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TECHNOLOGICAL CHANGE, OCCUPATIONAL TASKS AND DECLINING IMMIGRANT OUTCOMES: IMPLICATIONS FOR EARNINGS AND INCOME INEQUALITY IN CANADA

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ABSTRACT

The earnings and occupational task requirements of immigrants to Canada are analyzed. The growing education levels of immigrants in the 1990s have not led to a large improvement in earnings as one might expect if growing computerization and the resulting technological change was leading to a rising return to non-routine cognitive skills and a greater wage return to university education. Controlling for education, we find a pronounced cross-arrival cohort decline in earnings that coincided with cross-cohort declines in cognitive occupational task requirements and cross-cohort increases in manual occupational task requirements. The immigrant earnings outcomes had only a small effect on overall Canadian earnings inequality.

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1 Introduction

Concerns over the poor performance of recent immigrants to Canada, combined with evidence that income inequality has been growing in Canada, naturally leads to the question of whether the challenges faced by Canada's large immigration program is unintentionally contributing to inequality. At the same time, substantial changes in technology resulting from the rapid innovation in the IT sector raise questions about how skill is valued within developed economies. Autor, Levy, and Murnane (2003) identify adoption of computers over the past several decades, and the resulting differences in tasks that can be routinized by computers and tasks that cannot be routinized, as an important reason for the growing US earnings gap between university and high school educated workers. These technological shifts may have changed the way in which immigrant education and work experience are valued in the Canadian labour market making it more difficult for immigrants to successfully integrate. However, these technological changes have coincided with a period of rapid changes in Canadian immigration. Specifically, a large increase in immigrant intake coupled with a large shift towards highly educated immigrants coincided with a shift away from traditional immigrant sending countries such as the UK, US and European countries and towards countries in Asia, Africa and Latin America.

Our goal in this paper is to investigate the potential interaction between immigration and technological change in the Canadian case. The new more highly educated immigrants admitted to Canada should have benefited from the kind of rapid technological changes found in the US (Autor, Levy, and Murnane, 2003). However, that would only be the case if the new immigrants found jobs in the part of the task distribution that benefited from the technological change. If the shift of source countries meant that their language skills were weaker than earlier cohorts leading to their occupational outcomes not reflecting their higher education, then the technological change would have worsened their economic outcomes rather than improving them.

To investigate these possibilities, we analyze the earnings and occupational skill requirements of immigrants and the Canadian born using the 1991 to 2006 Canadian Census Master files. The detailed information in the Census allows us to evaluate whether immigrants and comparable native born end up in similar types of occupations in terms of tasks and allow us to explore how this has changed over time. Using the Occupational Information Network (O*NET), we determine the tasks similar to Autor, Levy, and Murnane (2003), who identify routine and non-routine cognitive and manual tasks, and we match these tasks to the 3 digit SOC information in the Canadian Census data.[1]

2 Immigrant Earnings and Returns to Human Capital in North America:

The labour market performance of immigrants in both Canada and the United States has received considerable attention in the economics literature due to concern that more recent cohorts have received lower earnings, for the same number of years in the receiving country, than did immigrants of earlier arrival cohorts (see for the US, Chiswick (1978), Borjas (1995), and Borjas and Friedberg (2009); see for Canada Baker and Benjamin (1994) and Grant (1999)). For the case of Canada, the declines across the 1980s were large while the declines in the 1990s were larger and have been documented using Canadian Census data (see, for example, Aydemir and Skuterud (2005) and Warman and Worswick (2004)).[2] While both Canada and the US have very different immigration policies, a shared experience since the 1960s of dramatic changes in source country composition has led to significant challenges in integrating the new immigrants into the receiving country labour markets.

A number of studies have attributed at least part of the poor performance of immigrant arrival cohorts to Canada after the 1970s to macroeconomic fluctuations and industry specific shocks. McDonald and Worswick (1998) argue that the poor earnings performance of immigrants to Canada in the 1980s relative to earlier decades could be due at least in part to

[1]See Imai, Stacey, and Warman (2011) for a description of this method.

[2]See Warman (2007) for an overview of the reasons for the declining outcomes.

the poor macroeconomic conditions over much of the period. Hou and Picot (2009) analyze the outcomes of immigrants to Canada in the 2000s at the time of the sharp decline in the information technology (IT) industry. They attribute a large part of the poor performance of immigrants who arrived in the 2000s to the decline in the outcomes of immigrants who came to Canada with the intention of working in either IT or engineering occupations.

However, evidence also suggests that longer run trends in the Canadian labour market are also important in understanding the labour market outcomes of successive arrival cohorts of immigrants. Green and Worswick (2012) analyze the earnings of immigrants in Canada and found strong negative cohort effects in the present discounted value of earnings of immigrant arrival cohorts to Canada since the early 1980s that coincided with a similar decline in the earnings of successive labour market entry cohorts of the Canadian born. They also find that the earnings returns to foreign experience went from being positive and comparable to those of the Canadian born to being basically zero between the early 1980s and the 1990s. Green and Worswick (2012) find that the lack of returns to foreign experience is a feature of the earnings patterns for non-English speaking, non-European immigrants in particular and the cross-cohort decline can be attributed primarily to the shifting source country composition.

2.1 Occupational Outcomes and Earnings of Immigrants

Green (1999) uses Canadian Census data and administrative data on immigrant landings to analyze the occupational outcomes and occupational mobility of immigrants to Canada. He finds that immigrants from more recent arrival cohorts are less represented in high skilled occupations than was the case in earlier arrival cohorts. Also, immigrants are more occupationally mobile than are the Canadian born and this is still present at higher values of years-since-migration.

A common result in the North American immigration literature is that the return to foreign education is significantly lower than that of education obtained in the host country (see, for example, Ferrer and Riddell (2008)). A number of studies have investigated whether immigrants are more likely to be over-educated for their occupations. If the wage return to the extra year of education is expected to be low for these workers, this could explain the low returns to education found for immigrants in Canada and the US. Chiswick and Miller (2008) show that the lower payoff to schooling for the foreign born in the US is linked to the labour market outcomes of immigrants in jobs mismatched to their education levels. Specifically they find that two thirds of the smaller effect of schooling on earnings was attributable to differences by nativity in the payoffs to over/under education. Similar results were found for immigrants in Canada (Chiswick and Miller, 2010). Li and Sweetman (2014) highlight the importance of differences in source country educational quality in determining labour market outcomes in Canada.

Warman, Sweetman, and Goldmann (2015) find that immigrants have difficulty matching their occupation when they first arrive in Canada and often end up working in low skilled occupations that are very different from their source country occupations or what we would expect given their education. Imai, Stacey, and Warman (2011) also study the capacity of immigrants to transfer their occupational human capital to the Canadian labour market but use occupational skill requirement created from the O*NET[3], similar to the approach in this paper. Using factor analysis[4], the detailed O*NET information on each occupation's skill requirement is reduced to a number of indexes. The authors then combine these indexes of occupational skill requirements with the Longitudinal Study of Immigrants to Canada data. They develop a model of occupational choice and skill accumulation and derive predictions about the international transferability of occupational human capital. Prior to immigration, male immigrants to Canada are employed mainly in occupations that require high levels of cognitive skills but not high levels of manual skills. However, the pattern is reversed after migration with employment more likely to be in occupations requiring manual skills rather than cognitive skills. It is important to note that the LSIC data is based on a single arrival cohort of immigrants to Canada. Consequently, they were unable to look at the cross-cohort

[3]See Robinson (2011) and Poletaev and Robinson (2008) for the advantages of using skill requirements over occupational classifications when measuring occupational transitions and occupational mismatches.

[4]See also Ingram and Neumann (2006).

patterns in terms of occupational skill requirements for immigrants.

The underlying causes for the occupational mismatches found in these studies remain an open question. It could be that the changing source country composition of immigrants to Canada means that the education and work experiences of the new immigrants are not easily transferred to the Canadian labour market. This could either be due to a lack of full equivalency to Canadian education and work experience, or due to a lack of English or French language fluency, on the part of the immigrants, needed for highly skilled workers to be able to find jobs in high skill occupations in Canada. Another possibility is that the changing source country composition of immigrants means that a higher share of immigrants arriving in Canada were members of visible minority groups and thus more likely to experience discrimination in the cohorts after 1980 than in the relatively more successful cohorts prior to 1980.

Oreopoulos (2011) provides evidence of employer discrimination in the Canadian labour market. Using thousands of randomly manipulated resumes sent in response to online job postings in Toronto, he finds evidence of substantial discrimination against applicants with foreign work experience as well as those with names whose origins are from India, Pakistan, China and Greece, relative to those of English origins. However, actual evidence of the impact of ethnic or racial discrimination on wages is difficult to measure given the presence of alternative explanations. When attention is restricted to the Canadian born, evidence of wage differentials across visible minority groups in Canada is present but is much smaller than the immigrant/Canadian-born wage gaps found for the equivalent visible minority groups.[5]

3 Technological Change and The Return to Skills:

The deteriorating immigrant entry outcomes corresponded with a period in which there were substantial structural changes in both the Canadian and US economies. For the US, a number of studies identified a shift in the wage structure that benefited college educated

[5] See, for examples, Pendakur and Pendakur (1998) and Skuterud (2010).

workers relative to other workers (see, for examples, Katz and Murphy (1992) and Juhn and Pierce (1993)). For Canada, Beaudry and Green (2000) demonstrate declining entry earnings across successive labour market entry cohorts for Canadian-born men. They show that this is true for different levels of education. Consequently, there was not the large widening of the return to a university degree in Canada as was the case in the US.

As noted above, Autor, Levy, and Murnane (2003) provide a plausible explanation for the increasing return to skill in the US over this period. They outline the importance that computerization had on changing job skill demand in the US. The authors show how computers act as substitutes for jobs that rely on tasks that follow explicit rules and are complements for jobs with tasks requiring *non-routine problem solving* and *complex communications*. They find that this can explain much of the increased demand for college educated workers in the US.

More recently evidence of a reversal in the demand for skill and cognitive tasks has emerged (see Beaudry, Green, and Sand (2014)). Since 2000, evidence for the US suggests that the strong ongoing increase in the demand for skilled workers has reversed. High skilled workers have moved down the occupational ladder and accepted jobs traditionally held by lower-skilled workers who consequently end up being pushed even further down the occupational ladder.[6]

4 Canadian Immigration Policy since 1985

Given that our Census data cover the period 1991 through 2006, we focus on two key changes in Canadian immigration policy since the mid 1980s (see Figure 1). Specifically, we are interested in the implications for immigrant earnings and overall income inequality in Canada due to: 1) the large and sustained expansion of annual immigrant intake to Canada beginning in the late 1980s; and 2) the increased emphasis on university education

[6] Beaudry, Green, and Sand (2013) present a model that considered cognitive tasks as a stock rather than a flow and show that this model can explain the demand reversal.

on immigrants selected under the point system beginning in 1993 (see Beach, Green, and Worswick (2011) and Sweetman and Warman (2013, 2014)).

Figure 1 demonstrates the steady increase in the level of immigration since the mid 1980s. Immigrant landings went from 99,354 in 1986 to 216,452 in 1990 reaching 256,641 in 1993 before levelling off and for the most part remaining reasonably stable in the range between 212,000 and 281,000 (with the exception of a dip to 174,195 in 1998 and one to 189,951 in 1999).[7] Figure 1 also demonstrates the growth in the share of economic immigrants over this period.

