Technological Change and Declining Immigrant Outcomes, Implications for Income Inequality in Canada

Casey Warman,
Dalhousie University

Christopher Worswick,
Carleton University

CLSRN/IRPP, February 2014
Large declines in earnings for immigrants arriving in the 1990s and 2000s compared to immigrants who arrived in the 1970s and 1980s
- Picot, Hou and Coulombe (2007)
- Green and Worswick (2012)

This has coincided with concern that income inequality has been growing in Canada

Have the challenges faced by Canada’s immigration program unintentionally contributed to income inequality?
The substantial changes in technology resulting from the rapid innovation in the IT sector raise questions about how different skills are valued within developed economies.

We analyze the earnings outcomes and occupational skill requirements of recent immigrant cohorts to Canada to see whether technological changes are driving the poor performance of recent immigrants rather than changes in the characteristics of the selected immigrants.
Possible Causes of Declining Immigrant Earnings across Arrival Cohorts:

**Macroeconomic Conditions:**
- McDonald and Worswick (1998) - current conditions
- Hou and Picot (2009) - IT Bust

**Cross Cohort Changes:**
- Green and Worswick (2000, 2012) - native born cohort effects, declining return to foreign work experience
- Aydemir and Skuterud (2005)
Occupational Matches and Over-education:

- Green (1999)
- Chiswick and Miller (2010) - low payoff to years of over-education for immigrants
- Goldmann, Sweetman and Warman (2011) - post-migration occupations often very different from pre-migration occupations
- Imai, Stacey and Warman (2011) - look at occupational skill requirements, ONET and LSIC data
  - Prior to immigration, male immigrants employed mainly in occupations that require high levels of cognitive skills but not high levels of manual skills.
  - After immigration, more likely to be in occupations requiring manual skills rather than cognitive skills.
  - Single arrival cohort
Technological Change and the Return to Skills

Deteriorating immigrant entry outcomes corresponded with a period in which there were substantial structural changes in both the Canadian and US economies.

**US:**
- Katz and Murphy (1992)
- Juhn and Pierce (1993)

**Canada:**
- True for university graduates, other post-secondary education holders, and high school or less educated.
- Not the large widening of the return to a university degree in Canada as was the case in the US.
Autor, Levy, and Murnane (2003) outline the importance that computerization had on changing job skill demand in the US.

- Computers act as substitutes for jobs that rely on tasks that follow explicit rules and are complements for jobs with tasks requiring nonroutine problem solving and complex communications.

- They find that this can explain much of the increased demand for college educated workers in the US.
Large and sustained expansion of annual immigrant intake to Canada beginning in the late 1980s.
Increased emphasis on university education on immigrants selected under the point system beginning in 1993
Steady decline in log earnings across arrival cohorts for both men and women (even after controlling for education).
Task Construction using the O*NET data


- As outlined in 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.

- Each task was found to be characterized by a single factor.
The 1,000 plus O*NET occupations are matched to the 1991 Standard Occupation Classification available in the Census.

We weight the factor analysis using the occupational distribution of the Canadian population from the 2001 Census Master file.

The resulting scores can be interpreted as having mean zero and a standard deviation equal to one with reference to the 2001 Canadian-born population.
Data


- Age 24-59

- Separate estimation for men and women

- Immigrants restricted to individuals aged 18 or older at the time of arrival in Canada
Immigrant men are more likely to work in jobs requiring lower Non-Routine Analytical, Non-Routine Interactive, and Non-Routine Manual tasks.

Only task requirement for which immigrants experience an advantage in most years is in Routine Manual tasks.
Figure 5: Immigrant/native born mean differences in Non-Routine Analytical Index
Cross cohort declines in the immigrant/native born difference in the Non-Routine Analytical index through to the 1990-94 cohort before a sharp reversal for the later cohorts.

First part of this pattern consistent with the earnings declines across the cohorts for the late 1960s through early 1990s.

The turn-around in this pattern coincides with the movement towards university education in immigrant selection beginning in the mid 1990s.
Figure 6: Non-Routine Interactive Task Requirements

Technological Change and Declining Immigrant Outcomes
Figure 7: Non-Routine Manual Task Requirements:

Technological Change and Declining Immigrant Outcomes
Figure 8: Routine Cognitive Task Requirements:

Immigrant/Canadian Difference

ysm

1960−64 1965−69 1970−74
1975−79 1980−84 1985−89
1990−94 1995−99 2000−04

Technological Change and Declining Immigrant Outcomes
Figure 9: Routine Manual Task Requirements

Technological Change and Declining Immigrant Outcomes
Men with University Degrees

Cohort patterns are much closer to being monotonic.

For the pre-1995 arrival cohorts, clear negative cohort patterns are apparent:

1. Non-Routine Analytical task requirements,
2. Non-Routine Interactive task requirements and
3. Routine Cognitive task requirements.

