are most prominent in occupations such as engineering and management;
- > *manual* tasks that can be replaced by IT technology;
- > *routine* tasks that tend to be replaced by IT capital and are found in clerical occupations and those on manufacturing production lines; and
- > *nonroutine* tasks where IT capital has limited impact because they are difficult to program and/or are characterized by personal interaction.

Following the general approach of Autor, Levy and Murnane (2003), we consider five task groupings: nonroutine analytical tasks, nonroutine interactive tasks, routine cognitive tasks, nonroutine manual tasks and routine manual tasks. We assign to each of the almost five hundred occupations a score representing the intensity level of each of these five types of tasks based on information provided in the O*NET dictionary of occupations. This approach allows us to take the detailed task information on these occupations and simplify it down to a set of five task index values for each occupation.² Basically, we want to gauge how the average value of the five task indices changed for each newly arrived cohort of male immigrants to see which occupational tasks became relatively more (or less) important over time in Canada, based on the occupation of each immigrant reported in each census year. Figure 2 shows the change in each task index for immigrants who arrived between 1975 and the early 2000s relative to those who arrived between 1970 and 1974. Since we do not control here for education, the lines in this figure can be compared with the solid line in figure 1.

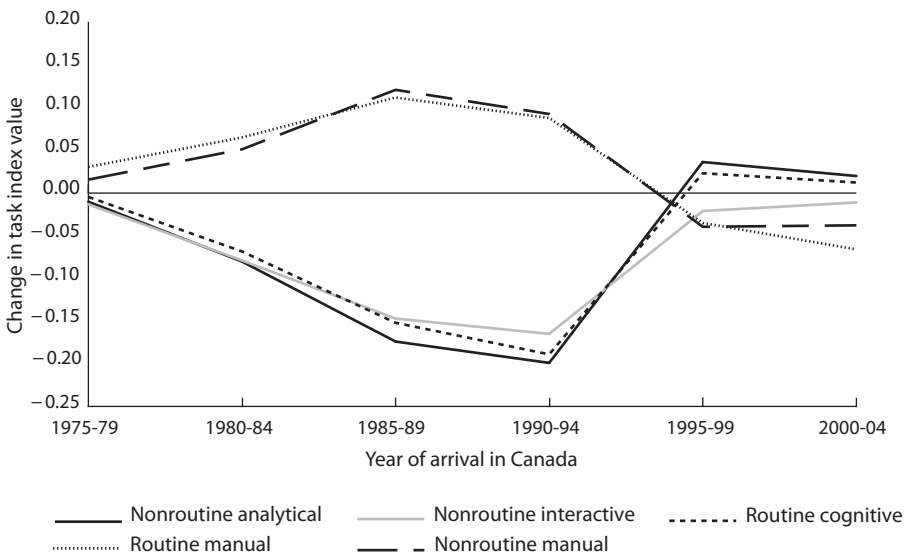
As figure 2 shows, the two manual-task-requirement indices (routine manual and nonroutine manual) moved together over the period, while the three indices for nonmanual tasks (routine cognitive, nonroutine interactive and nonroutine analytical) also moved together and in a pattern that is almost the mirror image of the manual-task index pattern. For male immigrants who arrived prior to the mid-1990s, the employment trend was toward occupations with high manual-task requirements and away from nonmanual occupations relative to the occupations held by immigrants who arrived in the early 1970s. Beginning in the late 1990s, however, the trend reversed and the occupations held by the most recent arrival

cohorts of immigrants moved toward occupations with higher nonmanual-task requirements and away from occupations with higher manual-task requirements.

Figure 3 again shows the change in the five occupational-task-requirement indices, but after holding education constant as we did for earnings in figure 1. The trend toward higher manual-task requirements for male immigrants continued into the early 2000s. For the three nonmanual-task indices, the pattern is less clear, but much of the increase in these indices in the mid- to late 1990s shown in figure 2 is not present. This suggests that the increase in educational requirements under the immigrant selection system beginning in the mid-1990s did indeed reverse the previous trend toward occupations with higher manual-task requirements and away from those with lower nonmanual-task requirements. Importantly, figure 3 indicates a long-run trend toward more male immigrants holding a manual job in all educational groups, including the most educated. This trend is largely eliminated, however, once we control for