The second policy change that we consider relates to the increase in points allocated for post-secondary education in the 1990s (see McWhinney (1998)'s Regime 12). The Principal Applicants under the Federal Skilled Worker program must pass the point system in order to be admitted. On August 9^{th}, 1993, the point system was amended placing much more weight on post-secondary education (see Beach, Green, and Worswick (2011)). Not surprisingly, this shift made it much easier for university graduates to qualify under the point system for admission as economic immigrants and much more difficult for other applicants.

Figure 2 is based on the Census data and demonstrates the sharp increase in the fraction of immigrants landing each year with a university degree after this policy change.[8] This fraction more than doubled between the early 1990s and the late 1990s and this was true for both immigrant men and immigrant women. Given that the figure represents all immigrants and the policy change only directed affected Principal Applicants in the Skilled Worker category, the size of this effect is remarkable since the policy changes did not affect the accompanying spouses or dependents and did not affect family reunification or humanitarian immigrants.

Next, we carry out a standard human capital earnings estimation using the 1991 to 2006 Census data. Following much of the literature, we employ a cohort/year-since-migration

[7] These figures were taken from the 2013 Facts and Figures, Immigration Overview, Permanent and Temporary Residents, Digital Library of Citizenship and Immigration Canada.

[8] For the 1970 to 1990 yearly cohorts, the level of education is determined at the time of the 1991 Census, for the 1991 to 1995 cohorts at the time of 1996 Census, for the 1996 to 2000 cohorts at the time of the 2001 Census and for the 2001 to 2005 cohorts at the time of the 2006 Census.

(YSM) structure for the right-hand side variables (in addition to the controls for education and a quadratic in age).[9] The dependent variable is the log of weekly earnings in the reference year and the model is estimated over the pooled sample of immigrants and the Canadian born. In the Figure 3, we present the immigrant/native-born estimated differences in log weekly earnings over each immigrant arrival cohort's relevant years-since-migration over the 1991-2006 period using two versions of our simple earnings model. On the left is a plot of the arrival cohort profiles for a model without controls for language fluency or source country region of the immigrants. To the right, the earnings profiles by arrival cohort come from a model that includes fixed effects for language fluency and source country region. The graph to the right is for the default category for the region controls (English language developed economies) and this explains the fact that the profiles are generally for higher levels of weekly earnings than is the case in the graph to the left where region controls are not included. The steady decline in log earnings across immigrant arrival cohorts is apparent in both graphs but the cross-cohort differences are larger based on the model without controls for language fluency or source country region. It should be noted that each model controls for education so that the increase in education levels for the post 1993 cohorts will be absorbed into the education fixed effects of the model. These two graphs are intended to demonstrate the cross-cohort decline in log weekly wages across recent immigrants and should be kept in mind when considering the analysis of the immigrant/native born occupational task skill requirements below.

5 Expected Implications of the Immigration Policy Changes for the Earnings Performance of New Immigrants

The fact that Canadian immigration policy expanded at a time in which concern had begun to be raised about the economic performance of immigrants in Canada could have led to a

[9] We interact the cohort dummies with the years-since-migration term but have a common quadratic years-since-migration term. (See Aydemir and Skuterud (2005)).

worsening of immigrant outcomes and a worsening of income inequality in Canada. However, the sharp increase in education levels of new immigrants should have led to relatively better economic outcomes for new immigrants as was certainly the intent of the policy change.[10] Therefore, the net effect of the expansion and the new focus on post-secondary education is ambiguous in terms of the expected impact on the earnings performance of new immigrants.

At the same time as the policy shift toward more highly educated immigrants in Canada, the pattern of increasing returns to education was emerging in the US. As noted above, Autor, Levy, and Murnane (2003) argue that the rapid decline in the price of computers reduced the demand for routine manual tasks and increased the return to non-routine tasks. This would have caused an increase in the return to education which one would expect to have also occurred in Canada over the same period given that the rapid decline in the cost of computers was also a feature of Canada's economy. We investigate this for Canada to see whether it may have led to weaker outcomes for less skilled immigrants thus increasing the inequality in the immigrant population and perhaps also in the Canadian population as a whole. It may also have led to better earnings outcomes for the more skilled immigrants who could have benefited from the increase in returns to non-routine tasks. These two effects could have led to an increase in income inequality among the entering immigrants to Canada.

However, the shifting source country distribution of immigrants to Canada over the 1980s and 1990s meant that the proportion of new immigrants who had strong English and/or French language skills was dropping sharply (see Green and Worswick (2012)) making it less likely for new immigrants to have their foreign education and foreign work experience recognized by employers in terms of the types of jobs offered to the new immigrants. While there was a large increase in the levels of formal education over the period of declining immigrant entry outcomes, the shift in source countries resulted in poorer local labour market language ability, which has been found to be one of the main reasons for the immigrant/native born wage differential (see Ferrer, Green, and Riddell (2006)). The declining language ability of new immigrants at a period where computerization placed a premium on non-routine

[10] Kahanec and Zimmermann (2009) find that high skilled immigrants tend to reduce inequality in Europe.

complex communication tasks may have pushed immigrants into occupations requiring less language intensive tasks that could be made routine with computers. As well, the difficulty that employers have in terms of assessing the foreign credentials of immigrants from non-traditional sending countries may also have resulted in immigrants only being hired in occupations characterized primarily by routine cognitive tasks, instead of non-routine problem solving. Therefore, the shifting source countries at a time of computerization of the economy may have pushed immigrants into lower paying occupations.

Dustmann, Frattini, and Preston (2013) show that immigrants experience poorer than expected outcomes when they first arrive in the UK. They show that when allocating immigrants across the wage distribution based on their observed age and educational distribution, immigrants are much more concentrated in the lower part of the distribution and underrepresented in the upper percentiles than what we would expect given their education.

A preliminary look at our data suggests that something similar may have happened in Canada as education levels of immigrants were rising in the 1990s. Figure 4 provides similar information for Canada. Rather than predicting wages to calculate where immigrants would be in terms of the native wage structure, we use counterfactual density estimates (see DiNardo, Fortin, and Lemieux (1996)) to produce the log weekly earnings density of recent immigrants if they had been paid based on the native wage structure, and we then difference the native-born densities from these counterfactual densities. As well, we present the differences between the actual densities of the immigrants and the native born. The counterfactual densities are calculated by re-weighting the native born's log weekly earnings function taking into consideration the characteristics of the immigrants. We use highest level of education dummies interacted with age dummies, as well as controls for province and major CMA of residence. We calculate these separately by gender. We want to examine how this has changed over the period in which there was a dramatic increase in educational attainment of new immigrants and therefore present the figures for the 1985-89 cohort versus the native born in 1991 and the 2000-04 cohort versus the native born in 2006.

Points above the horizontal axis represent part of the weekly earnings distribution where the immigrant density is greater than the native-born density whereas points below show where the native density is greater than the immigrant density. When we consider the actual densities, we see that the line is above the horizontal axis over the lower part of the weekly earnings distribution and below the axis over the upper part of the earnings distribution. This is consistent with the native-born distribution having greater mass at the upper part of the weekly earnings distribution relative to the immigrant distribution. This is true both for the 1985-89 cohort in 1991 and for the 2000-04 cohort in 2006. We see the same general patterns for men and women.

For the counterfactual analysis, the line for the 1985-89 cohort in 1991 is close to the horizontal axis which suggests that assigning this immigrant cohort the returns to education of the native born has a large effect pushing the mass of the weekly earnings distributions towards higher values of weekly earnings and leading to a distribution that is very similar to that of the native born in the same year. For the 2000-04 cohort, we see a similar change in that the line is much closer to the horizontal axis. However, it is worth noting that for this cohort, we see a range of weekly earnings for which the line is above the horizontal axis meaning that there is greater mass in the immigrant counterfactual earnings distribution than in the same range of the native-born distribution. The same can be said for the earlier arrival cohort but the size of this effect is much larger for the 2000-04 cohort in 2006. This is consistent with the large increase in education levels in the 1990s meaning that the new immigrants would have appeared in the upper part of the weekly earnings distribution if they had received the same returns to education as the native born. However, the fact that they did not receive the same returns means that they were more likely than the native born to appear in the lower part of the weekly earnings distribution. This is similar to what Dustmann, Frattini, and Preston (2013) found for the UK in that the immigrants should be more represented at higher values of earnings given their high education levels but instead are observed at lower parts of the earning distribution due to poor returns to their education.

A key issue for our analysis is whether these highly educated immigrants to Canada ended up in jobs suited to their education allowing them to benefit from the increase in demand for non-routine cognitive task requirements that Autor, Levy, and Murnane (2003) observed in the US. If instead, as our preliminary analysis suggests, they primarily found jobs lower down the income distribution perhaps with lower cognitive occupational task requirements and greater manual task requirements then they would have missed out on any wage gains due to any increasing demand for university education that might have been experienced by the university-educated native born.

6 Methodology

6.1 Task Construction using the O*NET data

We define the following five task groupings: non-routine analytical tasks, non-routine interactive tasks, routine cognitive tasks, non-routine manual, and routine manual used in Autor, Levy, and Murnane (2003). We use the Occupation Information Network (O*NET) to create these tasks using principal component analysis.[11] The O*NET provides detailed information on the tasks and skills required to perform a given occupation. For example, we can identify the amount of non-routine analytical tasks from variables such as *Innovation*, *Critical Thinking* and *Active Leaning* (see Table A.11) or cognitive skills that can be routinized from variables such as *Information Ordering*, *Memorization* and *Number Facility* (see Table A.13). We reduce the information in the O*NET by performing factor analysis. We first separate job characteristics that are related to each of the five tasks and reduce the variables using perform principal component analysis for each of the groups separately. As outlined in Yamaguchi (2012), Imai, Stacey, and Warman (2011) and elsewhere, performing factor analysis on separate pre-created groups rather than on all these characteristics gets around the problem of assuming that the resulting factors are orthogonal.[12] Each task was found to be characterized by a single factor. In Appendix A we describe the five tasks and

[11] Autor, Levy, and Murnane (2003) use the Dictionary of Occupational Titles (DOT) which was replaced by the O*NET.

[12] See Yamaguchi (2012) for a detailed discussion of the benefits of pre-selected groupings.

outline the variables used to create them.

We match the 1,000 plus O*NET occupations to the 1991 Standard Occupation Classification available in the Census.[13] We weight the factor analysis using the occupational distribution of the Canadian population from the 1991 Census Masterfile.[14] This allows for jobs that are more important in the economy to have a larger influence on determining the factors and less frequent jobs having less impact on the estimates. The resulting scores can be interpreted as having mean zero and a standard deviation equal to one with respect to the 1991 Canadian population.

6.2 Data and Sample Selection:

The data used in the estimation come from the 1991, 1996, 2001 and 2006 Canadian confidential census master files. This 20% sample of the Canadian population contains rich information on a number of personal characteristics. The age range in the analysis is restricted to individuals age 24 to 59. We have restricted the sample of immigrants to individuals aged 18 or older at the time of arrival in Canada in order to remove child arrival immigrants who would have acquired most of their education in Canada and have a very different experience than the adult arrival immigrants.[15] This could be especially problematic in a cohort analysis since the early cohorts will have child arrivals appearing whereas the later cohorts will have very few child arrivals since they would not yet be old enough to appear in the adult age range of the most recent Census.

6.3 Earnings and Task Requirement Regression Analysis

In Table 1 we present the first set of regression estimates of equation 1. We pool the data for immigrants and the native born and focus on the immigrant/native born differences by arrival cohort and years-since-migration.