For the two most recent, there is a slight turnaround for each of these cases but the magnitudes of these effects are much smaller than was found without conditioning on university education.


Same pattern is present whether one focuses on routine versus non-routine task requirements.
Men with High School or Less Education

The cohort patterns are less clear but similar cohort profile patterns to those of the university educated men.

Profiles that are:

1. shifting down across successive arrival cohorts for the cases of Non-Routine Analytical, Non-Routine Interactive and Routine Cognitive and

2. shifting upwards for the case of Routine Manual tasks.
Earnings and Task Requirement Regression Analysis

Standard cohort-ysm specification with controls for age, marital status, survey year and highest level of education.

<table>
<thead>
<tr>
<th></th>
<th>Earnings</th>
<th>NRAntalytical</th>
<th>NRAnteractive</th>
<th>RCognitive</th>
<th>NRManual</th>
<th>RManual</th>
</tr>
</thead>
<tbody>
<tr>
<td>immigrant</td>
<td>-0.348***</td>
<td>-0.224***</td>
<td>-0.224***</td>
<td>-0.164***</td>
<td>-0.0636***</td>
<td>0.0768***</td>
</tr>
<tr>
<td></td>
<td>-0.011</td>
<td>-0.0117</td>
<td>-0.012</td>
<td>-0.0117</td>
<td>-0.0109</td>
<td>(0.0118)</td>
</tr>
<tr>
<td>imm X 1965-69</td>
<td>0.0209**</td>
<td>0.0579***</td>
<td>0.0450***</td>
<td>0.0656***</td>
<td>0.0066</td>
<td>-0.0184**</td>
</tr>
<tr>
<td></td>
<td>-0.0086</td>
<td>-0.0089</td>
<td>-0.0094</td>
<td>-0.009</td>
<td>-0.0084</td>
<td>(0.00921)</td>
</tr>
<tr>
<td>imm X 1970-74</td>
<td>-0.0384***</td>
<td>-0.0418***</td>
<td>-0.0603***</td>
<td>0.00382</td>
<td>0.0269***</td>
<td>0.0347***</td>
</tr>
<tr>
<td></td>
<td>-0.0088</td>
<td>-0.0091</td>
<td>-0.0096</td>
<td>-0.0091</td>
<td>-0.0085</td>
<td>(0.0094)</td>
</tr>
<tr>
<td>imm X 1975-79</td>
<td>-0.0340***</td>
<td>-0.0232**</td>
<td>-0.0453***</td>
<td>0.0183*</td>
<td>0.0157*</td>
<td>0.0414**</td>
</tr>
<tr>
<td></td>
<td>-0.00921</td>
<td>-0.00967</td>
<td>-0.0102</td>
<td>-0.00974</td>
<td>0.00912</td>
<td>(0.00999)</td>
</tr>
<tr>
<td>imm X 1980-84</td>
<td>-0.0742***</td>
<td>-0.0697***</td>
<td>-0.0962***</td>
<td>-0.0223**</td>
<td>0.0307***</td>
<td>0.0708***</td>
</tr>
<tr>
<td></td>
<td>-0.00972</td>
<td>-0.0107</td>
<td>-0.0107</td>
<td>-0.0103</td>
<td>0.00959</td>
<td>(0.0105)</td>
</tr>
<tr>
<td>imm X 1985-89</td>
<td>-0.0954***</td>
<td>-0.143***</td>
<td>-0.153***</td>
<td>-0.0901***</td>
<td>0.0515***</td>
<td>0.0882***</td>
</tr>
<tr>
<td></td>
<td>-0.01</td>
<td>-0.0106</td>
<td>-0.011</td>
<td>-0.0107</td>
<td>-0.00996</td>
<td>(0.0108)</td>
</tr>
<tr>
<td>imm X 1990-94</td>
<td>-0.164***</td>
<td>-0.182***</td>
<td>-0.184***</td>
<td>-0.142***</td>
<td>0.0336***</td>
<td>0.0850***</td>
</tr>
<tr>
<td></td>
<td>-0.0103</td>
<td>-0.0109</td>
<td>-0.0113</td>
<td>-0.0109</td>
<td>-0.0102</td>
<td>(0.0111)</td>
</tr>
<tr>
<td>imm X 1995-99</td>
<td>-0.130***</td>
<td>-0.138***</td>
<td>-0.217***</td>
<td>-0.0686***</td>
<td>0.0820***</td>
<td>0.144***</td>
</tr>
<tr>
<td></td>
<td>-0.0108</td>
<td>-0.0115</td>
<td>-0.0118</td>
<td>-0.0116</td>
<td>-0.0108</td>
<td>(0.0117)</td>
</tr>
<tr>
<td>imm X 2000-04</td>
<td>-0.226***</td>
<td>-0.247***</td>
<td>-0.299***</td>
<td>-0.145***</td>
<td>0.176***</td>
<td>0.216***</td>
</tr>
<tr>
<td></td>
<td>-0.0115</td>
<td>-0.0124</td>
<td>-0.0125</td>
<td>-0.0124</td>
<td>-0.0116</td>
<td>(0.0125)</td>
</tr>
<tr>
<td>YSM</td>
<td>0.0208***</td>
<td>0.0111***</td>
<td>0.0083***</td>
<td>0.0102***</td>
<td>0.0039***</td>
<td>0.0021***</td>
</tr>
<tr>
<td></td>
<td>-0.0006</td>
<td>-0.0006</td>
<td>-0.0006</td>
<td>-0.0006</td>
<td>0.0006</td>
<td>(0.0006)</td>
</tr>
<tr>
<td>YSM^2/100</td>
<td>-0.0285***</td>
<td>-0.0163***</td>
<td>-0.0085***</td>
<td>-0.0178***</td>
<td>-0.0063***</td>
<td>-0.0043**</td>
</tr>
<tr>
<td></td>
<td>-0.0017</td>
<td>-0.0017</td>
<td>-0.0018</td>
<td>-0.0018</td>
<td>-0.0017</td>
<td>(0.0018)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.111</td>
<td>0.238</td>
<td>0.192</td>
<td>0.170</td>
<td>0.184</td>
<td>0.170</td>
</tr>
</tbody>
</table>