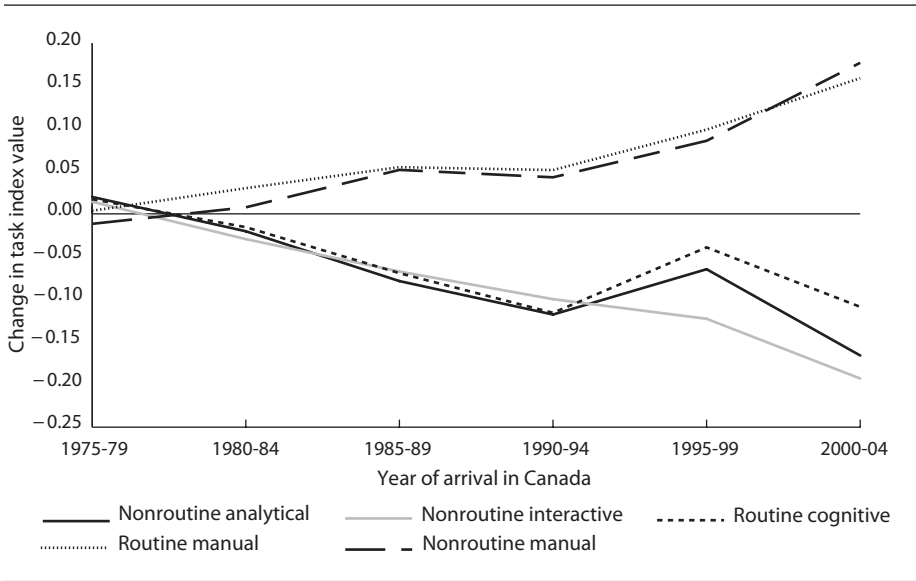
Figure 2

Change in the occupational-task requirements of later cohorts of male immigrants relative to those of the 1970-1974 cohort, by arrival cohort, Canada, 1975-2004 (not controlling for education)



Source: Authors' calculations based on Statistics Canada, Census of Canada, 1991, 1996, 2001 and 2006, confidential master files.

Figure 3
Change in the occupational-task requirements of later cohorts of male immigrants relative to those of the 1970-1974 cohort, by arrival cohort, Canada, 1975-2004 (controlling for education)



Source: Authors' calculations based on Statistics Canada, Census of Canada, 1991, 1996, 2001 and 2006, confidential master files.

language skills and region of birth, which suggests that the changing composition of immigrant source countries was a key factor explaining why more new immigrants ended up in jobs with high manual-task requirements. This trend was broken only in the mid-1990s, when the educational level of new immigrants was increased through the selection process. It is worth noting that the trend toward employment in manual occupations among recent immigrants over this period is the opposite of what occurred in the Canadian labour force as a whole (Green and Sand, forthcoming; and the summary in this volume).

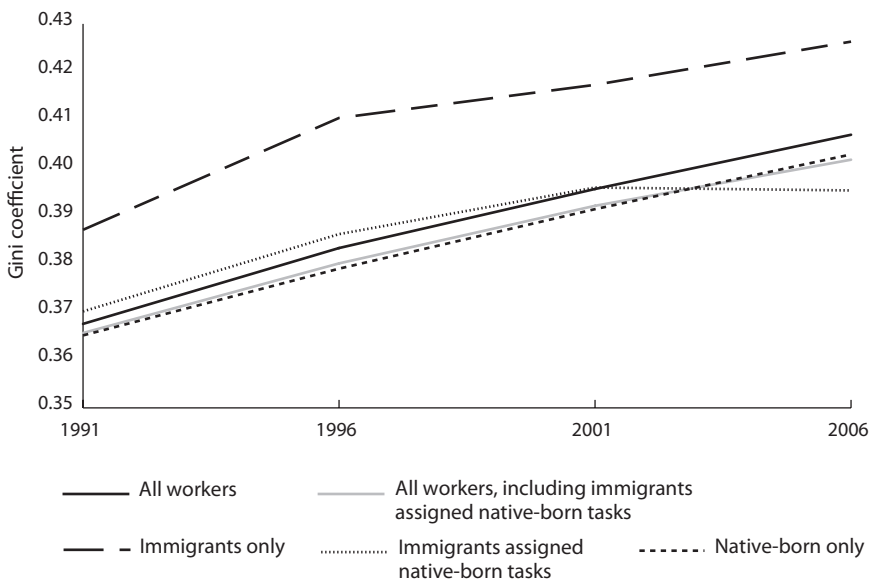
Earnings Inequality among New Immigrants since 1991

THE INCREASED EDUCATIONAL REQUIREMENTS FOR SELECTION UNDER THE FEDERAL SKILLED Worker Program had a meaningful effect on the educational composition of immigrant cohorts, which in turn reversed somewhat the decline in the earnings

of new arrivals and the trend toward more of them having manual-task occupations. Nonetheless, our analysis also shows that the immigrants who arrived in Canada beginning in the mid-1990s had lower earnings and were in occupations with higher manual-task requirements than one would expect given their high levels of education. These new immigrants ended up in jobs not suited to their education and likely in a lower part of the income distribution than would have been expected when they were selected for immigration. If so, the effect of their presence in Canada could have been to worsen overall income inequality, a possibility we explore in Warman and Worswick (forthcoming).