[13] We rely mainly on the matching in Imai, Stacey, and Warman (2011).
[14] The weights are for the population 18 to 64 who had occupational information.
[15] Around 18% of immigrants aged 24 to 59 immigrated prior to age 18.

$$Y_i = X_i\beta + \delta_1 imm_i + \sum_{j=2}^{k} \delta_j C_j + \alpha_1 YSM_i + \alpha_2 YSM_i^2 + \epsilon_i \qquad (1)$$

We estimate models where Y_i is either log weekly earnings or one of the five tasks.[16] In each model, the vector X_i includes a common set of controls for the respondent's age in linear/quadratic form, marital status, region of residence, with the default being Toronto, and Census year indicators.[17] We also estimate specifications with highest level of education dummies (less than high school, high school graduate (default), post secondary education below a Bachelor's degree, Bachelor's degree and a Graduate degree) and then add 10 region of origin dummies and knowledge of official language controls.[18]

The first three columns are estimates from a model where the dependent variable is the log of the weekly wage, and act as a point of reference for thinking about the cohort patterns in the tasks models to follow.[19] In the first column, where controls for education, official language fluency and place of birth are not included, the cross-cohort profile indicates declining weekly earnings across arrival cohorts but the magnitude of these effects are not that large especially for the 1995-99 cohort (-0.059). This reflects the fact that education is increasing across arrival cohorts in the 1990s and this goes against the overall trend of declining earnings of immigrants up to that point. When we compare this to the second column where education controls are included, the cohort effects are negative and larger in absolute value over the late 1990s and early 2000s which is not surprising since the education differences by cohort are controlled for in the analysis and are therefore not reflected in

[16]Note that the reference period for earnings is that of the calendar year prior to the May enumeration day while for the occupational information, it is the week prior to enumeration. If the respondent did not have a job during the reference week, then the job of longest duration since January 1^{st} of the reference year is used to calculate occupational tasks. For ease of presentation, we refer to the reference year in the remainder of the paper.

[17]We have separate controls for the rest of Ontario, Vancouver, the rest of British Columbia, Montreal and the rest of Quebec. Toronto, Montreal and Vancouver cities received well over 50% of the immigrants to Canada during our sample period. Consequently, it is important to control for them separately from their respective provincial controls.

[18]See Adserà and Ferrer (2014) for analysis examining the importance of mother tongue linguistic proximity on occupational outcomes.

[19]The 1970-74 cohort is the default group.

the cohort effects. In the third column, the set of controls is further expanded to include three indicators for fluency in the two official languages, English, French and bilingual. As expected these controls are strongly significant with higher weekly earnings associated with (self-reported) fluency in English and/or French. Relative to immigrants from the default region of the predominantly English language developed countries (US, UK, Australia, New Zealand, Ireland and White South African), lower weekly earnings are found for immigrants who were born in Western Europe (-.103), Southern Europe (-.172), Eastern Europe (-.257), the Caribbean, Central America or South America (-.331), sub-Saharan Africa (-.340), North Africa and Western Asia (-.391), Eastern Asia (-.438), South and Southeast Asia (-.369), and Oceania and all other countries (-.361).[20] Including these controls leads to a reduction of the coefficient on the immigrant indicator to -.222 which reflects the fact that the default group of immigrants are now those that come from countries with strong English language fluency and with education that is more easily transferred to the Canadian economy than the education of immigrants from other source country regions. The coefficients on the arrival cohort controls are also generally closer to zero although the 2000-04 cohort remains negative at -.082. This suggests that the declining cross-cohort pattern in weekly earnings found in the first two columns can largely be explained by the cross-cohort trend towards immigrants with weaker fluency in either English or French and/or immigrants being more likely to come from the newer source regions.

In the fourth, fifth and sixth columns of Table 1, we present the regression estimates for the three equivalent models where the non-routine analytical task requirement index is used as the dependent variable (instead of log weekly earnings). In the fourth column, without controls for education, language fluency or region of birth, we see significantly lower non-routine analytical task requirements for the earlier arrival cohort (from the -.186 coefficient on the immigrant indicator) and a cross-cohort pattern of declining cohort effects from the late 1960s through to the early 1990s then small but positive coefficients for the 1995-99 cohort (.036) and the 2000-04 cohort (.020). In the fifth column, this 'bounce back' for the

[20] The coefficients not shown in the table due to room constraints but available upon request.

last two cohorts is much less pronounced for the 1995-99 cohort (-.065) and really not present at all for the 2000-04 cohort (-.166). Recall that this coefficient can be interpreted as 16.6% of a standard deviation in the index so it represents a meaningful difference in this dimension of the occupational skill requirement. In column 6, the same model is estimated but with controls for language fluency and region of birth. The coefficient on the immigrant indicator is close to zero indicating that immigrants from English-language background countries have similar non-routine analytical task requirements in their occupations to those of otherwise similar Canadian born. The cohort coefficients are generally close to zero and are similar to those of column 3 in the weekly earnings analysis. Controlling for language and source country appears to account for the remaining cross-cohort pattern in this task requirement index that was found in column 5 (with education controls present).

In the next six columns of Table 1 equivalent models are estimated where the dependent variable is the non-routine interactive task requirement variable (columns 7-9) and the routine cognitive task requirement variable (columns 10-12). Strong similarities are present across the equivalent model for each of these three task requirement variables. Focusing on the simplest model and comparing columns 4, 7 and 10, we see that immigrants in the default arrival category (1970-74) are at a disadvantage compared to otherwise equivalent native born and the cross-cohort pattern is towards lower values of the task requirement variable through the early 1990s cohort and then a pronounced improvement after that for the latter two cohorts. However, once education controls are introduced (columns 5, 8 and 11) the coefficients on the immigrant indicator suggest that the earliest arrival cohort have lower task requirements associated with their jobs along the three dimensions and the cross-cohort pattern in each case is generally towards lower task requirements values of each index. Finally, once the controls are expanded to include official language and region of birth variables (columns 6, 9 and 12), the coefficient on the immigrant indicator is either not significantly different from zero or is much closer to zero (column 9), and the cross-cohort pattern is much less pronounced with the absolute values of the coefficients closer to zero than in the models with education controls but no language or source country controls.

In the final six columns of Table 1, estimates from equivalent models are presented for the non-routine manual and the routine manual task requirement indexes. In the relatively simple model of columns 13 and 16, we see that immigrants in the earliest arrival cohort (1970-74) have somewhat lower levels of the non-routine manual task requirement index (-.061) and significantly higher values of the routine manual index (.119) than do otherwise similar Canadian born. There is a clear cross arrival cohort pattern of positive cross-cohort difference starting with the 1975-79 cohort and ending with the 1985-89 cohort, similar but somewhat lower levels for the 1990-94 cohort, then a new pattern of decreasing cohort differences through to the 2000-04 cohort. In contrast, once we control for education (columns 14 and 17), the overall pattern is of positive cohort differences from the earliest cohorts to the most recent cohorts. Finally, when we consider the models with the richest set of controls (education, official language fluency and region of birth), we see fairly flat cross arrival cohort profiles until the late 1990s. For the routine-manual model the 1995-99 cohort has a somewhat smaller and positive cohort effect (.045) and the 2000-04 cohort has a larger still positive cohort effect (.138). For the routine manual model in column 17, the coefficient on the 1995-99 cohort is .023 and the coefficient on the 2000-04 cohort is .083.

In summary, the immigrant cross-cohort patterns in our Table 1 analysis suggest that the relevant task requirement distinction that is important for understanding the cross-cohort declining earnings of immigrants in Canada is not "routine versus non-routine" (as one might expect based on the computerization hypothesis of Autor, Levy, and Murnane (2003)) but "manual versus non-manual". For the three non-manual groupings (non-routine analytical, non-routine interactive and routine cognitive) the cohort profiles are similar to what was found in the log weekly earnings analyses of columns 1-3. Specifically, without controls for education, language or region of origin, outcomes were weaker across arrival cohorts until the mid 1990s and then improved somewhat after that. However, once education is included in the model, the effect of the large increase in education levels of immigrants arriving after the early 1990s is absorbed into the education controls and we see a reasonably clear pattern of cross-cohort declines in the skill requirements across these three non-manual task areas that is similar to the almost monotonic cross-cohort decline in earnings in column 2. However, for the two manual task groupings (routine manual and non-routine manual), quite a different cross-cohort pattern is present. Without education, language or region controls, we see rising manual task requirements in jobs held across cohorts through the late 1980s, a slight decline for the early 1990s and then a pronounced decline for the cohorts arriving after 1994. In the models with education controls, we see a pattern of monotonic positive cross-cohort effects. In the model with education, language and region of birth, we see very little in the way of a cross-cohort pattern except for a modest increase in the index for the last two cohorts.

We interpret these findings as evidence that the move to a more educated inflow of economic immigrants had a significant impact making new immigrants more likely to be in jobs with non-manual task requirements and less likely to be in jobs with manual task requirements. However, this occurred within a context of a strong cross-cohort trend of declining non-manual task requirements and increasing manual task requirements. Most of these trends can be explained by controls for language fluency and region of birth suggesting that the changing source country composition was a key factor in the cross-cohort trends away from non-manual jobs and towards manual jobs. It should be noted that we cannot identify from our analysis the underlying causes of this trend. As discussed in the literature review, they could include language fluency issues, discrimination or problems of credential equivalency and incomplete information.

6.4 The Earnings Return to Occupational Task Requirements

The final part of our regression analysis involves estimating equation 2 where we estimate the earnings models of the first three columns of Table 1 but re-estimating them after controlling for the five occupational task requirement indexes denoted by S_i. In the first set regressions we include the five tasks. The signs and magnitudes of these coefficients are interesting in their own right. However, we are also interested in seeing whether their inclusion has an effect on the estimated return to education and on the immigrant arrival cohort profiles.

$$Y_i = X_i\beta + S_i\eta + (\delta_1 imm_i + \sum_{j=2}^{k} \delta_j C_j) \times (S_i\eta) + \alpha_1 YSM_i + \alpha_2 YSM_i^2 + \epsilon_i \qquad (2)$$

In the last three columns, we also include interactions of the five task variables with the cohort dummies.

The first column of Table 2 contains the coefficient estimates of the model which contains the same specification as in the first column of Table 1: controls for immigrant status, age, marital status, Census year, immigrant arrival cohort (default of 1970-74), years-since-migration, region of residence in Canada and the five occupational task requirement indexes. The coefficient on the non-routine analytical tasks index is largest of the five indexes at 0.191 and strongly statistically significant. This indicates that a one standard deviation increase in this index (relative to the 1991 distribution) is associated with approximately 19% higher weekly wages for men. While each of the other indexes is statistically significant, the absolute values of their effects is much smaller ranging from a negative effect of -0.029 for the routine manual task index to 0.047 for the routine cognitive index.

In the second column of Table 2, the equivalent model's estimates are presented but with the education controls also included. The estimated coefficients are generally quite similar to what was found in the first column. However, the negative cohort effects for the last two cohorts, 1995-99 and 2000-04 are larger in absolute value which is consistent with what we found in Table 1 when education controls were included. In the third column of Table 2, we present equivalent estimates based on a model which also conditions on official language fluency controls and region of birth controls. The coefficient on the immigrant indicator in column 3 is -.208 which is lower than the coefficient in column 2 (-.4). This is not surprising given that the inclusion of the source country controls means that the coefficient on the immigrant indicator can be interpreted as the immigrant/Canadian born earnings difference for immigrants born in the primarily English-speaking developed economies. The coefficients on the arrival cohort controls are largely unaffected by the inclusions of the language fluency and region of birth controls.[21]

It is important to note that the inclusion of the five task requirement indexes does not appear to have a significant effect on the cross-cohort patterns when we compare the first three columns of Table 2 to their counterparts in the first three columns of Table 1. This suggests that the task requirement indexes cannot fully explain the underling patterns in earnings outcomes across immigrant arrival cohorts.