24/32 February 2014 Warman and Worswick

Technological Change and Declining Immigrant Outcomes
Regression analyses designed to identify what are the wage returns to each of the five occupational task requirements and how they have been changing through time.

- In each case, the time paths of the returns are small.

- Not much evidence of a downward trend in the return to Non-Routine Manual tasks in Canada over this time period as one would expect based on the findings for the US by Autor, Levy, and Murnane (2003).
The earnings models of the first two columns of Table 1 are re-estimated after controlling for the five occupational task requirement indexes.

Next, we estimate the model with a full set of cohort-task requirement index interactions.

**Non-Routine Analytical Task index:**
- the cross cohort pattern is positive and significant with an upward trend (at least through the end of the 1990s).
- Opposite pattern is found for Non-Routine Interactive Tasks.

**Non-Routine Manual Task index:**
- negative cross cohort pattern.
The cross-cohort pattern in returns for the case of the Routine Manual Tasks index is positive.

- The shifting source country composition of arrival cohorts over this period may in part explain these patterns.

- Lack of English and/or French language fluency may have made it more 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.

- The shift towards field of study in the engineering and IT sectors in the 1990s and early 2000s could explain the rising return to Non-Routine Analytical Task Requirements.
Empirical Findings for Women

The analysis above has been repeated for women with broadly similar findings.

Immigrant women are:

1. more likely to have high values of the three cognitive task requirement indexes (Non-Routine Analytical, Non-Routine Interactive and Routine Analytical) and
2. are less likely to have high values of the two manual task requirement indexes (Routine and Non-Routine).

The improvement in the cognitive task indexes for the late 1990s and early 2000s cohorts are not as pronounced for women as they are for men.
Non-parametric density estimation to analyze the actual
distribution of weekly earnings and the counterfactual distribution
(if same returns along these dimensions as the Canadian born).

- We track several recent arrival cohorts through the Census
tears.
- Counterfactual distribution for immigrants is shifted to the
  right and appears more compressed relative to the native born
distribution.
- Some convergence towards the native born distribution with
  more time in Canada.
Empirical evidence is mixed on the impact of immigration on the wages of the native born in Canada.

- However, Aydemir and Borjas (2007) find a 10% labor supply increase leads to a 3%-4% decline in wages.

- The expansion of the university educated part of the Canadian workforce over the 1980s and 1990s may have held back the widening of the university premium in Canada.

- Could explain 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.

- However, given our findings, highly educated recent immigrants may compete more with less-educated workers rather than university workers.
Conclusions

- Cross-cohort decline in earnings of immigrants to Canada coincided with a cross-cohort shift to working in manual skill-intensive occupations rather than cognitive skill-intensive.

- No evidence that the returns to Non-Routine Analytical and Non-Routine Interactive tasks have risen or that the return to Routine Manual tasks has fallen across the 1991-2006 period.

- Could be due to shifting source country composition (moving way 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.
Findings suggest that skilled immigrants not only be selected based on education but also based on their capacity to meet the task requirements of their intended occupations.

By incorporating occupational dictionaries such as the O*NET, one could develop an occupation specific point system selection grid that would yield future immigrant cohorts with better post migration economic outcomes.