To examine the effect of immigrants' earnings on inequality in Canada in the period between 1991 and 2006, we use the Gini coefficient of weekly earnings for all permanent residents of Canada (native-born and landed immigrants).³ As figure 4 shows, the Gini coefficient for the whole working population increased over the 15-year period from 0.368 in 1991 to 0.407 in 2006, which is considered a large increase. To put this in context, the Gini

Figure 4
Gini coefficients of earnings inequality, Canada, 1991-2006



Source: Authors' calculations based on Statistics Canada, Census of Canada, 1991, 1996, 2001 and 2006, confidential master files.

coefficient for income before taxes and transfers in the member countries of the Organisation for Economic Co-operation and Development in 2008-09 varied between 0.34 and 0.53.

For comparative purposes, figure 4 also shows four other Gini coefficients. The coefficient for the “native-born only” — that is, excluding all immigrants — is very close to the coefficient for “all workers.” The coefficient for the immigrant population, however, increased from 0.387 in 1991 to 0.426 in 2006, which mirrors the increase in inequality for the native-born population but at a significantly higher level each year. Together, these findings imply that immigration has had only a limited impact on overall Canadian inequality trends (see also Picot and Hou, in this volume). The final two Gini coefficients are based on a simulation in which we assign immigrants the level of each of the five occupational-task requirements that we would expect them to have if they were native-born (with the same level of education) and then adjust their weekly earnings as appropriate given the assigned level of each of the five task requirements in their job. Note that the “immigrants assigned native-born tasks” line is difficult to distinguish from both the “all workers” and “native-born only” lines. This suggests that the higher earnings inequality shown in the “immigrants only” line relative to the other lines can be explained by the lower earnings associated with the lower-cognitive-task occupations of immigrants compared with the higher-cognitive-task occupations of the native-born. It also suggests that, although the differences in the occupational-task requirements of immigrants and the native-born are important for understanding inequality among the immigrant subpopulation, they do not have a large impact on overall Canadian earnings inequality.⁴

Conclusion

OUR ANALYSIS INDICATES THAT THE DECLINE IN RECENT IMMIGRANTS’ EARNINGS SEEN from the mid-1970s to the early 1990s was on track to continue after the mid-1990s, but the improvement in the educational attainment of new arrivals as a result of changes in Canada’s immigration policy reversed this trend somewhat. At the same time, the types of jobs immigrants held trended toward manual tasks at the expense of cognitive tasks, again mitigated somewhat by the increase in immigrants’ education levels beginning in the mid-1990s. However, the better-educated immigrants who arrived after the mid-1990s did not have

earnings comparable to those of immigrants with the same levels of education who had arrived in the 1970s or 1980s. As well, holding education constant, immigrants who arrived beginning in the mid-1990s were employed in jobs with higher levels of manual-task requirements than were immigrants admitted in the 1970s and 1980s, which points to a significant underutilization of immigrants' skills.

The implications of these findings for Canadian income inequality are threefold. First, income inequality is higher among the immigrant population than among the native-born, but the trend toward increasing earnings inequality between 1991 and 2006 is similar for both groups. Second, the presence of immigrants has not had a large direct effect on Canadian income inequality. Finally, that immigrants tend to end up in jobs with high manual-task requirements and low cognitive-task requirements can explain much of the higher level of income inequality in the immigrant population relative to the native-born population.

One important caveat is that, in Warman and Worswick (forthcoming), we do not consider the impact that immigrants themselves might have had on the wage outcomes of Canadian workers. This is an important area for future work.

Notes

1. The estimates are taken from regression analysis based on log weekly earnings with controls for age, marital status, region of residence, census year and duration of residence in Canada. For more details on data and methodology, see Warman and Worswick (forthcoming).
2. Each index is generated through factor analysis. For a complete description, see Warman and Worswick (forthcoming).
3. The Gini coefficient is a summary measure of inequality that takes a value of 0 if there is no inequality (that is, if everyone in the population has the same income) and 1 if there is perfect inequality (that is, if all the income in the economy goes to one person).
4. This simulation ignores possible general-equilibrium effects that might occur from the presence of immigrants in Canada.

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