The first column of Table 3 contains the coefficients on the immigrant interaction for each occupational task index taken from column 6 of Table 2. Recall that this specification includes the education controls but does not include the controls for official language fluency or source country region. Each subsequent column of Table 3 contains the interaction of the index with each of the immigrant arrival cohorts. Given the default is the 1970-74 arrival cohort, the first column gives the interaction effect for that group of immigrants. The remaining cells in each row provide an estimate of the differences between the 1970-74 cohort interaction with the index and each of the other cohort interactions with the index. For the case of the non-routine analytical tasks index, the cross-cohort pattern is basically flat until the 1990s where we see an upward trend (at least through the end of the 1990s). This is consistent with the return on these types of tasks being increasing for more recent immigrant cohorts, although not for the 2000-04 cohort. Conversely, the opposite pattern is found for non-routine interactive tasks with statistically significant cohort differences (relative to the 1970-74 cohort) with the largest difference being -0.108 for the 1995-1999 cohort. The cohort patterns are less clear for the routine cognitive. For the non-routine manual task index, we once again see a negative cross-cohort pattern that is strongly significant. In contrast, the cross-cohort pattern in returns for the case of the routine manual tasks index is positive and significant beginning with the 1990-94 cohort with the largest effect being 0.055 for the 2000-04 cohort.

[21] The returns to skills and the coefficients on the cohort dummies are very similar to the results presented in column (3) of Table 2 when we add a set of 25 occupation group dummies.

The shifting source country composition of arrival cohorts over this period may in part explain these patterns. A lack of English and/or French language fluency may have made it relatively difficult to earn as much as a Canadian-born person when employed in an occupation with a relatively high level of non-routine interactive task requirements. In addition, the fact that there was a shift towards field of study in the engineering and IT sectors in the 1990s and early 2000s (Hou and Picot, 2009) could explain the rising return to non-routine analytical task requirements.[22] Since our model does not control for field of study, it may be falling into these returns as the composition of immigrant field of study shifted towards relatively high paying fields, at least until the IT Bust of the early 2000s. The fact that the coefficient on the interaction falls from 0.081 for the 1995-99 cohort to -0.017 for the 2000-2004 cohort is consistent with this interpretation. The opposite pattern of cohort interactions for the non-routine manual and routine manual tasks may also be explained by the shifting source country composition across arrival cohorts.

It may be that language is relatively unimportant in occupations with large routine manual requirements since once one learns the skills required, consulting with colleagues may be relatively less important than in the non-routine manual occupations where the fact that job activities are often not routine may necessitate greater communication with colleagues in order to learn how to resolve issues that are changing regularly. However, it is important to note that the equivalent interactions of the five task variables with the arrival cohort variables from the model of Table 2 that includes the language variables and the source country variables (column 6) has largely the same patterns of estimates as to what we present in Table 3. Consequently, it does not appear that cross arrival cohort variation in source country or language fluency can be used to explain these patterns.

[22] See also Sweetman and McBride (2004) for a study showing the importance of field of study in determining the earnings of immigrants to Canada within post-secondary educational categories.

7 Analysis of Earnings and Occupational Task Requirements for Immigrant Women

The analysis above has been repeated for women with broadly similar findings. We present equivalent regression results from Table 1 in Table 4 based on estimation over the sub-sample of women. As can be seen from Table 4, the coefficient estimates are generally similar to those of Table 1 for men. The same patterns of declining earnings across more recent arrival cohorts are present as well as declining occupational task requirements in the three cognitive areas as well as cross-cohort increases in the task requirements in the two manual indexes. One notable difference from the results for men is that the improvement in the cognitive task indexes for the late 1990s and early 2000s cohorts are not nearly as pronounced for women as they are for men in models where education controls are not included. This could reflect the fact that men are more likely than women to be the Principal Applicants under the point system; therefore, the shift in educational focus in immigrant selection may have directly impacted on the education levels of the Principal Applicants who were more likely to be men (See Sweetman and Warman (2010)). That said, the strong increase in university education for these cohorts that is shown in Figure 2 for men is also present in the equivalent figure for women so there was a large increase in university education for the immigrant women in these cohorts. The differences may be related to selection effects due to differential labour force participation behaviour for immigrant women compared to immigrant men. We condition all of our analysis on individuals who are employed at the time of the Census since we need the occupational information in order to generate the occupational task requirements. Research on these differences for immigrant women is an important area for future research.

8 Earnings Inequality of New Immigrants to Canada

Using the Gini Coefficients, we next examine the importance of immigrants on Canadian income inequality and take into consideration the interaction between immigrants and technical change. The Gini Coefficient is a measure of the degree of income inequality in a population and can be interpreted in terms of the Lorenz Curve.[23] The Gini can be shown to be an increasing function of the area between the Lorenz curve and the line of absolute equality, which is represented by a 45 degree line. The less inequality there is, the closer the Lorenz curve is to the 45 degree line. The Gini Coefficient includes the range of real numbers from zero to one, where a coefficient of zero would indicate perfect equality, so everyone would have the same income while a coefficient of one would indicate perfect inequality so that one person would have all the income.

In column one of Table 5, we present the overall Gini Coefficients for weekly earnings, first separately by year.[24] The Gini Coefficient increases over the fifteen-year period starting at .368 in 1991 and increasing to .407 in 2006. This is a notable increase in inequality of around 11%. In column 2, we present the Gini Coefficients using the actual weekly earnings of the native born but for immigrants we calculate what their earnings would have been if they had been assigned the tasks they would be given if they were native born. To calculate the counterfactual, we take each immigrant and adjust the person's actual earnings for the extra earnings that he/she would have received according to our reduced form models of: 1) tasks and 2) earnings returns to tasks if he/she had the same value of each occupational task requirement variable as an otherwise similar native-born person (based on gender and highest level of completed education). We end up with five task adjustment values per person and we use the coefficients from an earnings model with the five occupational task requirement variables on the right-hand side to determine one earnings adjustment for each immigrant. We then add that number (either positive or negative) to the immigrant's actual earnings and calculate the Gini coefficient with this adjusted earnings sample of observations.

Even with the increase in tasks and resulting weekly earnings,[25] we find that there is

[23] The Lorenz Curve represents the share of income held by a share of the population after the population has been sorted by income going from lowest to highest.

[24] We present five % confidence intervals in parentheses based on 99 bootstrap replications.

[25] We find the resulting increase in earnings grows over the sample period with the average increase in weekly earnings of $43.5 in 1991 and $87.4 in 2006 for men, or about $2,262 and $4,546 in terms of annual earnings. We find similar results for females.

very little change in the Gini Coefficients with them dropping from .368 to .366 in 1991 and from .407 to .402 in 2006. In column 3, we go even further by dropping immigrants and re-estimating the Gini Coefficients using only the native-born population in our sample. Again, we see very little change in the Gini Coefficient in each year.[26]

In the last two columns of Table 5, we focus on earnings inequality within the immigrant population and first investigate whether it has changed over time in the 1991-2006 period. The immigrant population in our sample experiences rising earnings inequality over the period from a Gini of .387 in 1991 to .426 in 2006 which mirrors the trend in inequality we see in column 3 for the native-born population but represents greater income inequality in each year than that of the native born. In the final column, we again focus on the immigrant sub-sample and calculate the Gini after assigning the immigrants the task levels across each of the five dimensions of otherwise equivalent native-born men using the method described above for the simulation of column 2. This leads to a small decline in the Gini in each year which is significant from 1996 onwards. The upward trend in earnings inequality is smaller in column 5 relative to column 4 which suggests that the low cognitive task requirements and the high manual task requirements received by immigrants (relative to otherwise similar native born) led to an increased level of inequality within the immigrant sub-population in Canada.

This simulation ignores possible General Equilibrium effects that may occur from the presence of the immigrants in Canada. For example, the presence of immigrants may have an impact on the wages of the Canadian born which could have an impact on overall income inequality in Canada and this would not be captured by our analysis. The majority of studies on the impact of immigration on the wages of the native born find either no statistically significant effect or a modest positive or negative effect (see, for examples, Altonji and Card (1991), Card (2001) for the US and Tu (2010) for Canada. However, Aydemir and Borjas (2007), find that a 10% labour supply increase is associated with a 3%-4% decline in wages.

[26] If we use the Theil Index, although the increase in inequality between 1991 and 2006 is much more pronounced, the impact on inequality of assigning immigrants the tasks of the native born or dropping immigrants from the sample again is only negligible. See Table A.16 in the appendix

They also find that international migration narrowed wage inequality in Canada while it raised wage inequality in the United States. Peri and Sparber (2009) find that the effect of the large inflow of low skilled immigrants in the US had only a small impact on the wages of the less educated. They conclude that less skilled immigration in the US led the highly skilled American-born workers to be more likely to pursue jobs with more communication intensive tasks. Consequently, we see this debate over the likely impact of immigration on the wages of natives as still unresolved but an important area for future work, especially for Canada.

Another possibility is that it was the expansion of the university educated part of the Canadian workforce over the 1980s and 1990s which held back the widening of the so called 'college premium' in Canada preventing it from being apparent in the data. This might also be an explanation for why we do not find a growing return to non-routine cognitive and non-routine interactive task requirements and a declining return to routine manual task requirements for Canada as one would expect given the findings of Autor, Levy, and Murnane (2003) in the US. In an early study on the topic, Freeman and Needels (1991) note that the college/high school differential increased much less in Canada in the 1980s than it did in the US and attribute this in part to the greater growth in the university graduate proportion of the labour force in Canada than the US. It may be that the highly skilled immigration that followed further served to hold back the growth in wages of the university educated. However, the low occupational task requirements in the three cognitive related areas and the high occupational task requirements in the two manual areas for these highly educated recent cohorts of immigrants indicate that these immigrants competed more directly with workers at the middle to bottom part of the skill distribution in Canada than workers at the top of the skill distribution.

9 Conclusions

The declining earnings outcomes of successive immigrant arrival cohorts to Canada since the 1970s have raised considerable attention in the policy and academic communities. In this paper, we explore the underlying causes of the poorer performance of new immigrants by focusing on the different types of occupational task requirements of the jobs held by immigrants and Canadian born.

Coinciding with the pattern of cross-cohort declines in the entry earnings of immigrant to Canada was a somewhat complex cohort pattern in terms of task requirements. Without accounting for the individual's education level, we observe declining levels of non-routine analytical, non-routine interactive and routine cognitive task requirements across the 1980s immigrant entry cohorts through the early 1990s entry cohorts. However, the pattern then reverses with an increase in these three occupational task requirements for immigrant men in the late 1990s and early 2000s which coincided with the expansion of a more highly educate inflow of immigrants to Canada. An almost opposite cohort pattern is found for each of the manual occupational task requirement indexes (routine and non-routine). Once, we control for education, the improvement in the late 1990s in the levels of the three cognitive dimensions (non-routine analytical, non-routine interactive and routine cognitive) is either eliminated or diminished. We interpret the finding as indicating that the underlying causes of the cross-cohort decline in immigrants to Canada apparent in the earnings data have been manifested in occupations that have relied in a generally increasing way on manual skills rather than cognitive skills.

The cross-cohort patterns in both earnings and the different occupational task requirement dimensions can be explained by the strong change in immigrant source country distribution (moving away from countries where individuals are likely to have strong fluency in English) coupled with the shift in field of study towards engineering and other IT related area of studies in the 1990s. The former shift meant that recent immigrants may have struggled in spite of their high levels of education to interact effectively with colleagues (as suggested by the low levels and returns to non-routine interactive tasks requirements) and may have been forced to take jobs with manual task requirements. The second shift could explain the fact that we see strong returns to non-routine analytical tasks requirements for the late 1990s cohort. However, this return drops dramatically at the time of the IT collapse in the early 2000s. Consequently, careful consideration of the links between education, intended occupation and language fluency in the selection of economic immigrants appear to be of paramount importance. The increased emphasis on language testing which occurred in Canada shortly after the end of the period covered by our data may have led to better outcomes for immigrants. Future research should explore this possibility.

The final part of our analysis involves an investigation of the role of immigration in determining overall income inequality in Canada. We find evidence of growing income inequality for both the native born and for immigrants with the overall level of earnings inequality somewhat higher for immigrants than for the native born in each Census year. The importance of immigration for overall income inequality in Canada appears to be small based on our Gini Coefficient analysis. We carried out simulations in which immigrants were assigned the occupational task requirement values of otherwise similar native born to see the impact that this would have on the overall level of earnings inequality in Canada and earnings inequality within the immigrant sub-population. The effect was small and not statistically significant for the overall earnings inequality. In terms of immigrant earnings inequality, the counterfactual exercise led to a slight reduction in inequality which was statistically significant in the 1996 and later Census years and was largest for the most recent Census of 2006.

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Figure 1: Immigrant Landings in Canada, All Immigrants and Economic Immigrants, 1980-2012

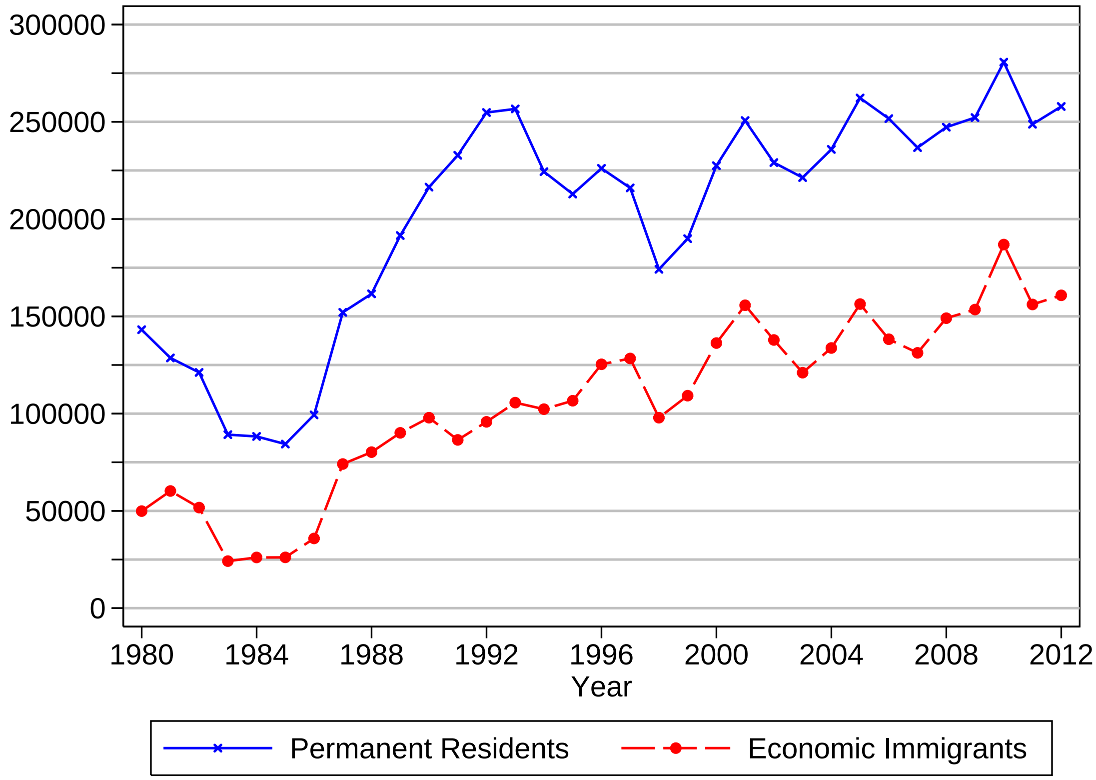


Figure 2: Highest Level of Education by Arrival Cohort, Males.

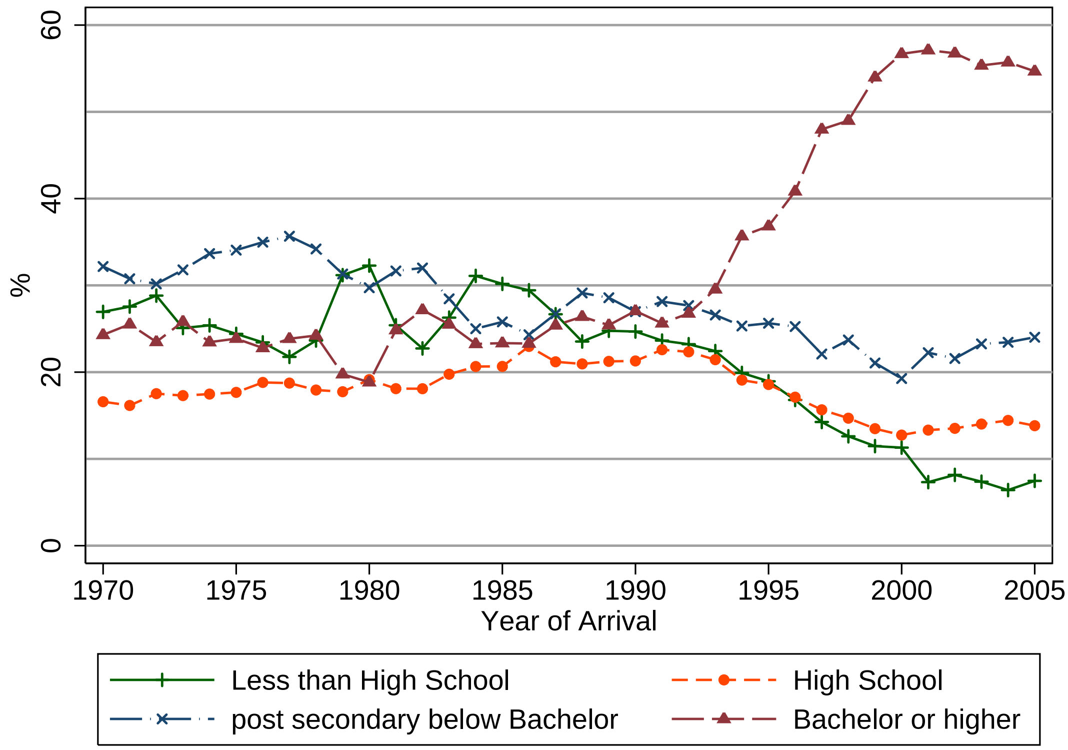


Figure 3: Weekly earnings, Males.

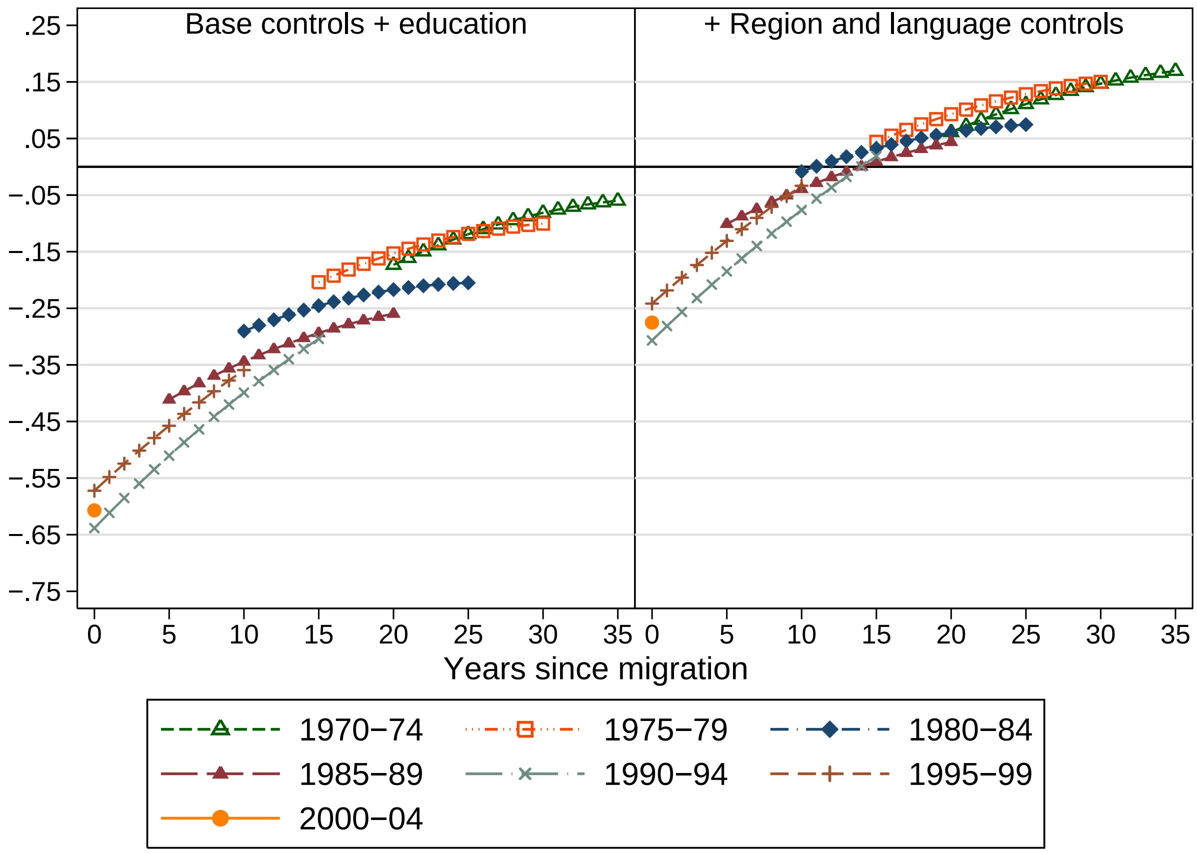
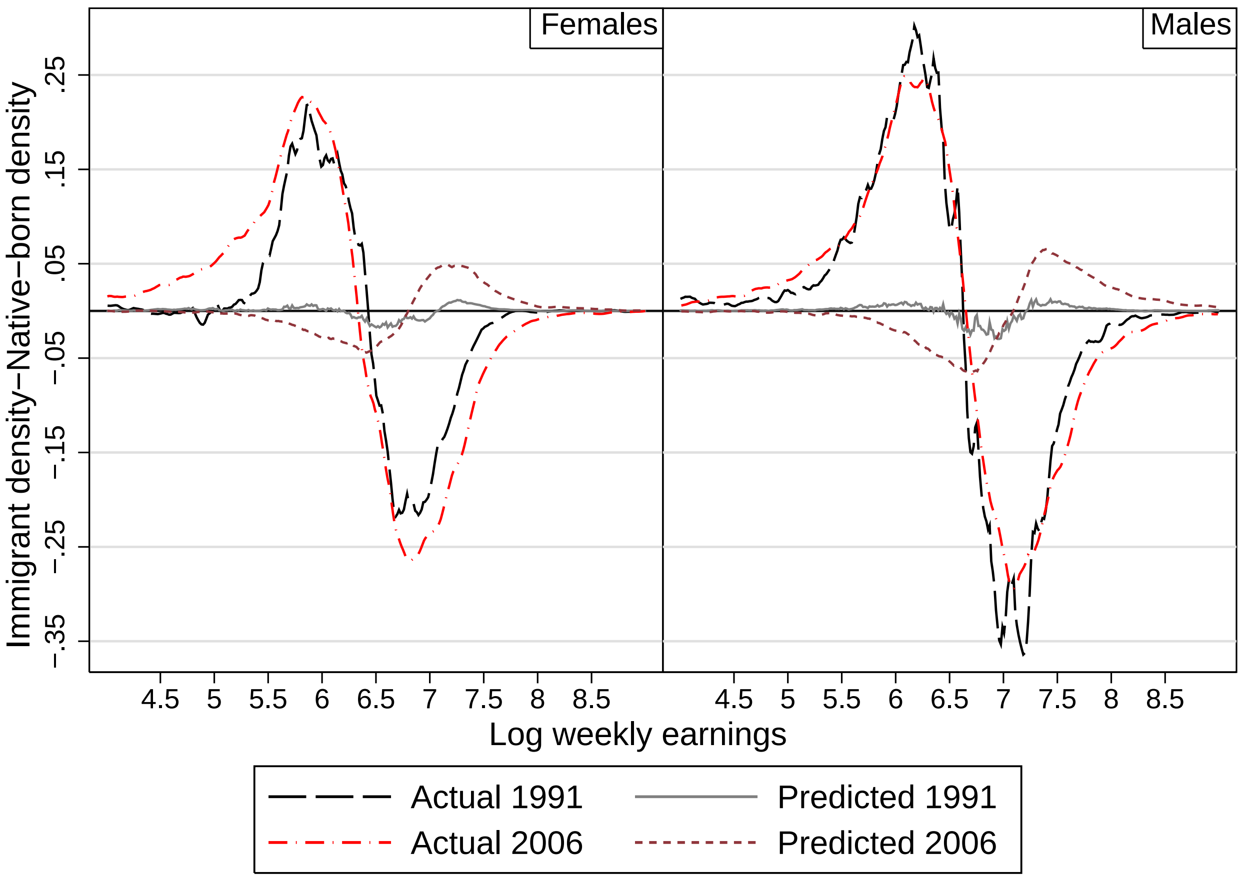


Figure 4: Immigrant-Native Born Differences in Earning Densities, For Recent Immigrant Cohort



Notes: 1991: 1985-89 cohort, 2006: 2000-04 cohort.

Table 1: Log Weekly Earnings and Task Regressions, Men Part 1

	earnings			Non-Routine Analytical			Non-Routine Interactive		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Immigrants	-0.404**	-0.467**	-0.222**	-0.186**	-0.364**	-0.0431**	-0.242**	-0.397**	-0.0718**
	(0.0086)	(0.0084)	(0.0087)	(0.0107)	(0.0092)	(0.0096)	(0.0103)	(0.0093)	(0.0097)
imm x 75-79	-0.0023	0.0079	0.0214**	-0.0101	0.0198**	0.0292**	-0.0132*	0.0141*	0.0275**
	(0.0052)	(0.0050)	(0.0050)	(0.0065)	(0.0055)	(0.0054)	(0.0065)	(0.0058)	(0.0056)
imm x 80-84	-0.0545**	-0.0322**	0.0117*	-0.0802**	-0.0204**	0.0311**	-0.0789**	-0.0296**	0.0378**
	(0.0059)	(0.0057)	(0.0056)	(0.0073)	(0.0062)	(0.0061)	(0.0072)	(0.0063)	(0.0063)
imm x 85-89	-0.0964**	-0.0611**	0.0069	-0.174**	-0.0788**	-0.0052	-0.1470**	-0.0676**	0.0226**
	(0.0064)	(0.0062)	(0.0062)	(0.0080)	(0.0068)	(0.0067)	(0.0079)	(0.0070)	(0.0069)
imm x 90-94	-0.160**	-0.129**	-0.0446**	-0.199**	-0.118**	-0.0336**	-0.165**	-0.100**	0.0025
	(0.0069)	(0.0067)	(0.0066)	(0.0086)	(0.0074)	(0.0073)	(0.0085)	(0.0076)	(0.0075)
imm x 95-99	-0.0589**	-0.0904**	-0.0052	0.0364**	-0.0649**	0.0167+	-0.0210*	-0.1230**	-0.0212*
	(0.0079)	(0.0077)	(0.0077)	(0.0101)	(0.0087)	(0.0086)	(0.0097)	(0.0087)	(0.0086)
imm x 20-04	-0.114**	-0.172**	-0.0816**	0.0200+	-0.166**	-0.0763**	-0.0110	-0.193**	-0.0829**
	(0.0092)	(0.0090)	(0.0089)	(0.0117)	(0.0102)	(0.0101)	(0.0112)	(0.0101)	(0.0100)
YSM	0.0189**	0.0218**	0.0211**	0.0054**	0.0135**	0.0145**	0.0047**	0.0120**	0.0130**
	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0007)	(0.0007)	(0.0008)	(0.0007)	(0.0007)
$YSM^2/100$	-0.0260**	-0.0324**	-0.0315**	-0.0061*	-0.0232**	-0.0267**	-0.0031	-0.0183**	-0.0220**
	(0.0022)	(0.0021)	(0.0021)	(0.0026)	(0.0022)	(0.0022)	(0.0025)	(0.0022)	(0.0022)
< High school		-0.136**	-0.127**		-0.283**	-0.259**		-0.283**	-0.262**
		(0.0027)	(0.0027)		(0.0028)	(0.0028)		(0.0030)	(0.0030)
Post Sec. below Uni		0.113**	0.108**		0.302**	0.295**		0.164**	0.158**
		(0.0022)	(0.0022)		(0.0025)	(0.0025)		(0.0027)	(0.0027)
Bachelor Degree		0.329**	0.323**		1.017**	0.995**		0.871**	0.851**
		(0.0027)	(0.0027)		(0.0030)	(0.0031)		(0.0031)	(0.0031)
Graduate Degree		0.488**	0.474**		1.400**	1.356**		1.232**	1.193**
		(0.0038)	(0.0038)		(0.0037)	(0.0037)		(0.0039)	(0.0039)
Region/Language	NO	NO	YES	NO	NO	YES	NO	NO	YES
R-squared	0.083	0.123	0.127	0.029	0.252	0.261	0.031	0.204	0.213
Observations	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200

Regressions include controls for region of residence, year, marital status, age and age squared. ** $p<0.01$, * $p<0.05$, + $p<0.1$.

Table 1: Log Weekly Earnings and Task Regressions, Men continued

	Routine Cognitive			Non-Routine manual			Routine manual		
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Immigrants	-0.112**	-0.250**	-0.0107	-0.0608**	0.0795**	-0.108**	0.119**	0.248**	-0.0219*
	(0.0106)	(0.0095)	(0.0099)	(0.0101)	(0.0092)	(0.0096)	(0.0106)	(0.0097)	(0.0103)
imm x 75-79	-0.0045	0.0171**	0.0189**	0.0158*	-0.0117*	-0.0107+	0.0307**	0.0037	-0.0012
	(0.0065)	(0.0058)	(0.0057)	(0.0062)	(0.0056)	(0.0055)	(0.0068)	(0.0062)	(0.0061)
imm x 80-84	-0.0684**	-0.0156*	0.0090	0.0513**	0.0076	-0.0274**	0.0652**	0.0301**	-0.0220**
	(0.0073)	(0.0064)	(0.0064)	(0.0069)	(0.0062)	(0.0061)	(0.0074)	(0.0067)	(0.0067)
imm x 85-89	-0.152**	-0.0695**	-0.0293**	0.1210**	0.0515**	0.0090	0.112**	0.0547**	-0.0127+
	(0.0080)	(0.0071)	(0.0071)	(0.0077)	(0.0069)	(0.0068)	(0.0081)	(0.0074)	(0.0073)
imm x 90-94	-0.189**	-0.116**	-0.0731**	0.0927**	0.0428**	0.0036	0.0880**	0.0513**	-0.0220**
	(0.0086)	(0.0077)	(0.0077)	(0.0083)	(0.0075)	(0.0074)	(0.0087)	(0.0080)	(0.0079)
imm x 95-99	0.0233*	-0.0393**	-0.00420	-0.0395**	0.0856**	0.0450**	-0.0350**	0.0987**	0.0227*
	(0.0100)	(0.0090)	(0.0089)	(0.0096)	(0.0086)	(0.0086)	(0.0010)	(0.0092)	(0.0091)
imm x 20-04	0.0124	-0.109**	-0.0692**	-0.0378**	0.177**	0.138**	-0.0660**	0.159**	0.0834**
	(0.0116)	(0.0105)	(0.0105)	(0.0111)	(0.0102)	(0.0101)	(0.0115)	(0.0107)	(0.0106)
YSM	0.0058**	0.0122**	0.0132**	0.0086**	0.0013+	0.0003	0.0053**	-0.0015+	-0.0020**
	(0.0008)	(0.0008)	(0.0007)	(0.0008)	(0.0007)	(0.0007)	(0.0008)	(0.0008)	(0.0007)
$YSM^2/100$	-0.0084**	-0.0224**	-0.0256**	-0.0152**	0.0002	0.0034	-0.0109**	0.0030	0.0055*
	(0.0026)	(0.0023)	(0.0023)	(0.0024)	(0.0022)	(0.0021)	(0.0025)	(0.0023)	(0.0023)
< High school		-0.267**	-0.246**		0.376**	0.351**		0.308**	0.282**
		(0.0028)	(0.0028)		(0.0029)	(0.0030)		(0.0028)	(0.0028)
Post Sec. below Uni		0.316**	0.311**		0.0578**	0.0599**		0.141**	0.145**
		(0.0026)	(0.0025)		(0.0028)	(0.0028)		(0.0028)	(0.0028)
Bachelor Degree		0.833**	0.813**		-0.911**	-0.883**		-0.849**	-0.823**
		(0.0031)	(0.0031)		(0.0030)	(0.0030)		(0.0031)	(0.0031)
Graduate Degree		1.003**	0.963**		-1.046**	-1.003**		-1.019**	-0.976**
		(0.0038)	(0.0039)		(0.0036)	(0.0036)		(0.0047)	(0.0048)
Region/Language	NO	NO	YES	NO	NO	YES	NO	NO	YES
R-squared	0.024	0.177	0.184	0.027	0.208	0.217	0.020	0.183	0.193
Observations	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200

Regressions include controls for region of residence, year, marital status, age and age squared. ** p<0.01, * p<0.05, + p<0.1.

Table 2: Log Weekly Earnings Regressions with Task Controls, Men

	No Interactions:			Interactions by Cohort		
Immigrant	-0.359**	-0.400**	-0.208**	-0.367**	-0.406**	-0.213**
	(0.0083)	(0.0082)	(0.0086)	(0.0085)	(0.0085)	(0.0088)
imm X 1975-79	0.0000	0.0051	0.0170**	-0.0023	0.0023	0.0170**
	(0.0049)	(0.0049)	(0.0049)	-0.0057	(0.0056)	(0.0056)
imm X 1980-84	-0.0370**	-0.0280**	0.0081	-0.0346**	-0.0265**	0.0119+
	(0.0056)	(0.0055)	(0.0055)	(0.0062)	(0.0061)	(0.0061)
imm X 1985-89	-0.0592**	-0.0482**	0.0081	-0.0547**	-0.0467**	0.0114+
	(0.0061)	(0.0061)	(0.0061)	(0.0066)	(0.0065)	(0.0065)
imm X 1990-94	-0.116**	-0.108**	-0.0371**	-0.116**	-0.111**	-0.0387**
	(0.0066)	(0.0065)	(0.0065)	(0.0070)	(0.0069)	(0.0069)
imm X 1995-99	-0.0665**	-0.0816**	-0.00940	-0.0837**	-0.0996**	-0.0265**
	(0.0076)	(0.0075)	(0.0075)	(0.0081)	(0.0081)	(0.0080)
imm X 2000-04	-0.119**	-0.150**	-0.0742**	-0.119**	-0.153**	-0.0768**
	(0.0088)	(0.0087)	(0.0087)	(0.0092)	(0.0092)	(0.0092)
Non-Routine Analytical	0.191**	0.134**	0.131**	0.177**	0.120**	0.119**
	(0.0025)	(0.0025)	(0.0025)	(0.0028)	(0.0029)	(0.0029)
Non-Routine Interactive	-0.0085**	0.0076**	0.0070**	0.0005	0.0158**	0.0160**
	(0.0019)	(0.0019)	(0.0019)	(0.0021)	(0.0021)	(0.0021)
Routine Cognitive	0.0470**	0.0530**	0.0540**	0.0494**	0.0571**	0.0571**
	(0.00176)	(0.0017)	(0.0018)	(0.0020)	(0.0020)	(0.0020)
Non-Routine Manual	0.0428**	0.0683**	0.0663**	0.0428**	0.0691**	0.0703**
	(0.0016)	(0.0016)	(0.0016)	(0.0018)	(0.0018)	(0.0018)
Routine Manual	-0.0291**	-0.0299**	-0.0270**	-0.0285**	-0.0312**	-0.0305**
	(0.00168)	(0.00167)	(0.00167)	(0.00192)	(0.00191)	(0.00191)
Years since migration	0.0174**	0.0191**	0.0183**	0.0173**	0.0191**	0.0186**
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Years since migration^2/100	-0.0241**	-0.0279**	-0.0266**	-0.0246**	-0.0283**	-0.0276**
	(0.0021)	(0.0020)	(0.0020)	(0.0021)	(0.0020)	(0.0020)
< High school		-0.0981**	-0.0940**		-0.0981**	-0.0942**
		(0.0027)	(0.0027)		(0.0027)	(0.0027)
Post Secondary < Bachelor's		0.0547**	0.0514**		0.0554**	0.0522**
		(0.0022)	(0.0022)		(0.0022)	(0.0022)
Bachelor's Degree		0.179**	0.179**		0.179**	0.180**
		(0.0028)	(0.0028)		(0.0028)	(0.0028)
Graduate Degree		0.279**	0.275**		0.275**	0.274**
		(0.0040)	(0.0041)		(0.0041)	(0.0041)
Region/Language	NO	NO	YES	NO	NO	YES
R-squared	0.148	0.158	0.160	0.148	0.158	0.161
Observations	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200	1,374,200

Regressions include controls for region of residence, year, marital status, age and age squared. ** p<0.01, * p<0.05, + p<0.1.

Table 3: Cohort by Task interaction effects, Men

	Immigrant	Imm X 1975-79	Imm X 1980-84	Imm X 1985-89	Imm X 1990-94	Imm X 1995-99	Imm X 2000-04
Non-Routine Analytical	0.0750**	-0.0025	0.0183	-0.0145	0.0353**	0.0814**	-0.0171
	(0.0105)	(0.0143)	(0.0145)	(0.0136)	(0.0135)	(0.0143)	(0.0161)
Non-Routine Interactive	-0.0126	-0.0138	-0.0324**	-0.0194+	-0.0659**	-0.108**	-0.0520**
	(0.0079)	(0.0108)	(0.0111)	(0.0105)	(0.0106)	(0.0115)	(0.0131)
Routine Cognitive	-0.0465**	0.0210*	0.0190+	0.0206*	0.0156+	0.0115	0.0461**
	(0.0070)	(0.0097)	(0.0097)	(0.0091)	(0.0091)	(0.0101)	(0.0112)
Non-Routine Manual	0.0061	0.0122	-0.0141	0.0013	-0.0151+	-0.0396**	-0.0435**
	(0.0069)	(0.0095)	(0.0097)	(0.0090)	(0.0090)	(0.0101)	(0.0109)
Routine Manual	-0.0048	-0.0141	0.0019	0.0006	0.0171+	0.0422**	0.0552**
	(0.0070)	(0.0094)	(0.0094)	(0.0090)	(0.0090)	(0.0101)	(0.0110)

Regressions include controls for region of residence, year, marital status, age and age squared. ** p<0.01, * p<0.05, + p<0.1.

Table 4: Log Weekly Earnings and Task Regressions, Women

		earnings			Non-Routine Analytical			Non-Routine Interactive	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Immigrants	-0.285**	-0.318**	-0.221**	-0.358**	-0.438**	-0.151**	-0.371**	-0.442**	-0.152**
	(0.0093)	(0.0091)	(0.0095)	(0.0110)	(0.0098)	(0.0101)	(0.0103)	(0.0092)	(0.0095)
imm x 75-79	-0.0216**	-0.0157**	-0.0077	-0.0236**	-0.0092	0.0056	-0.0215**	-0.0087	0.0071
	(0.0056)	(0.0054)	(0.0054)	(0.0067)	(0.0059)	(0.0058)	(0.0065)	(0.0057)	(0.0056)
imm x 80-84	-0.0613**	-0.0330**	-0.0122*	-0.0917**	-0.0330**	0.0094	-0.0943**	-0.0418**	0.0048
	(0.0063)	(0.0061)	(0.0061)	(0.0076)	(0.0066)	(0.0065)	(0.0072)	(0.0064)	(0.0063)
imm x 85-89	-0.0836**	-0.0500**	-0.0190**	-0.1270**	-0.0552**	0.0048	-0.122**	-0.0574**	0.0077
	(0.0069)	(0.0067)	(0.0067)	(0.0083)	(0.0073)	(0.0072)	(0.0079)	(0.0070)	(0.0069)
imm x 90-94	-0.163**	-0.136**	-0.0975**	-0.176**	-0.117**	-0.0327**	-0.166**	-0.114**	-0.0240**
	(0.0074)	(0.0072)	(0.0072)	(0.0090)	(0.0079)	(0.0078)	(0.0084)	(0.0075)	(0.0074)
imm x 95-99	-0.134**	-0.162**	-0.121**	-0.0238*	-0.0821**	0.0004	-0.0562**	-0.109**	-0.0198*
	(0.0086)	(0.0083)	(0.0084)	(0.0104)	(0.0091)	(0.0091)	(0.0097)	(0.0086)	(0.0085)
imm x 20-04	-0.203**	-0.275**	-0.231**	-0.0331**	-0.187**	-0.104**	-0.0443**	-0.182**	-0.0939**
	(0.0100)	(0.0098)	(0.0098)	(0.0121)	(0.0108)	(0.0107)	(0.0112)	(0.0101)	(0.0100)
YSM	0.0138**	0.0163**	0.0160**	0.0093**	0.0146**	0.0140**	0.00981**	0.0146**	0.0138**
	(0.0007)	(0.0007)	(0.0007)	(0.0009)	(0.0008)	(0.0008)	(0.0008)	(0.0007)	(0.0007)
$YSM^2/100$	-0.0166**	-0.0232**	-0.0228**	-0.0069**	-0.0195**	-0.0196**	-0.0085**	-0.0199**	-0.0198**
	(0.0022)	(0.0021)	(0.0021)	(0.0026)	(0.0023)	(0.0023)	(0.0024)	(0.0022)	(0.0021)
< High school		-0.210**	-0.200**		-0.328**	-0.305**		-0.298**	-0.275**
		(0.0031)	(0.0032)		(0.0030)	(0.0030)		(0.0028)	(0.0029)
Post Sec. below Uni		0.163**	0.160**		0.364**	0.358**		0.317**	0.311**
		(0.0023)	(0.0023)		(0.0025)	(0.0025)		(0.0024)	(0.0024)
Bachelor Degree		0.486**	0.474**		1.038**	1.023**		0.929**	0.914**
		(0.0027)	(0.0027)		(0.0029)	(0.0029)		(0.0028)	(0.0028)
Graduate Degree		0.659**	0.639**		1.472**	1.436**		1.316**	1.282**
		(0.00451)	(0.00456)		(0.00431)	(0.00436)		(0.00441)	(0.00446)
Region/Language	NO	NO	YES	NO	NO	YES	NO	NO	YES
R-squared	0.038	0.107	0.109	0.025	0.247	0.254	0.025	0.224	0.231
Observations	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380

Regressions include controls for region of residence, year, marital status, age and age squared. ** p<0.01, * p<0.05, + p<0.1.

Table 4: Log Weekly Earnings and Task Regressions, Women continued.

	Routine Cognitive			Non-Routine manual			Routine manual		
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Immigrants	-0.404**	-0.430**	-0.175**	0.328**	0.331**	0.0629**	0.310**	0.353**	0.0502**
	(0.0108)	(0.0100)	(0.0102)	(0.00845)	(0.00806)	(0.00818)	(0.0101)	(0.00976)	(0.0101)
imm x 75-79	-0.0004	0.0040	0.0013	-0.0039	-0.0027	-0.0087+	-0.0075	-0.0121*	-0.0322**
	(0.0066)	(0.0060)	(0.0059)	(0.0051)	(0.0048)	(0.0047)	(0.0063)	(0.0061)	(0.0059)
imm x 80-84	-0.0583**	-0.0245**	-0.0116+	0.0642**	0.0485**	0.0152**	0.0509**	0.0255**	-0.0297**
	(0.0074)	(0.0067)	(0.0067)	(0.0058)	(0.0055)	(0.0053)	(0.0071)	(0.0068)	(0.00662)
imm x 85-89	-0.0670**	-0.0306**	-0.0071	0.0379**	0.0227**	-0.0215**	0.0477**	0.0125+	-0.0627**
	(0.0081)	(0.0075)	(0.0074)	(0.0064)	(0.0060)	(0.0059)	(0.0077)	(0.0074)	(0.0073)
imm x 90-94	-0.118**	-0.0898**	-0.0550**	0.0713**	0.0620**	0.00131	0.0585**	0.0337**	-0.0677**
	(0.0088)	(0.0081)	(0.0080)	(0.0068)	(0.0065)	(0.0064)	(0.0083)	(0.0080)	(0.0079)
imm x 95-99	0.0492**	0.0140	0.0390**	0.0024	0.0257**	-0.0282**	-0.0029	0.0380**	-0.0609**
	(0.0101)	(0.0093)	(0.0092)	(0.0079)	(0.0075)	(0.0074)	(0.0095)	(0.0091)	(0.0090)
imm x 20-04	0.0687**	-0.0144	0.0062	-0.0317**	0.0142	-0.0364**	-0.0325**	0.0626**	-0.0385**
	(0.0117)	(0.0109)	(0.0108)	(0.0092)	(0.0088)	(0.0086)	(0.0110)	(0.0107)	(0.0106)
YSM	0.0105**	0.0136**	0.0130**	-0.00264**	-0.0046**	-0.0036**	0.0005	-0.0030**	-0.0023**
	(0.0009)	(0.0008)	(0.0008)	(0.0007)	(0.0006)	(0.0006)	(0.0008)	(0.0007)	(0.0007)
$YSM^2/100$	-0.0045+	-0.0141**	-0.0144**	-0.0074**	-0.0006	-0.000869	-0.0107**	-0.0031	-0.0031
	(0.0026)	(0.0024)	(0.0023)	(0.0020)	(0.0019)	(0.0018)	(0.0024)	(0.0023)	(0.0022)
< High school		-0.408**	-0.380**		0.364**	0.338**		0.234**	0.209**
		(0.0032)	(0.0032)		(0.0026)	(0.0027)		(0.0028)	(0.0028)
Post Sec. below Uni		0.198**	0.193**		0.0111**	0.0170**		0.0856**	0.0922**
		(0.0025)	(0.0025)		(0.0021)	(0.0021)		(0.0025)	(0.0025)
Bachelor Degree		0.517**	0.500**		-0.194**	-0.176**		-0.458**	-0.439**
		(0.00271)	(0.00272)		(0.00226)	(0.00228)		(0.00298)	(0.00301)
Graduate Degree		0.736**	0.699**		-0.273**	-0.236**		-0.669**	-0.628**
		(0.0040)	(0.0040)		(0.0034)	(0.0034)		(0.0053)	(0.0054)
Region/Language	NO	NO	YES	NO	NO	YES	NO	NO	YES
R-squared	0.022	0.125	0.133	0.021	0.073	0.086	0.016	0.085	0.094
Observations	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380	1,281,380

Regressions include controls for region of residence, year, marital status, age and age squared. ** p<0.01, * p<0.05, + p<0.1.

Table 5: Gini Coefficients

Year	Everyone	Immigrants assigned Tasks of Native born	Immigrants Dropped	Immigrants only	Immigrants only, but assigned Tasks of Native born
1991	0.3675	0.3656	0.3651	0.3871	0.3701
	(.3655-.3694)	(.3638-.3675)	(.3629-.3673)	(.3833-.3909)	(.3648-.3754)
1996	0.3833	0.3801	0.3790	0.4104	0.3862
	(.3809-.3856)	(.3777-.3824)	(.3762-.3819)	(.4072-.4136)	(.3833-.3890)
2001	0.3954	0.3921	0.3914	0.4173	0.3959
	(.3932-.3975)	(.3899-.3943)	(.3886-.3942)	(.4140-.4206)	(.3924-.3993)
2006	0.4069	0.4017	0.4028	0.4263	0.3953
	(.4042-.4096)	(.3987-.4046)	(.3995-.4060)	(.4201-.4326)	(.3901-.4005)

Five % confidence intervals in parentheses based on 99 bootstrap replications.

A Principal Component Factor Analysis

Table A.1: Non-Routine Analytical

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	8.62834	7.64472	0.719	0.719
Factor2	0.98362	0.21301	0.082	0.801
Factor3	0.77061	0.30553	0.0642	0.8652
Factor4	0.46508	0.18602	0.0388	0.904
Factor5	0.27906	0.0482	0.0233	0.9272
Factor6	0.23086	0.03219	0.0192	0.9465
Factor7	0.19867	0.06076	0.0166	0.963
Factor8	0.13792	0.02526	0.0115	0.9745
Factor9	0.11266	0.01617	0.0094	0.9839
Factor10	0.09649	0.0262	0.008	0.9919
Factor11	0.07028	0.04386	0.0059	0.9978
Factor12	0.02642	.	0.0022	1

Table A.2: Factor Loadings Non-Routine Analytical

Variable	Factor1	Uniqueness
var4A2b4	0.8544	0.27
var4A2b2	0.8777	0.2297
var4A2b1	0.9004	0.1892
var4A2a3	0.7494	0.4384
var2B4e	0.8874	0.2126
var2B2i	0.8697	0.2436
var2A2b	0.8353	0.3023
var2A2a	0.8808	0.2242
var1C7b	0.8239	0.3211
var1C7a	0.7146	0.4894
var1A1b2	0.8828	0.2207
var1A1b1	0.8772	0.2306

Table A.3: Non-Routine Interactive

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	5.38242	4.55028	0.6728	0.6728
Factor2	0.83214	0.19954	0.104	0.7768
Factor3	0.6326	0.26341	0.0791	0.8559
Factor4	0.36919	0.06674	0.0461	0.902
Factor5	0.30246	0.12871	0.0378	0.9399
Factor6	0.17375	0.00264	0.0217	0.9616
Factor7	0.17111	0.03477	0.0214	0.983
Factor8	0.13634	.	0.017	1

Table A.4: Factor Loadings Non-Routine Interactive

Variable	Factor1	Uniqueness
var4A4c2	0.8038	0.354
var4A4b1	0.8388	0.2964
var4A4a4	0.7485	0.4397
var4A4a1	0.7844	0.3848
var2B5d	0.8606	0.2593
var2B1c	0.8369	0.2996
var2A2d	0.8686	0.2455
var1C2b	0.8134	0.3384

Table A.5: Routine Cognitive

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.79523	2.15946	0.6988	0.6988
Factor2	0.63577	0.30742	0.1589	0.8578
Factor3	0.32835	0.08771	0.0821	0.9398
Factor4	0.24065	.	0.0602	1

Table A.6: Factor Loadings Routine Cognitive

Variable	Factor1	Uniqueness
var2A1e	0.7715	0.4048
var1A1d1	0.8126	0.3396
var1A1c2	0.8796	0.2263
var1A1b6	0.8752	0.2341

Table A.7: Routine Manual

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.21793	1.7507	0.7393	0.7393
Factor2	0.46723	0.15239	0.1557	0.8951
Factor3	0.31484	.	0.1049	1

Table A.8: Factor Loadings Routine Manual

Variable	Factor1	Uniqueness
var1A2c2	0.8363	0.3007
var1A2a3	0.8491	0.279
var1A2a2	0.8931	0.2024

Table A.9: Non-Routine Manual

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	5.52296	5.06699	0.789	0.789
Factor2	0.45597	0.11738	0.0651	0.8541
Factor3	0.33859	0.07623	0.0484	0.9025
Factor4	0.26236	0.04951	0.0375	0.94
Factor5	0.21284	0.07411	0.0304	0.9704
Factor6	0.13873	0.07017	0.0198	0.9902
Factor7	0.06856	.	0.0098	1

Table A.10: Factor Loadings Non-Routine Manual

Variable	Factor1	Uniqueness
var4A3a4	0.8685	0.2457
var1A2b1	0.9061	0.1789
var2B3l	0.7975	0.364
var4A3a3	0.9051	0.1807
var4A3a1	0.892	0.2043
var1A2b4	0.9111	0.1699
var1A2b2	0.9309	0.1334

Table A.11: Variables Used to Create Non-Routine Analytical Tasks

Variable ID	Variable Name	Description
1.A.1.b.1	Fluency of Ideas	The ability to come up with a number of ideas about a topic (the number of ideas is important, not their quality, correctness, or creativity).
1.A.1.b.2	Originality	The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.
1.C.7.a	Innovation	Job requires creativity and alternative thinking to develop new ideas for and answers to work-related problems.
1.C.7.b	Analytical Thinking	Job requires analyzing information and using logic to address work-related issues and problems.
2.A.2.a	Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
2.A.2.b	Active Learning	Understanding the implications of new information for both current and future problem-solving and decision-making.
2.B.2.i	Complex Problem Solving	Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
2.B.4.e	Judgment and Decision Making	Considering the relative costs and benefits of potential actions to choose the most appropriate one.
4.A.2.a.3	Evaluating Information to Determine Compliance with Standards	Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards.
4.A.2.b.1	Making Decisions and Solving Problems	Analyzing information and evaluating results to choose the best solution and solve problems.
4.A.2.b.2	Thinking Creatively	Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions.
4.A.2.b.4	Developing Objectives and Strategies	Establishing long-range objectives and specifying the strategies and actions to achieve them.

Table A.12: Variables Used to Create Non-Routine Interactive Tasks

Variable ID	Variable Name	Description
1.C.2.b	Leadership	Job requires a willingness to lead, take charge, and offer opinions and direction.
2.A.2.d	Monitoring	Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
2.B.1.c	Persuasion	Persuading others to change their minds or behaviour.
2.B.5.d	Management of Personnel Resources	Motivating, developing, and directing people as they work, identifying the best people for the job.
4.A.4.a.1	Interpreting the Meaning of Information for Others	Translating or explaining what information means and how it can be used.
4.A.4.a.4	Establishing and Maintaining Interpersonal Relationships	Developing constructive and cooperative working relationships with others, and maintaining them over time.
4.A.4.b.1	Coordinating the Work and Activities of Others	Getting members of a group to work together to accomplish tasks.
4.A.4.c.2	Staffing Organizational Units	Recruiting, interviewing, selecting, hiring, and promoting employees in an organization.

Table A.13: Variables Used to Create Routine Cognitive Tasks

Variable ID	Variable Name	Description
1.A.1.b.6	Information Ordering	The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
1.A.1.c.2	Number Facility	The ability to add, subtract, multiply, or divide quickly and correctly.
1.A.1.d.1	Memorization	The ability to remember information such as words, numbers, pictures, and procedures.
2.A.1.e	Mathematics	Using mathematics to solve problems.

Table A.14: Variables Used to Create Routine Manual Tasks

Variable ID	Variable Name	Description
1.A.2.a.2	Manual Dexterity	The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
1.A.2.a.3	Finger Dexterity	The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.
1.A.2.c.2	Wrist-Finger Speed	The ability to make fast, simple, repeated movements of the fingers, hands, and wrists.

Table A.15: Variables Used to Non-Routine Manual Tasks

Variable ID	Variable Name	Description
1.A.2.b.2	Multilimb Coordination	The ability to coordinate two or more limbs (for example, two arms, two legs, or one leg and one arm) while sitting, standing, or lying down. It does not involve performing the activities while the whole body is in motion.
1.A.2.b.4	Rate Control	The ability to time your movements or the movement of a piece of equipment in anticipation of changes in the speed and/or direction of a moving object or scene.
4.A.3.a.1	Performing General Physical Activities	Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling of materials.
4.A.3.a.3	Controlling Machines and Processes	Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).
2.B.3.l	Repairing	Repairing machines or systems using the needed tools.
1.A.2.b.1	Control Precision	The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.
4.A.3.a.4	Operating Vehicles, Mechanized Devices, or Equipment	Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or water craft.

Table A.16: Theil Index

Year	Everyone	Immigrants assigned Tasks of Native born	Immigrants Dropped	Immigrants only	Immigrants only, but assigned Tasks of Native born
1991	0.2829	0.2802	0.2780	0.3257	0.2988
	(.2756-.2901)	(.2730-.2875)	(.2694-.2866)	(.3083-.3432)	(.2765-.3212)
1996	0.3106	0.3058	0.3037	0.3605	0.3207
	(.3007-.3205)	(.2961-.3155)	(.2921-.3154)	(.3475-.3735)	(.3100-.3314)
2001	0.3414	0.3362	0.3349	0.3811	0.3441
	(.3315-.3513)	(.3266-.3458)	(.3229-.3469)	(.3658-.3964)	(.3300-.3582)
2006	0.3895	0.3808	0.3809	0.4363	0.3805
	(.3729-.4061)	(.3639-.3978)	(.3632-.3986)	(.3852-.4873)	(.3386-.4224)

Five % confidence intervals in parentheses based on 99 bootstrap replications.